URBAN ENGINEERING CONSULTANTS
CONSULTING CIVIL AND STRUCTURAL ENGINEERS

STORMWATER MANAGEMENT PLAN - CONSOLIDATION, REZONING AND SUBDIVISION OF ERF 998 TERGNIET AND PTN 5 OTF ZANDHOOGTE NO. 139, MOSSEL BAY

Report Number 22-160_SW

Date: October 2025

Revision (1)

QUALITY ASSURANCE DATA

Report Title:	STORMWATER MANAGEMENT PLAN - CONSOLIDATION, REZONING AND SUBDIVISION OF ERF 998 TERGNIET AND PTN 5 OTF ZANDHOOGTE NO. 139, MOSSEL BAY
Client:	3MP Sales and Education Services CC
Report Number:	22-160_SWMP
Revision Number	Revision (1)

Revision History

Date	Rev	Written By	Issued to		Distribution	Format
			Name	Institution		
1 October 2025	0	Douw Louwrens	Pieter Brown	Design Centre and Associates	Email	.pdf
			Jan Vrolijk	Jan Vrolijk Town Planners	Email	.pdf
15 October 2025	1	Douw Louwrens	Pieter Brown	Design Centre and Associates	Email	.pdf
			Jan Vrolijk	Jan Vrolijk Town Planners	Email	.pdf
			Kosie Pozyn	3MP Sales and Education Services Cc	Email	.pdf
			Michael Jon Bennett	Sharples Environmental Services	Email	.pdf

Prepared by:

Douw Louwrens (B.Eng)
on behalf of Urban Engineering (Pty) Ltd

TABLE OF CONTENTS

LIST OF ANNEXURES

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

Urban Engineering (Pty) Ltd was appointed by 3MP Sales and Education Services Cc to undertake a stormwater management plan pertaining to the proposed consolidation, rezoning and subdivision of Erf 998, Tergniet and PTN 5 of Farm Zandhoogte No. 139 Mossel Bay, Western Cape. The project is referred to as the Dolfin Circle Development.

1.1 PROJECT BENEFIT AND CONTEXT

The client has identified the need / opportunity for the creation of a mixed-use development consisting of both residential and business zones in the Tergniet / Groot Brak River area. To meet this demand, 3MP Sales and Education Services Cc is proposing the Dolfin Circle Development, which consists of the consolidation, rezoning and subdivision of Erf 998, Tergniet and PTN 5 of Farm Zandhoogte No. 139 Mossel Bay.

1.2 OBJECTIVES OF THIS REPORT

This report aims to provide a strategy for the management of stormwater for the proposed development. The objectives of these strategies are, inter alia to:

- Retain the peak stormwater flow to pre-development levels.
- Reduce the in-stream litter load.
- Protect the biodiversity within the catchment.
- Provide methods for removing, reducing, or retarding runoff flows, and preventing targeted stormwater runoff pollutants and contaminants from reaching receiving waters

It is important to note that this strategy document provides a range of principles and initial concepts based on site inspections as well as consultation with the relevant stakeholders. While conventional stormwater design has historically been a rather linear process (i.e. you design a piped network), this approach has had a significant impact on the environment through the erosion of natural channels, siltation of water bodies and pollution resulting in environmental degradation. An alternative approach to the conventional stormwater design system will be introduced, namely, Sustainable Urban Drainage Systems (SUDS).

1.3 STORMWATER MANAGEMENT PRINCIPLES

The underlying principle regarding Stormwater Management is that the peak runoff from the post-development site should not exceed that of the pre-developed site for the full range of storm periods (1:2 to 1:50). Mitigation measures must therefore be incorporated into the Site Development Plan to reduce and/or attenuate the post development flows to pre-development rates.

Although run-off calculations are performed with great care, it is still possible that the capacity of a system could be exceeded because of non-hydrological reasons. A limit to the elimination of probabilities must be incorporated as costs could become unrealistically high in comparison with the benefit of lower risks.

The relationship between function, risk, original cost and maintenance cost plays a major role in determining the design flood frequency, it is assumed in general that the flood frequencies as discussed in ***Table 1-1*** below should be provided for under normal circumstances.

Land Use	Design Storm Return Period (Major storm events)
Residential	50 years
Institutional (e.g.) schools	50 years
General Commercial and Industrial	50 years
High Value Central Business Districts	50 - 100 years
Land Use	**Design Storm Return Period (Minor storm events)**
Residential	1 - 5 years
Institutional (e.g.) schools	2 - 5 years
General Commercial and Industrial	5 years
High Value Central Business Districts	5 - 10 years

Table 1-1 - Typical stormwater analysis requirements based on land uses

1.4 SUSTAINABLE URBAN DRAINAGE SYSTEM (SUDS)

A conventional stormwater system manages the stormwater by collecting the runoff and channelling it into the nearest stormwater watercourse. The SUDS approach aims to mimic natural hydrological cycles, prevents the erosion of natural channels, siltation of water bodies, pollution and reducing environmental degradation.

SUDS embraces several options that are arranged in treatment trains, which helps to improve the efficiency and the resiliency of the system. There are three stages in the treatment train, each having slightly different combinations of SUDS options to control the stormwater:

1. ”**Source Controls**” manage stormwater runoff as close to its source as possible, typically on site. Typical SUDS options include green roofs, rainwater harvesting, permeable pavements and soak-aways.
2. ”**Local Controls**” manage stormwater runoff in the local area, typically within the road reserves. Typical SUDS options include bio-retention areas, filter strips, infiltration trenches, sand filters and swales.
3. ”**Regional Controls**” manage the combined stormwater runoff from several developments. Typical SUDS options include constructed wetlands, detention and retention ponds.

2 LOCALITY

The future area of the combined erven will be approximately 10.3ha. The site is situated between National Road 2 (N2) and MR344. DR1578 defines the property’s Western boundary and provides the only access onto the site. The site centre has approximate WGS 84 coordinates of 34° 3'49.05"S and 22°11'22.03"E. A basic locality plan has been included as ***Figure 2.1***.

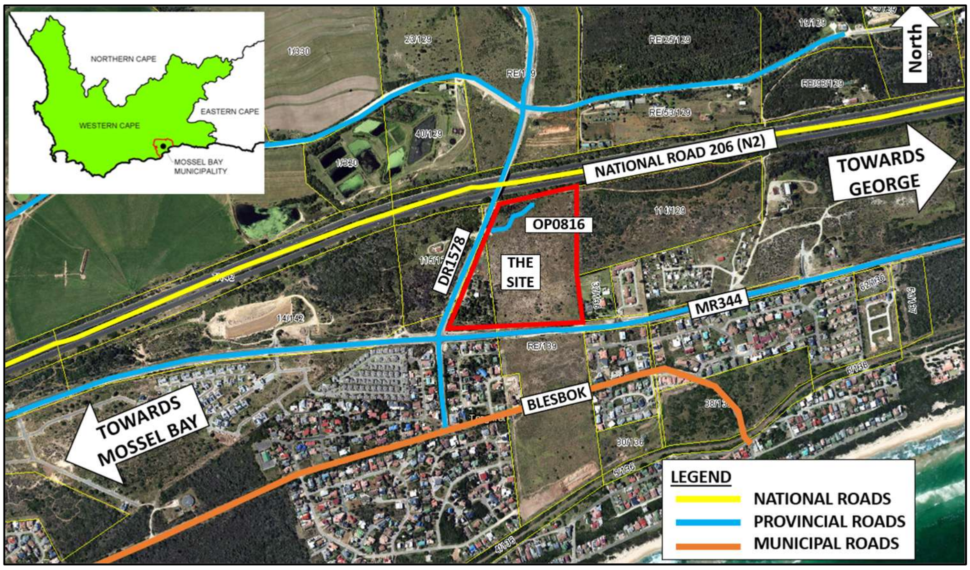


Figure 2-1 - Basic Locality Plan

3 STATUS QUO

The site consists of two erven with a frontal dimension of 370m and a width of 290m. There are currently structures on Erf 998, access onto both Erven from DR1578 (Sorgfontein Road), and a secondary access to the portion of RE/1578 from the MR344. The vegetation of the site is dry grasslands with some small shrubs.

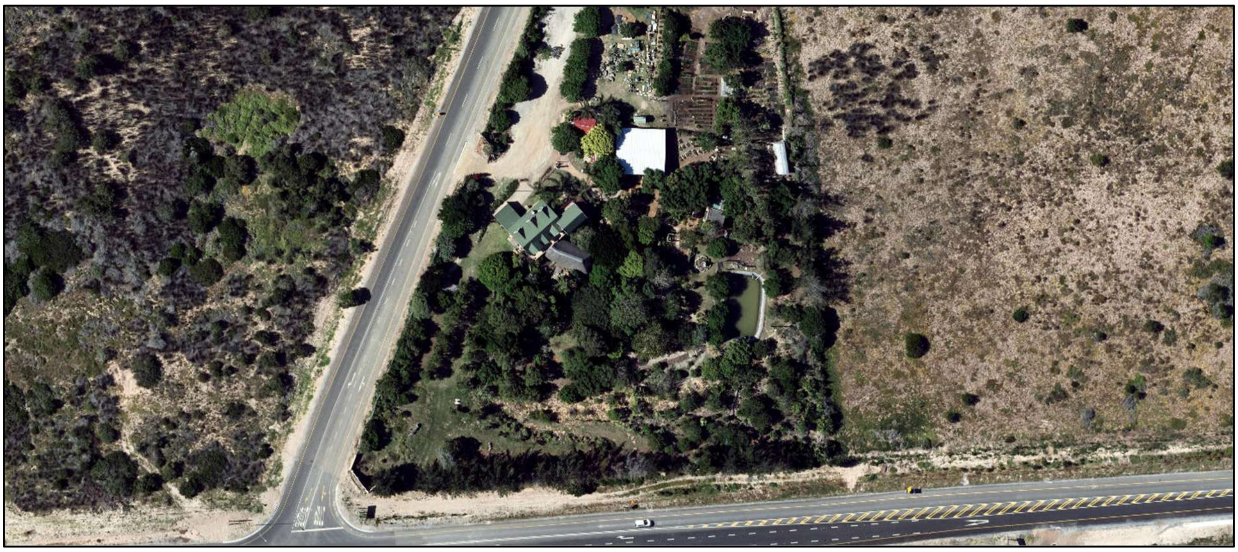


Figure 3-1 - Status Quo Photo

The site is currently zoned Agriculture Zone I as indicated in the extract of Mossel Bay Municipality's GIS database.

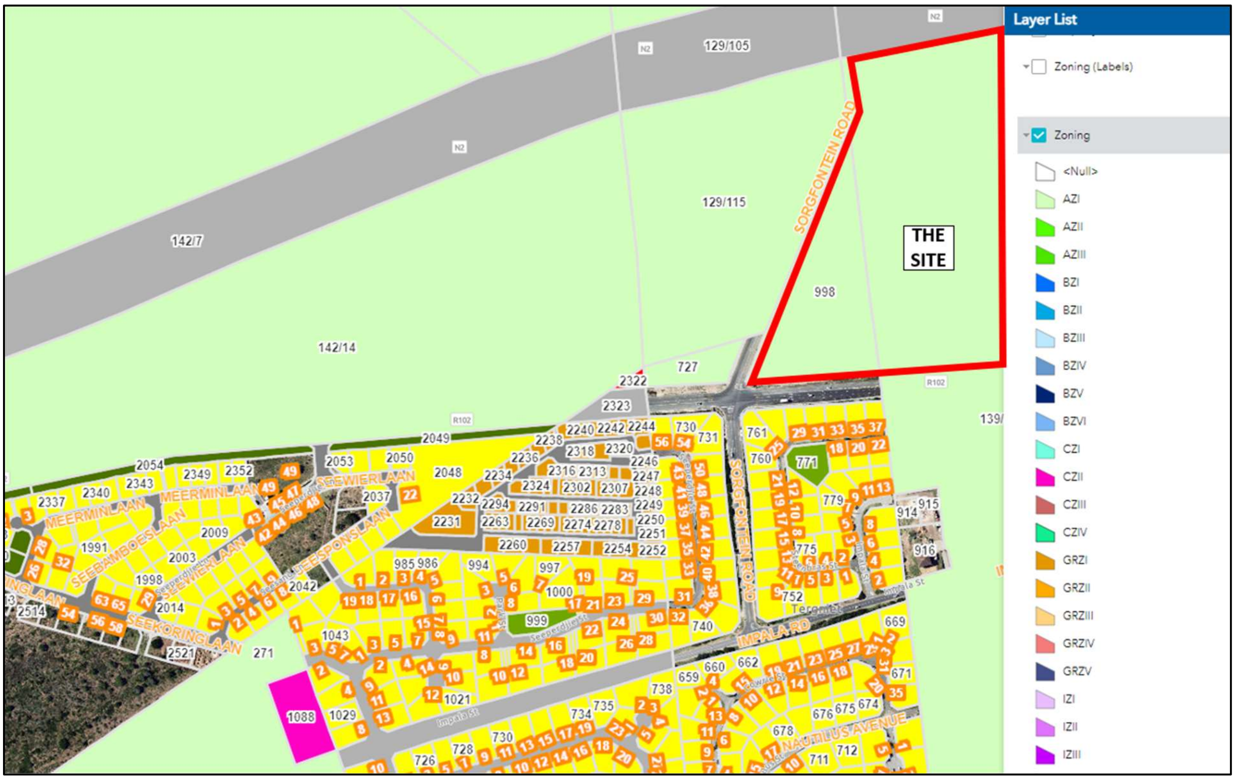


Figure 3-2 - Current Site Zoning

The 2018 Mossel Bay SDF prepared by CNdV planners identifies the site for future "Urban Expansion" potential (refer to Figure 3-3)

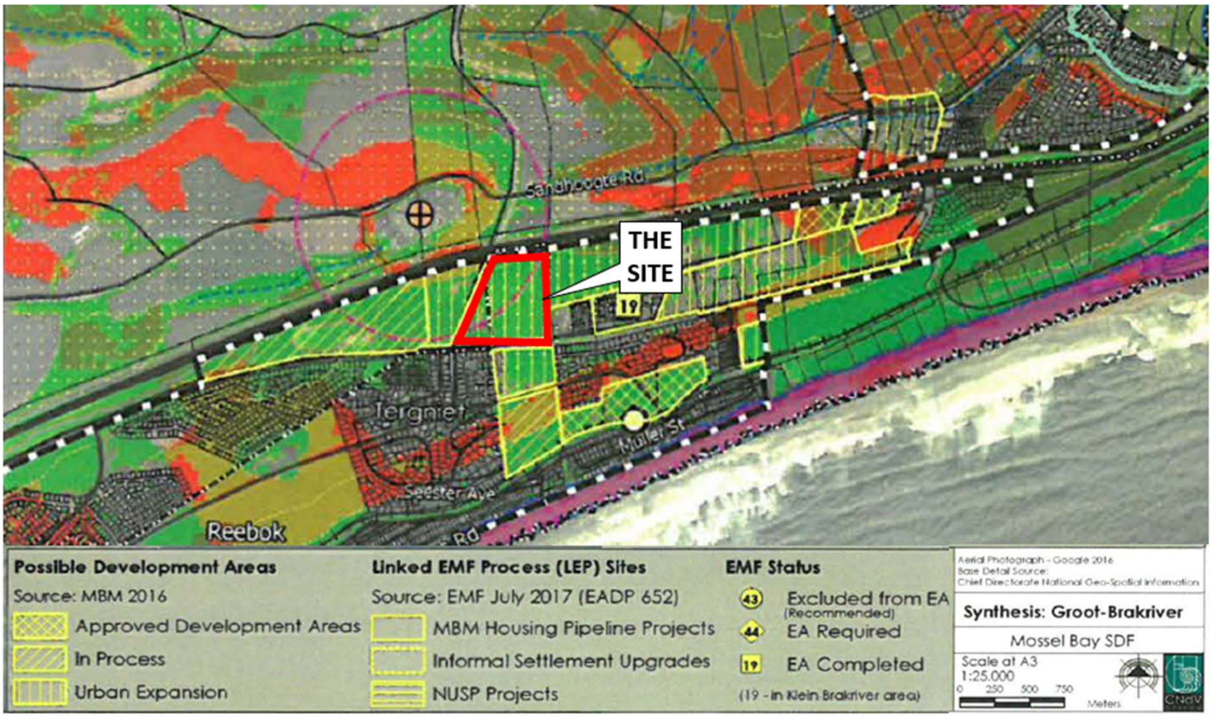


Figure 3-3 – Extract of Local Spatial Development Framework

4 PROPOSED DEVELOPMENT PARTICULARS

It is the intention of the landowner to develop the site into a new residential and commercial node. The main site access will remain on DR1578 but will be moved to the most optimum position along the DR1578.

The proposed development will consist of the following:

LAND USE DESCRIPTION	ABREVIATION	SIZE (ha)
Business Zone I	BZI	3.604
Business Zone IV	BZIV	0.268
Community Zone III	CZIII	0.527
Mixed Zone II	MZII	0.902
Open Space II	OSZII	2.225
General Residential Zone II	GRZII	0.697
General Residential Zone III	GRZIII	0.653
Transport Zone II	TZII	1.360
TOTAL		**10.236**

A subdivision plan was prepared by Pieter Brown of *Design Centre and Associates* and has been attached as **ANNEXURE B** to this report. For ease of reference, an extract of the SDP has been included as ***Figure 4-1*** below.

Table			
Zoning	Colour Notation	Size (ha)	%
Business Zone I (BZI)		3.604	35.21
Business Zone IV (BZIV)		0.268	2.62
Community Zone III (CZIII)		0.527	5.15
Mixed Zone II (MZII)		0.902	8.81
Open Space II (OSZII)		2.225	21.74
General Residential Zone II (GRZII)		0.697	6.81
General Residential Zone III (GRZIII)		0.653	6.38
Transport Zone II (TZII)		1.360	13.29
Total		10.236	100

Figure 4-1 - Proposed Site Development Plan

5 GEOTECHNICAL INVESTIGATION

No geotechnical investigation was carried out for the site, but the soil can be described as having a strong contrast in texture, a marked clay accumulation, strongly structured and a non-reddish in colour. In addition, one or more of vertic, melanic and plinthic soils may be present.

The geology can be described as variegated (reddish-brown and greenish) silty mudstone and sandstone, subordinate grey shale and sandstone.

The erodibility of the soil can be described as high with an erodibility factor of 0.61.

Less than 15% of clay is found on site at a depth between 450mm and 750mm.

For this report, the soil conditions are accepted to be as follows:

Soil Description : Soils with a strong texture contrast
Soil Type : CA
Conductivity : 10.9 mm/hr
Suction Head : 110.1 mm

Source: https://gis.elsenburg.com/apps/cfm/

6 STORMWATER RETICULATION

6.1 CALCULATIONS

Hydrological calculations were conducted with the PCSWMM computer program for the various Return Interval (RI) storm events. A 24-hour South Africa Type 1 SCS storm, peaking at 12 hours was used in the analysis.

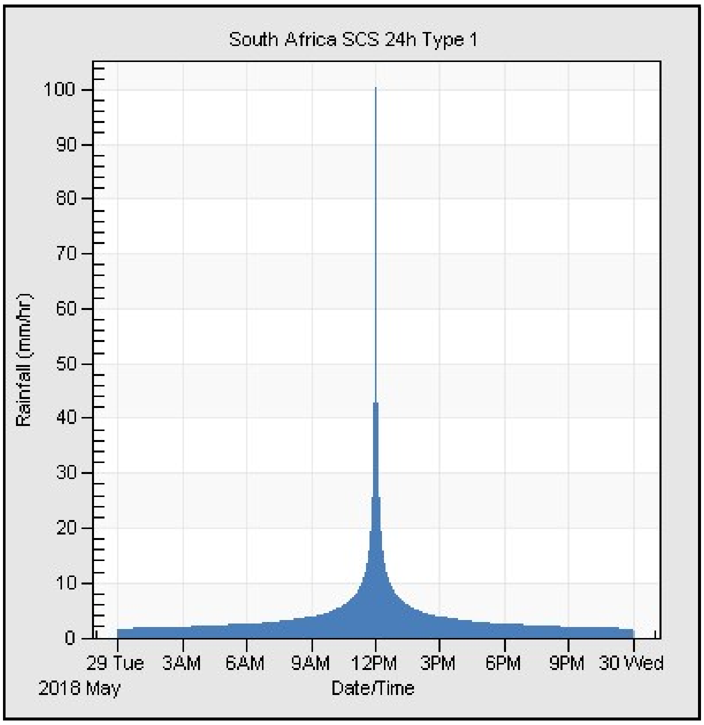


Figure 6-1 - SCS Type 1 Storm

6.2 HYDROLOGY

Tergniet is situated in the winter rainfall region of the Western Cape and no extreme rainfall intensities occur. A representative Mean Annual Precipitation (MAP) of 467mm has been obtained from the accompanying software of the *Design Rainfall and Flood Estimation in South Africa (JC Smithers and RE Schiltze)* report.

A summary of the rainfall station- and related storm rainfall data is given in ***Table 6-1*** and ***Table 6-2*** respectively.

Station name	SAWS Station No.	Latitude	Longitude	MAP (mm)	Altitude (m)	Distance from catchment centroid (km)	Length of records (years)
Sandhoogte (PUR)	0012303_W	34° 03'	22° 11'	576	76	1.8	72
Great Brak River	0012393_W	34° 03'	22° 13'	473	110	4.0	86
Mosselbaai (MAG)	0012220_W	34° 10'	22° 08'	437	94	12.1	39
Cape St Blaize (VRT	0012251_W	34° 11'	22° 09'	380	30	13.1	98
			Accepted	**467**			

Table 6-1 – Rainfall station data

	Rainfall Depth (mm)					
Rainfall return period	**1 in 2 year**	**1 in 5 year**	**1 in 10 year**	**1 in 20 year**	**1 in 50 year**	**1 in 100 year**
Sandhoogte (PUR)	46.8	68.7	85.5	103.4	129.6	151.7
Great Brak River	51.5	75.7	94.1	113.8	142.7	167.1
Mosselbaai (MAG)	51.8	76.1	94.6	114.4	143.4	167.9
Cape St Blaize (VRT	32.1	47.1	58.6	70.9	88.8	104.0
Accepted	**45.6**	**66.9**	**83.2**	**100.6**	**126.1**	**147.7**

Table 6-2 - Storm rainfall data

6.3 PRE-DEVELOPMENT RUNOFF

The National Road (N2) along the northern boundary of the proposed development acts as a cut-off drain for any runoff from the north, the DR1578 (Sorgfontein Road) acts as a cut-off drain for stormwater from the west of the proposed development, and the MR344 acts as a cut-off drain for stormwater from the south of the proposed development. There are an existing headwall structure and culvert that conveys stormwater from the north of the MR344, discharging via a headwall structure to the south.

The site consists of a catchment area of 102 360 m². A low point is situated close to the eastern border of the site, approximately 140 m to the north of MR344. The northern portion of the site drains in a southeastern direction towards the low point with an average gradient of approximately 6,6%. The southern portion drains in north-northeastern direction towards the low point with an average gradient of approximately 4%. ***Table 6-3*** summarizes the site characteristics in terms of the pre-development scenario. Based on the available information the site is currently only approximately 1,8 % impervious.

Scenario	Total site area (m²)	Impervious area (m²)	Impervious %
Pre-development	102 360	1885	1,8

Table 6-3 – Pre-development site characteristics

The development area was modelled with the PCSWMM program to determine stormwater runoff for the pre-development scenario for each of the storm events. Stormwater will accumulate at the low point on the eastern border of the site and drain further east overland from here. The peak pre-development flow and total runoff volume from the catchment area during the various storm events are indicated in ***Table 6-4***.

Recurrence Interval storm event	Pre-development runoff (m³/s)	Runoff volume (m³)
1:2	0.006	82
1:5	0.082	324
1:10	0.193	695
1:20	0.344	1 210
1:50	0.617	2 120
1:100	0.890	3 000

Table 6-4 – Pre-development stormwater runoff

6.4 POST-DEVELOPMENT RUNOFF

The available information includes a consolidation, rezoning and subdivision plan. The plan indicates the number of proposed land portions, size and land uses of each. Detailed Site Development Plans for each portion are not available at this stage. Pieter Brown of *Design Centre and Associates* however prepared a summary of the envisaged building footprints, parking areas, internal roads and loading zones which were used to determine the impervious areas for each portion. A summary of the envisaged areas for each portion is indicated in ***Table 6-5***.

No.	Total Area (m²)	Land Use	Roof Area (m²)	Parking and roads (m²)	Loading Zone (m²)	Yards (m²)	Storage (m²)	Outdoor Plant Tunnels (m²)	Open Space (m²)	Imp. %	Perv. %
1	21040	Business	7500	10125	1150				2265	89,2%	10,8%
2	5270	Community	400	810		50			4010	23,9%	76,1%
3	6970	Gen. Res.	2400	1295		360			2915	58,2%	41,8%
4	2890	Open Space							2890	0,0%	100,0%
5	2680	Business	600	1070					1010	62,3%	37,7%
6	6530	Gen. Res.	2610	2202					1718	73,7%	26,3%
7	9020	Mixed Zone	3500	3150	500		500		1370	84,8%	15,2%
8	10000	Open Space							10000	0,0%	100,0%
9a	10000	Business	1000		3000			6000		40,0%	60,0%
9b	5000	Business	1000	1200	400				2400	52,0%	48,0%
10	13600	Transport		7612					5988	56,0%	44,0%
11	9360	Open Space							9360	0,0%	100,0%
Total	**102360**		**19010**	**27464**	**5050**	**410**	**500**	**6000**	**43926**	**57,1%**	**42,9%**

Table 6-5 – Post-development site characteristics

Using the above characteristics, the development area was modelled with PCSWMM software to determine runoff for the post-development scenario for each of the storm events. It is anticipated that the development portions and roads will roughly follow the existing topographical characteristics of the current site, and the peak flow was measured at the low point on the eastern border of the property to be comparable to the pre-development scenario. The peak post-development flows and total runoff volumes from the site for the various storm events are indicated in ***Table 6-6***. Stormwater runoff from the site will increase considerably because of the development.

Recurrence interval storm event	Post-development runoff (m^3/s)	Runoff volume (m^3)
1:2	0.567	2440
1:5	0.916	3760
1:10	1.212	4830
1:20	1.562	6010
1:50	2.079	7800
1:100	2.483	9350

Table 6-6 – Post-development stormwater runoff

6.5 WATER QUALITY CONTROL

6.5.1 WATER QUALITY VOLUME (WQv)

Hydrologic studies indicate that most rainfall events producing stormwater runoff are small and occur frequently. These storms contribute substantially to the total annual pollutant load. By capturing, retaining, or treating these smaller, frequent events - along with part of the runoff from larger storms - it is possible to significantly reduce water quality impacts in developed areas.

The water quality volume (WQv) is specified to size best management practices (BMPs) to reduce / eliminate or treat these small storms up to a maximum runoff depth and the “first flush” of all larger storm events. This maximum depth is generally accepted to be the runoff generated from the ½ year 24-hour storm event. This volume is considered the point of optimisation between pollutant removal ability and cost-effectiveness. Capturing and treating a larger percentage of the annual stormwater runoff would provide only a small increase in additional pollutant removal but would considerably increase the required size (and cost) of the best management practices.

Required water quality volumes and proposed measures for each developable portion were investigated. To determine the treatment capacity required for the different facilities, the method proposed in the Georgia Stormwater Management Manual, which is based on Darcy’s Law was used:

$$WQv = RD \times Rv \times A$$

WQv = Water Quality Volume (m^3)
Rv = Volumetric Runoff Coefficient
= 0.05 + (0.009 x I)
A = Site Area (m^2)
RD = Rainfall depth for ½-year RI (m)
I = Percent Impervious Cover (%)

The above calculation was carried out for each of the development portions and the results are summarized in ***Table 6-7*** below.

Portion	Zoning	I (%)	Rv	A (m^2)	RD (m)	WQv (m^3)
1	Business	89,2%	0,85	21040	0,033	587,4
2	Community Zone	23,9%	0,27	5270	0,033	45,7
3	General Residential	58,2%	0,57	6970	0,033	130,8
5	Business	62,3%	0,61	2680	0,033	53,6
6	General Residential	73,7%	0,71	6530	0,033	152,4
7	Mixed Zone	84,8%	0,81	9020	0,033	240,1
9a	Business	40,0%	0,41	10000	0,033	134,2
9b	Business	52,0%	0,52	5000	0,033	84,8

Table 6-7 – Required WQv per development portion

6.5.2 WATER QUALITY CONTROL MEASURES

Due to detailed site development plans for each land use portion not available, exact details regarding layouts, positions, elevations and inlet and outlet structures of quality control measures cannot be prescribed at this time. Several viable measures are however explored in the following sections which include enhanced swales, permeable paving and bioretention ponds.

6.5.2.1 ENHANCED SWALES

Enhanced swales (also called bioswales, vegetated channels, or water quality swales) are engineered open channels designed to convey runoff while also capturing and treating the water quality volume (WQv) from a drainage area. Unlike standard swales, they include design features that improve pollutant removal. They are typically constructed with gentle slopes to slow flows, reduce erosion, and allow sediments to settle. Check dams or berms placed across the swale further encourage settling and infiltration.

Enhanced swales are suitable for various developments but are most effective in low- to medium-density residential or institutional areas with limited impervious cover, as well as along roads and highways. Common applications include large-lot housing, small impervious sites such as rooftops and parking areas, and rural road corridors.

Enhanced swales have the following pollutant removal capabilities:

Total Suspended Solids	=	80%
Total Phosphorous	=	50%
Total Nitrogen	=	50%
Metals	=	40%

Figure 6-2 provides a typical cross-section of an enhanced swale.

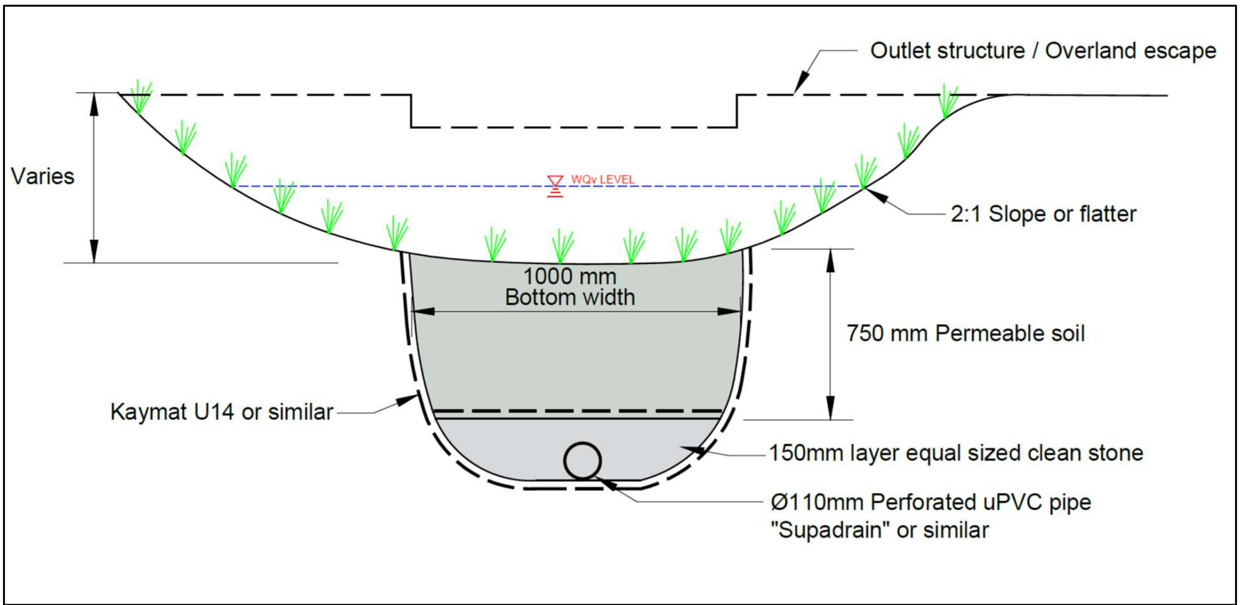


Figure 6-2 – Cross-section of an enhanced swale

6.5.2.2 PERMEABLE PAVING

Modular permeable paver systems are load-bearing pavement units with evenly spaced voids filled with pervious materials such as gravel. This design allows stormwater to infiltrate through the surface, reducing runoff volume, improving water quality, and supporting groundwater recharge. By replacing conventional paving, they also decrease a site’s impervious area.

These systems are typically installed over a stone aggregate base that serves as both structural support and a temporary storage layer. Runoff passes through the paver surface into the gravel base, where it gradually infiltrates into the subsoil. To function effectively, subgrade soils must have sufficient infiltration capacity to drain the captured runoff within 48–72 hours. Careful construction practices are essential to prevent compaction of the underlying soils and preserve infiltration performance.

Modular permeable paver systems are typically used in low-traffic areas with low to no tree coverage such as:

- Parking lots
- Overflow parking areas
- Residential driveways
- Residential street parking lanes
- Recreational trails
- Golf cart and pedestrian paths
- Emergency vehicle and fire access lanes

A key limitation of modular permeable paver systems is their higher cost and construction complexity compared to traditional pavements. They demand precise workmanship to perform effectively, and rehabilitation can be difficult and expensive if the surface becomes clogged. For this reason, both construction and long-term maintenance requirements and costs must be carefully considered when selecting this option.

Permeable paver systems have the following pollutant removal capabilities:

Total Suspended Solids	=	80%
Total Phosphorous	=	50%
Total Nitrogen	=	50%
Metals	=	60%

Figure 6-3 provides a typical cross-section of a permeable paver system.

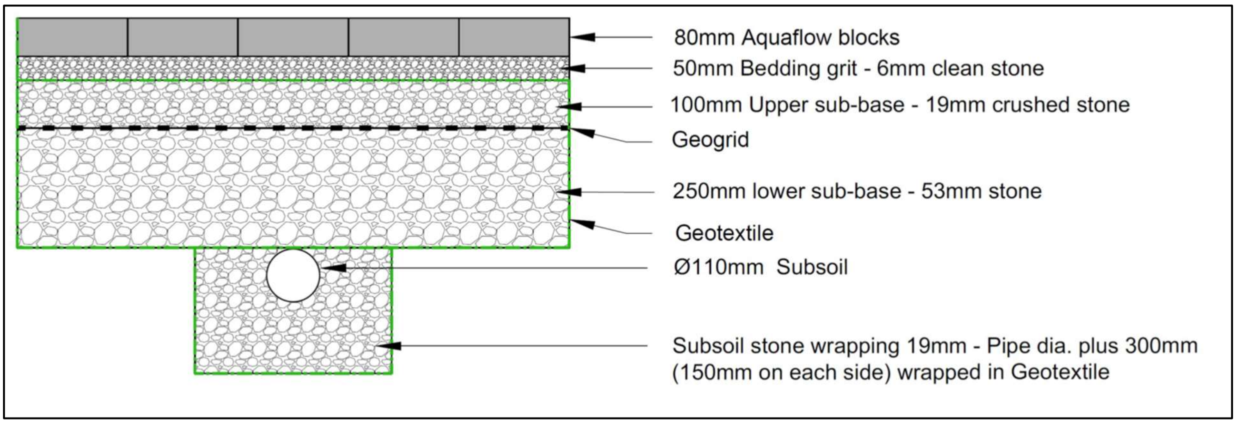


Figure 6-3 – Cross-section of a permeable paver system

6.5.2.3 BIORETENTION PONDS

Bioretention ponds are engineered stormwater facilities that capture and treat the water quality volume (WQv) within shallow landscaped basins using soil and vegetation.

Runoff enters a treatment zone typically made up of a ponding area, mulch or organic layer, engineered soil, and vegetation. Where soils are permeable, water infiltrates into the ground; where infiltration is poor, treated runoff is collected by an underdrain and discharged to the drainage system.

Unlike simple rain gardens, bioretention areas are fully engineered to handle larger drainage areas and often include underdrains to ensure reliable performance. ***Figure 6-4*** shows a typical bio-retention pond in a limited space environment.

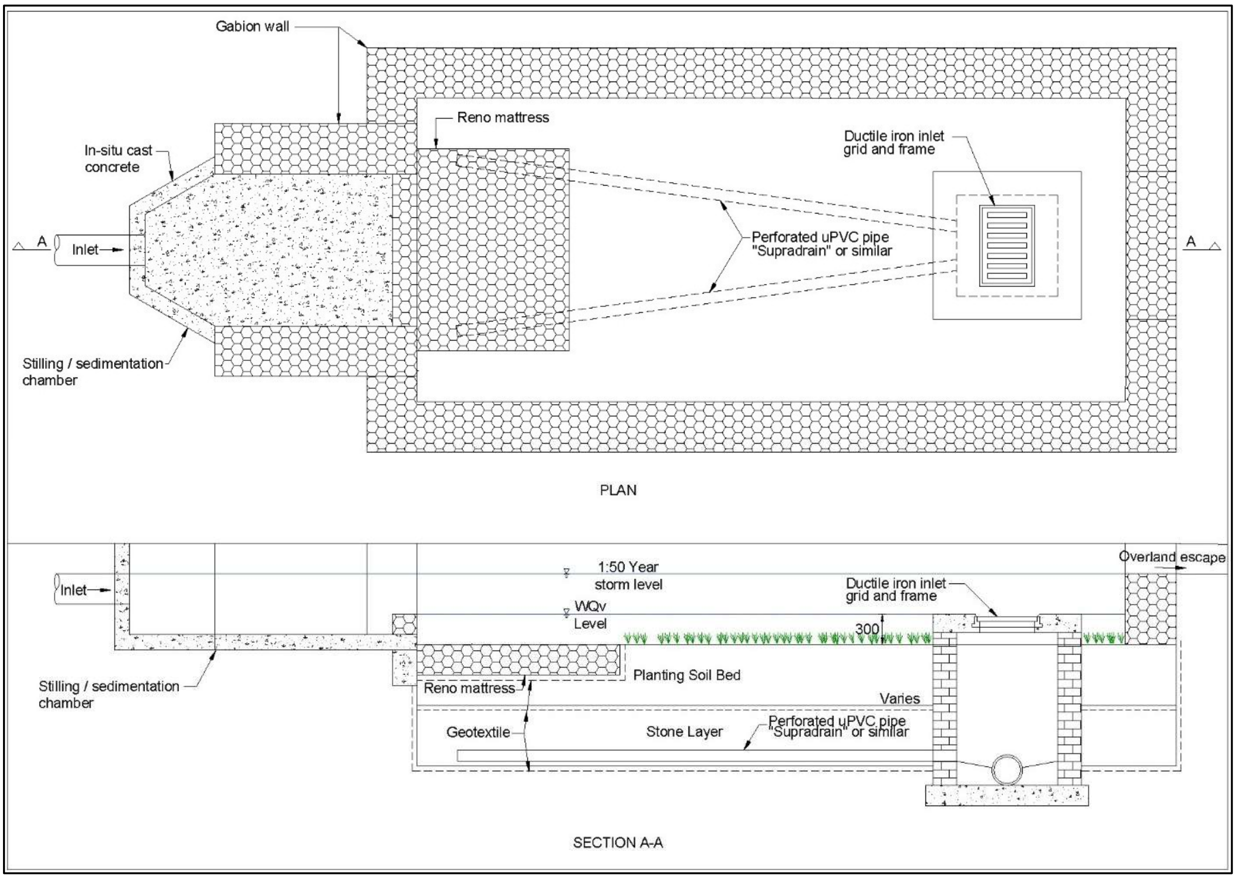


Figure 6-4 – Bioretention pond

Bio-retention facilities have the following pollutant removal capabilities:

Total Suspended Solids	=	85%
Total Phosphorous	=	80%
Total Nitrogen	=	60%
Metals	=	95%
Pathogens	=	90%

To quantify the effect of water quality control measures, especially the impact thereof on the total runoff from the site, bio-retention areas were identified to be included in a modelled scenario. Alternative measures such as enhanced swales and permeable paving can be further investigated when detailed Site Development Plans become available. These measures can then be used to supplement the proposed bioretention ponds and reduce their required size.

For the bioretention ponds to be modelled, they first had to be sized. The following formula as indicated in the Georgia Stormwater Management Manual was used to determine the surface of ponding area for bio-retention facilities for each of the land portions based on the WQv as described in *Paragraph 6.5.1*:

Af	=	*(WQv x df) / [k x (hf + df) x tf]*

Af = *Surface Area of Ponding Area (m²)*
WQv = *Water Quality Volume – total volume to be captured (m³)*
df = *Media depth (m)*
k = *Coefficient of permeability of planting media (m/day)*
hf = *Average height of water above planting bed (m)*
Tf = *Design planting media drain time – 1 day max.*

With:

df = *0.8 m*
k = *0.3 m/day*
hf = *0.3 m*
tf = *1 day*

The above calculation was carried out for the individual development portions of the site and the results summarised in ***Table 6-8***.

Portion	Zoning	Req. WQv (m³)	df (m)	k (m/d)	hf (m)	tf (days)	Af req. (m²)
1	Business	587,4	0,8	0,3	0,3	1	1424,0
2	Community Zone	45,7	0,8	0,3	0,3	1	110,9
3	General Residential	130,8	0,8	0,3	0,3	1	317,2
5	Business	53,6	0,8	0,3	0,3	1	129,9
6	General Residential	152,4	0,8	0,3	0,3	1	369,5
7	Mixed Zone	240,1	0,8	0,3	0,3	1	582,0
9a	Business	134,2	0,8	0,3	0,3	1	325,3
9b	Business	84,8	0,8	0,3	0,3	1	205,5

Table 6-8 – Required surface area of ponding area

The required surface of ponding areas for each portion of the site is shown to scale in ***Annexure B*** attached.

6.6 WATER QUANTITY CONTROL

The measures described in the previous Paragraph 6.6.2 were modelled in PCSWMM to determine the impact on the resulting rate of runoff from the site. The results are indicated in ***Table 6-9*** below.

Recurrence interval storm event	Pre-development runoff (m³/s)	Post-development runoff (m³/s)	Post-development runoff with water quality measures (m³/s)
1:2	0.006	0.567	0.073
1:5	0.082	0.916	0.300
1:10	0.193	1.212	0.737
1:20	0.344	1.562	1.032
1:50	0.617	2.079	1.379
1:100	0.890	2.483	1.635

Table 6-9 – Runoffs for pre- and post-development scenarios

From ***Table 6-9*** the proposed water quality control measures alone will not suffice to attenuate and reduce stormwater runoff from the developed site to that of the pre-developed state, especially for larger storm events. A detention pond near the low point of the site on Portion 4 was therefore investigated.

PCSWMM's 'Storage Calculator' was used to obtain estimates of the storage volume required to attenuate the post-development peak flows, which include the water quality measures, to pre-development flow rates. It is important to note that the 'Storage Calculator' computes the volume of storage required to reduce peak flow to a user-defined maximum design flow. This user-defined figure is based on the peak post-development scenario flow for the 1:50 RI Storm Event after inclusion of the water quality control measures.

Figure 6-5 provides an overview of how the storage tool works. The estimated discharge hydrograph is plotted in blue, and the storage volume required is taken to be the area between the post-development and estimated hydrograph (shaded in light blue).

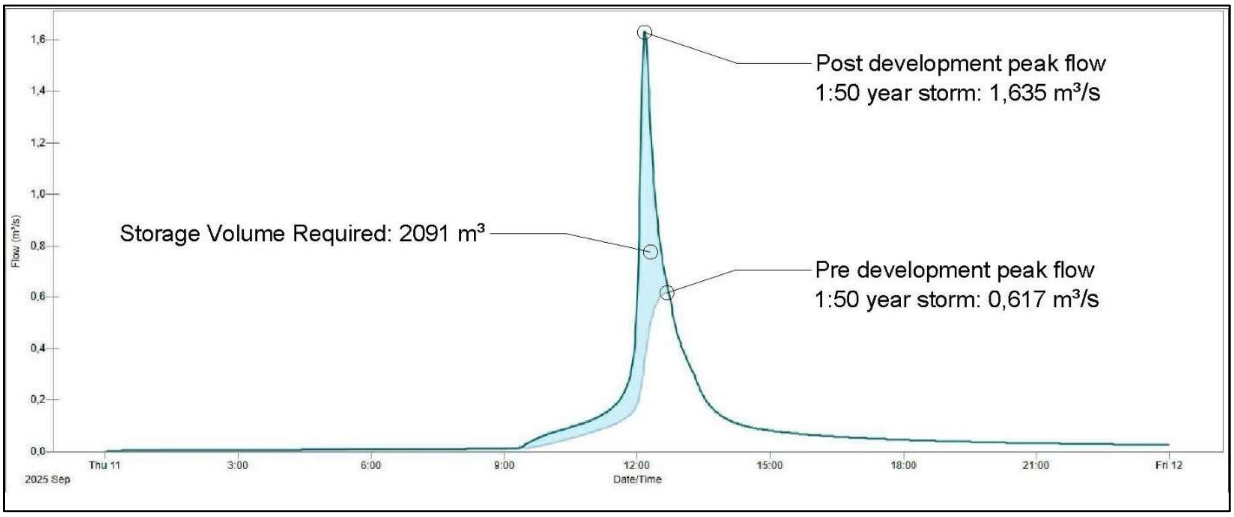


Figure 6-5 – Storage volume required

Based on the required volume and the available surface area available on Portion 4 of the development, the proposed detention pond should have the following characteristics:

Maximum depth	:	1,25 m
Surface area	:	2264 m²
Outlet	:	225 mm Ø pipe and a 375 mm Ø pipe, vertically placed;
	:	1500mm x 300mm rectangular overflow weir.

With the abovementioned characteristics, the pond will function as follows for each of the storm events:

Recurrence interval storm event	Peak outflow (m³/s)	Max. water depth of pond (m)	Min. freeboard (m)
1:2	0,005	0,060	1,19
1:5	0,105	0,290	0,96
1:10	0,196	0,540	0,71
1:20	0,365	0,730	0,52
1:50	0,607	0,920	0,33
1:100	0,852	1,030	0,22

Table 6-10 – Detention pond results

For reference, with the inclusion of the bioretention ponds as water quality controls described in *Paragraph 6.5.2.3* and the detention pond as described above, peak flow runoff from the site will be reduced to that of the pre-developed state as indicated in ***Table 6-11***:

Recurrence interval storm event	Pre-development runoff (m³/s)	Post-development runoff (m³/s)	Post-development runoff with water quality measures (m³/s)	Post-development runoff with water quality and quantity measures (m³/s)
1:2	0.006	0.567	0.073	0,005
1:5	0.082	0.916	0.300	0,105
1:10	0.193	1.212	0.737	0,196
1:20	0.344	1.562	1.032	0,365
1:50	0.617	2.079	1.379	0,607
1:100	0.890	2.483	1.635	0,852

Table 6-11 – Comparison of runoff scenarios

7 CONCLUSIONS

From the stormwater management plan for the proposed consolidation, rezoning and subdivision of Erf 998 Tergniet and Portion 5 of the Farm Zandhoogte No. 139 Mossel Bay the following can be concluded:

- That on-site water quality control measures including enhanced swales, permeable paving and bio-retention ponds be implemented to provide adequate treatment of stomwater runoff for the ½ year 24-hour storm event;

- That the proposed water quality control measures alone will not suffice to attenuate and reduce stormwater runoff from the developed site to that of the pre-developed state, especially for larger storm events. A detention pond near the low point of the site on Portion 4 is therefore proposed.

8 REFERENCES

1) Guidelines for Human Settlement Planning and Design, *Department of Housing*, 2000 CSIR

2) The Neighborhood Planning and Design Guide, *Department of Human Settlements*, 2019

3) Georgia Stormwater Management Manual, *Atlanta Regional Commission*, 2016

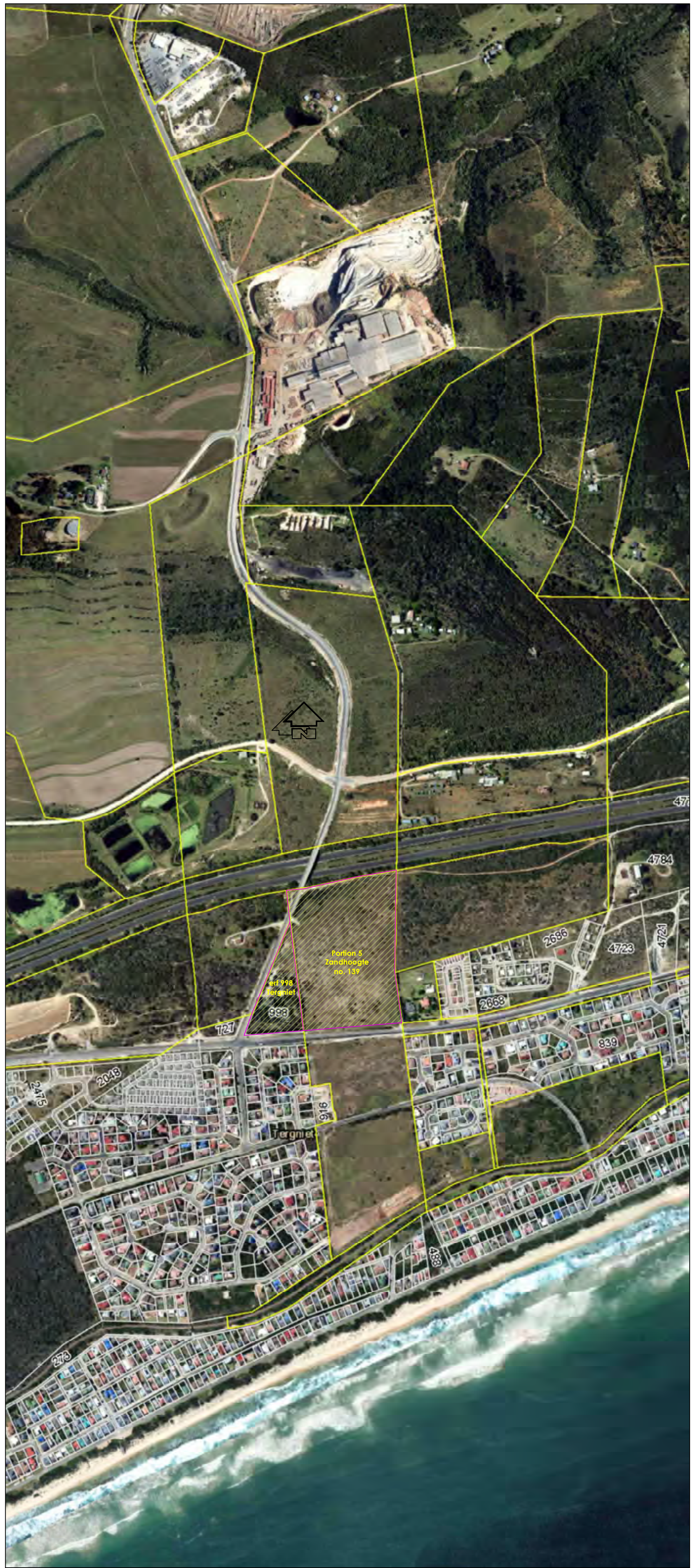
4) Drainage Manual 5th Edition, *The South African National Roads Agency Limited*, 2006

5) Guidelines for Urban Stormwater Management UTG 4, *Committee of Urban Transport Authorities*, 1999.

6) City of Cape Town Management of Urban Stormwater Impacts Policy – Version 1.1, 2009.

ANNEXURE A

SITE DEVELOPMENT PLAN



Locality Plan (n.t.s)

1 : 1000

Subdivision Plan

Consolidation of erf 998 and Portion 5 of the Farm Zandhoogte no. 139

Application for Consolidation, Rezoning and Subdivision

1. Application is made in terms of Article 15 (2)(e) of the Mossel Bay Municipality Zoning Scheme By-Law, 2021, to **consolidate Portion 5 of the Farm Zandhoogte no. 139** (figure A, B,C,D,E,F & G), **8.3676ha** in size and **Erf 998, Tergniet** (figuur G,H en I), **1.8684ha** in size.

2. Application is made in terms of Article 15(2) (a) for **rezoning** of the consolidated erf from Argiculture Zone I (AZI) to a subdivisional area to allow the following:

* **3 Business Zone I (BZI)** erven with a total size of 2.604 ha,
* **1 Business Zone IV (BZIV)** erf with a size of 0.268 ha,
* **1 Community Zone III (CZIII)** erf with a size of 0.527 ha,
* **1 Mixed Use Zone II (MZII)** erf with a size of 0.902 ha,
* **2 Open Space Zone II (OSZII)** erf with a size of 1.225 ha,
* **1 General Residential Zone II (GRZII)** erf with a size of 0.697 ha,
* **1General Residential Zone III (GRZII)** erf with a size of 0.653ha,
* **2 Transport Zone II (TZII)** one erf with a size of 1.220 ha and Remainder erf 998, Tergniet - size 0.140ha
* **1 Split zone erf** consisting of a portion **Business Zone I (BZI)** with a size of 1.0ha and a portion **Open Space Zone II (OSZII)** with a size of 1.0ha,

3. Application is made in terms of Article 15 (2) (d) for the **subdivision** of the subdivisional area into the following erven:

* **portions 1 & 9:** Business Zone I (BZI) erven,
* **portion 5:** Business Zone IV (BZIV) erf
* **portion 2:** Community Zone III (CZIII) erf
* **portion 7:** Mixed Use Zone II (MZII) erf
* **portion 4 & 11:** Open Space Zone II (OSZII) erf
* **portion 3:** General Residential Zone II (GRZII) erf
* **portion 6:** General Residential Zone III (GRZII) erf
* **portion 10 & 12:** Transport Zone II (TZII)
* **portion 8:** Split zone erf consisting of a portion Business Zone I (BZI) and a portion Open Space Zone II (OSZII)

4. Site survey:

4.1 Site survey done by WJ Marais (Reg no. S0691) Topographic and Engineer's Surveyor, 13 Cypress, Street, George.
4.2 Contour intervals: 1.0m

5. Servitudes:

5.1 Water line servitude - 5m wide northern side of the southern erf boundary (of the consolidated erf.
5.2 Sewer line servitude - 6m wide - south of the northern erf boundary (of the consolidated erf)
5.3 Sewer line servitute - 5m wide - eastern boundary of the line A, I and G.
5.4 Power line servitude - 20m wide - along the southern boundary - partly inside an partly outside the boundary line.
5.5 Power line (orange line) across the middle of the consolidated erf east to west - installed underground in the 25m road reserve.
5.6 A **40m wide no-go conservation buffer area** - portion 11.
5.7 A **5m wide right of way serwitude**, shown as **figure a,b, c& d**, to be registered over **portions 1** and a **5m wide right of way serwitude**, shown as **figure b, e, f & c**, to be registered over **portions 2** to give future access to portion 11.

Table

Zoning	Colour Notation	Size (ha)	%
Business Zone I (BZI)		3.604	35.21
Business Zone IV (BZIV)		0.268	2.62
Community Zone III (CZIII)		0.527	5.15
Mixed Zone II (MZII)		0.902	8.81
Open Space II (OSZII)		2.225	21.74
General Residential Zone II (GRZII)		0.697	6.81
General Residential Zone III (GRZIII)		0.653	6.38
Transport Zone II (TZII)		1.360	13.29
Total		10.236	100

8	portion number
0.687ha	portion size (ha)

Owner:	Signature:
	Design:
Design Centre and Associates:	Checked:
Reference no.: 2213	Scale: 1:1000 & n.t.s.
Date: 30 - 03 - 2024	Drawing no.: 2213-01
Stage:	

Amendments:

Date:	Description:
5-11-2022	* changes - erf sizes and road layout
25-01-2023	* power line serwituut - removed - change notes
20-11-2023	* changes - erf sizes and road reserves * add 10m wide conservation zone servitute * changes to all the tables and notes added
04-03-2024	* new layout - subdivision plan
30-03-2024	* changed to subdivision plan

Client:
3M Sales and Education Services CC

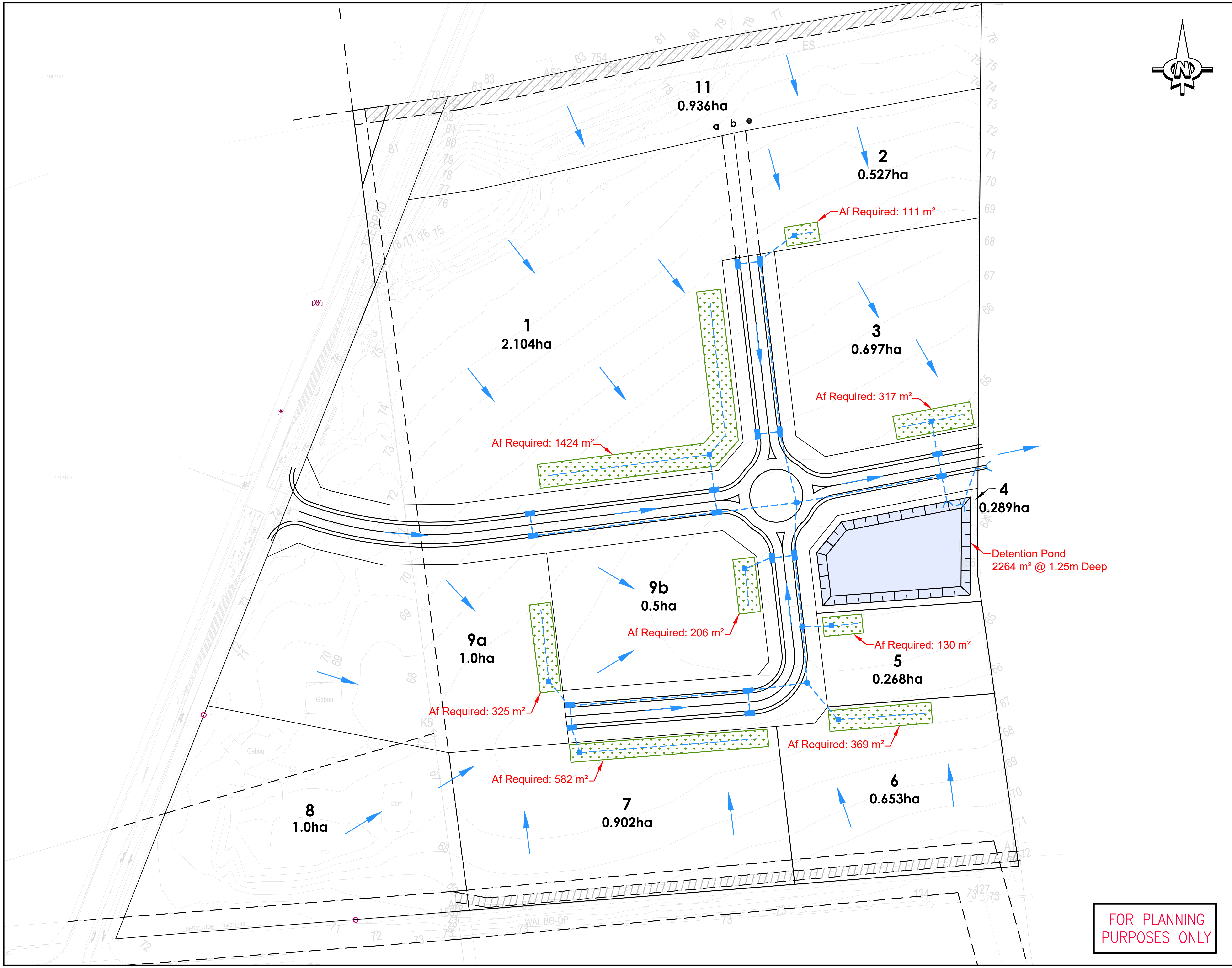
Project Description:
Proposed Consolidation of erf 998, Tergniet and Portion 5 of the Farm Zandhoogte no. 139
Rezoning and Subdivision

Project name:
Dolfin Circle

Drawing Description:
Consolidation, Rezoning and Subdivision Plan
Locality Plan

Design Centre
creating meaningful work
Design Centre and Associates
Architecture, Interior Design, Town Planning & Landscape Design
p.o. box 7 molendrift 6537 - cell no.. 083 599 2882
Email: pieterdesigncentre@gmail.com

ANNEXURE B
STORMWATER LAYOUT



LEGEND:

STORMWATER PIPE	
SUBSOIL DRAINAGE	
STORMWATER MANHOLE	
STORMWATER CATCHPIT	
BIORETENTION AREA	
INLET / OUTLET STRUCTURE	
OVERLAND FLOW DIRECTION	

URBAN ENGINEERING
CONSULTING CIVIL AND STRUCTURAL ENGINEERS
18 VARING STREET
PO BOX 9059 GEORGE
TEL : 044-874 4098

Project
CONSOLIDATION, REZONING AND SUBDIVISION OF ERF 998 TERGNIET AND PTN 5 OF THE FARM ZANDHOOGTE NO. 139, MOSSEL BAY

Drawing Title
PROPOSED STORMWATER MANAGEMENT

Scale (Paper Size)	Date
1 : 1500 (A3)	SEPT 2025
Designed: DL	Drawing Number: 22-160-01
Drawn: DL	Revision: -
Checked:	