STORMWATER MANAGEMENT PLAN
FOR ERVEN 1992, 1993, 1994 &1995
A PORTION OF ERF 1990
CAPE FARMS – DISTRICT C

PROPOSED NEW MIXED USE INDUSTRIAL DEVELOPMENT
FISANTEKRAAL – PAARL FARMS
CAPE TOWN

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DEFINITIONS AND TERMINOLOGY

ARI	- Average Recurrence Interval
Best Management Practice (BMP)	- Devices, practices or methods for removing, reducing, or retarding runoff flows, or preventing targeted stormwater runoff constituents, pollutants and contaminants from reaching receiving waters. BMPs include structural and non-structural controls and devices as well as operation and management procedures
Control Structure	- A stormwater structure design to detain, attenuate and/or treat stormwater
Detention	- To hold or contain stormwater temporarily
End-of-line	- Stormwater control structure at the most downstream point of the stormwater management system
Retention	- To hold or contain stormwater in a stormwater control structure
Forebay	- A runoff pre-treatment structure that sequesters larger sediment particles, trash, and organic debris upstream of inflow points into a stormwater control structure
Stormwater	- Water resulting from natural precipitation and/or the accumulation thereof and includes groundwater and spring water ordinarily conveyed by the stormwater system, as well as sea water within estuaries, but excludes water in a drinking water or wastewater reticulation system
'The Policy'	- City of Cape Town's Management of Stormwater Impacts Policy of 2009 Version 1.1.
WQV	- Water Quality Volume: Volume of water from a ½ year ARI, 24 hours storm event required to be stored and treated for an extended period by *The Policy* in order to improve the quality of stormwater runoff.
Wet pond	- A constructed stormwater retention basin that has a permanent pool (or micropool) of water
Permeable Paving	- Surfacing consisting of paving spaced to allow stormwater to flow through the gaps into the aggregate voids and/or soil below, reducing run-off and filtering pollutants.

1 INTRODUCTION

This Stormwater Management Plan (SWMP) report has been compiled as part of the approval process for a proposed new mixed use industrial development on Erven 1992, 1993, 1994 and 1995, Cape Farms – District C, Fisantekraal-Paarl Farms, Cape Town; (Previously CF 168 Portions 32 and 33). The development site is considered an *'Existing Development Site'* (Ref. 4) and has an area of approx. 20 ha which is intersected by the Upper Mosselbank River (Ref 8). The proposed development is required to comply with the City of Cape Town's Management of Stormwater Impacts Policy of 2009 (*The Policy*) due to the erven together being *''Existing Development Sites'* and greater than 50 000 m^2 (Ref. 4) as well as the City of Cape Town's Floodplain and River Corridor Management Policy (May 2009) (Ref 5).

The best management practices (BMP's) deemed to be the most appropriate for the proposed development are wet ponds, and on one site, a combination of wet ponds and permeable paving (PP), ranging in total volume per structure from 400 m^3 to 2022 m^3 within three 'development' or 'catchment' areas.

The proposed stormwater control structures have been sized to retain the Water Quality Volume (WQV) for the site, the volume required to improve the quality of stormwater runoff (treatment); as well as to attenuate a range of storms dictated by *The Policy,* required to control the quantity of stormwater runoff to pre-development levels. Although the wet ponds and the PP function differently, they are both designed to trap pollutants and can satisfactorily accommodate, using controlled attenuation, up to the full 50yr ARI storm run-off.

Preliminary sizing of the structures has shown that 6015m^3 of BMP structure is required (WQV and attenuation volume calculations), with approximately 6625m^3 (in the wet ponds or within the PP aggregate voids) available. The calculations are shown on the attached drawing, Stormwater Management Plan Layout (Annexure A). Emergency overflow, and storm run-off from > 50yr ARI storm events, are directed overland to the Upper Mosselbank River.

The Mosselbank River Flood Study at Groot Phesantekraal Farm undertaken by AECOM (Ref 15) has been used to provide up to date information on the flood lines affecting the site. The BMP Control Structures are located outside of the 100-year average recurrence interval (ARI) storm event flood line. It is assumed that the environmental buffer is accommodated within the 100-year ARI storm event flood line.

The proposed development satisfies both the City of Cape Town's *Management of Urban Stormwater Impacts Policy (May 2009)* as well as the *Floodplain and River Corridor Management Policy (May 2009),* using appropriately positioned and sized stormwater management structures controlling run-off from the site.

The following essential relevant information was provided for the compilation of this SWMP report:

- AECOM, 13 November 2017. *Mosselbank River Flood Study at Groot Phesantekraal Farm. Project number: 60546008* (Ref. 15)
- TV3 Town Planners, August 2025, Sub-division Plan Amended, Portions 32 & 33 of Farm 168, Fisantekraal (Ref. 16)
- Mike Paterson Assoc, Architect; August 2025, SDP and Development Schedule; Portion A; (Ref. 17)
- bpas Architects; September 2025, SDP, Portion B; (Ref.20)
- Core Geotechnical Consultants, 30 August 2023. "Project No 035-23 Fisantekraal, Erven 1992 & 1993 – Geotechnical Investigation (Ref. 18)
- BSI Consult, 16 September 2025. Proposed Industrial Developments of ERF 1990, Fisantekraal – Report on Provision of Civil Engineering Services (Ref. 19)

2 LEGISLATIVE REQUIREMENTS

The following City of Cape Town by laws and policies are appropriate to the site:

- Management of Urban Stormwater Impacts Policy of 2009 (Ref. 4)
- Floodplain and River Corridor Management Policy of 2009 (Ref. 5)
- Stormwater Management By-Law of 2005

The following related National Legislation, to be expanded upon by appropriate specialists, may be applicable:

- National Environmental Management Act (Act 107 of 1998) and associated regulations as amended in June 2010
- National Water Act (Act 36 of 1998)
- National Environmental Management Biodiversity Act (Act 10 of 2004)

3 SITE DESCRIPTION AND SURROUNDING SERVICES

The Erven are located at the intersection of three suburbs namely Cape Farms – District C, Fistantekraal Industrial and Greenville Garden City. The development site is considered an *'Existing Development Site'* (Ref.4) and has an area of approx. 20.5 ha (Ref 8, Ref 16, Annexure A)

The site is intersected by the Upper Mosselbank River and located before the confluence of the Upper Mosselbank and Mossel Bank Rivers. The developable area above the 100 yr ARI flood line is approx. 9.9 ha (53% of total Erf) on the North of the River and 3.1 ha (16% of total Erf) on the South of the River (Ref. 16, Annexure A). The Erven have a gradient of approximately 2% towards the Upper Mosselbank River (Ref. 15).

Existing services, although minimal on the largely undeveloped sites, are detailed on Drawing 1313/01C included in the Engineering Services Report by BSI Consult (Ref 19, Annexure L). Provision is made for servitudes and utility areas where bulk services are expected to be located as per the provided drawings. A 233 m long by 17 m wide servitude which connects the north and south development areas is expected to be utilized over the Upper Mosselbank River in the future when the river crossing construction commences. (Ref. 16, Annexure A).

Figure 1 overleaf shows aerial imagery of the project location and details of the locality.

Figure 1: Aerial photograph of site showing locality plan of Erven (Ref 8.)

3.1 Floodlines and Buffer Zone

AECOM SA (Pty) Ltd (AECOM), in association with Bigen Africa Services (Pty) Ltd, was appointed by Multidirect Investments 41 (Pty) Ltd to conduct a floodline investigation for a portion of the Mosselbank River system located north of Durbanville and Kraaifontein at the Groot Phesantekraal Farm. This report contains the 100 yr ARI floodline information for the reach of the river utilised for this development (Ref. 15).

The Mosselbank River consists of a number of tributaries that originate in the Durbanville and Kraaifontein areas. Downstream of urban areas, the river flows through predominantly agricultural land before joining the Diep River near the town of Klipheuwel. The watercourse channel is very shallow and is not well-defined (Ref. 15).

The development footprint on this site has been reduced to be outside of the 100yr ARI flood lines as established by AECOM (Ref. 15). The development is to be kept out of the watercourses and is unlikely to trigger the need for a Water Use License (WULA) application by virtue of its location, only by virtue of potential river crossings.

Typical buffers for industrial development near watercourses are 10 – 40 m. In general, the 100yr ARI flood line co-insides with the 40 m setback from watercourse channel and no further set-backs or buffers will be required (Ref 5). This should be confirmed through an Environmental and/or Wetland Specialist's classification of the watercourse and the wetlands on site and their associated environmental buffers (Annexure H).

3.2 Geotechnical and Geohydrological Conditions

A geotechnical investigation was carried out on Erven 1992 and 1993 by Core Geotechnical Consultants in August 2023. This investigation is representative of the entire subject site.
The general area is extensively underlain by deposits of the Tygerberg Formation (greywacke, phyllite and quartzitic sandstone). Transported alluvial deposits can be expected within the area which may have previously been a larger floodplain, given the proximity of the nearby river channel (Ref 18).

Regionally, the site is flat lying with only a slight fall towards the Upper Mossel bank River. The existing surface is variable across the site, including residential dwellings and farmstead structure and open unused land. Waterlogged and saturated surface conditions are also encountered across the site, likely caused by lenses of impermeable material.

The soil profile across the site is summarized with the following horizons encountered during the investigation:

- Uncontrolled fill from surface or below horizons of asphalt / topsoil. This is noted to occasionally extend down to depths of 2.7m in areas that have been filled to create berms or raised platforms.
- Sandy fill generally not deeper than 1.0m below surface. This material differs to the uncontrolled fill in that it comprises relatively clean sands with little to no rubble/refuse within it.
- Transported sands – grey, brown, orange, cream (or a combination of these) sands with variable silt and clay content.
- Transported clays – orange and/or light grey clays with variable sand and silt content.

Low permeability to practically impervious soils underlay the site, which would be a likely reason for observed perched water tables at varying depths. Soil permeabilities of samples range from 1 x 10^{-6} to 1 x 10^{-10} m/s. Given this in-situ soil characteristic, no lining to the permanent wet pool of the proposed wet pond structure is proposed.

Figure 2: Photo of geotechnical test pit on site showing orange clayey sand at depth.

3.3 Property Owners Association

Currently, Erf 1990 is owned by one entity, Pinetop Estates (Pty) Ltd and initially, all development conditions and requirements, including responsibility for maintenance of stormwater structures and complying with the Environmental Management Plan, will be undertaken by this entity.

However, it is the intention of the owner to sell off the subdivided portions of the property and it will be a condition of sale in every sales agreement that these responsibilities and complying with any development conditions, are ceded to the new owners.

At this point, a Property Owners Association shall be formed to generally control the development and to particularly control common areas, all servitudes, stormwater control structures on their sites and essentially to assume responsibility of the environmental processes such as the Post-Construction Environmental Management Plan (P-CEMP), the Operational Environmental Maintenance Plan (OEMP) and the Environmental Maintenance Management Plan (EMMP) incl. River Corridor EMMP.

3.4 Public Roads through the Development

There are a number of public roads planned to traverse Erf 1990. These roads shall be constructed by the developer of Erf 1990 and taken over by the City in due course.

From a stormwater point of view, it is a requirement from the City Catchment Management Department that stormwater flows from these roads, for storm scenarios up to and including the 50 yr ARI storm, shall be taken into the stormwater control structures located on private adjacent land. No stormwater shall flow directly into the Upper Mosselbank River.

Suitable servitudes shall be created, if necessary, to accommodate these flows. These servitudes shall be in favour of the City but maintenance shall be the responsibility of the Owner or POA to be formed.

The initially proposed River crossing to access Erf 1995, shall not be constructed at this stage and it is likely that development of this land shall wait until access is available from the road network to be constructed from the South.

4 COLLABORATING DOCUMENTS

4.1 Western Cape Government: Department of Environmental Affairs and Planning Development; Letter dated 12 July 2021; Amended Environmental Authorization (Annexure G)

- Original approved development proposal amended.

4.2 Water Use Registration Certificate and License (Annexure F)

- WUL dated 26 July 2018

4.3 Environmental Management Plan; Withers Environmaental Consulting; Sept 2016: (Annexure H)

- Construction Environmental Management Plan (CEMP)
- Post-Construction Environmental Management Plan (P-CEMP)
- Operational Environmental Maintenance Plan (OEMP)
- Environmental Maintenance Management Plan (EMMP) incl. River Corridor EMMP
- Construction Method Statements

4.4 Freshwater Assessment Report; Blue Science; June 2016 (Annexure I)

- Impacts and mitigating measures
- Qualitative Impact Statement regarding amended development proposal; FEN Consulting (Pty) Ltd; February 2025

4.5 Landscaping Master Plan; (Annexure M)

- Landscape Submission Package, Ptn 32 of CF 168, Fisantekraal; Veridian Consulting Landscape Architects; June 2025

4.6 Geotechnical Report; (Annexure J)

- Fisantekraal Investigation Erven 1992 & 1993; Core Geotechnical Consultants; August 2023

4.7 Civil Engineering Services Report (Annexure L)

- Erf 1990, Fisantekraal Report; BSi Consult, Civil and Structural Engineers; 16 September 2025

4.8 Development Phasing Plan to sequence Section 137 Clearances (Annexure K)

- Sub-division Plan (Amended) and Development Schedule; Portions 32 & 33 of Farm 168, Fisantekraal; TV3 Town Planners; August 2025
- SDP and Development Schedule; Portion A; Mike Paterson Assoc, Architect; August 2025
- SDP, Portion B; bpas Architects; September 2025

5 GENERAL DESIGN PHILOSOPHY AND DESCRIPTION OF PROPOSED STRUCTURES

5.1 Background and Assumptions

A model of the BMP structures has been set up using the Micro Drainage Software - a program which uses the SWMM dynamic operating engine for drainage calculations. Simulated storm scenarios, in the form of hyetographs based on rainfall data from the City of Cape Town (Ref 14), are run through a Micro Drainage Model developed by PWCE. Area, volumes and outlets for the Stormwater structures are optimized to identify the appropriate volume retained, critical duration and peak (out)flow. The storm scenarios are set by The Policy to achieve the City's objectives for attenuation and treatment of stormwater runoff.

5.2 Site Input Assumptions

The site has a fall of approx. 1% to 2% from northwest to southeast (Ref. 12).

Minimum falls are available for pipe and surface grades.

The on-site soils are assumed to have poor permeability with a co-efficient of permeability 1×10^{-6} m/s (0.0036 m/hr). The model takes into account the possibility of a high ground water table in winter and saturated soil conditions in higher order storms (Ref 15).

The City of Cape Town's 2010 Rainfall Data is used which includes a 15% factor for climate change (Ref. 14)

Rational design is carried out as per the Blue Book (Ref. 10), major assumptions are as follows (refer to Annexure C for detailed calculations):

– The site was previously farmland, with little impermeable cover. Pre-development calculations have assumed that the site is predominantly a *greenfields* site

– The site is divided into 3 catchment basins, namely Catchments 1 (Portion A), 2 (Portion B) and 3 (Erf 1995). All basins are similar in terms of ground cover, topography and permeability.

– Pre-development, runoff coefficients (C1= 0.25) assume a "permeable" soil with 50% "grass land" ground cover

– A corresponding Manning's coefficient (n= 0.08) for 80% "sparse vegetation" is assumed for pre-development conditions

Figure 3: Existing development ground cover for the site

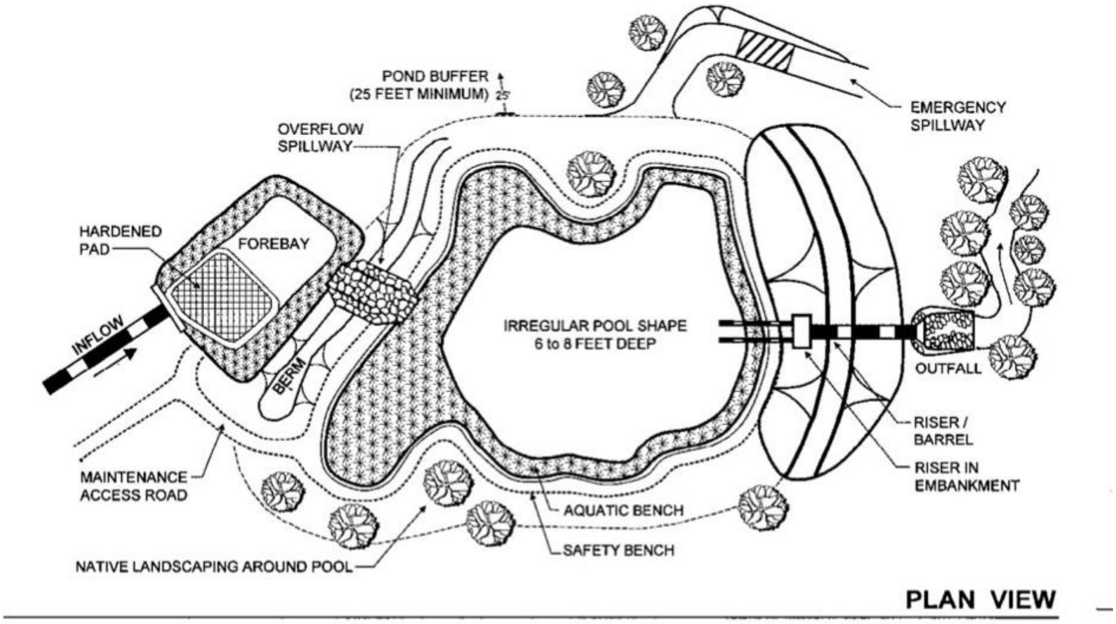
5.3 Description of Proposed Structures

Stormwater wet ponds (also referred to as retention ponds or wet extended detention ponds) are constructed stormwater retention basins that have a permanent (dead storage) pool of water throughout the year equal to the water quality volume (WQV). They can be created by excavating an existing natural depression or through the construction of embankments (Ref. 2) and are typically lined with natural or synthetic material.

In wet ponds, runoff from each storm event is detained and treated in the pool through gravitational settling and biological uptake until it is displaced by runoff from the next storm. The permanent pool also serves to protect deposited sediments from resuspension. Above the permanent pool level, additional attenuation volume (live, temporary storage) is provided for runoff quantity control for larger storm events (Ref. 2).

Figure 4: Photographs of Wet ponds (Ref. 2)

Stormwater ponds are among the most cost-effective and widely used stormwater practices. A well-designed and landscaped pond can be an aesthetic feature on a development site when planned, located, implemented, and maintained properly. However, ponds only work as designed until the design sediment volume is reached. At that point, the sediment must be removed to maintain treatment performance and aquatic re- source, channel and extreme flood protection (Ref 2). Sediment may also be flushed out of the ponds and deposited downstream if the structure is exposed to a large order storm event.



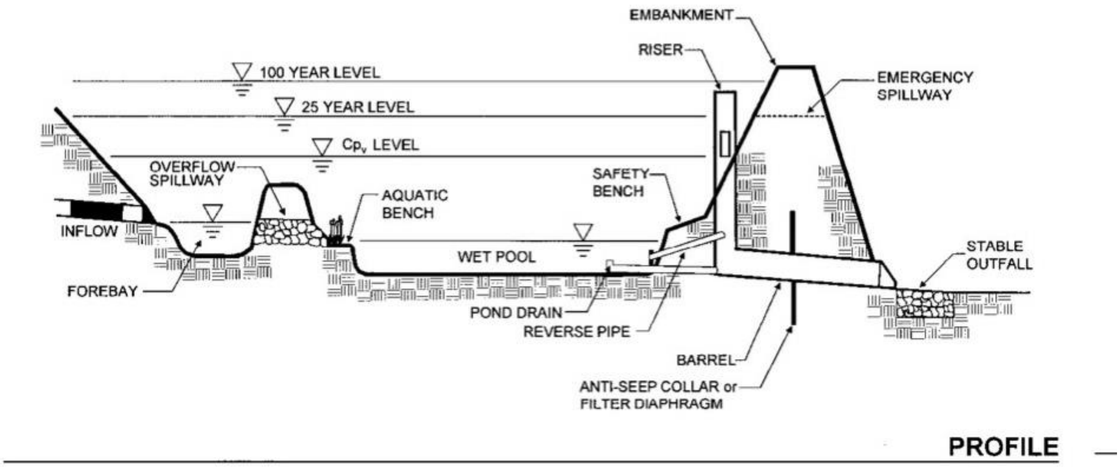


Figure 5: Illustration of a Wet pond structure, its components and function (Ref. 2)

Wet ponds treat incoming stormwater runoff by physical, biological, and chemical processes. The primary removal mechanism is gravitational settling of particulates, organic matter, metals, bacteria, and organics as stormwater runoff resides in the pond. Another mechanism for pollutant removal is uptake by algae and wetland plants in the permanent pool (WQv)—particularly of nutrients. Volatilization and chemical activity also work to break down and eliminate a number of other stormwater contaminants, such as hydrocarbons. Each pond is provided with a sediment forebay to capture larger particulate (sediment) and litter and reduce incoming runoff velocity from the runoff (Ref. 2).

Permeable paving structures typically consist of concrete pavers (wearing surface) with specifically moulded profiles to create regular, inter-dispersed void areas between paver joints. The void areas are filled with selected, rounded gravel to create a pavement surface that can infiltrate stormwater runoff but also trap particulate materials in the joints between pavers. Permeable pavers are laid on structural, compacted, crushed stone aggregate base course layers. Runoff infiltrates through the permeable paver joints into the stone base course, which acts as a storage reservoir. Permeable paver systems provide water quality (treatment) benefits in addition to attenuation and groundwater recharge (where the in-situ soil allows this). A suitably sized outlet pipe is constructed above the invert level of the lower stone layer, creating a 50 mm sacrificial layer at the base as a pollutant removal mechanism. Hydrocarbons, heavy metals, nutrients and other pollutants are removed from stormwater through settlement and anaerobic biological digestion processes in the lower basecourse layer. The permeable paving structure perimeter is lined with a geofabric as a separation layer between the stone subbase and the in-situ soils. This promotes the infiltration of treated stormwater and prevents pollutant from entering the in-situ ground (Ref. 1 & 2). A typical section through the permeable paving structure is shown below:

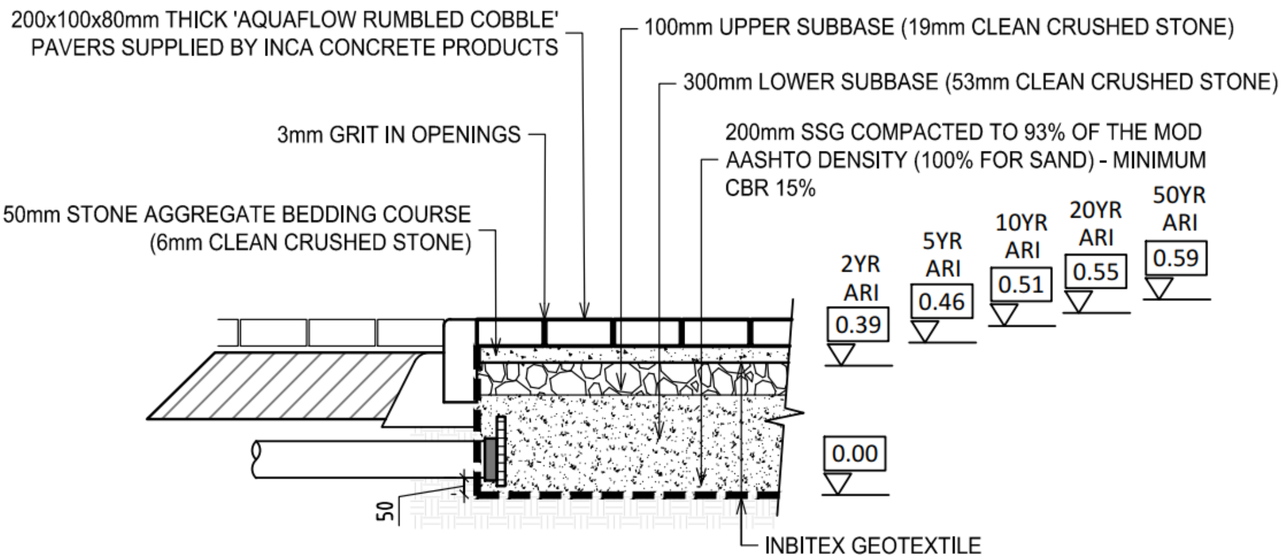


Figure 6: Typical section through Permeable Paving Structure (Refer to drawings in Annexure A). Indicated levels are the modelled critical storm depths as shown in the Tables in Section 7 (Catchment 1B)

Details of the proposed stormwater structures are summarized in the table below:

Summary Description of Stormwater Control Structures		
PERMEABLE PAVING 1A & 1B Refer to Figure 6	Description:	2.6/40 MPa Concrete permeable paver (to SANS 1058) with 3 mm grit (round granite aggregate), 50 mm deep layer of 6 mm single sized stone, 100 mm deep layer of 20 mm single sized stone and 300 mm deep layer of 53 mm single sized stone on A2 Bidim geofabric.
	Effective PP Catchment Area (Total Catchment Area):	1A: 11820 m^2 – 17% of total catchment 1B: 16400 m^2 – 23% of total catchment (68920 m^2)
	Permeable Paving Area Provided:	4100 m^2 – area ratio 1 : 3
	Total Permeable Paving Depth:	0.53 m
	Storage Volume Provided:	502 m^2
	Permeable Paving Percolation Rate:	4500 mm/hr
	Modelled Base Infiltration Co-eff.:	Base = 0.036 mm/hr (fair permeability – conservative)
	Outflow:	• Fin-drains with 110 mm ø outlet @ 1:100 fall min. to stormwater headwall, outfalling to Mosselbank River
	Emergency Overflow (> 50 ARI storms):	Overland toward Mosselbank River
POND 1A & 1B	Description:	Wet pond with vertical walls of gabion boxes. Wet pool to be lined, in the absence of in-situ clay.
	Bottom Area:	526 m^2
	Permanent Pool Depth:	0.7m
	Attenuation Storage Depth:	1.3m
	Outflow:	Outflow manhole with 160mm Ø orifice
	Emergency Overflow (> 50 ARI storms):	Overland toward Mosselbank River
POND 2	Description:	Wet pond with 1:3 side slopes and 1.5m aquatic bench at permanent pool surface level. Wet pool to be lined, in the absence of in-situ clay.
	Bottom Area:	1743
	Permanent Pool Depth:	0.7m
	Attenuation Storage Depth:	1m
	Permanent Pool Volume:	559 m^3
	Attenuation Volume:	1463 m^3
	Outflow:	Outflow manhole with 160mm Ø orifice above permanent pool and 200mm Ø 0.5m above
	Emergency Overflow (> 50 ARI storms):	Overland toward Mosselbank River
POND 3	Description:	Wet pond with 1:3 side slopes and 1.5m aquatic bench at permanent pool surface level. Wet pool to be lined, in the absence of in-situ clay.
	Bottom Area:	1362
	Permanent Pool Depth:	0.7m
	Attenuation Storage Depth:	1m
	Permanent Pool Volume:	448 m^3
	Attenuation Volume:	1150 m^3
	Outflow:	Outflow manhole with 160mm Ø orifice above permanent pool and 200mm Ø 0.5m above
	Emergency Overflow (> 50 ARI storms):	Overland toward Mosselbank River

5.4 Description of the proposed stormwater system

The project comprises three development areas, referred to below as catchments 1 ,2 and 3. Catchments 1 and 2 are located north of the Upper Mosselbank River and Catchment 3 in the south. Mixed-use/Light industrial development is intended for each development area. Runoff from roofs and hardened areas will be conveyed by means of gutters and channels and collected by a system of catchpits. Runoff will then be conveyed through the underground reticulation system to outfall into proposed permeable paving and wet ponds that serve the function of treating and attenuating runoff to the standards specified by The Policy. Storms greater than the 5yr ARI storm, will flow overland via the internal road system.

Figure 7 below, extracted from Annexure A, shows the wet pond sizes and proposed positions, along with the permeable paving area, in the three development areas.

Figure 7: Extract from Annexure A drawing showing Wet pond sizes and proposed locations on the Erven

Discharge from each pond will be via orifices into outflow risers, located in the pond. Orifice size and elevation have been modelled using the Micro Drainage software, to ensure that outflow is less than the calculated pre-development stormwater flows. A 160mmØ orifice at the invert of the attenuation storage, in combination with a 200mmØ 0.5m above the permanent pool controls the outflow at the required rates, as shown in Figure 8 below.

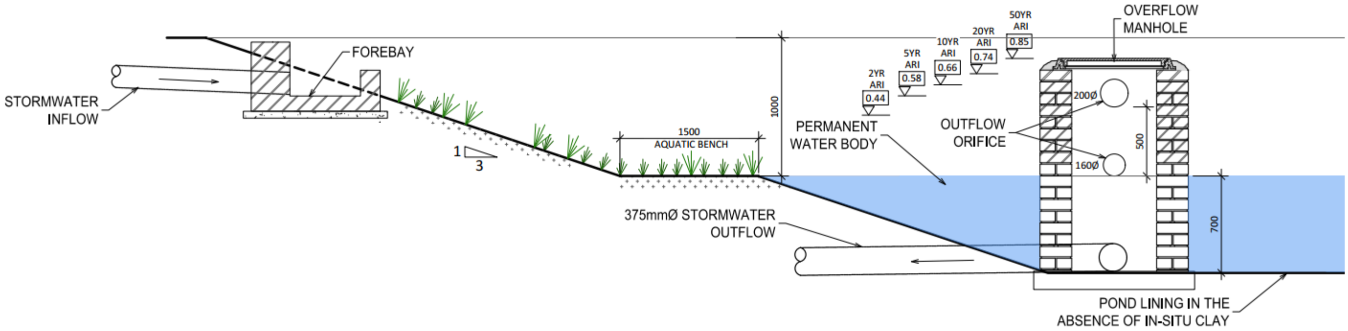


Figure 8: Typical cross section of proposed Wet Pond in Catchment 2 and outflow structures

6 CoCT STORMWATER MANAGEMENT IMPACT POLICY OBJECTIVES

The Development's stormwater controls are required to satisfy the SuDS objectives requirements in terms of the City of Cape Town Management of Urban Stormwater Impacts Policy. These objectives are attached as Annexure B and summarized below:

Table 1: CoCT Stormwater Management Impacts Policy Objectives (Ref 4)

Improve Quality Runoff		
	Description	Storm Scenario as per Policy
Objective 1 *(refer to section 6.1)*	Pollutant Reduction Targets: 80% Total Suspended Solids (TSS) 45% Total Phosphorous (TP)	Treatment of the ½ year ARI, 24hr duration storm event (water quality volume)

Quantity and Rate of Runoff		
	Description	Storm Scenario as per Policy
Objective 2 *(refer to section 6.2)*	Protect Stability of downstream channels	24 hour extended detention of the 1-year ARI, 24hr duration storm event
Objective 3 *(refer to section 6.3)*	Protect downstream properties from fairly frequent nuisance floods	2, 5 and 10-year ARI Peak Flow reduced to Pre-Development Level
Objective 4 *(refer to section 6.4)*	Protect floodplain developments and floodplains from adverse impacts of extreme floods	20 and 50-year ARI Peak Flow reduced to existing development levels.

7 RESULTS AND CALCULATIONS

7.1 Objective 1: Improve Quality Runoff (pollutant reduction)

7.1.1 WQV Calculation

Water Quality Volume calculations to meet the requirements of *The Policy* are in accordance with the Georgia Stormwater Management Manual Volume 2 (Ref. 2). The CoCT Rainfall Data spreadsheet (Ref. 14) was used to extrapolate the half year ARI storm rainfall depth, per the data and trendline shown in the graph below.

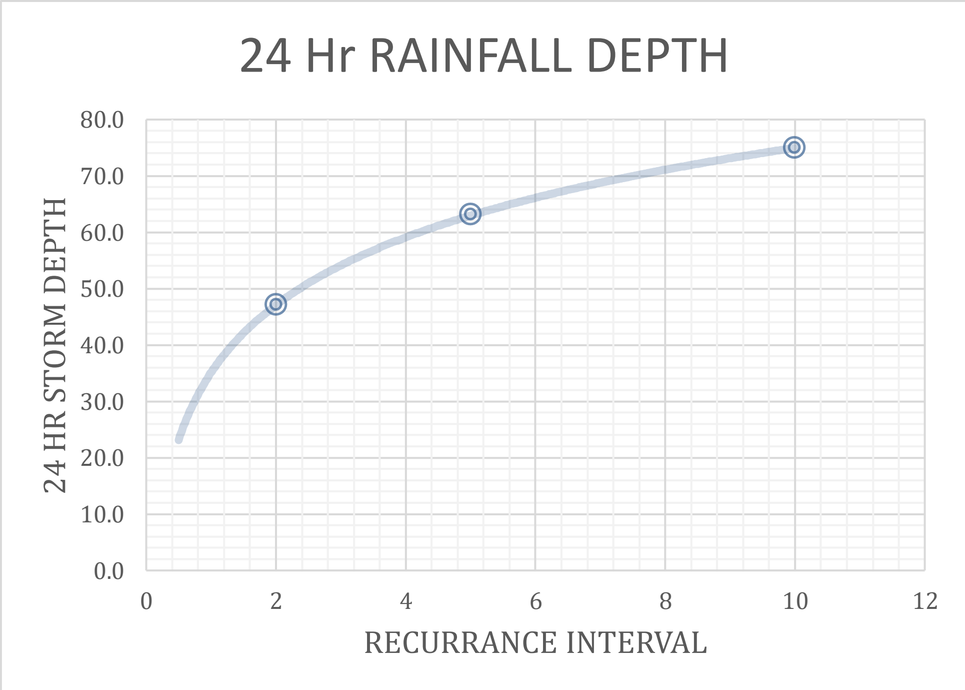


Table 2 below shows the major site assumption made to calculate WQV for the Wet ponds.

Table 2: Summary Water Quality Volume Calculation (Ref. 2)

Assumptions	
Site Area (m^2)	As per Table 3 below
½ yr Rainfall Intensity (mm/hr) [CoCT Rainfall Data 1992]	0.94
P½yr, 24 hrs (mm)	22.5
Coverage (I) (%)	72% (typical Industrial Area)
Calculated Runoff Co-efficient (Rv = 0.05 + 0.009*I)	0.70
WQv Required = P x Rv x Area (m^3)	As per Table 3 below

Table 3 below shows a summary of the calculated WQv required for each of the catchment areas of the site and the estimated total volume (WQv and attenuation volume) required to attenuate the up to 10-year ARI and up to 50-year ARI storm events for each wet pond.

Table 3: Summary of WQV and BMP Volumes Provided for Each Catchment Area in the Development

WQv Calculation							
ERF	(Catchment) **Area**	**Size** (ha)	**Calculated WQv** (m^3)	**BMP**	**WQv Provided** (m^3)	**Total Attenuation Volume of BMP's Provided** (m^3)	**Provided Footprint (Area) of Wet pond** (m^2)
1992 & 1993	1	6.892	986	POND 1A POND 1B PP 1A PP 1B	1638	2268	8418
1994	2	3.811	545	POND 2	559	1463	1743
1995	3	3.104	444	POND 3	448	1149	1362
TOTAL			1975		2645	4880*	

* In a PP Control Structure, the WQV and the Attenuation Volume occupy the same physical space.

The Policy's WQv objectives are met as the volume provided in proposed BMP structures' volume is greater than the WQv.

7.1.2 Treatment

All of the stormwater pond design variants are presumed to remove 80% of the Total Suspended Solids and 45% of Total Phosphorous load in typical urban post-development runoff when sized, designed, constructed, and maintained in accordance with the recommended specifications. Undersized or poorly designed ponds can reduce TSS removal performance, as can excess sediment (Ref. 2).

The quality policy objectives of *The Policy* can therefore be met for the proposed well-designed and constructed BMP structures as shown in Table 4 below, as per the median pollutant removal efficiencies in Annexure E.

Table 4: CoCT Policy Objective 1: Treatment (pollutant reduction) (Ref. 4)

	Total Suspended Solids (TSS)	Total Phosphorous (TP)
Required		
Policy Requirements	80%	45%
Provided		
Wet Pond	45-90%	20-70%
Permeable Pavements	60-95%	50-80%

7.2 Objective 2: Protect Stability of Downstream Channels (1-year 24hr ARI)

Table 5: CoCT Policy Objective 2 (Ref 4)

Quantity and Rate of Runoff		
	Description	Storm Scenario
Objective 2	Protect Stability of downstream channels	24 hour extended detention of the 1-year ARI, 24hr duration storm event

7.2.1 Calculations

Refer to Annexure D for summary software output.

7.2.2 Results

The BMPs recommended for the site consist of wet ponds and permeable paving. Analysis of the 1yr 24 hr ARI storm as is shown below:

Table 6: Results for 24 hour extended detention of 1 year 24 hour ARI

Control Structure	**Storm Scenario**	**Peak Outflow Pipe Discharge** (L/s)	**Max. Peak Volume** (m^3)	**Actual Attenuation Volume of Control Structure** (m^3)	**Detention (min)**	**Max. Depth (m)**
Permeable Paving 1A	1yr ARI, 24hr	4.6	42.3	400	**>1440**	0.18
Permeable Paving 1B	1yr ARI, 24hr	6.1	74.1	503	**>1440**	0.25
Pond 1 A	1yr ARI, 24hr	21.2	124.8	947	**>1440**	0.24
Pond 1 B	1yr ARI, 24hr	21.2	124.8	947	**>1440**	0.24
Pond 2	1yr ARI, 24hr	27.6	442.3	1463	**>1440**	0.35
Pond 3	1yr ARI, 24hr	25.1	9299.6	1149	**>1440**	0.30

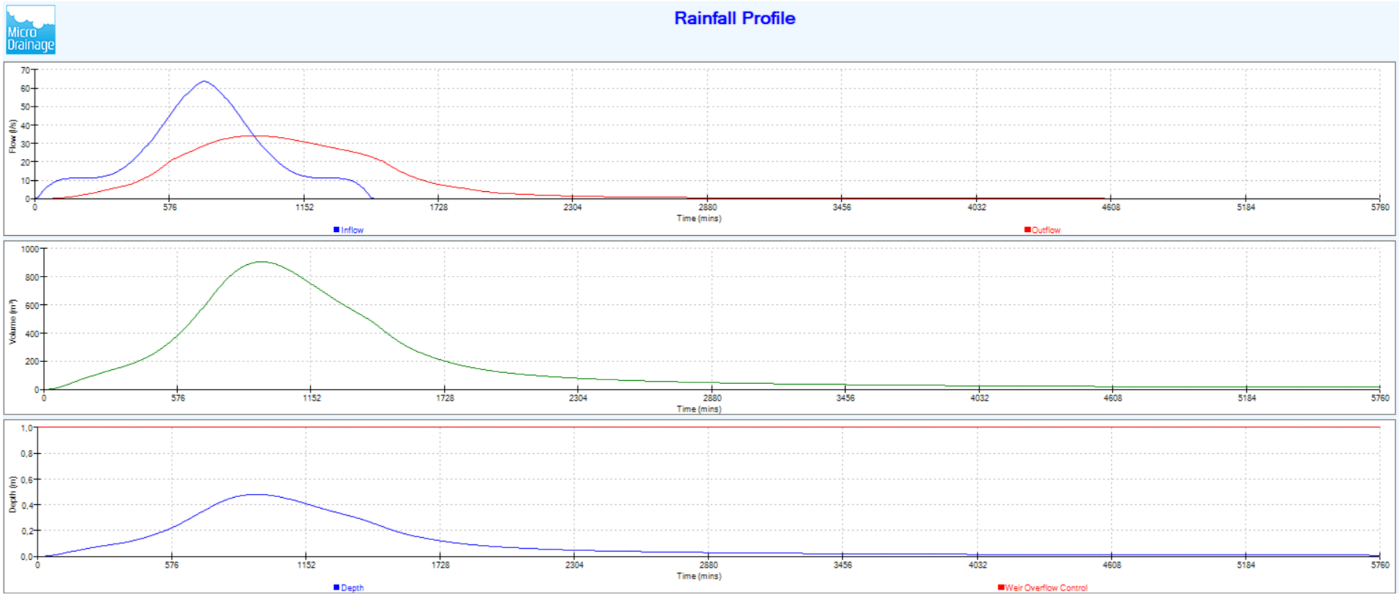


Figure 9: Micro Drainage software extract showing the peak flow (red line top), volume (green line middle) and depth (blue line bottom) (y-axis) vs. extended detention (x-axis) of 1yr ARI, 24hr storm for wet pond 2

7.2.3 Conclusion

For the 1yr ARI, 24hr Duration storm, the maximum volume required within the control structures can be accommodated within the volume provided in the control structures. This is sufficient to attenuate the 1yr ARI, 24hr storm scenario.
The Policy’s requirements are met as the extended detention of the 1yr ARI, 24hr duration storm is greater than 24 hours.

7.3 Objective 3: Protect Downstream Properties (up to 10-year ARI)

Table 7: CoCT Policy Objective 3: Protect Downstream Properties (up to 10 year ARI) (Ref 4)

Quantity and Rate of Runoff		
	Description	Storm Scenario
Objective 3	Protect downstream properties from fairly frequent nuisance floods	2, 5 and 10-year ARI Peak Flow reduced to Pre-Development levels

7.3.1 Calculations

Refer to Calculations of Pre-development Peak Flows attached as Annexure C. Refer to Micro Drainage printout attached as Annexure D.

7.3.2 Results

Performance of the BMP's with simulated 2, 5 and 10 ARI peak storms is summarized in the table below. A visual representation of the critical storm levels within the Permeable Pavement and Wet Pond 2 structure is shown in Figure 6 and 8 respectively, of section 5.3.

Table 8: Summary peak flows for up to 10-year ARI

Storm Scenario	**Control Structure** (Catchment Area)	**Calculated Critical Storm Duration** (min)	**Calculated Max. Depth *** (m)	**Calculated Peak Flow Off Site** (L/s)	**Allowable Pre-development Peak Flow** (l/s)
2yr ARI	Permeable Paving 1A	180	0.29	7.1	**88.8**
	Permeable Paving 1B	240	0.39	8.4	
	Pond 1A	120	0.47	33.3	
	Pond 1B	120	0.47	33.3	
	Pond 2	360	0.44	32.0	**58.6**
	Pond 3	240	0.42	31.1	**41.8**
5yr ARI	Permeable Paving 1A	180	0.36	8.1	**140.9**
	Permeable Paving 1B	240	0.46	9.5	
	Pond 1A	120	0.64	40.0	
	Pond 1B	120	0.64	40.0	
	Pond 2	360	0.58	42.0	**91.5**
	Pond 3	360	0.56	39.3	**66.0**
10yr ARI	Permeable Paving 1A	240	0.40	8.7	**176.2**
	Permeable Paving 1B	240	0.51	10.2	
	Pond 1A	120	0.78	44.7	
	Pond 1B	120	0.78	44.7	
	Pond 2	360	0.66	56.1	**115.5**
	Pond 3	360	0.64	52.4	**82.3**

7.3.3 Conclusion

The Policy's requirements are met as the peak flows from the 2, 5 yr and 10 ARI storms do not exceed the Pre-development Peak Flow calculated for this site.
Refer to Annexure D for selected summary software outputs.

7.4 Objective 4: Protect Downstream Properties (up to 50-year ARI)

Table 9: CoCT Policy Objective 4: Peak flows for up to 50-year ARI

Quantity and Rate of Runoff		
	Description	Storm Scenario
Objective 4	Protect floodplain developments and floodplains from adverse impacts of extreme floods	20 and 50-year ARI Peak Flow reduced to existing development levels.

7.4.1 Calculations

Refer to Calculations of Existing Development Peak Flow attached as Annexure C. Refer to Micro Drainage printout attached as Annexure D.

7.4.2 Results

Performance of the BMP's with simulated 20 and 50 ARI peak storms is summarized in the table below. A visual representation of the critical storm levels within the permeable pavement and dry pond structure is shown in Figure 6 and 8 respectively, of section 5.3.

Table 10: Results of Peak Flows for up to 50-year ARI

Storm Scenario	**Control Structure** (Catchment Area)	**Calculated Critical Storm Duration** (min)	**Calculated Max. Depth *** (m)	**Calculated Peak Flow from BMP** (L/s)	**Allowable Pre-development Peak Flow** (l/s)
20yr ARI	Permeable Paving 1A	180	0.49	9.3	**218.2**
	Permeable Paving 1B	180	0.55	10.7 (OVERFLOW = 4.2)	
	Pond 1A	120	0.92	49.1	
	Pond 1B	120	0.92	49.1	
	Pond 2	240	0.74	70.6	**143.6**
	Pond 3	240	0.72	67.4	**101.1**
50yr ARI	Permeable Paving 1A	240	0.50	10.0	**290.9**
	Permeable Paving 1B	240	0.59	11.2 (OVERFLOW = 27.1)	
	Pond 1A	120	1.14	54.9	
	Pond 1B	120	1.14	54.9	
	Pond 2	340	0.85	88.9	**194.3**
	Pond 3	240	0.83	85.7	**137.7**

7.4.3 Conclusion

The Policy's requirements are met as peak flows from the 20 and 50 ARI storms are below Existing/Pre-Development Peak Flows calculated for this site.

Weir overflows are provided as emergency overland escapes and are routed directly toward the Mosselbank River Corridor. Outfall pipes from the ponds and PP, as well as constructed overflow channels, shall terminate at the 100yr floodline. Details of the pipes, spillways, weirs, channels, energy breakers and headwalls shall be developed at Final Civilworks Design Stage.
The >50 yr ARI storm scenarios are therefore well considered in the stormwater control system.

Refer to Annexure D for selected summary software outputs.

7.5 Calculations summary

Table 11 Below summarizes calculated and modelled peak flows for the storm scenarios of varying recurrence intervals and lists the attenuation volumes achieved by the BMP.

Table 11: Summary of Pre and Post Development Peak Flows and Attenuation Volumes

Storm Scenario (Annual Return Interval)	**Basin**	**Post Development Peak Flow** (L/s)	**Pre-Development Peak Flow** (L/s)	**Post Attenuation Peak Flow** (L/s)	**Attenuation Volume** (m^3)
2yr ARI	CATCHMENT 1	523.9	88.8	82.1	774.4
	CATCHMENT 2	237.1	58.6	32.0	568.2
	CATCHMENT 3	228.8	41.8	31.1	427.2
5yr ARI	CATCHMENT 1	827.3	140.9	97.6	1084.6
	CATCHMENT 2	355.2	91.5	42.0	775.4
	CATCHMENT 3	350.6	66.0	39.3	586.8
10yr ARI	CATCHMENT 1	982.6	176.2	108.3	1327.1
	CATCHMENT 2	440.6	115.5	56.1	903.1
	CATCHMENT 3	442.1	82.3	52.4	684.9
20yr ARI	CATCHMENT 1	1240.4	222.4	122.4	1573.2
	CATCHMENT 2	535.4	143.6	70.6	1014.6
	CATCHMENT 3	547.8	101.1	67.4	779.8
50yr ARI	CATCHMENT 1	1540.7	290.9	148.1	1922.4
	CATCHMENT 2	700.2	194.3	88.9	1203.8
	CATCHMENT 3	680.2	137.7	85.7	911.2

8 MAINTENANCE

A Stormwater Maintenance Plan for each of the structures must be implemented to ensure the long-term functionality of the system as a whole. These maintenance plans shall be implemented by the Owner of the development initially, ceded to a future Property Owner Association.

In general maintenance consists of:

- Maintaining regular inspections of the outflow manholes
- Maintaining regular visual inspections of the stormwater control structure and its performance (drainage time)
- Vegetation must not become overgrown, especially invasive species, which might impeded emergency overflow paths in extreme storm events

Refer Annexure N for typical Maintenance Schedules for the proposed BMP Control Structures

9 MASTER LANDSCAPE PLANNING

A Landscape Master Plan has been completed for Ptn 32 of Farm 168 and is attached as Annexure M. It sets the vegetation recommendations and requirements for the entire site and in particular, it takes into account the vegetation types required per the City's Landscape and Indigenous Plant Species Guidelines for SUDS structures (Ref 7).

10 CONCLUSION

This SWMP proposes various wet ponds and permeable paving areas to attenuate and treat stormwater run-off. The required volumes are easily accommodated in the control structures proposed.

A total stormwater control structure volume of 6625m^3 is provided with a total required volume of 6015 m^3 The analysis in this report shows that the required Water Quality Volume (WQV) required for run-off treatment, together with the volumes required to attenuate and reduce the site's peak flows to pre-development levels, can be easily accommodated. Should maintenance not be completed timeously, on the structures and/or the control systems fail temporarily, or in higher order storm scenarios, emergency overflow can be satisfactorily directed overland toward the Upper Mosselbank River.

Tables 12 and 13 below summarize the designed BMP structures.

Table 12: Summary of wet pond volumes proposed

	PERMANENT POOL				ATTENUATION VOLUME				
BMP	TOP AREA	BOTTOM AREA	DEPTH (m)	DEAD STORAGE (m^3)	TOP AREA	BOTTOM AREA	DEPTH (m)	STORAGE (m^3)	TOTAL VOL. (m^3)
POND 1A	526	526	0.7	368.20	526	526	1.3	683.00	1052.00
POND 1B	526	526	0.7	368.20	526	526	1.3	683.00	1052.00
POND 2	943	653	0.7	558.60	1743	1183	1	1463.00	2021.60
POND 3	753	527	0.7	448.00	1362	937	1	1149.50	1597.50
TOTAL				1743				3978.5	5723.1

Table 13: Summary of permeable paving volumes provided

	AREA	STONE DEPTH	POROSITY	STORAGE
PERMEABLE PAVING 1A	3266	0.35	0.35	400.09
PERMEABLE PAVING 1B	4100	0.35	0.35	502.25
TOTAL				902.34

Critical storm depths for up to the 50 ARI simulated storm are shown to be contained within the storage volume of the structures, with discharges not exceeding pre-development levels. Minor overflows from the structures occur in the higher order storms, but the overall post-development outflows into the receiving watercourse, in all storm scenarios, do not exceed the pre- or existing-development condition.

These best management practice structures create a stormwater management system that is appropriate to the site and satisfies the Policy's objectives for controlling run-off at source, by treatment and attenuation, prior to the run-off reaching downstream watercourses.

PM WIUM Pr.Eng

PETER WIUM CONSULTING ENGINEERS

17/07/2025 Rev 1
22/09/2025 Rev 2

11 REFERENCES

1. Armitage Prof. A. May 2013. *The South African Guidelines for Sustainable Drainage Systems (SuDS).* Water Research Commission Report No. TT558/13
2. Atlanta Regional Commission (U.S. Environmental Protection Agency). 2016 *Georgia Stormwater Management Manual*, *Vol 2 Technical Handbook*
3. Australian Water Quality Document (adopted by City of Cape Town). *Adjustment of Water Quality Volume (WQV) for Single Predominant Land Surface*
4. City of Cape Town Roads and Stormwater Department, Catchment Stormwater and River Management Branch. 27 May 2009 *Management of Urban Stormwater Impacts Policy* (the Policy). Ver 1.1 C 58/05/09
5. City of Cape Town, Roads and Stormwater Department, Catchment Stormwater and River Management Branch 27 May 2009 *Floodplain and River Corridor Management Policy.* Ver 2.1 C 58/05/09
6. City of Cape Town, City Engineers Department. August 1992 *Rainfall Intensity-Duration-Frequency Curves*
7. City of Cape Town. 28 February 2011 *SUSTAINABLE URBAN DRAINAGE SYSTEMS Landscape and Indigenous Plant Species Guideline* Ver. 1.0
8. City of Cape Town https://citymaps.capetown.gov.za/EGISViewer/ (June 2021)
9. CSIR Building and Construction Technology (Department of Housing). 2005 *Guidelines for Human Settlement Planning and Design: Volume 2* (Red Book)
10. Department of Community Development. 1983 *The Guidelines for the Provision of Engineering Services for Residential Townships (*Blue Book)
11. Debo TN. & Reese AJ. 2003 *Municipal Stormwater Management*
12. Google Maps. Accessed June 2021 and August 2025
13. Milandri SG., Winter KJ., Chimphango SBM., Armitage NP., Mbui DN,, Jackson GE. and Liebau V. October 2012 The performance of plant species in removing nutrients from stormwater in biofiltration systems in Cape Town
14. Smithers JC. August 2010 The Estimation of Design Rainfall for Cape Town Metro Area ,ACRUcons Report 64
15. AECOM, 13 November 2017. Mosselbank River Flood Study at Groot Phesantekraal Farm. Project number: 60546008
16. TV3 Town Planners; Proposed Sub-division Plan Amendment, Portions 32 and 33 of Farm 168, Fisantekraal (now Erven 1990 and 1991, Fisantekraal); (May 2025)
17. Mike Paterson Associates cc; Drawing No. 2152 E – 21 Proposed Industrial Development on Erven 1992, 1993, 1994 and 1995 A portion of Erf 1990, Fisantekraal; Site Development Plan, (Portion A of Amended Sub-division, Ref.16); (August 2025)
18. Core Geotechnical Consultants, 30 August 2023. “Project No 035-23 Fisantekraal, Erven 1992 & 1993 – Geotechnical Investigation
19. BSI Consult, 16 September 2025. Proposed Industrial Developments of ERF 1990, Fisantekraal – Report on Provision of Civil Engineering Services
20. bpas Architects; Site Development Plan (Portion B of Amended Sub-division Ref.16); (May 2025)

12 ANNEXURE A: DRAWINGS

Locality Plan

Erven 1992,1993.1994 and 1995, a Portion of Erf 1990, Fisantekraal

Stormwater Management Plan Layout

Erven 1992,1993.1994 and 1995, a Portion of Erf 1990, Fisantekraal

Proposed Sub-division Plan Amendment

Portion 32 of Farm 168 (Erf 1990), Fisantekraal

Site Development Plan

Erven 1992, 1993, 1997, and 1998, A portion of Erf 1990, Fisantekraal

Portion A of Sub-division Plan Amendment

Site Development Plan

Erf 2006, a Portion of Erf 1990, Fisantekraal

Portion B & C of Sub-division Plan Amendment

13 ANNEXURE B: CITY OF CAPE TOWN: STORMWATER POLICY OBJECTIVES

<table>
<tr><th colspan="2"><u>SUDS</u>

<u>OBJECTIVES</u></th><th>Greenfield Developments

and

Brownfield and Existing Development Sites located in catchments of sensitive receiving water systems</th><th>Brownfield and Existing Development Sites

> 50 000 m^2</th><th>Brownfield and Existing Development Sites

4000 m^2 – 50 000 m^2

and

Total impervious area (exist & new) > 15% of site</th><th>Brownfield and Existing Development Sites

< 4000 m^2

and

Total impervious area (exist and new) > 600m^2</th></tr>
<tr><td rowspan="4"><u>CONTROL QUANTITY AND RATE OF RUNOFF</u></td><td>Protect the stability of downstream channels</td><td>24 hour extended detention of the1-year RI, 24h storm event</td><td>24 hour extended detention of the1-year RI, 24h storm event</td><td rowspan="3">Combination of on-site and regional off-site measures to achieve requirements as for development sites >50 000m^2</td><td rowspan="3">On-site runoff control measures not required but encouraged where practicable

Regional off-site runoff control measures to be provided to achieve requirements as for development sites > 50 000m^2</td></tr>
<tr><td>Protect downstream properties from fairly frequent nuisance floods</td><td>Up to 10-year RI peak flow reduced to pre-development level</td><td>Up to 10-year RI peak flow reduced to pre-development level</td></tr>
<tr><td rowspan="2">Protect floodplain developments and floodplains from adverse impacts of extreme floods</td><td>Up to 50-year RI peak flow reduced to existing development levels. Evaluate the effects of the 100-year RI storm event on the stormwater management system, adjacent property, and downstream facilities and property.
Manage the impacts through detention controls and / or floodplain management</td><td>Up to 50-year RI peak flow reduced to existing development levels. Evaluate the effects of the 100-year RI storm event on the stormwater management system, adjacent property, and downstream facilities and property.
Manage the impacts through detention controls and / or floodplain management</td></tr>
<tr><td colspan="4">Developments adjacent to floodplains must adhere to the requirements of the Floodplain and River Corridor Management Policy</td></tr>
<tr><td colspan="2"><u>ENCOURAGE NATURAL GROUNDWATER RECHARGE</u></td><td colspan="4">Where appropriate, site specific requirements to be considered in consultation with Council</td></tr>
</table>

<table>
<tr><th><u>SUDS</u>

<u>OBJECTIVES</u></th><th>Greenfield Developments

and

Brownfield and Existing Development Sites located in catchments of sensitive receiving water systems</th><th>Brownfield and Existing Development Sites

> 50 000 m^2</th><th>Brownfield and Existing Development Sites

4000 m^2 – 50 000 m^2

and

Total impervious area (exist & new) > 15% of site</th><th>Brownfield and Existing Development Sites

< 4000 m^2

and

Total impervious area (exist and new) > 600m^2</th></tr>
<tr><td rowspan="3"><u>IMPROVE QUALITY OF RUNOFF</u>

Remove pollutants through combination of reducing and/or disconnecting impervious areas, and the use of BMPs which infiltrate or capture and treat stormwater runoff</td><td colspan="4">Design storm event for water quality treatment:
1/2-year RI, 24 h storm</td></tr>
<tr><td>Pollutant removal target:

Reduction of post-development annual stormwater pollutant load discharged from dev. site:

SS & TP - reduce to undeveloped catchment levels,
<u>or</u>
SS - 80% reduction
TP - 45% reduction

whichever requires higher level of treatment</td><td>Pollutant removal target:

On-site reduction of post-development annual stormwater pollutant load discharged from developmenrt site:

SS - 80% reduction
TP - 45% reduction</td><td>Pollutant removal target:

Combination of on-site and regional off-site measures to achieve target reductions:

SS - 80% reduction
TP - 45% reduction</td><td>On-site stormwater treatment not required but encouraged where practicable.

Regional off-site treatment measures to achieve target reductions:

SS - 80% reduction
TP - 45% reduction</td></tr>
<tr><td colspan="4">All developments are required to trap litter, oil, grease at source</td></tr>
</table>

14 ANNEXURE C: CALCULATIONS

14.1 WQV Calculation

14.2 Rational Method Calculation:

Pre-Development Peak Flows

- **Catchment 1**
- **Catchment 2**
- **Catchment 3**

Post Development Peak Flows

- **Catchment 1**
- **Catchment 2**
- **Catchment 3**

15 ANNEXURE D: Selected Micro Drainage Software Print Outs

Summary outputs for the 1yr 1440 min ARI storm (Objective 1) and up to the 50yr storm for critical storm durations are inserted into the report below. All data is available from PWCE upon request.

-	CATCHMENT 1	POND 1A/1B
		PERMEABLE PAVING (PP) 1A PERMEABLE PAVING (PP) 1B
-	CATCHMENT 2:	POND 2
-	CATCHMENT 3:	POND 3

Micro Drainage Terminology:

- 'Max Depth' = depth of stormwater within pond structure (max allowable depth = 1.0 m)
- 'Max Infiltration' = the infiltration and flow into the soil (permeability assumed to be poor)
- 'Max Control' = stormwater outflow through 160+200 diameter orifices
- 'Max Overflow' = the flow of stormwater over weir
- 'Max Sum Outflow" = Sum of all outflows including infiltration, control and overflow. Infiltration ignored as contributing to stormwater flow off site.
- Status – indicates 'Flood risk' when water level is within 0.3 m of the cover level of the control structure (ignore).

CATCHMENT 1

PONDS 1A AND 1B

(PONDS AND SUB-CATCHMENTS OF EQUAL SIZE)

1 YR ARI – 24 HOUR
2 YR ARI – 120 MIN.
5 YR ARI – 120 MIN.
10 YR ARI – 240 MIN.
20 YR ARI – 240 MIN.
50 YR ARI – 240 MIN.

CATCHMENT 1

PERMEABLE PAVING 1A

1 YR ARI – 24 HOUR
2 YR ARI – 180 MIN.
5 YR ARI – 180 MIN.
10 YR ARI – 180 MIN.
20 YR ARI – 180 MIN.
50 YR ARI – 240 MIN.

CATCHMENT 1

PERMEABLE PAVING 1B

1 YR ARI – 24 HOUR
2 YR ARI – 240 MIN.
5 YR ARI – 240 MIN.
10 YR ARI – 240 MIN.
20 YR ARI – 180 MIN.
50 YR ARI – 240 MIN.

CATCHMENT 2

POND 2

1 YR ARI – 24 HOUR
2 YR ARI – 360 MIN.
5 YR ARI – 360 MIN.
10 YR ARI – 360 MIN.
20 YR ARI – 240 MIN.
50 YR ARI – 360 MIN.

CATCHMENT 3

POND 3

1 YR ARI – 24 HOUR
2 YR ARI – 240 MIN.
5 YR ARI – 360 MIN.
10 YR ARI – 360 MIN.
20 YR ARI – 240 MIN.
50 YR ARI – 240 MIN.

16 ANNEXURE E: POLLUTANT REMOVAL CAPACITIES

17 ANNEXURE F: Department of Water & Sanitation;

Water Use Registration Certificate and Licence

18 ANNEXURE G: Department of Environmental Affairs and Development Planning; Amendment to Environmental Authorization Letter

19 ANNEXURE H: Environmental Management Plan

Construction Environmental Management Plan (CEMP)

Post-Construction Environmental Management Plan (P-CEMP)

Operational Environmental Maintenance Plan (OEMP)

Environmental Maintenance Management Plan (EMMP) incl. River Corridor EMMP

Construction Method Statements

20 ANNEXURE I: Freshwater Specialist Assessment

21 ANNEXURE J: Geotechnical Report

22 ANNEXURE K: Development Phasing Plan

23 ANNEXURE L: Civil Engineering Services Report

24 ANNEXURE M: Landscaping Master Plan

25 ANNEXURE N: Maintenance Schedules for Stormwater Control Structures