M A T T E R

MATTER CONSULTING
STRUCTURAL ENGINEERS

Level 5/550 Bourke Street
Melbourne VIC 3000
(03) 8692 7262

1 Walkerville Terrace, Gilberton SA 5081

Stormwater Management Plan

Project No.: 23084A
5 December 2024
Revision No. 1

REVISION	DATE	COMMENT	AUTHOR	CHECKER
1	05 December 2024	Final	DK	WE

MATTER CONSULTING
ABN: 31 619 088 229

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Contents

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1. Introduction

1.1 Site Description

This report relates to the construction of a proposed engineering services for 1 Walkerville Terrace, Gilberton SA 5081, which consists of a 11-level hotel / mixed-use building, consisting of 2 car parking basements 9 floor above ground.

Following additional services are required for the above site. The scope of work required includes the following:

- Assess existing stormwater infrastructure in the vicinity of the subject site.
- Explore treatment initiatives to achieve stormwater pollutant reduction targets.
- This Stormwater Management Plan provides an outline of the proposed design criteria for the development.

Figure 1 - Site Location of the Proposed Development

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1.2 Regulatory Requirements

The following standards and guidance documents were referred to in preparation of the SWMP.

- AS/NZS 3500.3:2018 – Plumbing and Drainage Part 3: Stormwater Drainage
- 2023 - 2033 Stormwater Asset - Management Plan- Town of Walkerville
- Adopted November 2023 WSUD Engineering Procedures: Stormwater (CSIRO 2005 EPS)
- MUSIC – Modelling – Guidelines – August - 2015
- Bureau of Meteorology for Rainfall Data and IFD Charts

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2 Proposed Stormwater Management System

The design approach for the stormwater system of the development will be based on water sensitive urban design (WSUD) principles. The adopted principles for stormwater design will be consistent with Walkerville Council Development Plan. The following items will be considered during the design:

- Provide adequate drainage to ensure a free draining development.
- Pavement levels and drainage design to ensure ponding does not occur on adjacent properties.
- The discharge volume, timing, and velocity of stormwater runoff from the subject site has no adverse effect on any surrounding properties or receiving waters.
- The pollutant discharge from the subject site is minimised so that the environmental value of surrounding properties and receiving water is maintained.
- Major overland flow paths / systems are considered in the design.

2.1 Stormwater Design Parameters

Referring to the Walkerville stormwater catchment, 1 Walkerville Terrace sits within Gilberton area. The subject site location is indicated on the below map from Appendix A of this document using a green cross.

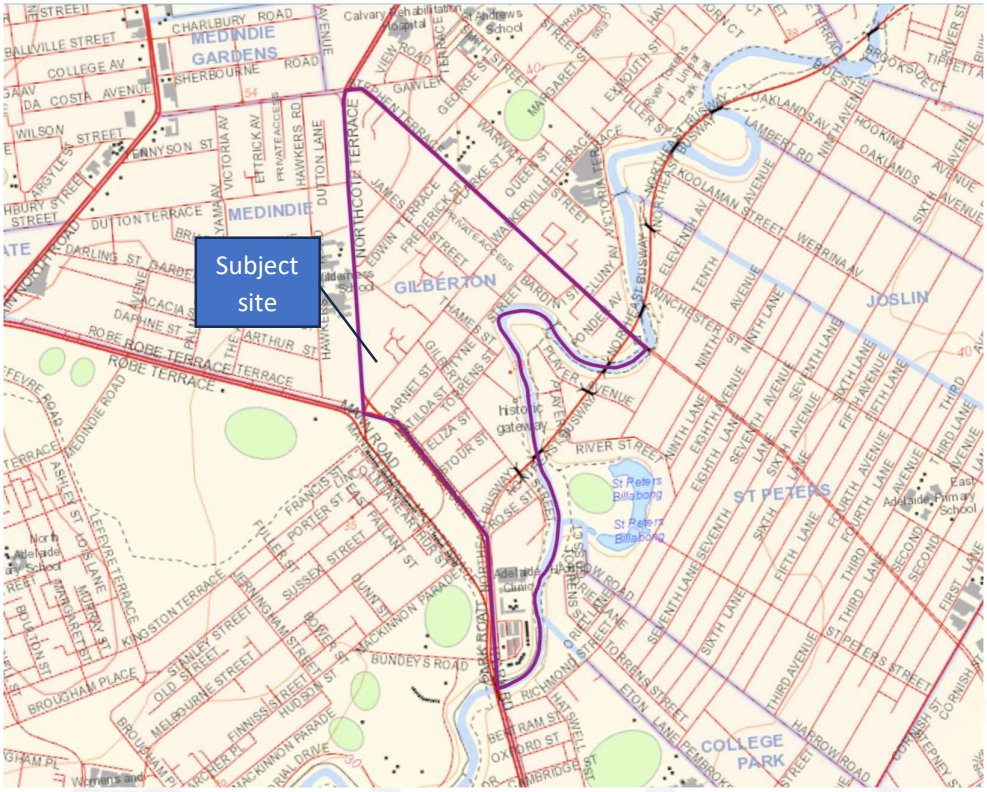

Figure 2 – Stormwater Catchment Area

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Permissable Site Discharge

The purpose of the Permissible Site Discharge is to limit the site discharge to a pre-determined rate. The Permissible Site Discharge is calculated as the runoff generated from the pre-developed site during a 20% Annual Exceedance Probability design storm event of 5 minute duration.

The Permissible Site Discharge is calculated using the Rational Method Formula. The value for I is taken from the Bureau of Meteorology for Rainfall Data and IFD Charts, using the coordinates of the subject site.

$$\text{Permissible Site Discharge (litres/s)} = \frac{C_{20} \times I_{20}^{5} \times A}{3600}$$

Where,

C_{20} = 20% Annual Exceedance Probability Runoff Coefficient

= $0.95 \times [F_{imp} \times 0.9 + (1-F_{imp}) \times 0.143]$

F_{imp} = Fraction Impervious for Pre-Developed Site

I_{20}^{5} = Rainfall Intensity for 20% Annual Exceedance Probability event of 5 minute duration (mm/hr)

A = Site Area (m^2)

Site Storage Requirement

The Site Storage Requirement is calculated from the post development runoff generated from a 100 year Average Recurrence Interval rainfall event (1% Annual Exceedance Probability). The difference between the maximum post development flow considering this occurrence, and the permissable site discharge calculated above gives the site storage required in terms of detention.

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2.2 Legal Point of Discharge (LPD)

The discharge points for stormwater on this development site confirmed the current existing pits located at Walkerville Terrace (Refer to survey plan for more info). Matter Consulting has investigated the best approach to guarantee the attainment of water quality standards and permissible site discharge goals.

Figure 3 – Legal Points of Discharge

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2.3 Catchment Areas Breakdown

2.3.1 Pre-Development Area

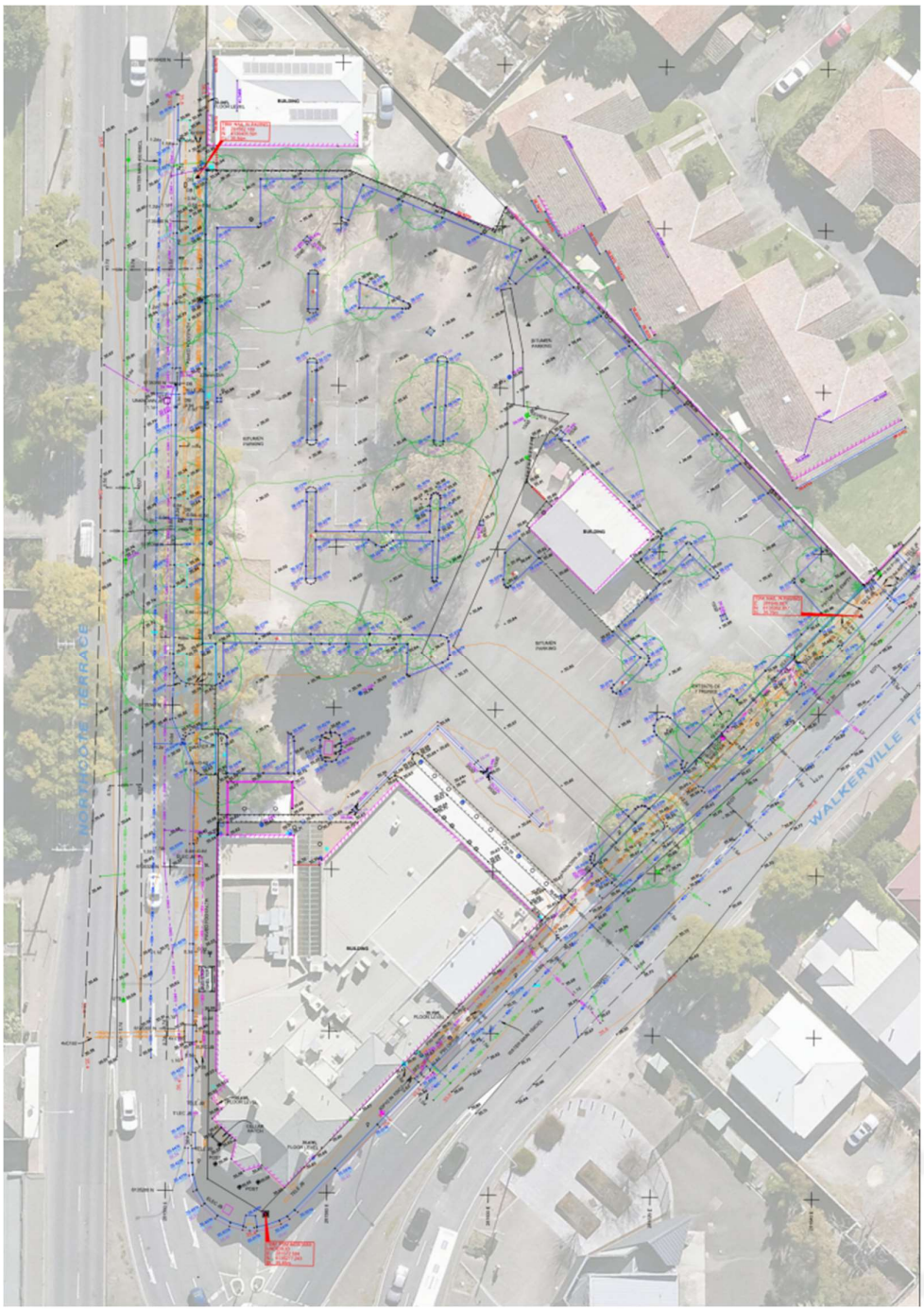

Figure 4 – Existing site areas

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2.3.2 Post- Development Area

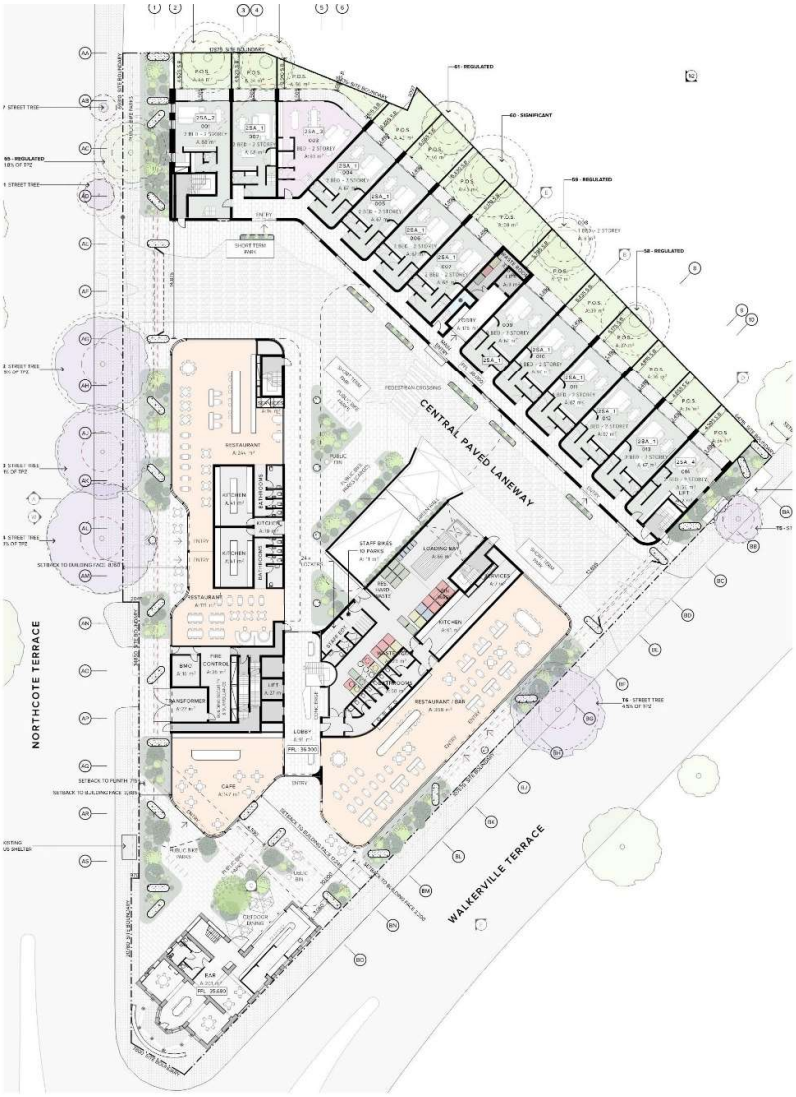

Figure 4-1 – Proposed site areas

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MUSIC MODELLING:

The below image is a snapshot from the MUSIC modelling to ensure accurate run-off coeeficients are used in our detention volume calculation.

Figure 5 – MUSIC treatment train

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Summary of Assumed Catchment Areas

Surface Type	*Pre-Development*	*Post-Development*	
	Area (m2)	**Area (m2)**	**Coefficient of Runoff**
Roof	1290	3381	1.0
Paving	4347	1904	0.9
Landscaping	612	964	0.3
Total	6249	6249	0.933

Figure 6 – Run-off area summary table

2.4 Detention Volume Calculation

Permissible site discharge calculations have been conducted in accordance with the design parameters.

On-site detention volume required has been calculated with the rational method and with the following parameters.

- **AEP Pre-development:** 10% (1:10 Years)
- **AEP Post-development:** 1% (1:100 Years)
- **Coefficient of Runoff Pre-Development:** 0.933
- **Catchment area combined:** 6249 m2

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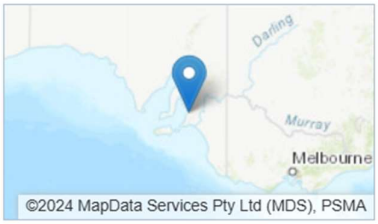
Location

Label: Not provided

Latitude: -34.9011 [Nearest grid cell: 34.9125 (S)]

Longitude: 138.6095 [Nearest grid cell: 138.6125 (E)]



IFD Design Rainfall Depth (mm)

Issued: 04 December 2024

Rainfall depth for Durations, Exceedance per Year (EY), and Annual Exceedance Probabilities (AEP).
FAQ for New ARR probability terminology

Table | Chart | Coefficients

Unit: mm

	Annual Exceedance Probability (AEP)						
Duration	**63.2%**	**50%#**	**20%***	**10%**	**5%**	**2%**	**1%**
5 min	4.17	4.75	6.78	8.33	10.0	12.5	14.6
6 min	4.63	5.28	7.54	9.26	11.1	13.9	16.2
10 min	6.04	6.90	9.88	12.1	14.6	18.2	21.2
20 min	8.26	9.44	13.5	16.6	19.9	24.9	29.0
30 min	9.73	11.1	15.9	19.5	23.4	29.2	34.1
1 hour	12.6	14.3	20.4	25.0	30.0	37.4	43.8
1.5 hour	14.5	16.5	23.4	28.6	34.3	42.7	50.0
2 hour	16.1	18.2	25.7	31.4	37.6	46.8	54.6
3 hour	18.4	20.9	29.3	35.7	42.6	52.8	61.4
4.5 hour	21.1	23.8	33.2	40.4	48.0	59.2	68.6
6 hour	23.2	26.1	36.3	44.0	52.2	64.0	73.9
9 hour	26.3	29.7	41.0	49.5	58.4	71.1	81.6
12 hour	28.7	32.4	44.6	53.6	63.0	76.3	87.2
18 hour	32.4	36.4	49.8	59.6	69.7	83.7	95.1
24 hour	35.1	39.4	53.6	63.9	74.5	89.0	101
48 hour	42.0	46.9	62.8	74.2	85.7	101	113
72 hour	46.2	51.4	68.1	79.8	91.6	107	119

Note:
The 50% AEP IFD **does not** correspond to the 2 year Average Recurrence Interval (ARI) IFD. Rather it corresponds to the 1.44 ARI.
* The 20% AEP IFD **does not** correspond to the 5 year Average Recurrence Interval (ARI) IFD. Rather it corresponds to the 4.48 ARI.

Figure 7 – BOM Rainfall Data used in analysis

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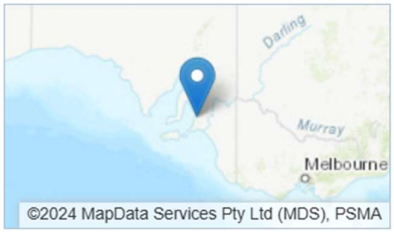
Location

Label: Not provided

Latitude: -34.9011 [Nearest grid cell: 34.9125 (S)]

Longitude: 138.6095 [Nearest grid cell: 138.6125 (E)]



IFD Design Rainfall Intensity (mm/h)

Issued: 04 December 2024

Rainfall intensity for Durations, Exceedance per Year (EY), and Annual Exceedance Probabilities (AEP).
FAQ for New ARR probability terminology

Table | Chart | Coefficients

Unit: mm/h

	Annual Exceedance Probability (AEP)						
Duration	**63.2%**	**50%#**	**20%***	**10%**	**5%**	**2%**	**1%**
5 min	50.0	57.0	81.3	100.0	120	150	175
6 min	46.3	52.8	75.4	92.6	111	139	162
10 min	36.3	41.4	59.3	72.9	87.5	109	127
20 min	24.8	28.3	40.5	49.8	59.8	74.6	87.1
30 min	19.5	22.2	31.7	39.0	46.9	58.4	68.3
1 hour	12.6	14.3	20.4	25.0	30.0	37.4	43.8
1.5 hour	9.70	11.0	15.6	19.1	22.9	28.5	33.3
2 hour	8.03	9.11	12.8	15.7	18.8	23.4	27.3
3 hour	6.14	6.95	9.75	11.9	14.2	17.6	20.5
4.5 hour	4.69	5.29	7.39	8.98	10.7	13.2	15.2
6 hour	3.86	4.36	6.05	7.34	8.70	10.7	12.3
9 hour	2.92	3.30	4.56	5.50	6.49	7.90	9.07
12 hour	2.40	2.70	3.71	4.46	5.25	6.36	7.27
18 hour	1.80	2.02	2.77	3.31	3.87	4.65	5.28
24 hour	1.46	1.64	2.23	2.66	3.11	3.71	4.19
48 hour	0.874	0.976	1.31	1.54	1.78	2.10	2.35
72 hour	0.642	0.714	0.946	1.11	1.27	1.49	1.65

Note:
The 50% AEP IFD **does not** correspond to the 2 year Average Recurrence Interval (ARI) IFD. Rather it corresponds to the 1.44 ARI.
* The 20% AEP IFD **does not** correspond to the 5 year Average Recurrence Interval (ARI) IFD. Rather it corresponds to the 4.48 ARI.

Figure 7-1 – BOM Rainfall Data used in analysis

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Copyright Commonwealth of Australia 2016 Bureau of Meteorology (ABN 92 637 533 532)							
IFD Design Rainfall Coefficients							
Issued:	4-Dec-24						
Location Label:							
Requested	Latitude	-34.9011	Longitude	138.6095			
Nearest gri	Latitude	34.9125 (S	Longitude	138.6125 (E)			
Coefficient	63.20%	50%	20%	10%	5%	2%	1%
C0	0.24996	0.382061	0.738469	0.945254	1.128348	1.348594	1.503993
C1	0.883343	0.866472	0.844062	0.844567	0.852209	0.872201	0.89069
C2	-0.09017	-0.07057	-0.04592	-0.04816	-0.05897	-0.08499	-0.1086
C3	-0.00836	-0.01637	-0.02568	-0.02386	-0.01837	-0.00626	0.004501
C4	0.004477	0.005946	0.007487	0.006956	0.005719	0.003196	0.001003
C5	-0.00052	-0.00065	-0.00077	-0.00071	-0.00058	-0.00035	-0.00014
C6	1.98E-05	2.39E-05	2.74E-05	2.49E-05	2.03E-05	1.21E-05	5.23E-06

Figure 7-2 –Coefficient Data used in analysis

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2.5 Legal Point of Discharge – DRAINS Calculation

Major Storm:

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project **Buckingham Arms**

On-site Detention Requirements

job no.	23084A -	designed	DK	date	26/11/2024	page no.	1

Stormwater detention/infiltration design (via Modified Rational Method)

Location of design		USER DATA	
Pre-development flows			
ARI adopted for pre-development		*10*	
Pre-development time of concentration		*5*	minutes
Design Rainfall Intensity		*100.93*	mm/hr
Development areas			
Roof	(c=1.0)	*1290*	m^2
Concrete paving	(c=0.9)	*4374*	m^2
Bitumen paving	(c=0.7)	*0*	m^2
Soft landscaping	(c=0.3)	*612*	m^2
sum		6276	m^2
Pre-development weighted C		0.862	User override C
Adopted pre-development C		0.862	
Maximum Pre-development flow		**151.69**	**l/s**
Post-development flows			
ARI adopted for post-development		*100*	
Post-development time of concentration		*5*	minutes
Design Rainfall Intensity		*175.07*	mm/hr
Development areas			
Roof	(c=1.0)	*3381*	m^2
Concrete paving	(c=0.9)	*1904*	m^2
Bitumen paving	(c=0.7)	*0*	m^2
Soft landscaping	(c=0.3)	*964*	m^2
sum		6249	m^2
Post-development weighted C		0.862	User override C
Adopted pre-development C		0.862	
Maximum Post-devleopment flow		**261.82**	**l/s**
Difference between pre and post areas		**27**	
WARNING: PRE AND POST AREAS DON'T MATCH			
Soil infiltration			
Infiltration rate (l/s/m2)		*0*	
Infiltration area		*0*	
Infiltration system absorption rate (l/s)		*0.0*	
Required detention system capacity (l)		**33054.4**	for a 5.16 minute event duration
Required detention system capacity (m^3)		33.05435548	

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On-site Detention Requirements

job no.	23084A -	designed	DK	date	26/11/2024	page no.	2

Intensity frequency duration table

Iteration No.	Duration (min)	100 year mm/hr	Post-development flowrate (l/s)	Difference b/w pre and post flows (l/s)	**Required detention volume (litres)**
0	5	175.069	261.82	110.13	**33039**
1	7.5	146.598	219.24	67.55	**30398**
2	3.33333	203.917	304.96	153.27	**30654**
3	2.5	223.437	334.15	182.46	**27370**
4	2.91667	213.143	318.75	167.07	**29237**
5	3.125	208.405	311.67	159.98	**29997**
6	3.4375	201.76	301.73	150.05	**30947**
7	3.69792	196.608	294.03	142.34	**31582**
8	3.98438	191.305	286.10	134.41	**32133**
9	4.25781	186.566	279.01	127.32	**32527**
10	4.53776	182.01	272.20	120.51	**32810**
11	4.81445	177.773	265.86	114.17	**32981**
12	5.09277	173.755	259.85	108.16	**33052**
13	5.37028	169.971	254.19	102.51	**33029**
14	5.23153	171.837	256.98	105.30	**33051**
15	5.16215	172.789	258.41	106.72	**33054**
16	5.05809	174.244	260.58	108.90	**33048**
17	5.11012	173.513	259.49	107.80	**33053**
18	5.13613	173.15	258.95	107.26	**33054**
19	5.17516	172.61	258.14	106.45	**33054**
20	5.20768	172.163	257.47	105.78	**33053**
21	5.19142	172.386	257.80	106.12	**33054**
22	5.18329	172.498	257.97	106.28	**33054**
23	5.17109	172.666	258.22	106.54	**33054**
24	5.16093	172.806	258.43	106.75	**33054**
25	5.14975	172.961	258.66	106.98	**33054**
26	5.15534	172.884	258.55	106.86	**33054**
27	5.15814	172.845	258.49	106.80	**33054**
28	5.16233	172.787	258.40	106.72	**33054**
29	5.16582	172.739	258.33	106.64	**33054**
30	5.16407	172.763	258.37	106.68	**33054**

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Minor Storm:

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On-site Detention Requirements

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job no. 23084A -	designed DK	date 26/11/2024	page no. 1

Stormwater detention/infiltration design (via Modified Rational Method)

Location of design		USER DATA	
Pre-development flows			
ARI adopted for pre-development		*10*	
Pre-development time of concentration		*5*	minutes
Design Rainfall Intensity		*100.93*	mm/hr
Development areas			
Roof	(c=1.0)	*1290*	m^2
Concrete paving	(c=0.9)	*4374*	m^2
Bitumen paving	(c=0.7)	*0*	m^2
Soft landscaping	(c=0.3)	*612*	m^2
sum		6276	m^2
Pre-development weighted C		0.862	User override C
Adopted pre-development C		0.862	
Maximum Pre-development flow		**151.69**	**l/s**
Post-development flows			
ARI adopted for post-development		*20*	
Post-development time of concentration		*5*	minutes
Design Rainfall Intensity		*122.09*	mm/hr
Development areas			
Roof	(c=1.0)	*3381*	m^2
Concrete paving	(c=0.9)	*1904*	m^2
Bitumen paving	(c=0.7)	*0*	m^2
Soft landscaping	(c=0.3)	*964*	m^2
sum		6249	m^2
Post-development weighted C		0.862	User override C
Adopted pre-development C		0.862	
Maximum Post-devleopment flow		**182.58**	**l/s**
Difference between pre and post areas		**27**	
WARNING: PRE AND POST AREAS DON'T MATCH			
Soil infiltration			
Infiltration rate (l/s/m2)		*0*	
Infiltration area		*0*	
Infiltration system absorption rate (l/s)		*0.0*	
Required detention system capacity (l)		**12360.4**	for a 2.91 minute event duration
Required detention system capacity (m^3)		12.36035367	

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project **Buckingham Arms**

On-site Detention Requirements

job no.	23084A -	designed	DK	date	26/11/2024	page no.	2

Intensity frequency duration table

Iteration No.	Duration (min)	20 year mm/hr	Post-development flowrate (l/s)	Difference b/w pre and post flows (l/s)	**Required detention volume (litres)**
0	5	122.088	182.58	30.90	**9269**
1	7.5	102.089	152.67	0.99	**445**
2	3.33333	142.241	212.72	61.04	**12207**
3	2.5	155.801	233.00	81.31	**12197**
4	2.91667	148.657	222.32	70.63	**12360**
5	2.70833	152.132	227.51	75.83	**12322**
6	2.8125	150.371	224.88	73.19	**12351**
7	2.86458	149.508	223.59	71.90	**12358**
8	2.94271	148.236	221.69	70.00	**12359**
9	3.00781	147.195	220.13	68.44	**12352**
10	2.97526	147.713	220.91	69.22	**12357**
11	2.95898	147.974	221.29	69.61	**12358**
12	2.93457	148.367	221.88	70.20	**12360**
13	2.91423	148.697	222.38	70.69	**12360**
14	2.89185	149.061	222.92	71.23	**12360**
15	2.90304	148.879	222.65	70.96	**12360**
16	2.90863	148.788	222.51	70.83	**12360**
17	2.91702	148.651	222.31	70.62	**12360**
18	2.91283	148.719	222.41	70.72	**12360**
19	2.91492	148.685	222.36	70.67	**12360**
20	2.91388	148.702	222.38	70.70	**12360**
21	2.91335	148.711	222.40	70.71	**12360**
22	2.91256	148.724	222.42	70.73	**12360**
23	2.91191	148.734	222.43	70.75	**12360**
24	2.91119	148.746	222.45	70.76	**12360**
25	2.9105	148.757	222.47	70.78	**12360**
26	2.91084	148.752	222.46	70.77	**12360**
27	2.91102	148.749	222.45	70.77	**12360**
28	2.91127	148.745	222.45	70.76	**12360**
29	2.91114	148.747	222.45	70.76	**12360**
30	2.91108	148.748	222.45	70.77	**12360**

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2.6 Controlled Site Discharge

2.6.1 Drainage Pipe to LPoD

Three existing pits to be nominated as legal point of discharges which outfall drains on site to be connected as per below sketch to limit discharge to the pre-development flow of 151.69 l/s.

Figure 8 – Legal point of discharge

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Up to the 1% AEP event, the Surface Basin full while discharging at existing side entry pits as shown and marked on figure8 with flow of 151.69 l/s, matching the 10% AEP pre-development flow. Over the 1% AEP event, stormwater bypasses the system by overflowing the overland basin and discharging to the legal point of discharge.

2.7 Rainwater Tank

10kL rainwater harvesting and reuse is proposed for the development. It will reduce the overall volume of stormwater load going to the receiving water course. It is proposed to provide rainwater harvesting tanks (RWT's) to capture roof runoff for re-use as irrigation and toilet flushing etc. The use of rainwater tanks will allow for a reduction of TSS by the settling of particles over time and through the screening of water before it enters the tank. These tanks will be installed when the development is constructed.

One rainwater tank has been proposed by this office and modelled in MUSIC to reuse water for irrigation and toilet flushing respectively.

2.8 Other treatment devices

As illustrated in section 2.3.2, 10sq.m Raingarden, 3xJellyFish & GPT treatment pits will further treat stormwater to achieve the project's stormwater objectives. Refer to MUSIC result for a detailed analysis.

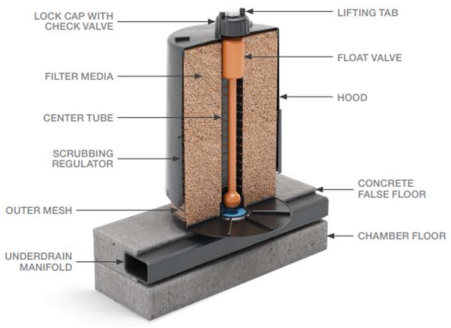

Figure 1: StormFilter® components

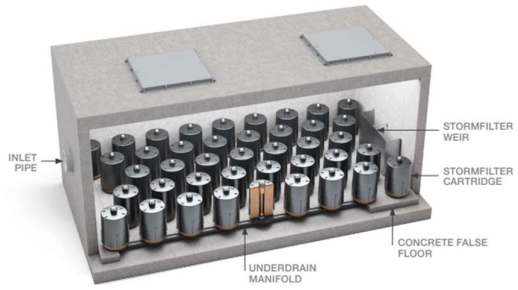

Figure 2: Example conceptual diagram of a StormFilter® system

Cartridge Name / Siphon Height (mm)	690	460	310
Physical Height (H) mm	840	600	600
Typical Weir Height from outlet (Head Loss, mm)	920	690	540
Flow Rate ZPG (L/s)	1.60	1.10	0.70
Flow Rate PSorb (L/s)	0.90	0.46	0.39

Table 1: StormFilter® cartridge details

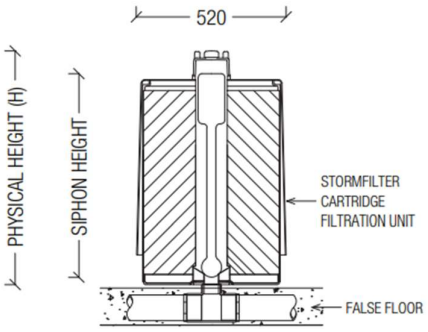

Figure 3: StormFilter® cartridge dimensions

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3 Summary

The entire subject site development has been considered in the calculation of the detention requirements. A 1 in 100-year, 5-minute duration event, gives a required capacity of **34kL** which the proposed solution provides across legal point of stormwater discharge.

In accordance with the Infrastructure Design Manual a MUSIC analysis has been carried out for this development. The treatment train effectiveness of the proposed treatment system is designed to fully achieve the stormwater discharge quality targets.

- Appendix