Engineering Service Report - Submission for Planning

for two new dwellings at Hawthorns, Killakee Lawns, Firhouse, Dublin 24.

Project No.		21175	Document Ref:		210909_Site Services Report.doc
Revision	**Purpose / Description**	**Originated**	**Checked**	**Authorised**	**Date**
0	Issued for Planning	SG	SG	CK	09.09.2021
Doherty Finegan Kelly, Civil & Structural Engineers, Botanic Court, 30-32 Botanic Road, Glasnevin, Dublin 9					

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APPENDICES

1.0 INTRODUCTION

GENERAL

The site is located at Hawthorns, Killakee Lawns, Firhouse, Dublin 24. The overall site is currently occupied by a residential dwelling and has an overall area of 1808.0m^2.

PROPOSED DEVELOPMENT

It is proposed to sub-divide the overall site, with the 2no. new dwellings located to the front of the existing dwelling. The total site area for the two new dwellings is approx. 680.0m^2. The development proposed is for 2no. two-storey dwellings with off street parking.

This report will address the proposed infrastructural requirements for the development.

All work will be carried out to the satisfaction of South Dublin County Council (SDCC) and will adhere to the requirements of the "Greater Dublin Regional Code of Practice for Drainage Works" (GDRC). The design principles adopted will be those of best engineering practice and standards used will be from the most recent applicable publications, in particular reference is made to the "Greater Dublin Strategic Drainage Study Volume 3 New Developments" (GDSDS).

This report should be read in conjunction with the following drawings; which are enclosed with this submission:

DRAWING NUMBER	DESCRIPTION
21175-01	**Proposed Drainage + Watermain Layout**
21175-02	**Drainage + Watermain Details – Sheet 1 of 2**
21175-03	**Drainage + Watermain Details – Sheet 2 of 2**

Table 1 - Drawing Schedule

2.0 WATER SUPPLY

GENERAL

In general, the watermain and supply servicing the development shall comply with the "Code of Practice for Water Infrastructure" ((IW-CDS-5020-03) and Standard Details for Water (IW-CDS-5020-01) published by Irish Water, in conjunction with "Recommendations for Site Development Works for Housing Areas" (current edition) published by the (DOEHLG).

DESIGN SUMMARY

It is proposed to provide a separate 25mmØ service connection for each of the proposed dwellings. The connections will be taken from the existing 100mmØ watermain located on the southeast side of 'Killakee Lawns' road.

It is estimated that the maximum water demand for the 2no. proposed dwellings will be approx. 0.81m^3/day with a peak demand of 0.17m^3/hr; where peak flow has been estimated at 5 times average daily flow. The calculations are based on a water demand of 150l/person/day in accordance with Irish Water "Code of Practice for Water Infrastructure" (IW-CDS-5020-03).

The calculations are included in **Appendix I.** The watermain layout is shown on DFK **Drg. 21175-01** with the site specific details shown on DFK **Drg. 21175-02** and **Drg. 21175-03.**

3.0 Surface Water

General

The surface water network will be designed and arranged in accordance with the requirements of the GDSDS and the GDRC in conjunction with "Recommendations for Site Development Works for Housing Areas" (current edition) published by the (DOEHLG). Cognisance has also been taken of the recommendations contained within the Building Regulations Part H – Drainage and Waste Water Disposal

The surface water network for each dwelling will be laid as a separate system and drains will be laid such as to minimise the risk of misconnections.

We have used the extreme rainfall matrix table for Killakee Lawns was used to obtain a rainfall profile for calculation of storage requirements. The rainfall values have been increased by 20% to include for climate change characteristic which is greater than the 10% as required by the GDSDS.

Design Summary

The run-off generated onsite will be dealt with using infiltration systems with no surface water run-off leaving the site. An infiltration rate of $1x10^{-5}$ m/sec (36mm/hr) has been adopted for the design calculations. A site investigation to determine the infiltration rate and water table level once planning has been granted and the surface water design calculations revised to reflect the results and this can be a condition of planning.

The surface water run-off from the roof areas will be collected and diverted to the proposed soakaways located in the rear gardens of the proposed dwellings. The soakaways are to be constructed using Wavin Aquacells or similar approved. The driveways and parking spaces will be constructed using permeable paving where the run-off from these areas are collected in the stone media below the permeable paving system where it will infiltrate back into the ground.

The soakaways and permeable paving have been designed for a 1 in 100 year return period storm, as required by GDSDS "Regional Drainage Policies Vol 2 New Development". The surface water calculations are included in **Appendix II.**

The surface water layout is shown on DFK **Drg. 21175-01** with the site specific details shown on DFK **Drg. 21175-02** and **Drg. 21175-03.**

PRFA

A review of the PFRA Mapping available on the OPW website indicates the site is outside any Flood risk area. Maps included in **Appendix III.**

4.0 FOUL WATER

GENERAL

The foul water network will be designed and arranged in accordance with the requirements of the GDSDS and the GDRC in conjunction with "Recommendations for Site Development Works for Housing Areas" (current edition) published by the (DOEHLG). Cognisance has also been taken of the recommendations contained within the Building Regulations Part H – Drainage and Waste Water Disposal. The Guidelines published by Irish Water will also be followed.

The foul water network for each dwelling will be laid as a separate system and drains will be laid such as to minimise the risk of misconnections.

DESIGN SUMMARY

It is proposed to provide a new connection to this existing foul sewer located on the southeast side of 'Killakee Lawns' road. The internal pipework for the foul sewer will be 100mmØ pipe laid at a gradient not flatter than 1:60.

The runoff from the 2no. proposed dwellings has been calculated to be 0.010l/sec DWF, with the 6DWF being 0.062l/sec. The hydraulic loading data is based on a foul discharge of 165l/person/day in accordance with Irish Water "Code of Practice for Wastewater Infrastructure" (IW-CDS-5030-03). The additional discharge is negligible.

The full foul sewer calculations are included in **Appendix IV.** The proposed foul water network is shown on DFK **Drg. 21175-01** with the site specific details shown on DFK **Drg. 21175-02** and **Drg. 21175-03.**

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APPENDIX I

WATER DEMAND DESIGN CALCULATIONS

WATER DEMAND CALCULATIONS INDEX

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Botanic Court, 30-32 Botanic Road,
Glasnevin, Dublin 9
Tel: 8301852 / Fax: 8827988

Project	Design	☑	Telephone Log	☐
2no. Dwellings @ Hawthorn, Firhouse	Minutes:	☐	Other Record	☐

Project No:	Element	Prepared:	Checked
21175	Water Demand Calculations	SG	CK

Reference: Output:

Water Supply

Description	Occupancy	Total
House #1	2.7 persons	2.7
House #2	2.7 persons	2.7
		5.4 persons

Water Usage Rate	150.000 l/person/day

Water Usage Rates in accordance with Irish Water Code of Practice for Water, IW-CDS-5020-03

Daily and Peak Demand

Tot. Daily Demand	0.009 l/sec	Peak Demand	0.047 l/sec
Tot. Daily Demand	0.81 cu.m/day	Peak Demand	0.17 cu m/hr

APPENDIX II

SURFACE WATER DESIGN CALCULATIONS

SURFACE WATER CALCULATIONS INDEX

- Return Period Rainfall Depths Table for proposed site
- Soakaway Design
- Plane Infiltration - Permeable Paving

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 310400, Northing: 226635,

	Interval		Years											
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.6,	3.7,	4.2,	5.1,	5.7,	6.2,	7.8,	9.5,	10.7,	12.4,	13.8,	15.0,	16.8,	18.2,	19.3,	N/A ,
10 mins	3.6,	5.1,	5.9,	7.2,	8.0,	8.7,	10.8,	13.3,	14.9,	17.2,	19.3,	20.9,	23.4,	25.3,	26.9,	N/A ,
15 mins	4.2,	6.0,	7.0,	8.4,	9.4,	10.2,	12.7,	15.6,	17.5,	20.3,	22.7,	24.6,	27.5,	29.8,	31.7,	N/A ,
30 mins	5.6,	8.0,	9.3,	11.2,	12.5,	13.5,	16.9,	20.7,	23.2,	26.8,	30.0,	32.5,	36.3,	39.3,	41.7,	N/A ,
1 hours	7.5,	10.7,	12.4,	14.9,	16.7,	18.0,	22.4,	27.5,	30.8,	35.5,	39.7,	42.9,	47.9,	51.8,	55.1,	N/A ,
2 hours	10.1,	14.3,	16.5,	19.9,	22.2,	24.0,	29.8,	36.4,	40.8,	47.0,	52.5,	56.7,	63.3,	68.4,	72.6,	N/A ,
3 hours	12.0,	16.9,	19.6,	23.6,	26.2,	28.3,	35.2,	43.0,	48.1,	55.3,	61.8,	66.8,	74.5,	80.5,	85.4,	N/A ,
4 hours	13.5,	19.1,	22.1,	26.5,	29.6,	31.9,	39.6,	48.3,	54.1,	62.2,	69.4,	75.0,	83.6,	90.3,	95.9,	N/A ,
6 hours	16.1,	22.6,	26.1,	31.4,	35.0,	37.7,	46.8,	57.0,	63.8,	73.3,	81.8,	88.3,	98.4,	106.3,	112.8,	N/A ,
9 hours	19.1,	26.8,	30.9,	37.1,	41.3,	44.6,	55.2,	67.3,	75.2,	86.4,	96.3,	104.0,	115.9,	125.1,	132.7,	N/A ,
12 hours	21.5,	30.2,	34.9,	41.9,	46.6,	50.2,	62.2,	75.7,	84.6,	97.1,	108.2,	116.8,	130.1,	140.4,	148.9,	N/A ,
18 hours	25.6,	35.8,	41.3,	49.5,	55.1,	59.4,	73.4,	89.3,	99.8,	114.5,	127.5,	137.6,	153.1,	165.2,	175.2,	N/A ,
24 hours	28.9,	40.4,	46.6,	55.8,	62.1,	66.9,	82.7,	100.5,	112.2,	128.6,	143.3,	154.6,	172.0,	185.5,	196.6,	235.7,
2 days	36.6,	49.9,	56.8,	67.1,	73.9,	79.2,	96.2,	115.1,	127.3,	144.4,	159.4,	170.9,	188.5,	202.0,	213.2,	251.8,
3 days	42.9,	57.5,	65.0,	76.1,	83.5,	89.1,	107.1,	127.0,	139.8,	157.5,	172.9,	184.7,	202.7,	216.5,	227.8,	266.8,
4 days	48.4,	64.1,	72.2,	84.0,	91.8,	97.7,	116.7,	137.3,	150.6,	168.9,	184.8,	196.9,	215.3,	229.4,	240.9,	280.3,
6 days	58.1,	75.7,	84.7,	97.7,	106.2,	112.7,	133.1,	155.3,	169.4,	188.7,	205.4,	218.1,	237.3,	251.8,	263.7,	304.3,
8 days	66.7,	85.9,	95.7,	109.7,	118.8,	125.7,	147.5,	170.9,	185.7,	205.9,	223.4,	236.5,	256.4,	271.4,	283.7,	325.3,
10 days	74.6,	95.3,	105.7,	120.5,	130.2,	137.5,	160.5,	184.9,	200.4,	221.5,	239.5,	253.1,	273.6,	289.1,	301.7,	344.3,
12 days	82.0,	104.0,	115.0,	130.6,	140.8,	148.5,	172.4,	197.9,	214.0,	235.7,	254.4,	268.4,	289.4,	305.3,	318.2,	361.8,
16 days	95.7,	120.0,	132.1,	149.2,	160.2,	168.5,	194.3,	221.6,	238.7,	261.7,	281.4,	296.1,	318.2,	334.8,	348.2,	393.5,
20 days	108.5,	134.9,	147.9,	166.2,	178.0,	186.8,	214.3,	243.1,	261.0,	285.2,	305.8,	321.2,	344.1,	361.4,	375.3,	422.0,
25 days	123.5,	152.2,	166.2,	186.0,	198.6,	208.0,	237.2,	267.8,	286.7,	312.2,	333.7,	349.8,	373.8,	391.7,	406.2,	454.6,

NOTES:
N/A Data not available
These values are derived from a Depth Duration Frequency (DDF) Model
For details refer to:
'Fitzgerald D. L. (2007), Estimates of Point Rainfall Frequencies, Technical Note No. 61, Met Eireann, Dublin',
Available for download at www.met.ie/climate/dataproducts/Estimation-of-Point-Rainfall-Frequencies_TN61.pdf

	Doherty Finegan Kelly *Consulting Structural & Civil Engineers,*	**Botanic Court, 30 Botanic Road, Glasnevin, Dublin 9** **Tel: 8301852 / Fax: 8602265**			
	Project	Design:	☑	Telephone Log.	☐
	2no. Dwellings @ Hawthorn. Firhouse	Minutes:	☐	Other Record	☐
Project No	Element	Prepared.		Checked	
21175	**Soakaway Design**	**SG**		**CK**	

Reference: Output

Vertical Sided System

SOAKPIT DESIGN IN ACCORDANCE WITH BRE 365

Description	Type	Result
Infiltration Rate	clay	36.000 mm/hr
		0.036 m/hr

Storm Duration (hrs)	6
Total Rainfall (100 Year)	88.3 mm
Assume - Cl505b Stone (n)	0.95
Impermeable Area	90 m²

Soakaway dimensions

Length	6.000 m
Width	1.000 m
Effective Depth	1.200 m

Base Area (A_b)	6.000 m²
Perimeter (P)	14.000 m

Storage Volume Required

Inflow, I =	7.95	m^3
Eff. Volume=	6.84	m^3
As,50 =	8.40	m^2
Outflow =	1.81	m^3
Volume reqd =	6.13	m^3

Volume Required is **LESS THAN** effective volume provided therefore **OK**

	Doherty Finegan Kelly 32 Botanic Road Glasnevin, Dublin 9	**Botanic Court, 30-32 Botanic Road, Glasnevin, Dublin 9** **Tel: 8301852 / Fax: 8602265**			
	Project	Design	☑	Telephone Log	☐
	2no. Dwellings @ Hawthorn, Firhouse	Minutes	☐	Other Record	☐
Project No		Prepared		Checked	
21175	**Infiltration Drainage - Permeable Paving**	**SG**		**CK**	

Reference | Output

Hawthorn, Firhouse Extreme Rainfall Matrix

RP5 60min= 18.0 mm RP5 2d= 79.2 mm ANNUAL RAINFALL= 856.0 mm

RETURN PERIOD (YEARS)

DURATION	0.5	1	2	5	10	20	30	50	100
2 min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5 min	37.4	53.3	60.5	80.3	112.3	136.8	154.1	178.6	216.0
10 min	25.9	36.7	42.5	62.6	77.8	95.8	107.3	123.8	150.5
15 min	20.2	28.8	33.6	49.0	61.0	74.9	84.0	97.4	118.1
30 min	13.4	19.2	22.3	32.4	40.6	49.7	55.7	64.3	78.0
60 min	9.0	12.8	14.9	21.6	26.9	33.0	37.0	42.6	51.5
2 hr	6.1	8.6	9.9	14.4	17.9	21.8	24.5	28.2	34.0
4 hr	4.1	5.7	6.6	9.6	11.9	14.5	16.2	18.7	22.5
6 hr	3.2	4.5	5.2	7.5	9.4	11.4	12.8	14.7	17.7
12 hr	2.2	3.0	3.5	5.0	6.2	7.6	8.5	9.7	11.7
24 hr	1.4	2.0	2.3	3.3	4.1	5.0	5.6	6.4	7.7
48 hr	0.9	1.2	1.4	2.0	2.4	2.9	3.2	3.6	4.3
72 hr	0.7	1.0	1.1	1.5	1.8	2.1	2.3	2.6	3.1

Rainfall intensity shown as mm/hr (includes 20% allowance for climate change)

Plane Infiltration - Area No.1 (Permeable Paving)

From CIRIA Report No 156(1996) - Infiltration Drainage Manual of Good Practice

Description	Type	Result
Infiltration Rate	clay	36.000 mm/hr
FOS	Damage to buildings	1.50
q		0.024 m/hr

Assume - uniform gravel (n)	0.40

Area to be Drained

A_D	275 m²

Area to be drained –

Equations Applied to Determine h_{max}

$$h_{max} = \frac{D}{n}(R - q) \quad (1)$$

Where.

R= A_D/A_b= 1.00

Infiltration system dimensions

Width	-
Length	-
Base Area (A_b)	275 m²

H_{max} Calculation

10 Year Return Period

Duration (D)	h_{max}
15.000 min	0.025
30.000 min	0.021
60.000 min	0.007
120.000 min	0.000
240.000 min	0.000
360.000 min	0.000

30 Year Return Period

Duration (D)	h_{max}
15.000 min	0.038
30.000 min	0.040
60.000 min	0.032
120.000 min	0.002
240.000 min	0.000
360.000 min	0.000

50 Year Return Period

Duration (D)	h_{max}
15.000 min	0.046
30.000 min	0.050
60.000 min	0.047
120.000 min	0.021
240.000 min	0.000
360.000 min	0.000

100 Year Return Period

Duration (D)	h_{max}
15.000 min	0.059
30.000 min	0.068
60.000 min	0.069
120.000 min	0.050
240.000 min	0.000
360.000 min	0.000

Plane Infiltration - Time to Empty

The time taken to half-empty the system is given by:

$$\frac{nh_{max}}{q} \quad (2)$$

$$q = \frac{nh_{max}}{T_{empty}} \quad (3)$$

Event	Time to Empty
1 in 10 years	0.385 hrs
1 in 30 years	0.660 hrs
1 in 50 years	0.840 hrs
1 in 100 years	1.145 hrs

Event	Min feasible (q)
1 in 10 years	0.0002 m/hr
1 in 30 years	0.0007 m/hr
1 in 50 years	0.0008 m/hr
1 in 100 years	0.0011 m/hr

APPENDIX III

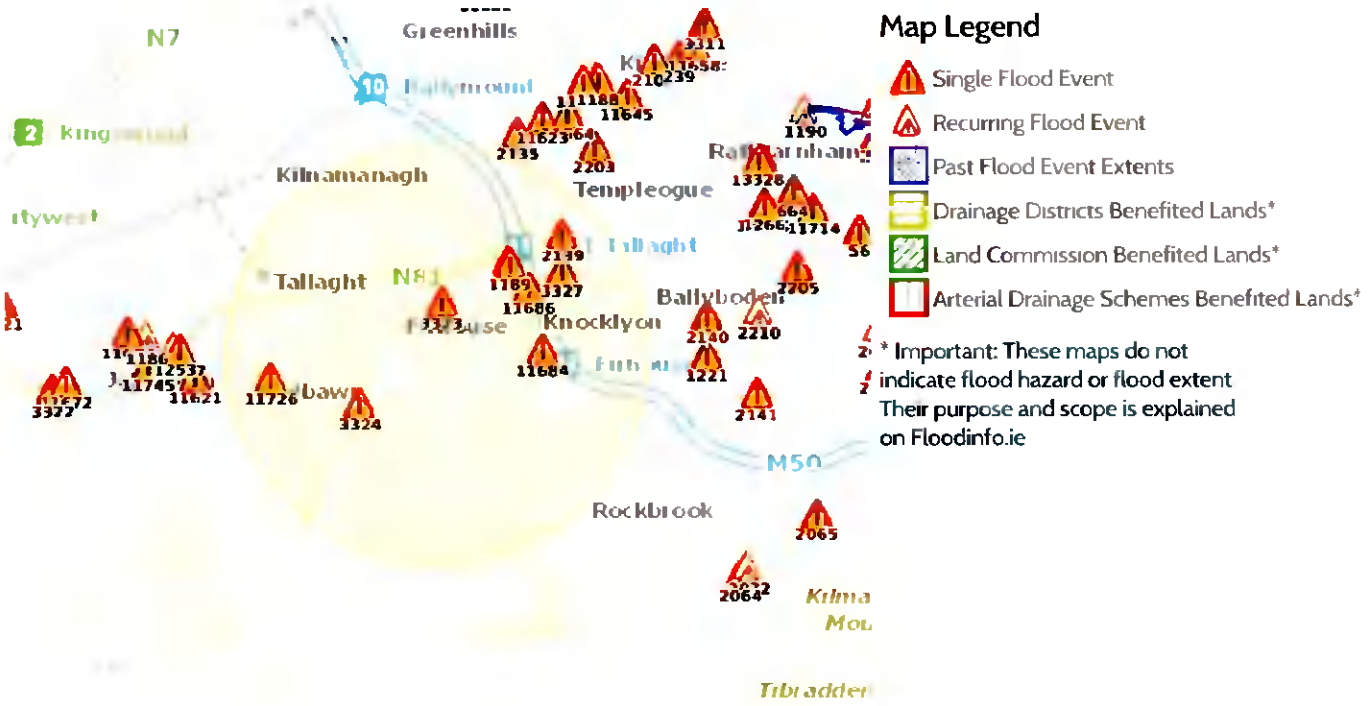
FLOOD MAP REPORT

Past Flood Event Local Area Summary Report

Report Produced: 9/9/2021 16:51

This Past Flood Event Summary Report summarises all past flood events within 2.5 kilometres of the map centre.

This report has been downloaded from www.floodinfo.ie (the "Website"). The users should take account of the restrictions and limitations relating to the content and use of the Website that are explained in the Terms and Conditions. It is a condition of use of the Website that you agree to be bound by the disclaimer and other terms and conditions set out on the Website and to the privacy policy on the Website.



9 Results

	Name (Flood_ID)	Start Date	Event Location
1.	Dodder Mount Carmel Park recurring (ID-1189)	n/a	Approximate Point
	Additional Information: Reports (2) Press Archive (1)		
2.	Old City water Course Spawell House Feb 1994 (ID-2139)	03/02/1994	Exact Point
	Additional Information: Reports (1) Press Archive (0)		
3.	Dodder Avonmore Park Nov 2000 (ID-3323)	05/11/2000	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		
4.	Dodder Kiltipper Road Nov 2000 (ID-3324)	05/11/2000	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		
5.	Knocklyon Ave Nov 2000 (ID-3327)	05/11/2000	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		
6.	Mount Carmel Park Firhouse Nov 2000 (ID-3333)	05/11/2000	Approximate Point
	Additional Information: Reports (1) Press Archive (1)		

	Name (Flood_ID)	Start Date	Event Location
7.	Flooding at Whitestown Way, Tallaght, Dublin 24 on 24th Oct 2011 (ID-11726) Additional Information: Reports (1) Press Archive (0)	24/10/2011	Exact Point
8.	Flooding at Castlefield, Glenvara and Glenlyon, Knocklyon, Dublin 16.on 24th Oct 2011 (ID-11684) Additional Information: Reports (1) Press Archive (0)	24/10/2011	Exact Point
9.	Flooding at Homeville, Knocklyon, Dublin 16.on 24th Oct 2011 (ID-11686) Additional Information: Reports (1) Press Archive (0)	24/10/2011	Exact Point

APPENDIX IV

FOUL DESIGN CALCULATIONS

FOUL DESIGN CALCULATIONS INDEX

DFK	**Doherty Finegan Kelly** *Consulting Structural & Civil Engineers,*	Botanic Court, 30-32 Botanic Road, Glasnevin Dublin 9 Tel: 8301852 / Fax: 8602265			
	Project	Design: ☑		Telephone Log: ☐	
	2no. Dwellings @ Hawthorn, Firhouse	Minutes ☐		Other Record ☐	
Project No.	Element	Prepared		Checked	
21175	**Foul Drainage**	**SG**		**CK**	

Reference: | Output.

Design Population

Description	Occupancy	Total
House #1	2.7 persons	2.7
House #2	2.7 persons	2.7
		5.4 persons

DWF and Peak Design Flow

* Foul Discharge	165.0 l/day

DWF	0.010 l/sec
6*DWF	0.062 l/sec

*Irish Water "Code of Practice for Wastewater Infrastructure" (IW-CDS-5030-03)

Colebrook-White Formula

Q =	0.062 l/sec	Pipe Dia. Ø	100.00 mm	
ks =	0.06 mm	Gradient	1 in 60.0	
Kinematic viscosity	1.141x10^-6 m²/sec	Q =	9.925 l/sec	OK
Self Cleansing Vel.	0.750 m/sec	v =	1.264 m/sec	OK

BOD_5[2]

BOD_5	60.0 g/person/day	Total BOD_5	0.3 kg/day

Design Summary

APPENDIX V

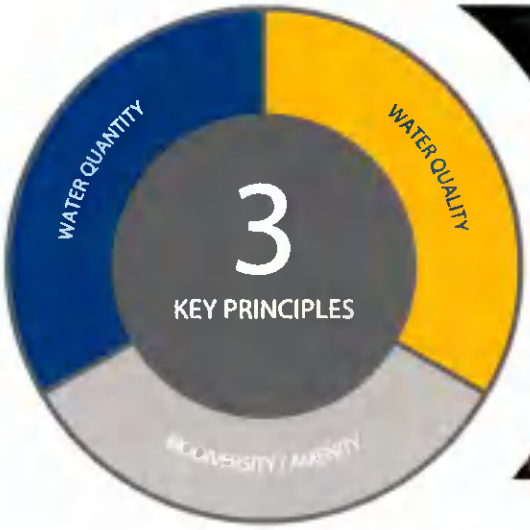
MATERIAL SPECIFICATIONS

MATERIAL SPECIFICATIONS INDEX

- Roadstone Aquaflow Permeable Paving
- Wavin Aquacell

SuDS - SUSTAINABLE URBAN DRAINAGE SYSTEM

A sustainable urban drainage system (SuDS) is an alternative to the traditional pipes, gullies and culverts approach to a development and its drainage strategy. A SuDS system comprises components and techniques that are deemed to be more sustainable and deal with storm water at source.

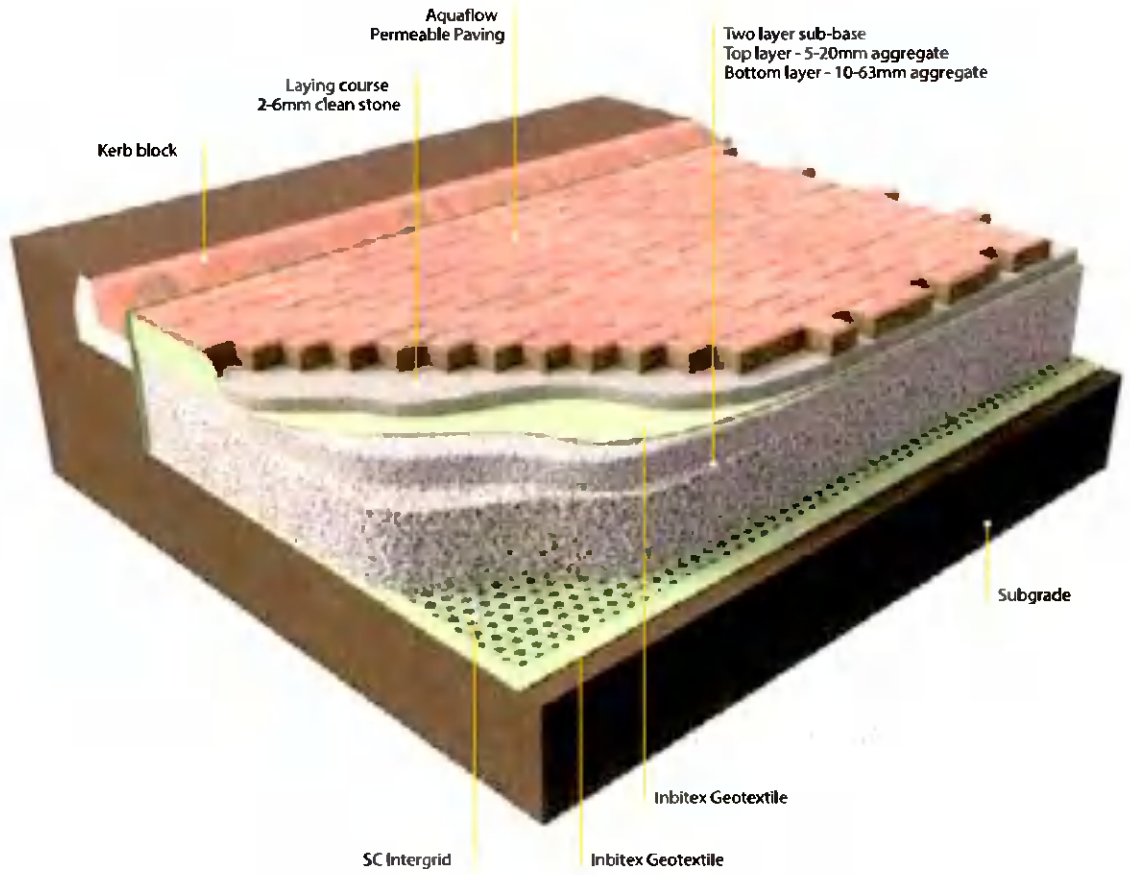


Sustainable urban drainage systems (SuDS) mimic natural drainage processes by employing these three key principles: water quality, water quantity and biodiversity/ amenity.

The Roadstone Aquaflow system provides the means to not only achieve but excel in the three key SuDS principles. Through considerate design, careful selection of techniques and materials, the Roadstone Aquaflow blocks and the Roadstone Aquaflow system deliver the following benefits:

- **Reducing water quantity** - Dealing with surface water at the source reduces the effects of urbanisation and the impact of localised flooding
- **Improving water quality** - Roadstone Aquaflow. provides two levels of storm water treatment: removing harmful pollutants and protecting the environment downstream
- **Contributing to the biodiversity** - Contributing to the biodiversity of development by working in conjunction with other SuDS techniques. Roadstone Aquaflow. allows any hard standings, including roads, to be used as drainage, producing a traditional looking surface with many desirable features.

AQUAFLOW® PAVING SOLUTION



AQUAFLOW® system

Roadstone Aquaflow has used research and design to evolve the Roadstone Aquaflow permeable paving system into one of the most cost effective and functional SuDS within the marketplace.

The Roadstone Aquaflow system has a unique sub-base design incorporating SC Intergrid which reduces construction costs whilst giving superior structural performance. Water quality improvement is realised through the use of our tried and tested Inbitex Geotextile which removes the requirement for downstream pollution control. The patented Roadstone Aquaflow system fits neatly within any block paving project, where your paving design becomes your drainage design and vice versa.

Roadstone Aquaflow SuDS can be designed as fully attenuation, fully infiltration or as a partial infiltration system. Attenuation (tanked) systems capture storm water to be collected and released in a controlled manner into sewers and downstream watercourses. Infiltration systems allow rainwater to be infiltrated into the ground mimicking a green field environment. Storm water leaving the Roadstone Aquaflow system is cleaned and filtered through the Inbitex Geotextile layers that promote microbial action. Water quality improvement allows secondary non-potable uses to be carried out such as flushing toilets and watering the garden. The Roadstone Aquaflow system can be designed for use in both trafficked and pedestrianised areas, allowing the collection and treatment of storm water from any paved surface.

Advantages of Roadstone Aquaflow

- Dealing with storm water at source
- Reduces water quantity
- Improves water quality
- Lowers construction costs
- Allows collection of storm water from impermeable surfaces
- Improved maintenance programme.

TYPICAL INFILTRATION SYSTEMS

There are four basic systems designs (see below). Each design can be tailored for infiltration or tanked according to requirements.

Infiltration

The system is underlaid with a pervious geotextile membrane (Inbitex®) and is suitable for use where it is proposed to infiltrate the water directly into a suitable sub-grade.

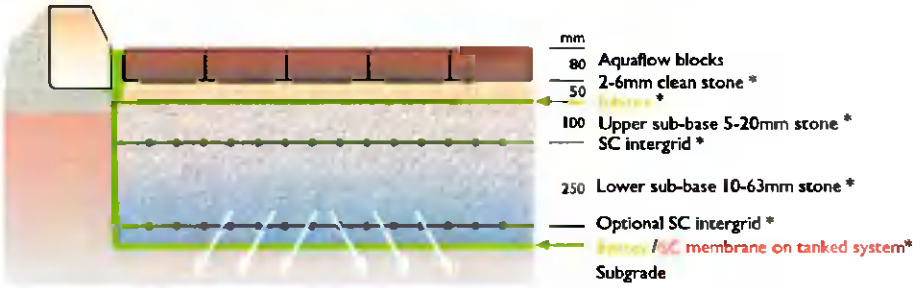
Tanked

The system is underlaid by an impervious plastic membrane (SC membrane) and is suitable for use where it is proposed to attenuate storm water before releasing it in a controlled manner, harvest the water for re-use or where difficult or contaminated sub-grades are encountered.

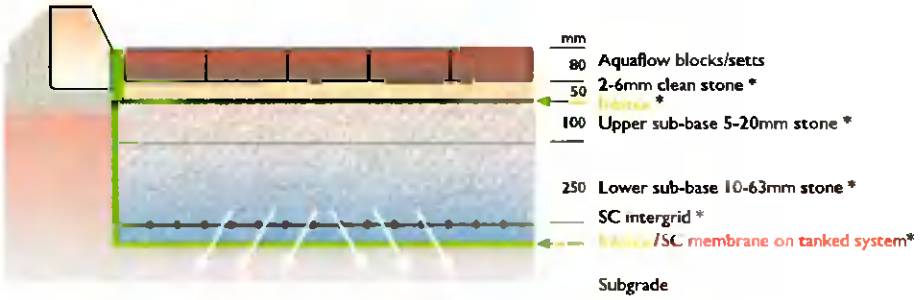
The type of membrane used and the method of sealing will depend upon the application. In some circumstances, the membrane will require additional protection from puncturing and specialist advice should be obtained.

The impervious membrane restricts water entering the sub-grade and preserves sub-grade structural integrity. This is very important where clay subgrades are encountered.

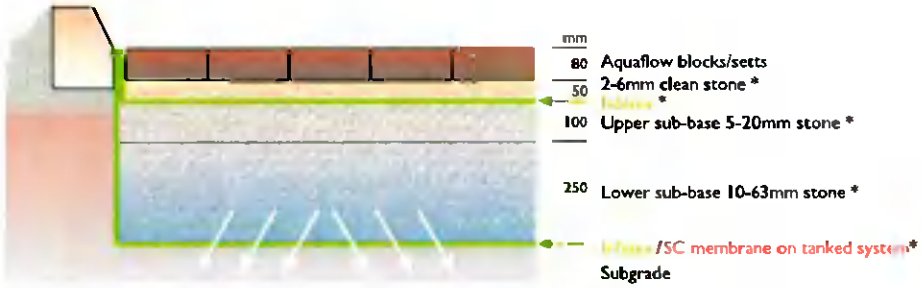
Typical Infiltration system
Areas subject to trafficking by HGV's



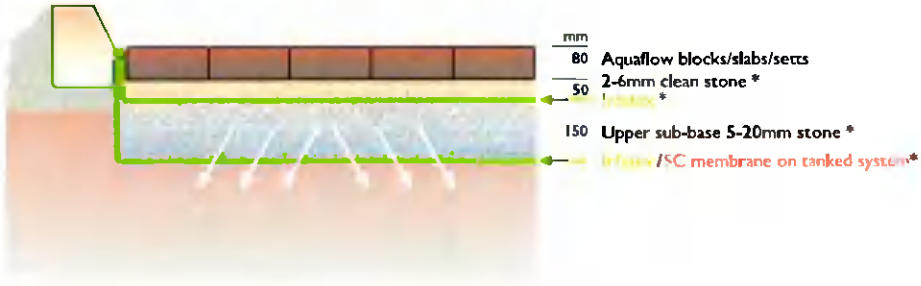
Typical Infiltration system with a sub-grade CBR of between 2-5%
Parking areas subject to trafficking by cars and vans only



Typical Infiltration system with a sub-grade CBR of 5% or greater
Parking areas subject to trafficking by cars and vans only



Typical footpath construction
For Aquaflow



STONE SPECIFICATIONS

Lower sub-base layer 10-63mm clean crushed stone

Sieve sizes	% passing
80mm	90-100
63mm	90-100
40mm	60-80
20mm	15-30
10mm	0-5
Reference specification	BS EN 13242:2002

Laying course 2-6mm clean crushed stone

Sieve sizes	% passing
10mm	98-100
6.3mm	80-100
2mm	0-100
1mm	0-5
Reference specification	BS EN 13242:2002

Upper sub-base layer 5-20mm clean crushed stone

Sieve sizes	% passing
40mm	100
20mm	90-100
10mm	25-75*
4mm	0-15
2mm	0-5
Reference specification	BS EN 13242:2002
Material specification	Material supplied shall be referred to as 5-20mm clean crushed stone and conform to the above sieve analysis and aggregate testing

Surface Dressing 2-4mm clean crushed stone

Sieve sizes	% passing
6.3mm	100
5mm	95-100
3.35mm	66-90
1.18mm	0-20
600 microns	0-8
600 microns	0-1.5
Reference specification	BS EN 1097-2:1998 BS EN 1091-8:2000 Annex A

**Aggregate Testing*

Los Angeles Coefficient (LA) - Determination of resistance to fragmentation = 20 BS EN 13242:2002. Note: Lower values than those specified signifies better resistance to fragmentation and abrasion and is therefore acceptable.

AQUAFLOW® COMPONENTS

Inbitex Geotextile

Exclusive to Roadstone/Formpave Aquaflow system, this non-woven geotextile is used for separation, filtration and pollution control.

SC Intergrid

Exclusive to Roadstone/Formpave and the Aquaflow system this sub-base stabilisation grid improves structural strength, increases design life and reduces construction costs.

SC Membrane

This impermeable membrane allows the storage of collecting storm water. Used for the Aquaflow attenuation system it can be welded or taped dependent on the application. A higher grade SC Membrane GT can be specified when contamination is present.

SC Findrain

This drainage component allows efficient and high flow removal of storm water from the Roadstone Aquaflow system. Wrapped in Inbitex Geotextile which provides further filtration and cleansing.

Aquaflow Distribution Tanks

Voided crates that are extremely strong structurally and are wrapped in Inbitex Geotextile, which provides filtration and cleansing. Allows the collection of impermeable surface water catchment, such as roofs to the Aquaflow system.

Top Hats, Tape and Fittings

Roadstone Aquaflow system components.

SuDS SPECIFICATION

Types(s) of Paving
Roadstone Aquaflow permeable concrete block paving range.

Reference
Roadstone Aquaflow paving.

Size
As per Roadstone Ltd.

Colours
Various colours and finishes available.

Setting Out
See page 47/48 of brochure.

Kerbs
See page 30-32.

Laying course
50mm depth of 2-6mm single size clean crushed stone to BS EN 13242: 2002. The crushed stone used for the laying course must have a minimum LA Coefficient of 25.

Inbitex Geotextile
As specification.

Depth of Sub-base
It is recommended that a sub-base depth of 350mm should be used. The depth of sub-base may be varied at the discretion of the engineer.

Sub-base Specification
All granular sub-base material shall comprise crushed rock or concrete possessing well defined edges. It must be sound, clean, non-friable and free from clay or other deleterious matter.

The material must be non-plastic when tested in accordance with BS1377 Test No.4.

The crushed stone used for the sub-base must have a minimum LA Coefficient of 25.

The selected test samples shall not be oven dried and should be soaked in water at room temperature for 48 hours before the test. The 100mm deep upper layer of sub-base material should be graded 5mm-20mm to BS EN 13242: 2002.

Intergrid(s)
SC Intergrid Geogrid.

DBM Running Course
To be 20mm dense base binder course manufactured with 100/150 grade bitumen to BS4987. The DBM shall conform with the Requirements of BS 4987.

SC Membrane Geomembrane
Generally a taped membrane will be suitable for most applications of the tanked system. If a guaranteed watertight system is required a fully welded system should be installed.

Examples of this type of application would be sites with a high water table, methane contamination, areas above basements or retaining walls. Further advice should be sought from the Formpave design team.

Findrain
150/300mm Findrain to BBA Number 95/85.

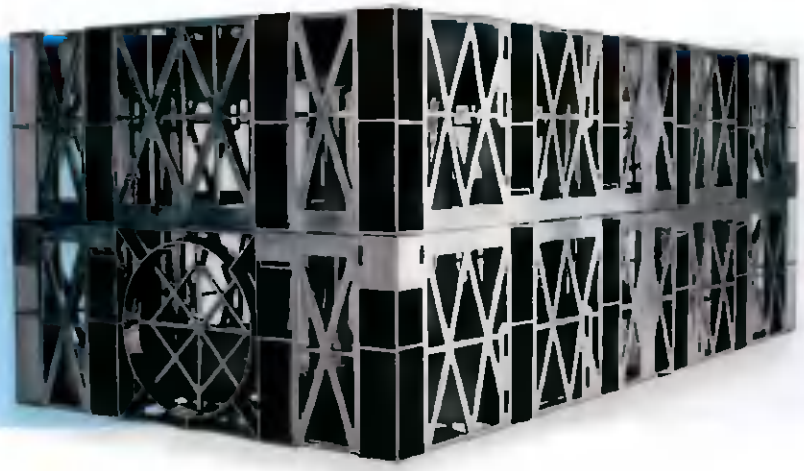
Top hat seal
Formpave top hat seal.

Product Datasheet

AquaCell Eco

Product description

AquaCell Eco is manufactured from specially reformulated, recycled material and has been specifically designed for shallow, non-trafficked, landscaped applications. AquaCell Eco is NOT suitable for locations subject to high water tables.



Technical specification

Product code / SAP code	6LB025 / 4040289	**Void ratio**	95%
Colour	Black	**Material**	Recycled PP
Dimensions	1m x 0.5m x 0.4m	**Vertical loading**	21.3 tonnes/m² (213 kN/m²)
Weight	7kg	**Lateral loading**	5.2 tonnes/m² (52 kN/m²)
Storage volume	190 litres	**BBA approval**	Certificate 03/4018

Maximum installation depths

	Maximum depth of installation – to base of units (m)[1]		
Typical soil type	**Soil weight kN/m³**	**Angle of internal friction φ (degrees)[2,3]**	**Landscaped areas**
Over consolidated stiff clay	20	24	1.53
Silty sandy clay	19	26	1.68
Loose sand and gravel	18	30	2.08
Medium dense sand and gravel	19	34	2.35
Dense sand and gravel	20	38	2.68

Minimum cover depths

	Landscaped areas
Minimum cover depth (m)	0.30[3]

1. These values relate to installations where the groundwater is a minimum of one metre below the base of the excavation.
2. AquaCell Eco units should not be used where groundwater is present.
3. 0.5m cover is required where a ride-on mower may be used.

Assumptions made:

- Ground surface is horizontal
- Shear planes or other weaknesses are not present within the structure of the soil

Source: BBA

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