

SUDS Drainage Report

Re: D22A/0124
Citywise Science & Language Centre,
Durkan Centre,
Fortunestown Way,
Tallaght,
Dublin,
A94 YX22.

Client: Citywise Education

Date: 28th May 2021



*Unit B19, KCR Estate,
Ravensdale Park,
Kimmage, Dublin 12.*

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REV	DESCRIPTION	DATE	BY	APPROVED	DOCUMENT

1.0 Introduction:

With reference to Condition No.2 of the Additional Information requested, regarding the details of the Sustainable Drainage Systems (SUDS), and storm water management to be included in the proposed development.

The existing site is 0.43ha, has an existing building used for education purposes, with a footprint area of 800m².

The surface water drainage is currently serviced by a 300mm diameter public storm sewer which runs adjacent to the front/north boundary of the site, and a 225mm diameter public storm sewer to the rear/south-east of the site in Bawnlea Close.

The new development has impermeable roof area of 705m² and pavement area of 173m², the stormwater runoff of which is to be managed as parts of the SUDs plan for the new development.

All proposed developments must ensure that SUDS are incorporated into the development. SUDS requires that post development run-off rates be maintained at the equivalent to, or lower than, the predevelopment run-off levels. Thus, the development must be able to retain, within its boundaries, storm water volumes from extreme storm events up to and including a design for a 1 in 100year storm event, more commonly expressed as a 1.0% AEP (Annual Exceedance Probability), while also allowing for climate change factors (+CC). Any new development must have physical capacity to retain storm water volumes as directed under the Greater Dublin Strategic Drainage Study (GDSDS) and, if necessary, release this attenuated surface water runoff before it enters a natural watercourse or into a public sewer, which ultimately discharges to a water body. This is to ensure the highest possible standard of storm water quality.

All hardstanding contributing areas (i.e. pavement and flat roof) are applied directly to the surface water network at the appropriate time of concentration

2.0 Site Specific SUDs Measures:

Sustainable Drainage Systems (SUDS) were considered for the site, in line with recommendations of Greater Dublin Strategic Drainage Strategy (GDSDS). SUDS are a method of replicating the natural characteristics of rainfall runoff from any site.

2.1 Soakaway:

Soakaways are below ground, rainwater infiltration structures, that can have different forms from the traditional stone filled excavations with a void ratio of 0.3 to those using modular geo-cellular units to form a below ground void, with a void ratio of 0.95.

Soakaways provide stormwater attenuation, stormwater treatment and ground water recharge.

In this development various types of SUDS systems were considered, but primarily due to the following factors; the Ground Water Table at approximately 1.4m below ground level, the flat topography of the site, and the relatively shallow invert levels of the existing outfall Storm Water Manholes, it was deemed that the most suitable SUDS measure to cater for the 'point' flows from the roof of the new development is use of a Soakaway structure, using a proprietary modular system with a high void ratio, i.e. 'Aquacells' to reduce area required.

2.2 Permeable/Pervious Paving:

It is also proposed to use a Type A [Total Infiltration] Permeable Pavement to receive the run-off from the majority of the new paved areas.

Permeable pavements provide a pavement suitable for pedestrian and/or vehicular traffic, while allowing rainwater to infiltrate through the surface and into the underlying structural layers, and also attenuates the rainwater beneath the overlying surface before infiltration. Pervious pavements are an efficient means of managing surface water runoff close to its source – intercepting runoff, reducing the volume and frequency of runoff, and providing a treatment medium.

3.0 Hydraulic Design:

3.1 Infiltration Rate Calculation:

The soil characteristics and suitability for infiltration were carried out in accordance with the procedure described in BRE Digest 365. This was carried out from the 27th to the 30th of July 2022. See attached photos #'s 01-06.

An infiltration rate (f) of 8.79×10^{-7} m/s was calculated*. With reference to CIRIA C753 SUDS Manual, a Factor of Safety of 5 was applied to give an Adjusted Soil Infiltration Rate (q) of 1.76×10^{-7} m/s, which was used for hydraulic calculations associated with the SUDS elements. See attached calculation sheet.

[* Trial pit was already empty after third fill when inspection of the -30th July 2022, therefore f value calculated is believed to be conservative].

After the initial excavation, ground water was noted at a depth of 1.5m below ground level. This was taken into consideration for SUDS measures design.

3.2 Attenuation Volume Design: (See attached calculation sheet):

Design Parameters:		Ref.
Max Run-off Rate	2L/s/ha	GSDSDS & GDRCP
Storm Return Period	10yr.; 100yr.	
Storm Duration	60 in.; 30min	
Max Rainfall for		
Extreme Rainfall Return Period	20.9mm; 28mm	Met Eireann (Casement)
Impermeable area	846m ²	
Permeable area	208m ²	
Climate Change Factor	20%	

3.3 Outlet Flow Control Design: (See attached calculation sheet):

As noted above the maximum run-off/discharge rate from the site to watercourses/storm sewer is 2L/sec/ha as to replicate the movement of naturally infiltrated rainwater on the site prior to any development on the site. As a means of controlling the outflow from the development, a Perforated Riser is the proposed control structure to restrict the overflow from the Soakaway structure. With reference to the development area, the Perforated Riser located within a flow control chamber downstream of the proposed SUDS measures, has been designed in accordance with SUDS Handbook CIRIA C753 28.5.3 to have a Total Flow Capacity of 2L/sec/ha when connected to the existing stormwater sewer within the site.

Signed: _____ Date: _____

Marty Wardick
Chartered Engineer

Appendix A - Photos



#01 – Trial pit excavation for percolation test – 27th July 2022.



#02 – Trial pit before 1st fill, 27th July 2022.



#03 – Immediately after 1st Fill, 27th July 2022.



#04 – Immediately after 3rd fill, 29th July 2022.



#05 – Immediately after 3rd fill, 29th July 2022, Top of Water to Ground Level – 980mm.



#06 – Day after 3rd fill, 30th July 2022.

Appendix B

- Drainage Layout Plan - Drawing D-01 Rev B
- Drainage Details – Drawing D-02
- Infiltration Rate Calculation Sheet
- Soakaways Calculations Sheet – 10 Year Storm
- Soakaways Calculations Sheet – 100 Year Storm
- Perforated Riser Flow Control Calculation Sheet

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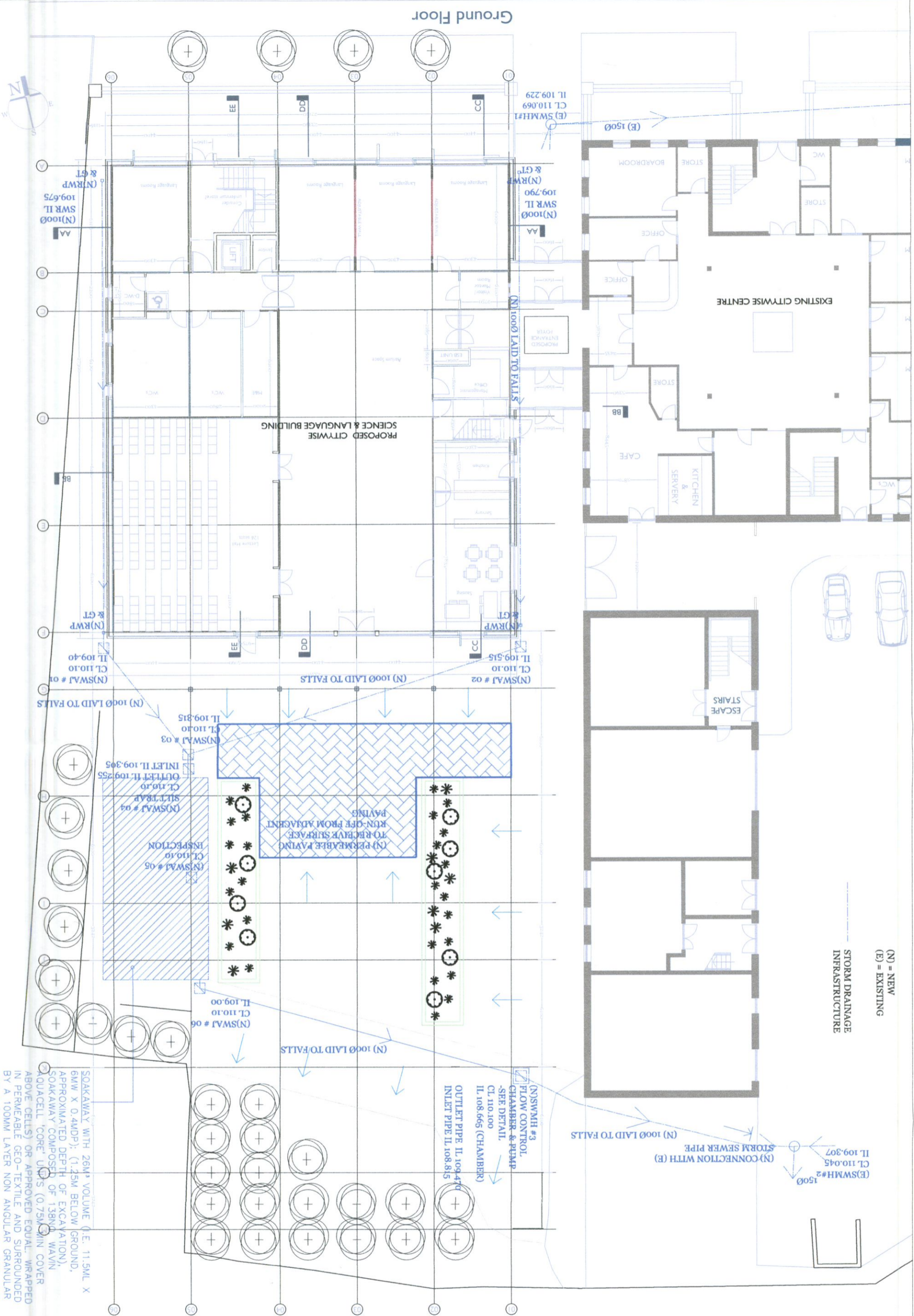
DRAINAGE PLAN - PROPOSED

Project:
 Citywise,
 Durkan Centre,
 Fortunestown Way,
 Jobstown, Dublin 24.

SOAKAWAY LOCATION TO BE 5M FROM BUILDINGS; AND 3M FROM ADJACENT BOUNDARIES. LOCATION TO BE APPROVED CONSULTANT ENGINEER.

Client: Citywise Education
 Drawing Title: Drainage Plan
 Scale: 1:200 [A3]
 Drawing No.: D-01 Rev B
 Date: Aug. 2022

SOAKAWAY WITH 26M³ VOLUME (I.E. 11.5ML X 6MW X 0.4MDP); (1.25M BELOW GROUND), APPROXIMATED DEPTH OF EXCAVATION), SOAKAWAY COMPOSED OF 138M² WAIN QUACELL 'CORE' UPS (0.75M SKIN COVER ABOVE CELLS) OR APPROVED EQUAL. WRAPPED IN PERMEABLE GEO-TEXTILE AND SURROUNDED BY A 100MM LAYER NON ANGULAR GRANULAR STONE (PEA GRAVEL) TO ALL SIDES, TOP AND BOTTOM.



(N) = NEW
 (E) = EXISTING

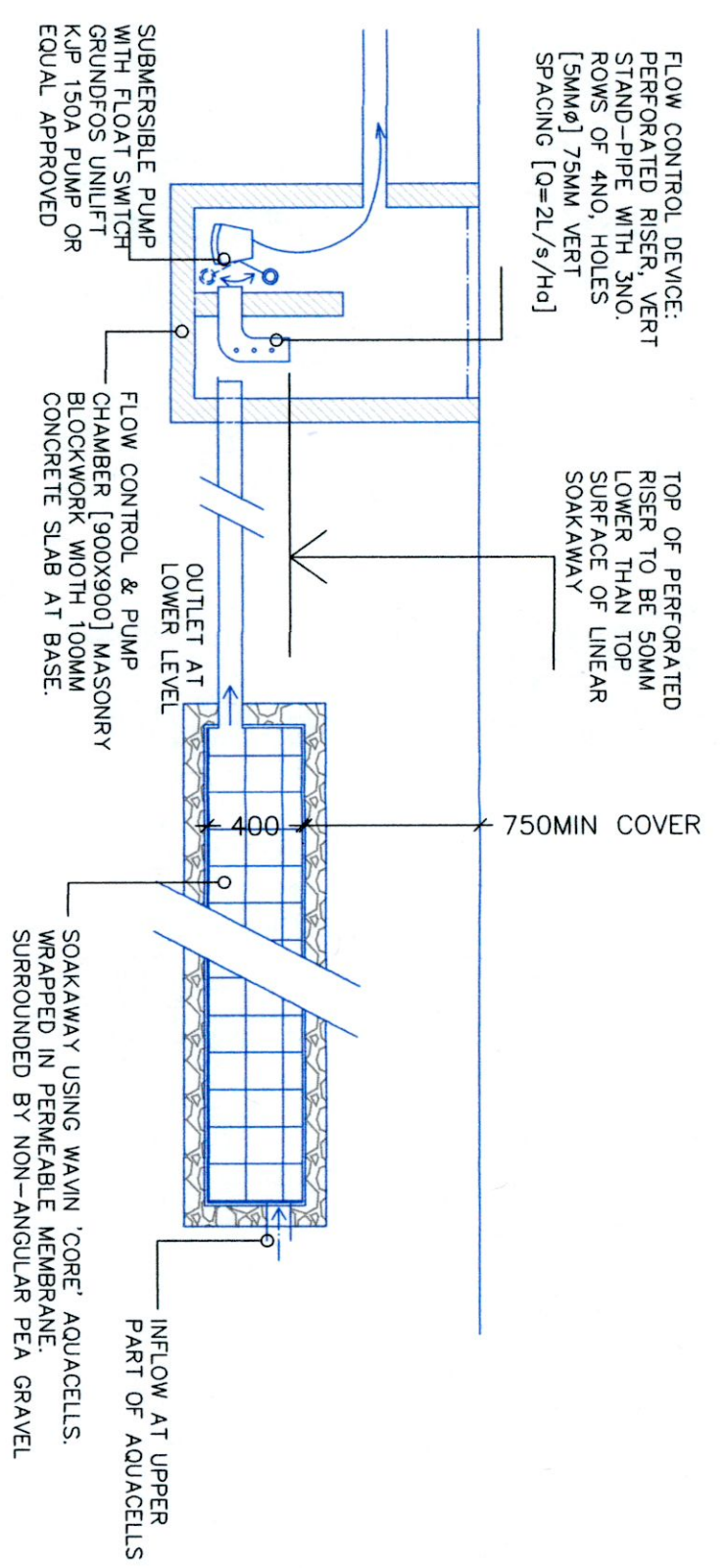
STORM DRAINAGE INFRASTRUCTURE

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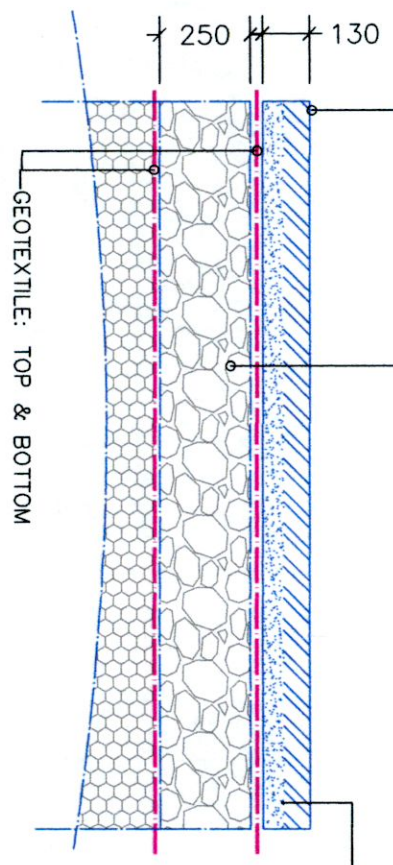


**PERFORATED RISER
FLOW CONTROL CHAMBER-OUTFALL**

SELECTED PERMEABLE PAVEMENT (CE
APPROVED), INSTALLED IN
ACCORDANCE WITH MANUFACTURERS
INSTRUCTIONS

PERMEABLE SUB-BASE:
COURSE GRADED
AGGREGATE 5/20MM
[BS EN 13242:2002]

50MM LAYING COURSE 2/6.3MM
[BS EN 13242:2002]



PERMEABLE PAVEMENT [TYPE A : TOTAL INFILTRATION]- SECTION/DETAIL

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Project:
Citywise Science & Language Centre,
Durkan Centre,
Fortunestown Way,
Dublin 24.

Client: Citywise Education
Drawing Title: SUDS Details
Scale: NTS
Drawing No.: D-02
Date: August 2022



SECTIONAL ELEVATION

SECTIONAL ELEVATION



SECTIONAL ELEVATION

Soil Infiltration Rate Calculation:

Project: *New Citywise Science & Language Centre*

Location: *Durkan Centre, Fortunstown Way, Tallaght, Dublin 24.*

Trial Pit

Dimensions:

Length (l) =	0.6 m	1st filling:	27-Jul-22
Width (w) =	0.875 m	2nd filling:	28-Jul-22
Hole Depth=	1.5 m	3rd filling:	29-Jul-22
Depth of water (d1) =	0.520 m	15.35 pm	29-Jul-22
Depth of water (d2) =	0.00 m	12.30 pm	30-Jul-22
Depth delta =	0.52 m	[use 24hr clck]	
Initial Volume of Water	0.273 m3		
Final Volume of Water	0 m3		

Soil Infiltration Rate (f) = $V_p(75-25) / A_{p50} \times t_p(75-25)$
as per BRE 365

tp (75-25)		
Time delta =	1257 minutes	20.95 hrs
	75420 secs	

Vp(75-25)	0.1365 m3
Volume delta	

50% percolation in 24hrs test
percentage drop in volume of water in 24 hours
100.00%
OK percolation volume greater than 50% in 24hrs

Ap50=	2.059 m2
Ap50= [(l+w) x 2 x delta d] + [l x w]	

Soil Infiltration Rate (f) = 8.79E-07 m/s

0.00316441 m/hr

Safety Factor (1.5 - 10)

5

Ref SUDS Manual C697 4-30

Adjusted Soil Infiltration Rate (q) 1.758E-07 m/s
0.00063288 m/hr

Name	Address	City	State
John Doe	123 Main St	New York	NY
Jane Smith	456 Elm St	Los Angeles	CA
Bob Johnson	789 Oak St	Chicago	IL
Alice Brown	101 Pine St	Houston	TX
Charlie White	202 Cedar St	Phoenix	AZ
Diana Green	303 Birch St	Philadelphia	PA
Ethan Black	404 Maple St	San Antonio	TX
Fiona Grey	505 Walnut St	San Diego	CA
George Blue	606 Spruce St	Dallas	TX
Hannah Yellow	707 Ash St	San Jose	CA
Ivan Purple	808 Hickory St	Austin	TX
Julia Pink	909 Sycamore St	Jacksonville	FL

Total: 10 records
 Page 1 of 1
 Date: 2023-10-27

Project: *New Citywise Science & Language Centre*
Location: *Durkan Centre, Fortunstown Way, Tallaght, Dublin 24.*

Total Area of Site **4348 m²**

Area Data:

Area	Impermeability [%]	Effective Area [m ²]
Impermeable area 846 m²	New Roof Area 100%	846 m²
Partial permeable area 83 m²	Soakaway area 100%	83 m²
Other: Landscaped, green roof 0 m²	0%	0 m²
929 m²		
Eff. Area drained to Soakway		929 m² incl 20% CCA

Return Period Rainfall Depths [Ref. Met Eireann]

Location: Casement Aerodrome Dublin

10 year Return Period - 60 minute duration

20.9 mm

Design Rainfall [R10-60min]:

10 year storm - 60 min duration:

Inflow to Soakway [A x R10-60]:

19.4 m³ Inflow

SUDS MEASURE #1

SOAKAWAY

Proposed Soakway - Dimensions:

Length: **11.5 m**
 Breadth: **6 m**
 Depth: **0.4 m**

Total Volume of Soakway **27.6 m³**

Net Volume of Soakway **26.22 m³**

Free volume %

95% 138

[95% for 'Aquacells'; 30% for stone]

Outflow from Soakways during storm (O) $O=As_{50} \times f \times D$

SOAKAWAY

As₅₀= **7.00 m²**
 f= **1.76E-07 m/s**
 D= **21600 secs**

Internal surface area (excl. base area) of soakway to 50% effective depth
 Calculated Adjusted Infiltration Rate (FOS)
 Duration of storm

Outflow = 0.03 m³

Inflow - Outflow = Storage Required

[I-O=S]

19.39 m³ Storage Required

SOAKAWAY Storage Volume = 26.2 m³

6.83 m³ Surplus

Adequate free volume of soakway; greater than inflow

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Project: New Citywise Science & Language Centre
Location: Durkan Centre, Fortunstown Way, Tallaght, Dublin 24.

Total Area of Site 4348 m²

Area Data:		Area	Impermeability [%]	Effective Area [m ²]
Impermeable area	846 m ²	New Roof Area	100%	846 m ²
Partial permeable area	83 m ²	Soakaway area	100%	83 m ²
Other: Landscaped, green roof	0 m ²		0%	0 m ²
	929 m ²			
Eff. Area drained to Soakway				929 m ² incl 20% CCA

Return Period Rainfall Depths [Ref. Met Eireann]

Location: Casement Aerodrome Dublin

100 year Return Period - 30 minute duration

28 mm

Design Rainfall [R100-30min]:

100 year storm - 30 min duration:

Inflow to Soakway [A x R10-60]:

26.0 m³ Inflow

SUDS MEASURE #1

SOAKAWAY

Proposed Soakway - Dimensions:

Length: 11.5 m
 Breadth: 6 m
 Depth: 0.4 m

Total Volume of Soakway 27.6 m³

Net Volume of Soakway 26.22 m³

Free volume %

95% 138
 [95% for 'Aquacells'; 30% for stone]

Outflow from Soakaways during storm (O) O=As50 x f x D

SOAKAWAY

As50= 7.00 m²
 f= 1.76E-07 m/s
 D= 21600 secs

Internal surface area (excl. base area) of soakway to 50% effective depth
 Calculated Adjusted Infiltration Rate (FOS)
 Duration of storm

Outflow = 0.03 m³

Inflow - Outflow = Storage Required

[I-O=S]

25.98 m³ Storage Required

SOAKAWAY Storage Volume = 26.2 m³
 0.24 m³ Surplus

Adequate free volume of soakway; greater than inflow

Project: *New Citywise Science & Language Centre*
Location: *Durkan Centre, Fortunstown Way, Tallaght, Dublin 24.*

Ref.: CIRIA C753
 28.5.3

Total Flow capacity
 of **Perforated Riser** $Q=C_p \cdot 2A_p \cdot (2g)^{1/2} \cdot (H^3/2)/3H_s$ m³/s

Q= 0.000200236 m³/sec (using input below in blue)
 2.00E-04 m³/sec = 0.20023568 L/sec

Q= discharge, m ³ /s	=		
C _p = discharge coeff (0.61 for perforations)	=	0.61	
A _p =Cross sectional area for all holes, m ²	=	0.000942 m ²	
radius of holes	=	5 mm	0.005 m
no of holes per row	=	4 no.	
no. of rows	=	3 no.	
Total no. of holes	=	12 no.	
g= gravity	=	9.81 m/s ²	
H _s = Distance from S/2 below the lowest row of holes to S/2 above the top row,m	=	225 mm	0.225 m
S= distance between holes, m	=	75 mm	0.075 m
H= effective head, m	=	89 mm	0.089 m

Allowable flow= 2 L/s/ha= 0.0000002 m³/s/m²
 Impermeable area receiving= 1000 m² = 0.100 ha
 therefore allowable flow for area= 0.0002 m³/sec
 2.00E-04 m³/sec
 0.2 L/sec

Date	Description	Amount	Balance
1/1/2020	Opening Balance		100.00
1/15/2020	Deposit	50.00	150.00
2/1/2020	Withdrawal	20.00	130.00
2/15/2020	Deposit	30.00	160.00
3/1/2020	Withdrawal	10.00	150.00
3/15/2020	Deposit	40.00	190.00
4/1/2020	Withdrawal	15.00	175.00
4/15/2020	Deposit	25.00	200.00
5/1/2020	Withdrawal	10.00	190.00
5/15/2020	Deposit	35.00	225.00
6/1/2020	Withdrawal	20.00	205.00
6/15/2020	Deposit	45.00	250.00
7/1/2020	Withdrawal	15.00	235.00
7/15/2020	Deposit	30.00	265.00
8/1/2020	Withdrawal	10.00	255.00
8/15/2020	Deposit	40.00	295.00
9/1/2020	Withdrawal	25.00	270.00
9/15/2020	Deposit	35.00	305.00
10/1/2020	Withdrawal	15.00	290.00
10/15/2020	Deposit	45.00	335.00
11/1/2020	Withdrawal	20.00	315.00
11/15/2020	Deposit	30.00	345.00
12/1/2020	Withdrawal	10.00	335.00
12/15/2020	Deposit	40.00	375.00
1/1/2021	Opening Balance		375.00