

**ENGINEERING SERVICES REPORT**

**Doc. No:** P2005-C-001

**PROJECT:** U-STORE-IT, LIFFEY VALLEY

**STATUS:** PLANNING PERMISSION

**CLIENT:** OCEANGLADE LTD

**ARCHITECT:** CAREW KELLY ARCHITECTS



**Ireland Office:**  
Scope House  
Whitehall Road  
Dublin 12K8PP

**UK Office:**  
75 Shelton St  
Covent Garden  
London WC2H 9JQ

*Where this document has been revised it is recorded as indicated below. Please replace all superseded pages of this document with current version.*

Rev	Date	Description	By	Checked	Approvals	
P1	14 Oct 2021	Planning Submission	SJ	GD/CP		
P2	25 Jan 2022	RFI Response	SJ	GD/CP		
<input checked="" type="checkbox"/> Entire Document Issued this Revision						

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## 1.0 INTRODUCTION

This Engineering Services Report (ESR) has been prepared by GDCL Consulting Engineers on behalf of U-Store-It which relates to the proposed residential development located at the Liffey Valley Complex, Fonthill Rd, Quarryvale, Co. Dublin. The site location is shown in Figure 1 below:



Figure 1 – Site Location Map

The site is approximately 0.73ha in area and is bordered to the west by a Giraffe Childcare facility and greenfield site, to the east by a multi-storey office complex, to the west by an An Post distribution facility, to the south by Liffey Valley Complex service road, and to the north by the N4 Motorway.

The proposed development will consist of the construction of a storage facility comprising two floors over a drive-in basement, comprising of:

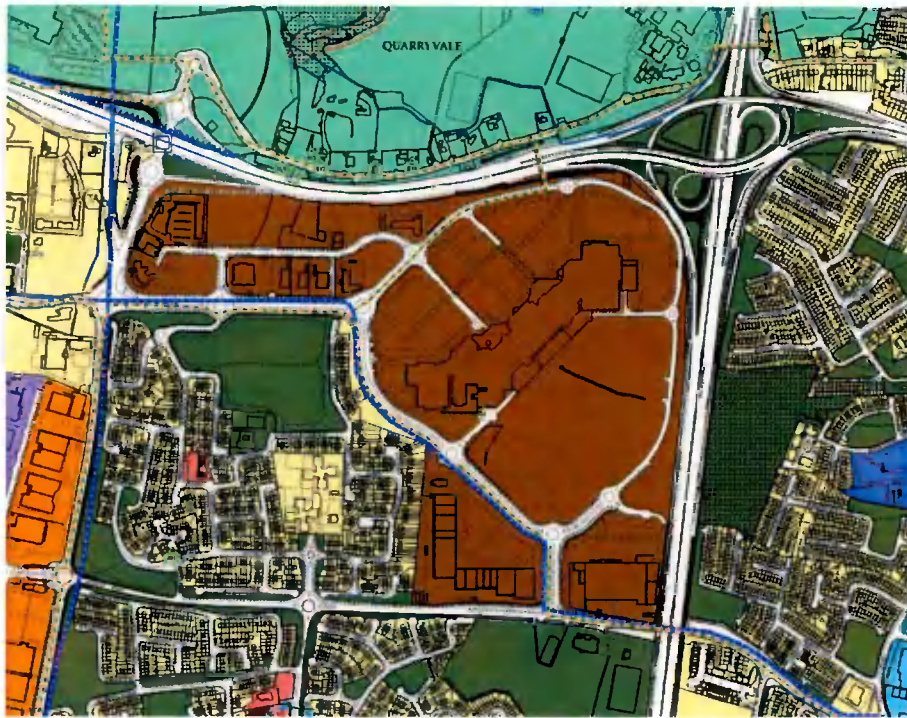
- Reception/admin office/toilets on the ground floor
- Walk in storage units from the ground floor upwards
- A commercial unit on the ground floor

- Drive in storage units at basement level







The proposed development forms part of a larger site previously granted planning permission under Planning Register Reference S99A/0948 & S01A/0332, with much of the external drainage and watermain infrastructure already constructed.

The proposed development site is accessible at ground floor level via the existing has a single-entry point on the Liffey Valley Complex service road with the drive-in basement/undercroft level accessible by an existing access road to the east of the proposed site, currently serving the adjacent office complex.

The site is located within the South Dublin County Council Development Plan 2016 - 2022 Map 2 boundary and zoned as Objective MRC - *'To protect, improve and provide for the future development of a Major Retail Centre'*. Please refer to the below Figure for details.



### Use Zoning Objectives

	Objective RES	To protect and/or improve residential amenity
	Objective RES-N	To provide for new residential communities in accordance with approved area plans
	Objective SDZ	To provide for strategic development in accordance with approved planning schemes
	Objective REGEN	To facilitate enterprise and/or residential-led regeneration
	Objective TC	To protect, improve and provide for the future development of Town Centres
	Objective MRC	To protect, improve and provide for the future development of a Major Retail Centre

**Figure 2 - South Dublin County Council Development Plan 2016 - 2022 Map 2 Excerpt**

The aim of this report is to provide information on the calculations, estimates and assumptions used to design the foul drains, surface water drains, SuDS systems, surface water attenuation and water supply for the proposed development.

Foul and surface water systems for the site will be separate and are designed in accordance

with the requirements of South Dublin County Council, the recommendations of the Greater Dublin Strategic Drainage Study (GSDSDS), the Building Regulations and the recommendations of the DOE Recommendations for Site development works for Housing areas. In addition, sewers have been designed with reference to the 'The Planning System and Flood Risk Management Guidelines', the Greater Dublin Regional Code of Practice for drainage works and Irish Water Standards Details for water and wastewater as applicable.





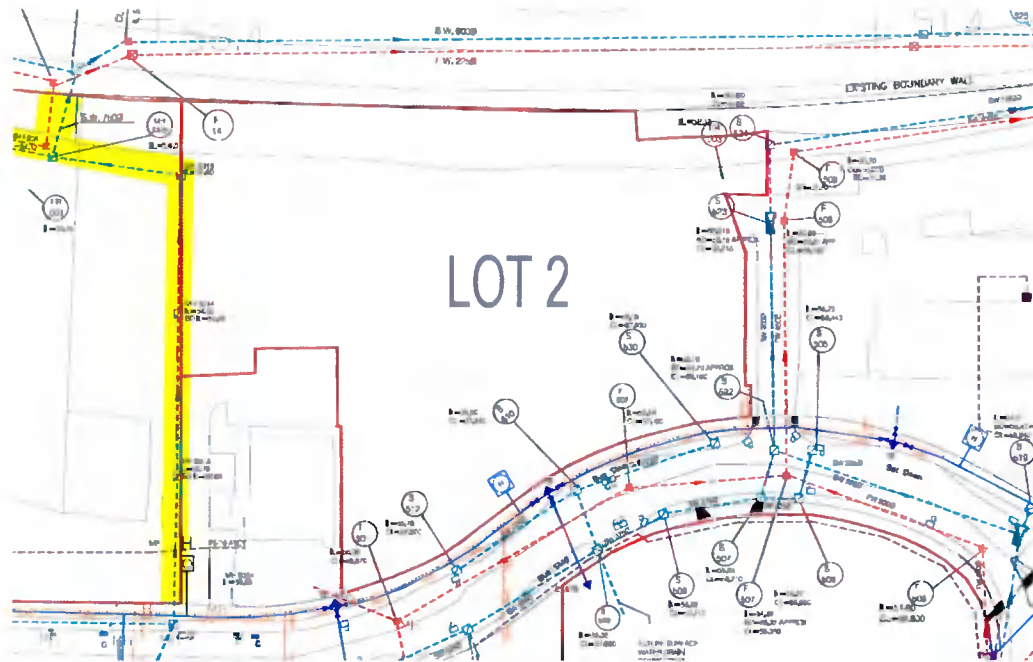


Figure 4 - Existing Site Services – Lot 2 MMOS Report

It is proposed that the surface water discharge into the existing 1050mm diameter surface water sewer located to the east of the subject site:

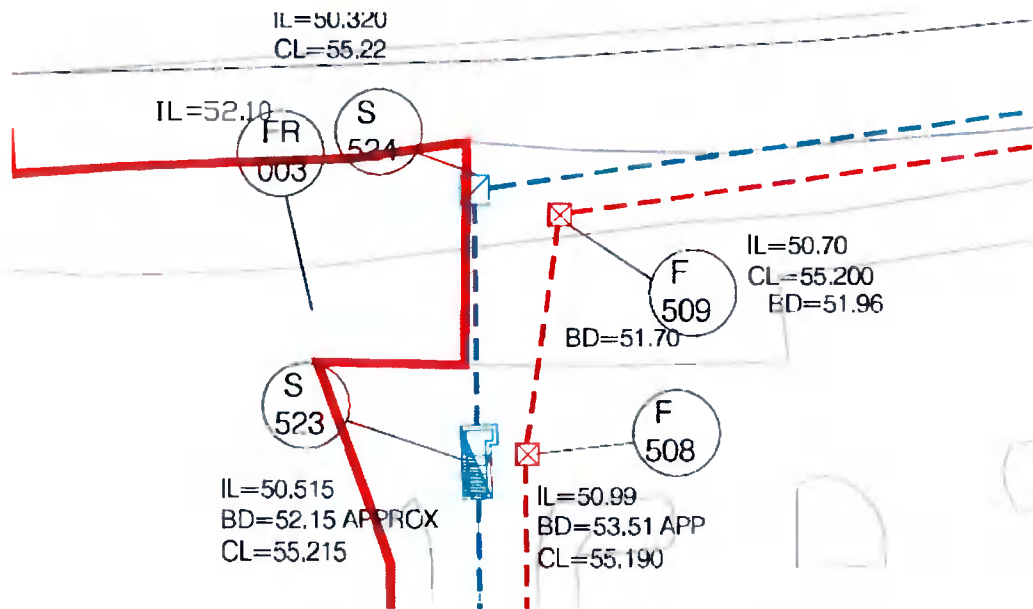


Figure 5 - Proposed Surface Water Connection Point



It is proposed that the foul water discharge into the existing 450mm diameter foul water sewer located to the south of the subject site. Additionally, it is proposed that the watermain be connected to the existing services in this location. Irish Water records indicate that the watermain is 100mm in diameter.

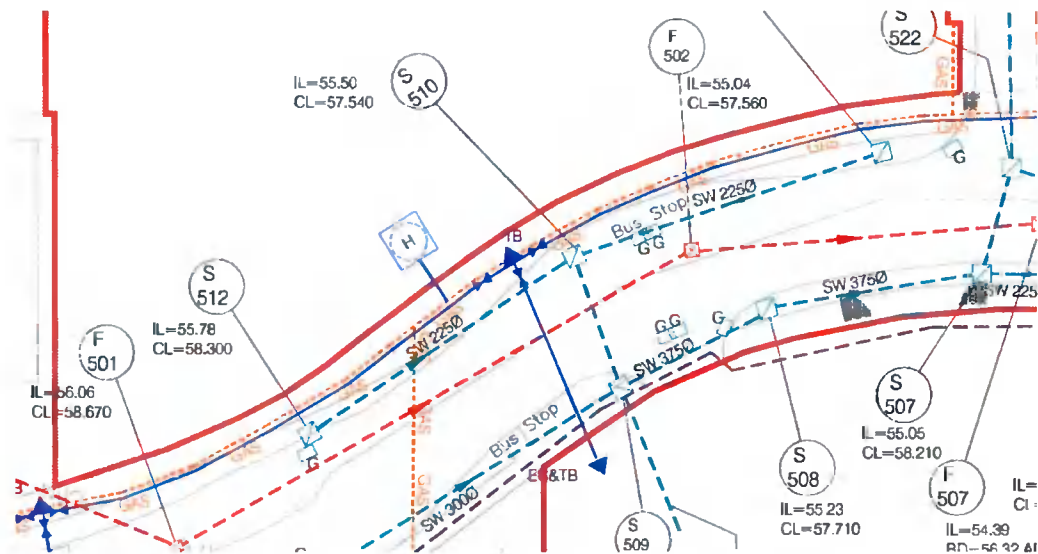


Figure 6 - Proposed Foul Water and Watermain Connection Point

Please refer to GDCL Drawing No. P2005-C-101 for details.

According to the Land Direct website ([landdirect.ie](http://landdirect.ie)), the proposed site and connection points to the existing sewers and watermain are all within one land holding:

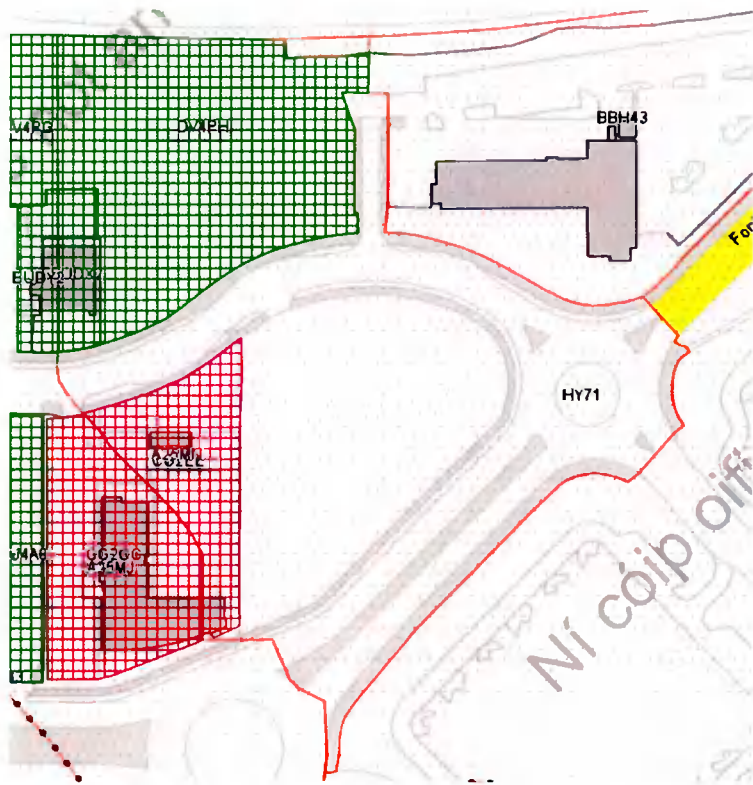


Figure 7 - Extract from Land Direct Website (landdirect.ie)

### 3.0 SURFACE WATER DRAINAGE

#### 3.1 Attenuation Strategy

Surface water attenuation system will be provided using an off-line Stormtech SC740 attenuation system. The attenuation facility will be located within the covered carparking footprint, located at the basement level. Surface water discharge from the site will be controlled using a hydrobrake flow control device fitted at the outlet from the attenuation system. The total volume of the attenuation system is 340m<sup>3</sup>.

The hydraulic modelling software system 'WinDes' was used to calculate the attenuation volumes required. Maximum rainfall data from Extreme Rainfall Return Period values produced by Met Eireann (Rainfall Return Periods Table website) was used to input into WinDes to determine maximum flood volume. For Cookstown (706800, 735100 ITM):

SAAR = 776mm

Ratio  $M_{5_{60}}/M_{5^{2d}} = 0.28$

$M_{5_{60}} = 16.5\text{mm}$

As per current practice a 10% increase to rainfall figures within 'WinDes' was applied to allow for climate change.

Runoff from roads and footpaths was assumed to be 80% impermeable. Runoff from traditional roofs areas was assumed to be 100% impermeable. Runoff from green areas/landscaping are assumed to be 10% as at least 95% of the rainfall during an extreme event would be percolate to ground, with the excess discharging to the site attenuation system.

The individual catchment characteristics are as follows: -

Catchment Characteristics			
Liffey Valley	Area (m <sup>2</sup> )	Runoff Coeff.	Effective Area (m <sup>2</sup> )
Roofs - Type 1 (Draining to gullies)	2,324	1.00	2324.2
Roofs - Type 2 (Draining to SUDS features)	-	0.70	0.0
Roofs - Type 3 (Draining to Back Gardens)	-	0.00	0.0
Green Roofs	571	0.90	513.7
Grass over Basements/Podiums	-	0.70	0.0
Roads and Footpaths - Type 1 (Draining to gullies)	3,381	0.80	2704.8
Roads and Footpaths - Type 2 (Draining to Suds features)	-	0.70	0.0
Permeable Paving	-	0.50	0.0
Gardens	-	0.30	0.0
Verges	-	0.15	0.0
Parks	-	0.15	0.0
Public Open Space	1,017	0.10	101.7

Effective Catchment Area (Impermeable) **0.564** Hectares

Effective Catchment Runoff Coefficient **0.77**

**Table 1 - Catchment Characteristics**

The Greater Dublin Strategic Drainage Study (GSDSDS) recommends that surface water runoff from new developments is limited to 2l/s/ha or Qbar (calculated using the UK IH124 equation). As the development catchment area is approximately 0.73ha, this results in a Qbar value of 1.5 l/s, see appendix for calculation.

It should be noted that the existing development is a brownfield site which currently does not provide any attenuation measures, therefore this reduction in flow would result in a significant benefit to the downstream system capacity.

A calculation sheet has been appended to this report which shows how the attenuation volume and discharge rate were calculated.

### 3.2 Interception Storage

It is current good practice in sustainable surface water drainage design that no run-off should directly pass to a receiving surface water system for rainfall depths of 5mm, therefore interception/infiltration storage should be provided at source where practicable. The volume of interception required is based on 5mm of rainfall depth from 80% of the runoff from impermeable areas and is calculated as follows:

$$\text{Interception storage required} = 5650\text{m}^2 \times 0.8 \times 0.005 = 22 \text{ m}^3$$

Interception storage will be provided within the 150mm deep stone layer at the base of the geocellular attenuation facility.

**Interception storage provided (Stormtech Stone Base) =  $467\text{m}^2 \times 0.15 \times 0.4 = 28.02\text{m}^3$**

**Interception storage provided (Permeable Paving) =  $232.7\text{m}^2 \times 0.50 \times 0.3 = 34.91\text{m}^3$**

**Interception storage provided (Swale Filter Drain) =  $126.8\text{m} \times 0.5^2 \times 0.4 = 12.68\text{m}^3$**

**Interception storage provided (Green Roof) =  $570.83\text{m}^2 \times 0.1 \times 0.35 = 19.97 \text{m}^3$**

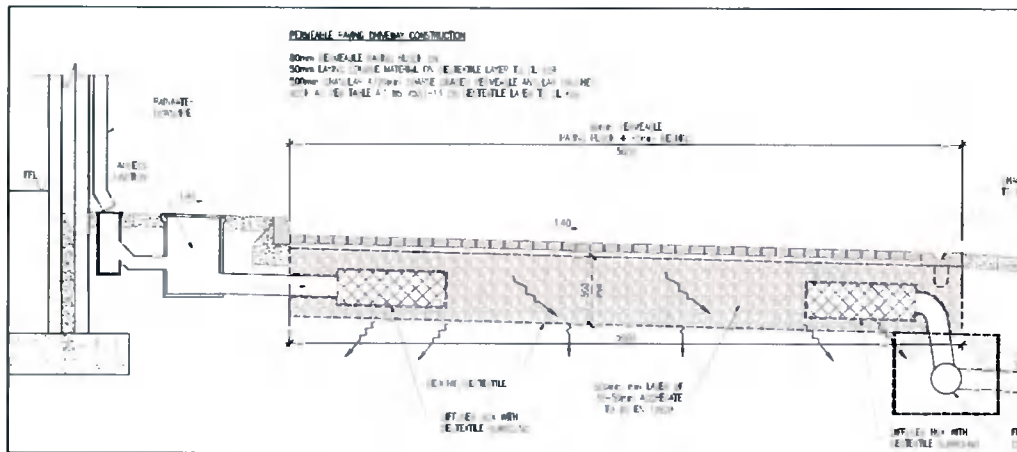
In addition to the above, interception storage is also provided throughout the site where runoff, gullies and rainwater downpipes have been routed through the nearest SuDS measure, with the SuDS measure being fitted with a high-level overflow back into the surface water network. The advantage of this approach is that adequate interception storage is provided throughout the site, and not localized to one area in the development. Please refer to GDCL Drawing No. P2005-C-210 for details.

### **3.3 Treatment Volume**

It is also current good practice in sustainable surface water drainage design that a "treatment volume" is provided in order to prevent any pollutants or sediments discharging into river systems, additionally a 'treatment train' stormwater runoff management system should be applied. According to CIRIA document C697 the following treatment train approach is necessary:

- Surface Water Runoff from Roofs – 1 Treatment Stage
- Surface Water Runoff from Roads – 2 Treatment Stages
- Surface Water Runoff from other Paved Areas excluding Roads – 1 Treatment Stage

The treatment train approach has been applied to the proposed development, and rainwater downpipes and gullies have been connected to the nearest SuDS feature. A typical detail of rainwater downpipes connecting to the permeable paving areas is shown in the Figure below, which is also reflected on GDCL Drawing No. P2005-C-210.



**Figure 8: Typical Section through Permeable Paving**

In addition to gullies being connected to the nearest SuDS measure, runoff from roads and other hard surfaces such as footpaths are directed to swales and tree pits where possible. The SuDS features are then fitted with a high-level stormwater overflow that connects back into the surface water system to cater for large storm events. This approach yields an additional treatment stage for the runoff. All runoff is ultimately temporarily attenuated during storm events using an unlined Stormtech Attenuation system. Flow will be restricted by a 'Hydrobrake', or similarly approved flow control device fitted downstream of the attenuation system (manhole S2).

As reflected on GDCL Drawing No. P2005-C-201, it is also proposed to provide 3 no. 'brio' manholes to the swale north of the attenuation system, which will be used to filter the swale to the adjacent attenuation system during larger storm events.

The treatment volume is based on treatment 15mm of rainfall depth from 80% of the runoff from impermeable areas as defined in the GSDSDS. Treatment volume required for the development is summarised in below:

$$\text{Treatment storage required} = 5650\text{m}^2 \times 0.8 \times 0.015 = 68\text{m}^3$$

It is proposed that treatment volume be provided throughout the site where runoff, gullies and rainwater downpipes have been routed through the nearest SuDS measure, with the SuDS measure being fitted with a high-level overflow back into the surface water network. The advantage of this approach is that adequate treatment volume is provided throughout the site, and not localized to one area in the development. Please refer to GDCL Drawing No. P2005-C-210 for details.



The treatment storage provided by the SuDS measures proposed for the site is as follows:

Treatment storage provided (Stormtech Stone Base)	= $467\text{m}^2 \times 0.15 \times 0.4$	= $28.02\text{m}^3$
Treatment storage provided (Permeable Paving Base)	= $232.7\text{m}^2 \times 0.50 \times 0.3$	= $34.91\text{m}^3$
Treatment storage provided (Swale Filter Drain)	= $126.8\text{m} \times 0.5^2 \times 0.4$	= $12.68\text{m}^3$
Interception storage provided (Green Roof)	= $570.83\text{m}^2 \times 0.1 \times 0.35$	= $19.97\text{m}^3$

In addition to the above, all runoff is also routed through the proposed petrol interceptor and silt trap manhole as part of the offline attenuation system that will provide an additional measure of treatment storage in the system.

### 3.4 Surface Water Drainage System

Surface water throughout the site will be collected by downpipes from the roof and road gullies within the tarmac areas, draining via the surface water pipe network before discharging into the attenuation facility.

Flows from the attenuation facility will be throttled to greenfield runoff rates as required by South Dublin County Council by means of a hydrobrake. The surface water will then discharge into the existing 1050mm diameter surface water sewer in running in an easterly direction, located at the northeast corner of the development site.

Surface water drains were designed using the Rational Method to size the pipes for a 1-year storm event. The following parameters applied:

Return period 1 year

Time of entry 4 minutes

Pipe Ks 0.6mm (concrete)

Minimum velocity 1.0 m/s

Maximum velocity 3.0 m/s

The peak surface flow from the proposed development is 1.5l/s. The surface water outfall pipe from the development would comprise an existing 1050mm diameter pipe at a gradient of not flatter than 1 in 150. This pipe at full capacity of the sewer is estimated at 2263l/s.

### 3.5 SuDS Measures

The SuDS strategy adopted by South Dublin County Council aims to provide an effective system to mitigate the adverse effects of urban stormwater runoff on the environment by reducing runoff rates, volumes, and frequency, reducing pollutant concentrations in stormwater, contributing to amenity, aesthetics and biodiversity enhancement where possible. In addition, SuDS features aim to replicate the natural characteristics of rainfall runoff for any site by providing control of run-off at source.

In terms of compliance with the principles outlined in the GSDSDS (Greater Dublin Strategic Drainage Study) Regional Drainage Policies Volume 2 New Development and Sustainable Drainage Systems (SuDS), the introduction proposed extensive green roof system would provide ecological, aesthetic and amenity benefits and intercept and retain rainfall at source, reducing the volume of runoff and attenuating peak flows.

The proposed SuDS measures will not be taken in charge by South Dublin County Council.

A breakdown of the various sustainable drainage systems is provided below:

Green Roof: Green roofs provide ecological, aesthetic and amenity benefits and intercept and retain rainfall, at source, reducing the volume of runoff and attenuating peak flows. Green roofs absorb most of the rainfall that they receive during ordinary events although they will only contribute to attenuation of flows for larger events. Additionally, green roofs treat surface water through removal of atmospherically deposited urban pollutants. A typical extensive green roof will comprise a plant layer, extensive substrate layer (typically 100mm deep), laid on a filter layer, water retention and drainage layer, protection layer and a separation layer. The expected service life of typical green roof systems is 50 years.



*Figure 9 - Typical Extensive Green Roof*

According to Appendix 16, Green Roofs Guidance Document, of the Dun Laoghaire-Rathdown County Council development plan 2016-2022, it is required that a roof plan area for a new development comprise of 60% green roof.

In this regard, it is proposed that 79% of the total roof area of the subject site comprise of green roof.

Petrol Interceptor: A proprietary oil/water separator which prevents hazardous chemical and petroleum products from entering watercourses and public sewers. This is proposed at the outfall from the site. For the subject site, it is proposed to use a NSBD3 bypass interceptor. The expected service life of a NSBD3 petrol interceptor is 50 years.

Cellular Attenuation System (Stormtech): A proprietary modular block or arch structure with a maintenance/inspection tunnel for providing underground surface water attenuation storage and can infiltrate runoff to the ground where the subgrade is suitable. The expected service life of the Stormtech SC-740 attenuation tank proposed for this development is 50-75 years.



Figure 10 - Typical Cellular Storage (Stormtech) Installation

### 3.6 SuDS Maintenance

For the SUDS strategy to work as designed it is important that the entire drainage system is well maintained. It will be the responsibility of the site management team to ensure the drainage system is maintained. Maintenance and cleaning of the SUDS features will ensure adequate performance. The recommended program is outlined in the tables below:

Table 2 - Green Roof Maintenance Schedule

SUDS Element	Maintenance		
Green Roof	Maintenance Issues	Vegetation becoming either overgrown or dying	
	Maintenance Period	Maintenance Task	Frequency
	Regular	Inspect all components including soil substrate, vegetation, drains, membranes and roof structure for proper operation, integrity of waterproofing and structural stability	Annually and after severe storms
		Inspect soil substrate for evidence of erosion channels and identify any sediment source	Annually and after severe storms
		Inspect drain inlets to ensure unrestricted run-off from the drainage layer to conveyance or roof drain system.	Annually and after severe storms
Inspect underside of roof for evidence of leakage.	Annually and after severe storms		

		Remove debris and litter to prevent clogging of inlet drains and interference with plant growth.	Six monthly and annually or as required
		During establishment (i.e. year one), replace dead plants as required.	Monthly
		Post-establishment, replace dead plants as required (where >5% of coverage)	Annually (in autumn)
		Remove fallen leaves and debris from deciduous plant foliage	Six monthly or as required
		Remove nuisance and invasive vegetation, including weeds	Six monthly or as required

**Table 3 - Petrol Interceptor Maintenance Schedule**

SUDS Element	Maintenance		
Petrol Interceptor	Maintenance period	Maintenance Task	Frequency
	Regular Inspections	Inspect upstream and downstream manholes visually and assess silt build-up	Quarterly
		Measure the thickness of oil and assess the level of sludge/silt	Biannually
		Level of sludge/silt to be assessed	Biannually
	Regular maintenance	Servicing of petrol interceptor by manufacturer	Biannually
		Integrity of interceptor to be assessed by manufacturer	Biannually
		Interceptor to be cleared of possible blockages by means if inspections	Quarterly
	Remedial work	Removal and replacing of interceptor to be carried out by manufacturer	As required
		Inspector to produce written interceptor inspection report	Post-inspection

**Table 4 – Attenuation Tank Maintenance Schedule**

SUDS Element	Maintenance		
Attenuation Tank	Maintenance Issues	Failure of components, blockage from debris	
	Maintenance Period	Maintenance Task	Frequency
	Regular	Inspect and identify any elements that are not operating correctly. If required, take remedial action.	Monthly for three months, then annually
		Remove sediment/debris from catchment surface that may lead to blockage of structures.	Monthly or as required
Remove sediment/debris from catch pits/gullies and control structures.		Annually, after severe storms or as required	

		Cleaning of grated "brio" manholes	Annually, after severe storms or as required
	Remedial Work	Repair inlets, outlets, vents, overflows and control structures.	As required
	Monitoring	Inspect all inlets, outlets, vents, overflows and control structures to ensure they are in good condition and operating as designed.	Annually or after severe storms
		Survey inside of tank for sediment build-up and remove if necessary	Every year or as required



#### 4.0 FOUL DRAINAGE

There is an existing 225mm diameter foul sewer in running in an easterly direction on the Liffey Valley Complex service road, to the south of the site. Proposed foul drainage will discharge to this foul sewer.

Foul sewage within the site will be drained via gravity by a separate system via 225mm diameter pipes.

A Pre-Connection Enquiry Form was submitted to Irish Water and a response has been received on the 30<sup>th</sup> of May 2020, confirming that a foul connection to the public network can be facilitated. Please refer to Appendix A for details.

Drains generally will consist of thermoplastic structured wall pipes (IS EN 13476) pipes. Foul sewers have been designed in accordance with the Building Regulations and in accordance with the EPA Treatment Systems for Small Communities, Business, Leisure and Hotel, DOE 'Recommendations for Site Development Works' and the recommendations of the 'Greater Dublin Strategic Drainage Study' (GDSDS) and Irish Water requirements.

The following design criteria have been applied in the design of foul sewers:

- (i) Pipe Ks 0.6 mm (uPVC)
- (ii) Minimum velocity 0.75 m/s (self-cleansing velocity)
- (iii) Maximum velocity 3 m/s
- (v) Minimum gradients:

**Table 5 – Foul Sewer Gradients**

No. of Connections	Minimum Pipe Gradient
1	100mm dia. @ 1:60 or self-cleansing gradient
2-8	150mm dia. @ 1:80 or self-cleansing gradient
>8	Min 150mm dia.; 1: DN or self-cleansing gradient

The foul water drainage for the proposed development has been designed so that minimum cleansing velocities outlined in the "Irish Water Code of Practice for Wastewater

Infrastructure" are achieved for all foul sewers. The peak foul flow is based on Irish Water recommended peak demand/flow factors which are provided in the Irish Water 'Code of Practice for Wastewater Infrastructure', Wastewater Flow Rates for Design. Please refer to Appendix D for the foul sewer loading calculations.

The peak flow from the proposed development is estimated at 0.32l/s, please refer to Appendix F for details. The foul outfall pipe from the development would comprise a 225mm diameter pipe at a gradient of not flatter than 1 in 150. This pipe at full capacity of the sewer is estimated at 37.21l/s.

Sewers and drains shall be laid to comply with the requirements of the Building Regulations 1997 in accordance with the recommendations contained in the Technical Guidance Documents, Section H (revised 2005) and Irish Water.

## 5.0 WATER SUPPLY

The development will be serviced by a proposed 100mm diameter watermain which connects to the existing 100mm diameter watermain located on the Liffey Valley Complex service road, to the south of the site.

A Pre-Connection Enquiry Form was submitted to Irish Water and a response has been received on the 30<sup>th</sup> of May 2020, confirming that a foul connection to the public network can be facilitated. Please refer to Appendix A for details.

The external areas of the development will be served by existing fire hydrants together with additional hydrants to be located on the new 150mm diameter watermains.

A bulk water meter will be provided at the connection to the site from the existing watermain. This electromagnetic flow meter will include a remote telemetry unit and associated mini kiosk, to the requirements of SDCC Water Management Section and Irish Water.

The supply arrangements will be carried out to the requirements of Irish Water. The Peak Hour Water demand for the proposed development is estimated at 0.3l/s.

Please refer to Appendix G for the water supply calculations.

## 6.0 FLOOD RISK ASSESSMENT

The subject site is located more than 0.5km from the River Liffey. Additionally, the site is also located more than 12km from the coast and is therefore not prone to coastal flooding. The ECFRAMS Flood Study Mapping indicates outside of the 0.1% Fluvial AEP Event and the site is therefore deemed to be within Flood Zone C, i.e. outside the 1000-year flood events. It is therefore not necessary to carry out a Site-Specific Flood Risk Assessment.

The sequential approach recommended by *"The Planning System and Flood Risk Management Guidelines for Planning Authorities"* has been complied with for the subject site as it is within Flood Zone C.

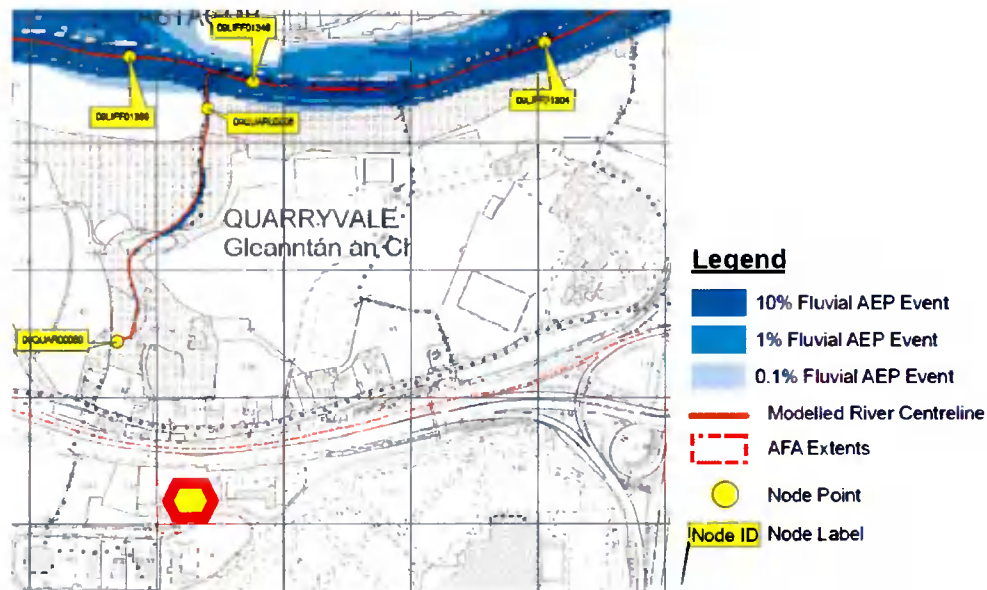


Figure 11 - Floodinfo.ie showing OPW Flood Mapping

The Strategic Flood Risk Assessment for South Dublin County Council Development Plan 2016-2022 Fluvial Flood Zone Mapping was consulted and indicated that there was no risk of Fluvial Flooding.

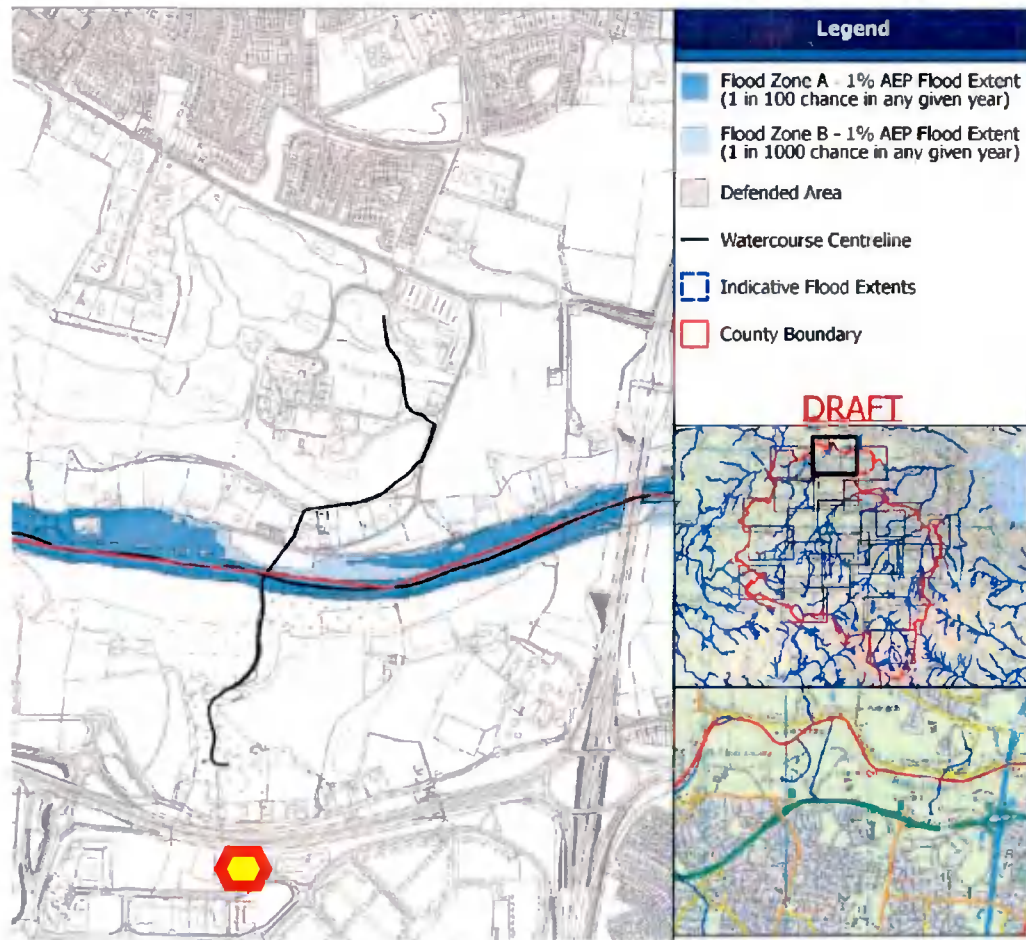


Figure 12 - South Dublin County Development Plan 2016-2022 Fluvial Flood Zone Map 2

Extract

The Office for Public Works (OPW) historical flood maps were consulted with regards to recorded flood events in the vicinity of the subject site. A map showing historical flood events within 2.5km of the subject site was generated. There were no recorded flood events within the immediate vicinity of the subject site, and it is therefore considered that there is a low likelihood of flooding from surrounding areas.



Map Scale 1:15,532

Map Legend	
	Flood Points
	Multiple / Recurring Flood Points
	Areas Flooded
	Hydrometric Stations
	Rivers
	Lakes
	River Catchment Areas
	Land Commission *
	Drainage Districts *
	Benefiting Lands *

\* Important: These maps do not indicate flood hazard or flood extent. Their purpose and scope is explained in the Glossary.

Figure 13 - Floodmaps.ie showing no historical flooding event with 0.5km of site



**APPENDIX A**

**Confirmation of Feasibility Letter (Irish Water)**



Alan Fitzsimons  
GDCL Consulting Eng  
Scope House  
Whitehall Road West  
Perrystown, Dublin 12  
D12K8PP

13 May 2020

Dear Alan Fitzsimons,

Ulster Business  
Box 67 448  
Long Moorhills  
Cathlamet Road  
Carnarvon Street

Irish Water  
PO Box 498  
South City  
Delivery Office  
Cork City

[www.water.ie](http://www.water.ie)

**Re: Connection Reference No CDS20002854 pre-connection enquiry -  
Subject to contract | Contract denied**

**Connection for Business Connection of 1 unit at Unit A, Liffey Valley Office Campus, Dublin 22,  
Co. Dublin.**

Irish Water has reviewed your pre-connection enquiry in relation to water and wastewater connections at Unit A, Liffey Valley Office Campus, Dublin 22, Co. Dublin. Based upon the details you have provided with your pre-connection enquiry and on the capacity currently available as assessed by Irish Water, we wish to advise you that, subject to a valid connection agreement being put in place, your proposed connection to the Irish Water network can be facilitated.

You are advised that this correspondence does not constitute an offer in whole or in part to provide a connection to any Irish Water infrastructure and is provided subject to a connection agreement being signed at a later date.

A connection agreement can be applied for by completing the connection application form available at [www.water.ie/connections](http://www.water.ie/connections). Irish Water's current charges for water and wastewater connections are set out in the Water Charges Plan as approved by the Commission for Regulation of Utilities.

If you have any further questions, please contact us on 1850 278 278 or +353 1 707 2828, 8.00am-4.30pm, Mon-Fri or email [newconnections@water.ie](mailto:newconnections@water.ie). For further information, visit [www.water.ie/connections](http://www.water.ie/connections).

Yours sincerely,

**Maria O'Dwyer**

**Connections and Developer Services**

**APPENDIX B**

**Irish Water Services Records**



**APPENDIX C**

**Existing Site Services**

**by Murphy Matson O'Sullivan**





**APPENDIX D**

**Surface Water Attenuation Calculations**

Met Eireann  
Return Period Rainfall Depths for sliding Durations  
Irish Grid: Easting: 306860, Northing: 235050,

DURATION	Interval		Years													
	6months	1year	2	3	4	5	10	20	30	50	75	100	150	200	250	500
5 mins	2.3	3.4	4.1	5.0	5.6	6.2	7.9	9.8	11.2	13.1	14.8	16.1	18.2	19.9	21.3	N/A
10 mins	3.3	4.8	5.7	7.0	7.9	8.6	10.9	13.7	15.6	18.2	20.6	22.5	25.4	27.7	29.7	N/A
15 mins	3.8	5.7	6.7	8.2	9.3	10.1	12.9	16.1	18.3	21.4	24.2	26.5	29.9	32.6	34.9	N/A
30 mins	5.1	7.4	8.6	10.6	11.9	12.9	16.3	20.3	22.9	26.7	30.1	32.7	36.8	40.0	42.7	N/A
1 hour	6.7	9.6	11.2	13.6	15.2	16.5	20.7	25.5	28.7	33.2	37.3	40.4	45.3	49.1	52.3	N/A
2 hours	8.9	12.5	14.5	17.5	19.5	21.1	26.2	32.1	35.9	41.4	46.2	50.0	55.8	60.3	64.1	N/A
3 hours	10.4	14.7	16.9	20.3	22.6	24.3	30.1	36.7	41.0	47.0	52.4	56.6	63.0	68.0	72.1	N/A
4 hours	11.7	16.4	18.8	22.5	25.0	27.0	33.2	40.3	45.0	51.5	57.3	61.8	68.7	74.0	78.5	N/A
6 hours	13.8	19.1	21.9	26.1	28.9	31.1	38.2	46.1	51.3	58.6	65.0	70.0	77.6	83.5	88.3	N/A
9 hours	16.3	22.3	25.5	30.3	33.5	35.9	43.9	52.7	58.5	66.6	73.7	79.2	87.6	94.1	99.4	N/A
12 hours	18.2	24.9	28.4	33.6	37.1	39.8	48.4	58.0	64.3	73.0	80.6	86.5	95.5	102.4	108.2	N/A
18 hours	21.5	29.1	33.1	39.0	42.9	45.9	55.6	66.3	73.3	83.0	91.4	97.9	107.9	115.5	121.8	N/A
24 hours	24.1	32.5	36.9	43.3	47.6	50.8	61.4	73.0	80.5	90.9	100.0	107.0	117.6	125.7	132.4	155.6
2 days	30.0	39.5	44.4	51.4	56.1	59.6	70.9	83.1	91.0	101.8	111.1	118.2	129.0	137.2	143.9	166.9
3 days	34.8	45.1	50.4	58.0	63.0	66.8	78.7	91.5	99.7	110.9	120.5	127.8	138.9	147.3	154.1	177.4
4 days	39.0	50.1	55.7	63.7	69.0	73.0	85.4	98.8	107.3	118.9	128.8	136.3	147.6	156.2	163.2	186.8
6 days	46.3	58.7	64.9	73.7	79.4	83.7	97.2	111.5	120.5	132.8	143.2	151.1	162.9	171.8	179.1	203.5
8 days	52.8	66.2	72.9	82.4	88.5	93.1	107.4	122.6	132.0	144.8	155.8	164.0	176.2	185.5	193.0	218.1
10 days	58.7	73.1	80.2	90.3	96.8	101.6	116.7	132.5	142.4	155.8	167.1	175.6	188.3	197.8	205.5	231.4
12 days	64.3	79.5	87.0	97.6	104.4	109.5	125.2	141.7	152.0	165.8	177.5	186.3	199.4	209.1	217.1	243.5
16 days	74.6	91.4	99.6	111.1	118.4	124.0	140.9	158.5	169.5	184.1	196.5	205.8	219.5	229.8	238.0	265.7
20 days	84.1	102.3	111.1	123.4	131.3	137.1	155.1	173.8	185.3	200.7	213.7	223.4	237.7	248.4	257.0	285.6
25 days	95.2	115.0	124.5	137.7	146.1	152.4	171.6	191.4	203.6	219.8	233.4	243.5	258.5	269.7	278.7	308.5

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](http://www.met.ie/climate/dataproducts/Estimation-of-Point-Rainfall-Frequencies_TN61.pdf)

**Qbar Calculation**  
Using IOH Report 124 for Sites < 25 km<sup>2</sup>

Catchment Name  
**Liffey Valley**

$Q_{bar} = 0.00108 \cdot (AREA)^{0.89} (SAAR)^{1.17} (SOIL)^{3.17}$  Estimation of QBAR from IOH Report 124 for catchments less than 25 km<sup>2</sup> using the 3 variable equation

AREA = **0.73** Ha Overall Catchment Area (Hectares) For catchments < 50 hectares in area, flow rates are linearly interpolated for smaller areas

AREA = **0.007** km<sup>2</sup> Area of the Catchment (km<sup>2</sup>)

SAAR = **776** mm Standard Annual Average Rainfall (mm)

SOIL = **0.30**

ME<sub>50</sub> = **16.8** mm

ME<sub>200</sub> = **16.8** mm

Ratio ME<sub>50</sub>/ME<sub>200</sub> = **0.277**

Soil Type Expressed as a Percentage	Soil 1	Soil 2	Soil 3	Soil 4	Soil 5
SOIL Value	0.75	0.30	0.40	0.25	0.50

Soil index value (SPR) calculated from Flood Studies Report Vol V Fig 14.18(1) - The Classification of Soils from Winter Rainfall Acceptance Rate

Flood Return Event	Growth Factor	Permitted Flow (l/s)
1	0.85	1.3
QBAR	1	1.5
10	1.67	2.5
50	2.33	3.5
100	2.6	3.9
200	2.85	4.3
1000	3.5	5.3

Qbar from Site with Factorial Error Allowance	
r =	0.847
z =	71
ise =	1.851
C <sub>100</sub>	2.48

(With Allowance for the standard factorial error)

Pro-rata based on 50 Ha Site area to calculate Qbar

Q<sub>50</sub> = **0.00004** cumecs/Ha      Q<sub>50</sub> = **2.1** l/s/Ha

Q<sub>bar(Liffey)</sub> = **1.5** l/s

Catchment Characteristics			
	Area (m <sup>2</sup> )	Runoff Coeff.	Effective Area (m <sup>2</sup> )
Liffey Valley			
Roofs - Type 1 (Draining to gullies)	2,000	1.00	2,000
Roofs - Type 2 (Draining to SUDS features)		0.75	0.0
Roofs - Type 3 (Draining to Back Gardens)		0.25	0.0
Green Roofs	571	0.00	571
Grass over Basements/Podiums		0.20	0.0
Roads and Footpaths - Type 1 (Draining to gullies)	1,301	0.50	2,704
Roads and Footpaths - Type 2 (Draining to SUDS features)		0.20	0.0
Permeable Paving		0.20	0.0
Gardens		0.20	0.0
Verdes		0.20	0.0
Parks		0.20	0.0
Public Open Space	1,301	0.20	1,617

Effective Catchment Area (Impermeable) = **0.564** Hectares

Effective Catchment Runoff Coefficient = **0.7**



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Summary of Results for 100 year Return Period (+10%)

Half Drain Time : 2854 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	53.587	0.257	0.1	1.3	1.4	82.9	O K
30 min Summer	53.684	0.354	0.1	1.3	1.4	114.0	O K
60 min Summer	53.785	0.455	0.1	1.3	1.4	146.7	O K
120 min Summer	53.815	0.565	0.1	1.3	1.4	182.1	O K
180 min Summer	53.881	0.631	0.1	1.3	1.4	203.5	O K
240 min Summer	53.929	0.679	0.1	1.3	1.4	219.0	O K
360 min Summer	53.996	0.746	0.1	1.3	1.4	240.5	O K
480 min Summer	54.041	0.791	0.1	1.3	1.4	255.0	O K
600 min Summer	54.073	0.823	0.1	1.3	1.4	265.3	O K
720 min Summer	54.096	0.846	0.1	1.4	1.4	272.8	O K
960 min Summer	54.126	0.876	0.1	1.4	1.5	282.5	O K
1440 min Summer	54.148	0.898	0.1	1.4	1.5	289.7	O K
2160 min Summer	54.149	0.899	0.1	1.4	1.5	289.9	O K
2880 min Summer	54.141	0.891	0.1	1.4	1.5	287.3	O K
4320 min Summer	54.116	0.866	0.1	1.4	1.5	279.3	O K
5760 min Summer	54.087	0.837	0.1	1.4	1.4	269.8	O K
7200 min Summer	54.055	0.805	0.1	1.3	1.4	259.5	O K
8640 min Summer	54.022	0.772	0.1	1.3	1.4	248.9	O K
10080 min Summer	53.988	0.738	0.1	1.3	1.4	238.1	O K
15 min Winter	53.538	0.288	0.1	1.3	1.4	93.0	O K
30 min Winter	53.647	0.397	0.1	1.3	1.4	128.0	O K
60 min Winter	53.761	0.511	0.1	1.3	1.4	164.8	O K
120 min Winter	53.885	0.635	0.1	1.3	1.4	204.8	O K
180 min Winter	53.961	0.711	0.1	1.3	1.4	229.4	O K
240 min Winter	54.017	0.767	0.1	1.3	1.4	247.4	O K
360 min Winter	54.095	0.845	0.1	1.4	1.4	272.5	O K
480 min Winter	54.148	0.898	0.1	1.4	1.5	289.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	79.458	0.0	84.0	19
30 min Summer	54.933	0.0	111.6	34
60 min Summer	35.659	0.0	150.9	64
120 min Summer	22.503	0.0	190.6	124
180 min Summer	17.041	0.0	214.9	184
240 min Summer	13.968	0.0	219.0	242
360 min Summer	10.521	0.0	219.8	362
480 min Summer	8.593	0.0	219.8	482
600 min Summer	7.348	0.0	220.1	602
720 min Summer	6.452	0.0	220.6	722
960 min Summer	5.261	0.0	222.5	962
1440 min Summer	3.946	0.0	227.8	1440
2160 min Summer	2.957	0.0	444.9	1792
2880 min Summer	2.408	0.0	440.5	2164
4320 min Summer	1.799	0.0	417.0	2984
5760 min Summer	1.463	0.0	594.7	3856
7200 min Summer	1.245	0.0	632.8	4680
8640 min Summer	1.091	0.0	665.7	5528
10080 min Summer	0.976	0.0	694.8	6352
15 min Winter	79.458	0.0	94.1	19
30 min Winter	54.933	0.0	113.6	34
60 min Winter	35.659	0.0	169.1	64
120 min Winter	22.503	0.0	213.4	122
180 min Winter	17.041	0.0	219.9	180
240 min Winter	13.968	0.0	220.7	240
360 min Winter	10.521	0.0	221.6	358
480 min Winter	8.593	0.0	223.0	474



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Summary of Results for 100 year Return Period (+10%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control I (l/s)	Max Outflow I (l/s)	Max Volume (m³)	Status
600 min Winter	54.188	0.938	0.1	1.4	1.5	302.3	O K
720 min Winter	54.217	0.967	0.1	1.4	1.5	311.9	O K
960 min Winter	54.258	1.008	0.1	1.5	1.6	325.0	O K
1440 min Winter	54.297	1.047	0.1	1.5	1.6	337.5	O K
2160 min Winter	54.303	1.053	0.1	1.5	1.6	339.5	O K
2880 min Winter	54.290	1.040	0.1	1.5	1.6	335.5	O K
4320 min Winter	54.253	1.003	0.1	1.5	1.6	323.4	O K
5760 min Winter	54.204	0.954	0.1	1.4	1.5	307.7	O K
7200 min Winter	54.151	0.901	0.1	1.4	1.5	290.6	O K
8640 min Winter	54.097	0.847	0.1	1.4	1.4	273.2	O K
10080 min Winter	54.043	0.793	0.1	1.3	1.4	255.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
600 min Winter	7.340	0.0	225.0	590
720 min Winter	6.452	0.0	227.7	706
960 min Winter	5.261	0.0	233.6	934
1440 min Winter	3.946	0.0	238.8	1384
2160 min Winter	2.957	0.0	459.8	2008
2880 min Winter	2.408	0.0	454.7	2276
4320 min Winter	1.799	0.0	443.5	3200
5760 min Winter	1.463	0.0	666.2	4152
7200 min Winter	1.245	0.0	708.7	5048
8640 min Winter	1.091	0.0	745.7	5960
10080 min Winter	0.976	0.0	760.5	6856



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#### Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.500	Shortest Storm (mins)	15
Ratio R	0.277	Longest Storm (mins)	10000
Summer Storms	Yes	Climate Change %	+10

#### Time Area Diagram

Total Area (ha) 0.565

Time (mins)	Area
From:	To: (ha)
0	4 0.565





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Model Details

Storage is Offline Cover Level (m) 55.200 Dividing Weir Level (m) 53.250

Cellular Storage Structure

Invert Level (m) 53.250 Safety Factor 2.0  
Infiltration Coefficient Base (m/hr) 0.00100 Porosity 0.66  
Infiltration Coefficient Side (m/hr) 0.00100

Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	488.6	488.6	1.100	488.6	675.6	1.200	0.0	675.6

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0056-1500-1110-1500 Sump Available Yes  
Design Head (m) 1.110 Diameter (mm) 56  
Design Flow (l/s) 1.5 Invert Level (m) 53.200  
Flush-Flo™ Calculated Minimum Outlet Pipe Diameter (mm) 75  
Objective Minimise upstream storage Suggested Manhole Diameter (mm) 1200  
Application Surface

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.110	1.5	Kick-Flo®	0.501	1.0
Flush-Flo™	0.247	1.3	Mean Flow over Head Range	-	1.2

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.1	0.800	1.3	2.000	2.0	4.000	2.7	7.000	3.5
0.200	1.3	1.000	1.4	2.200	2.0	4.500	2.8	7.500	3.6
0.300	1.3	1.200	1.6	2.400	2.1	5.000	3.0	8.000	3.7
0.400	1.2	1.400	1.7	2.600	2.2	5.500	3.1	8.500	3.8
0.500	1.1	1.600	1.8	3.000	2.4	6.000	3.2	9.000	3.9
0.600	1.1	1.800	1.9	3.500	2.5	6.500	3.4	9.500	4.0

# STORMTECH Stormwater Management System Design Tool

ver: Jun14

PROJECT REF:	U Stone II
LOCATION:	Liffey Valley
DATE:	13/04/2020
CREATED BY:	PTC

Instructions:  
 Fill in blue highlighted cells  
 Set width to maximum allowance  
 Adjust site parameters and system dimension until volume achieved  
 For Rectangular systems only, for irregular shape dig contact Microstrain

<b>SYSTEM PARAMETERS</b>	
Required Total Storage	340 m <sup>3</sup>
Stormtech chamber model	SC740
Number of Isolator Rows for TSS Removal	1

<b>STORMTECH SYSTEM DETAIL</b>	
StormTech Chamber Model	SC740
Unit Width	1.295 m
Unit Length	2.17 m
Unit Height	0.76 m
Min Cover Over System	0.3 m
Max Cover Over Chamber	2.4 m
Internal Storage Vol. (Chamber only)	1.3 m <sup>3</sup>

<b>SITE PARAMETERS</b>	
Maximum Width at Excavation Base	6.23 m
Stone Porosity	40%
Excavation Batter Angle (degrees)	60°
Stone Below Chambers	0.15 m
Stone Above Chambers	0.15 m
Additional Storage, E.g. manholes, pipe	0 m <sup>3</sup>

<b>STONE AND EXCAVATION DETAIL</b>	
Volume of Dig for System	576 m <sup>3</sup>
Area of Dig at Base of System	491 m <sup>2</sup>
Area of Dig at Top of System	597 m <sup>2</sup>
Void Ratio	60%
Stone Requirement - tonne	637 tonne

Minimum Requirement  
 0.15  
 0.15

<b>CALCULATED CHAMBER SYSTEM DIMENSIONS</b>	Calculated	Adopted
Number of Rows	4	ea
Number of units per Row	36	ea
Number of SC740 Chambers	144	ea
Number of SC740 Endcaps	8	ea
System Installed Storage Depth (effective storage depth)	1.060	m
Tank overall installed Width at base	6.23	m
Tank overall installed Length at Base	78.82	m
<b>Total Effective System Storage</b>	<b>343.3</b>	<b>343.3 m<sup>3</sup></b>



**APPENDIX E**

**Surface Water Network Calculations**

**Design Settings**

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	5	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	Scotland and Ireland	Connection Type	Level Soffits
M5-60 (mm)	16.500	Minimum Backdrop Height (m)	0.200
Ratio-R	0.280	Preferred Cover Depth (m)	1.200
CV	1.000	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	✓

**Nodes**

Name	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
13	4.00	55.800	1200	59332.684	-64997.725	1.550
12		55.000	1200	59334.164	-64984.447	1.122
11		54.900	1200	59337.011	-64984.598	1.041
10		54.850	1200	59417.156	-64985.863	1.071
9	4.00	58.450	1200	59377.097	-65053.945	1.550
8		58.250	1200	59398.182	-65040.327	1.592
7		58.340	1200	59423.362	-65029.911	1.818
6		58.600	1200	59435.733	-65029.601	2.140
5		58.400	1200	59436.849	-65005.982	4.700
4		55.000	1200	59435.434	-64991.915	1.538
3		54.900	1200	59420.984	-64985.811	1.595
2		55.200	1200	59421.212	-64981.123	1.918
1		55.220	1200	59442.460	-64980.951	2.044

**Links (Inout)**






Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.007	2	1	71.265	0.600	53.282	53.176	0.106	200.0	225	7.40	50.0
1.006	3	2	4.698	0.600	53.305	53.282	0.023	200.0	300	7.01	50.0
2.003	10	3	3.830	0.600	53.779	53.760	0.019	200.0	300	6.94	50.0
1.005	4	3	15.686	0.600	53.462	53.305	0.157	100.0	300	5.63	50.0
1.004	5	4	14.140	0.600	53.700	53.462	0.238	59.3	300	5.46	50.0
1.003	6	5	23.650	0.600	56.460	56.342	0.118	200.0	300	5.34	50.0
1.002	7	6	12.375	0.600	56.522	56.460	0.062	200.0	300	4.99	50.0
1.001	8	7	27.249	0.600	56.658	56.522	0.136	200.0	300	4.80	50.0
1.000	9	8	25.100	0.600	56.900	56.733	0.167	150.0	225	4.39	50.0
2.002	11	10	80.185	0.600	53.859	53.779	0.080	1000.0	300	6.88	50.0
2.001	12	11	2.851	0.600	53.878	53.859	0.019	150.0	300	4.15	50.0
2.000	13	12	13.383	0.600	54.250	53.953	0.297	45.0	225	4.11	50.0

**Pipeline Schedule**









Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.007	21.265	200.0	225	Circular	55.200	53.282	1.693	55.220	53.176	1.819
1.006	4.698	200.0	300	Circular	54.900	53.305	1.295	55.200	53.282	1.618
2.003	3.830	200.0	300	Circular	54.850	53.779	0.771	54.900	53.760	0.840
1.005	15.686	100.0	300	Circular	55.000	53.462	1.238	54.900	53.305	1.295
1.004	14.140	59.3	300	Circular	58.400	53.700	4.400	55.000	53.462	1.238
1.003	23.690	200.0	300	Circular	58.600	56.460	1.840	58.400	56.342	1.758
1.002	12.375	200.0	300	Circular	58.340	56.522	1.518	58.600	56.460	1.840
1.001	27.249	200.0	300	Circular	58.250	56.658	1.292	58.340	56.522	1.518
1.000	25.100	150.0	225	Circular	58.450	56.900	1.325	58.250	56.733	1.292
2.002	80.155	1000.0	300	Circular	54.900	53.859	0.741	54.850	53.779	0.771
2.001	2.851	150.0	300	Circular	55.000	53.878	0.822	54.900	53.859	0.741
2.000	13.383	45.0	225	Circular	55.800	54.250	1.325	55.000	53.953	0.822

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.007	2	1200	Manhole	Adoptable	1	1200	Manhole	Adoptable
1.006	3	1200	Manhole	Adoptable	2	1200	Manhole	Adoptable
2.003	10	1200	Manhole	Adoptable	3	1200	Manhole	Adoptable
1.005	4	1200	Manhole	Adoptable	3	1200	Manhole	Adoptable
1.004	5	1200	Manhole	Adoptable	4	1200	Manhole	Adoptable
1.003	6	1200	Manhole	Adoptable	5	1200	Manhole	Adoptable
1.002	7	1200	Manhole	Adoptable	6	1200	Manhole	Adoptable
1.001	8	1200	Manhole	Adoptable	7	1200	Manhole	Adoptable
1.000	9	1200	Manhole	Adoptable	8	1200	Manhole	Adoptable
2.002	11	1200	Manhole	Adoptable	10	1200	Manhole	Adoptable
2.001	12	1200	Manhole	Adoptable	11	1200	Manhole	Adoptable
2.000	13	1200	Manhole	Adoptable	12	1200	Manhole	Adoptable

**Manhole Schedule**

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
13	59332.684	-64997.725	55.800	1.550	1200					
12	59334.164	-64984.447	55.000	1.122	1200		0	2.000	54.250	225
							1	2.000	53.953	225
11	59337.011	-64984.598	54.900	1.041	1200		0	2.001	53.878	300
							1	2.001	53.859	300
10	59417.156	-64985.863	54.850	1.071	1200		0	2.002	53.859	300
							1	2.002	53.779	300
9	59377.097	-65053.945	58.450	1.550	1200		0	2.003	53.779	300
							0	1.000	56.900	225

**Manhole Schedule**

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
8	59398.182	-65040.327	58.250	1.592	1200		1 1.000	56.733	225
							0 1.001	56.658	300
7	59423.362	-65029.911	58.340	1.818	1200		1 1.001	56.527	300
							0 1.002	56.522	300
6	59435.733	-65029.601	58.600	2.140	1200		1 1.002	56.460	300
							0 1.003	56.460	300
5	59436.849	-65005.982	58.400	4.700	1200		1 1.003	56.342	300
							0 1.004	56.342	300
4	59435.434	-64991.915	55.000	1.538	1200		1 1.004	53.700	300
							0 1.005	53.462	300
3	59420.984	64985.811	54.900	1.595	1200		1 2.003	53.760	300
							2 1.005	53.305	300
							0 1.006	53.305	300
2	59421.212	-64981.123	55.200	1.918	1200		1 1.006	53.282	300
							0 1.007	53.282	225
1	59442.460	64980.951	55.220	2.044	1200		1 1.007	53.176	225

**Simulation Settings**

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	Scotland and Ireland	Skip Steady State	x
M5-60 (mm)	16.500	Drain Down Time (mins)	240
Ratio-R	0.280	Additional Storage (m <sup>3</sup> /ha)	20.0
Summer CV	1.000	Check Discharge Rate(s)	x
Winter CV	1.000	Check Discharge Volume	x

**Storm Durations**

15	60	180	360	600	960	2160
30	120	240	480	720	1440	2880

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
5	10	0	0



**APPENDIX F**

**Foul Water Network Calculations**

**Design Settings**

Frequency of use (kDU)	1.00	Minimum Velocity (m/s)	1.00
Flow per dwelling per day (l/day)	2700	Connection Type	Level Soffits
Domestic Flow (l/s/ha)	0.0	Minimum Backdrop Height (m)	0.200
Industrial Flow (l/s/ha)	0.0	Preferred Cover Depth (m)	0.800
Additional Flow (%)	0	Include Intermediate Ground	✓

**Nodes**

Name	Cover Level (m)	Manhole Type	Easting (m)	Northing (m)	Depth (m)
5	58.250	Adoptable	59397.918	-65028.215	1.250
1	57.560	Adoptable	59414.982	-65046.340	1.569
3	58.450	Adoptable	59381.327	-65048.848	1.250
4	58.250	Adoptable	59405.469	-65034.071	2.000

**Links (Input)**


Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
1.001	4	1	15.538	1.500	56.250	55.991	0.259	60.0	225
2.000	5	4	9.558	1.500	57.000	56.841	0.159	60.0	225
1.000	3	4	28.307	1.500	57.200	56.728	0.472	60.0	225

**Pipeline Schedule**


Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.001	15.538	60.0	225	Circular	58.250	56.250	1.175	57.560	55.991	1.344
2.000	9.558	60.0	225	Circular	58.250	57.000	1.025	58.250	56.841	1.184
1.000	28.307	60.0	225	Circular	58.450	57.200	1.025	58.250	56.728	1.297

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.001	4	1200	Manhole	Adoptable	1	1200	Manhole	Adoptable
2.000	5	1200	Manhole	Adoptable	4	1200	Manhole	Adoptable
1.000	3	1200	Manhole	Adoptable	4	1200	Manhole	Adoptable

**Manhole Schedule**

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
5	59397.918	-65028.215	58.250	1.250	1200		0			
							0	2.000	57.000	225
1	59414.982	-65046.340	57.560	1.569	1200		1	1.001	55.991	225
3	59381.327	-65048.848	58.450	1.250	1200		0	1.000	57.200	225

**Manhole Schedule**

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
4	59405.469	-65034.071	58.250	2.000	1200		1	2.000	56.841	225
							2	1.000	56.728	225
							0	1.001	56.250	225

**APPENDIX G**

**Foul Sewer Loading Calculations**

PROJECT TITLE: U Store It, Liffey Valley

JOB REFERENCE: U Store It

SUBJECT  
Wastewater Load for Irish Water

**gdcl**  
CONSULTING ENGINEERS

DRAWING NO.                      CALCULATIONS BY                      CHECKED BY                      DATE

**POST DEVELOPMENT DEMAND**

Wastewater flow per head<sup>1</sup>                      150 litres                      Unit Consumption Allowance<sup>3</sup>                      10

Average Occupancy Ratio<sup>2</sup>                      2.7 person/3 bed unit                      DWF Peak Factor<sup>4</sup>                      6

Residential Unit Type	5 Bed Unit	4 Bed Unit	2 Bed Unit A	2 Bed Unit B	1 Bed Unit
Average Occupancy(persons)	5	4	4	3	1.5
Number of Units	0	0	0	0	0
Average Occupancy <sup>2</sup> (PE)	0	0	0	0	0

Residential Dry Weather Flow(DWF) Volume<sup>5</sup>                      0 litres

Commercial Unit Type	Shopping	Office/ Factory	Pub/ Restaurant	Leisure/ Gym	Medical/ Care Home	Creche
Average Occupancy (per m2)	18	25	5	5	20	20
Area(m2)	0	2100	0	0	0	0
Average Occupancy <sup>5</sup> (PE)	0	84	0	0	0	0
Average Usage(litres per person/day) <sup>6</sup>	25	50	50	50	350	60
Daily Usage(l)	0	4200	0	0	0	0

Commercial Dry Weather Flow(DWF) Volume<sup>5</sup>                      4,620 litres

**WASTEWATER LOADING SUMMARY**

	Residential	Commercial	Total
Average Daily Discharge	0.00 l/s	0.05 l/s	0.05 l/s
Peak Discharge <sup>6</sup>	0.00 l/s	0.32 l/s	0.32 l/s

**ORGANIC LOADING**

EPA Wastewater Parameters Loading Concentrations		Residential Organic Loading		Commercial Organic Loading		Total Organic Loading	
Average Concentration <sup>7</sup>	Max Concentration <sup>8</sup>	Average Conc <sup>7</sup>	Max Conc <sup>8</sup>	Average Conc <sup>7</sup>	Max Conc <sup>8</sup>	Average Conc <sup>7</sup>	Max Conc <sup>8</sup>
BOD(mg/l)		BOD(kg/day)		BOD(kg/day)		BOD(kg/day)	
168.0	432.0	0.00	0.00	0.78	1.95	0.78	1.95
SS (mg/l)		SS (kg/day)		SS (kg/day)		SS (kg/day)	
163.0	435.0	0.00	0.00	0.75	2.01	0.75	2.01
N (mg/l)		N (kg/day)		N (kg/day)		N (kg/day)	
40.6	78.6	0.00	0.00	0.19	0.36	0.19	0.36
P (mg/l)		P (kg/day)		P (kg/day)		P (kg/day)	
7.1	15.5	0.00	0.00	0.03	0.07	0.03	0.07

**Notes:**

1. Waste Water flow - 150 l/head as per Irish Water Code of Practice - (3.6)
2. Average Occupancy ratio of 2.7 persons per dwelling from Irish Water Code of Practice - (3.6)
3. 10% Unit Consumption Allowance as per Irish Water Code of Practice - (3.6.3)
4. DWF Peak Factor is 6 as per Irish Water Code of Practice - (3.6)
5. Dry Weather Flow = No. of Residential Units X Average Occupancy Ratio X Waste Water Flow X UCA<sup>3</sup>
6. Peak Discharge = Average Daily Discharge X DWF Peak Factor
7. The average concentrations of wastewater parameters taken from EPA "Wastewater Treatment Manuals, Treatment Systems for Small Communities, Business, Leisure Centres and Hotels".
8. Assumed Maximum concentration is equal to the average concentration plus 2 times the standard deviation (for the 95%ile) taken from EPA "Wastewater Treatment Manuals, Treatment Systems for Small Communities, Business, Leisure Centres and Hotels".

**APPENDIX H**

**Water Demand Calculations**



PROJECT TITLE: U Store It, Liffey Valley

JOB REFERENCE: U Store It

SUBJECT  
Water Demand for Irish Water



DRAWING NO.

CALCULATIONS BY

CHECKED BY

DATE

**POST DEVELOPMENT DEMAND**

Per-Capita Consumption<sup>1</sup>  litres/person/day

Average Occupancy Ratio<sup>2</sup>  person/3 bed unit

Residential Unit Type	5 Bed Unit	4 Bed Unit	2 Bed Unit A	2 Bed Unit B	1 Bed Unit
Average Occupancy(persons)	5	4	4	3	1.5
Number of Units	0	0	0	0	0
Average Occupancy <sup>3</sup> (PE)	0	0	0	0	0

Average Residential Demand<sup>6</sup>  l/day

Commercial Unit Type	Shopping	Office/ Factory	Pub/ Restaurant	Leisure/ Gym	Medical/ Care Home	Creche
Average Occupancy (per m2)	18	25	5	5	20	20
Area(m2)	0	2100	0	0	0	0
Average Occupancy <sup>3</sup> (PE)	0	54	0	0	0	0
Average Usage(litres per person/day)	25	50	60	50	350	60
Daily Usage(l)	0	4200	0	0	0	0

Average Commercial Demand<sup>6</sup>  l/day

Average Day/Week Demand Factor<sup>3</sup>

Peak Demand Factor<sup>4</sup>

**WATER DEMAND SUMMARY**

	Residential	Commercial	Total
Average Daily Demand	<input type="text" value="0.00"/> l/s	<input type="text" value="0.05"/> l/s	<input type="text" value="0.05"/> l/s
Average Day/Peak Week Demand <sup>7</sup>	<input type="text" value="0.00"/> l/s	<input type="text" value="0.06"/> l/s	<input type="text" value="0.06"/> l/s
Peak Hour Water Demand <sup>8</sup>	<input type="text" value="0.000"/> l/s	<input type="text" value="0.304"/> l/s	<input type="text" value="0.304"/> l/s

**Notes:**

- Per-Capita Consumption 150l/person/day as per Irish Water Code of Practice - (3.7.2)
- Average Occupancy ratio of 2.7 persons per dwelling from Irish Water Code of Practice - (3.7.2)
- Average Day/Week Demand Factor is 1.25 as per Irish Water Code of Practice - (3.7.2)
- Peak Demand Factor is 5 as per Irish Water Code of Practice - (3.7.2)
- Average Occupancy(or PE=Population Equivalent) = No. of Residential Units X Average Occupancy Ratio
- Average Domestic Demand = Average Occupancy X Per-Capita Consumption
- Average Day/Peak Week Demand = Average Daily Domestic Demand X Average Day/Week Demand Factor
- Peak Hour Water Demand = Average Occupancy X Per-Capita Consumption X Average Day/Week Demand Factor X Peak Demand Factor

**APPENDIX I**

**South Dublin County Council Development Plan**

**2016 - 2022 Zoning Objectives - Map 2**



**APPENDIX J**

**South Dublin County Development Plan 2016 -**

**2022 Strategic Flood Risk Assessment Fluvial Flood**

**Zone Mapping - Map 2**





**Legend**

- Flood Zone A - 1% AEP Flood Extent (1 in 100 chance in any given year)
- Flood Zone B - 1% AEP Flood Extent (1 in 1000 chance in any given year)
- Defended Area
- Watercourse Centreline
- Indicative Flood Extents
- County Boundary

**DRAFT**

**RPS**

North Carolina State University  
 Strategic Flood Risk Assessment

**Figure 1: Rural Flood Zone Mapping**

Project No. 187010001  
 Client: NCEM  
 Date: 12/15/2018  
 Scale: 1:50,000  
 Drawing No. 1 of 1

Approved: [Signature]  
 Date: 12/15/2018

1. No portion of this map should be used to the detriment of the user's safety.

**APPENDIX K**

**CFRAMS Flood Mapping**







**APPENDIX L**

**OPW National Flood Hazard Mapping**

**Summary Report**

**Summary Local Area Report**

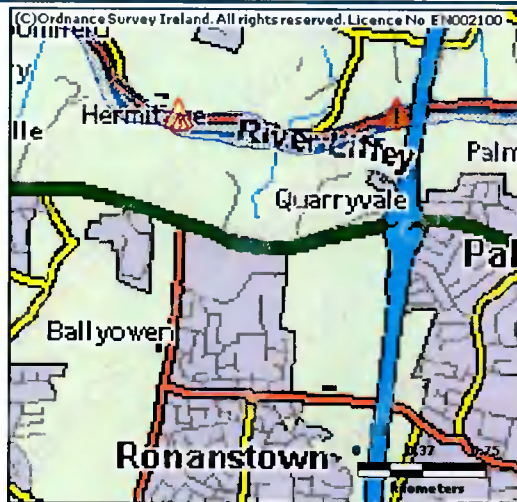
This Flood Report summarises all flood events within 2.5 kilometres of the map centre

The map centre is in:

County: Dublin

NGR: O 068 350

This Flood Report has been downloaded from the Web site [www.floodmaps.ie](http://www.floodmaps.ie). The users should take account of the restrictions and limitations relating to the content and use of this Web site that are explained in the Disclaimer box when entering the site. It is a condition of use of the Web site that you accept the User Declaration and the Disclaimer.



Map Scale 1:30,979

**Map Legend**

	Flood Points
	Multiple / Recurring Flood Points
	Areas Flooded
	Hydrometric Stations
	Rivers
	Lakes
	River Catchment Areas
	Land Commission *
	Drainage Districts *
	Benefiting Lands *

\* Important. These maps do not indicate flood hazard or flood extent. Their purpose and scope is explained in the Glossary.

**7 Results**

	1 Liffey Lower - Dec 1954 County: Kildare, Dublin Additional Information: Reports (4) Press Archive (2) More Mapped Information	Start Date: 08/Dec/1954 Flood Quality Code:2
	2 Liffey Sommerton Rd Luttrellstown Golf C Oct 2004 County: Dublin Additional Information: Reports (1) More Mapped Information	Start Date: 26/Oct/2004 Flood Quality Code:4
	3 Liffey R109 at the Strawberry Beds Nov 2002 County: Dublin Additional Information: Reports (2) More Mapped Information	Start Date: 13/Nov/2002 Flood Quality Code:3
	4 Liffey Strawberry Beds June 1993 County: Dublin Additional Information: Photos (1) Reports (1) Press Archive (1) More Mapped Information	Start Date: 10/Jun/1993 Flood Quality Code:2
	5 Beech Row Ronanstown Recurring County: Dublin	Start Date: Flood Quality Code:3



Additional Information: Reports (2) More Mapped Information

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6. Palmerston Mill Lane Recurring

County: Dublin

Start Date:

Flood Quality Code:4

Additional Information: Reports (1) More Mapped Information

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7. Lucan St Edmonsbury Road Recurring

County: Dublin

Start Date:

Flood Quality Code:4

Additional Information: Reports (1) More Mapped Information