Comhairle Contae Átha Cliath Theas
South Dublin County Council

DOCUMENT LEAD SHEET

ENGINEERING SERVICES REPORT

DOC. NO: P2005-C-004

PROJECT: LIFFEY VALLEY

STATUS: PLANNING PERMISSION

CLIENT: OCEANGLADE LTD

ARCHITECT: CAREW KELLY ARCHITECTS

gdcl CONSULTING ENGINEERS

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 Please replace all superseded pages of this document with current version.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	
P	28 Oct 2022	Planning Submission	SJ	GD/CP		

☑ Entire Document Issued this Revision

1.0 INTRODUCTION

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

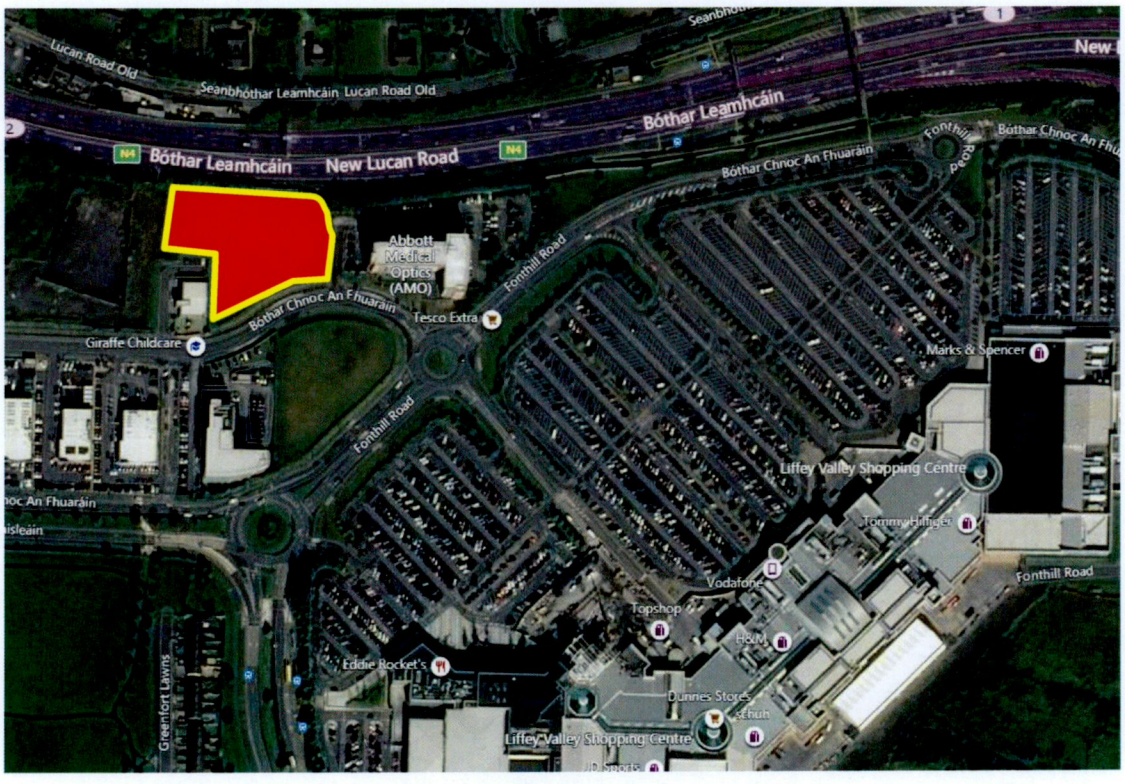

Figure 1 – Site Location Map

Oceanglade Ltd intend to apply for planning permission for development at this site of 0.72 Ha at Liffey Valley, Dublin 22, to the south of the N4, to the west of the existing Johnson and Johnson office building, to the north and east of Giraffe Childcare and to the north of Liffey Valley secondary estate road.

The proposed development will consist of modifications to the self-storage facility and ground floor cafe permitted by South Dublin County Council under Reg. Ref. SD21A/0284.

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APPENDICES

1.0 INTRODUCTION

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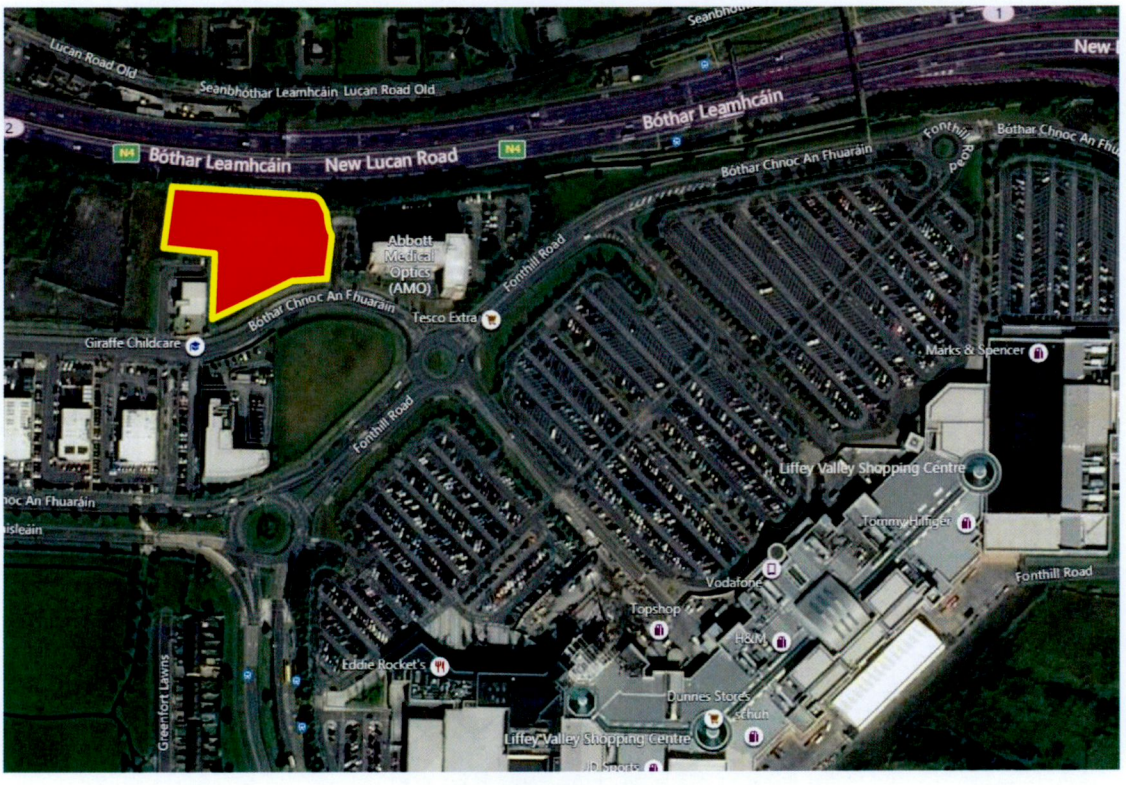

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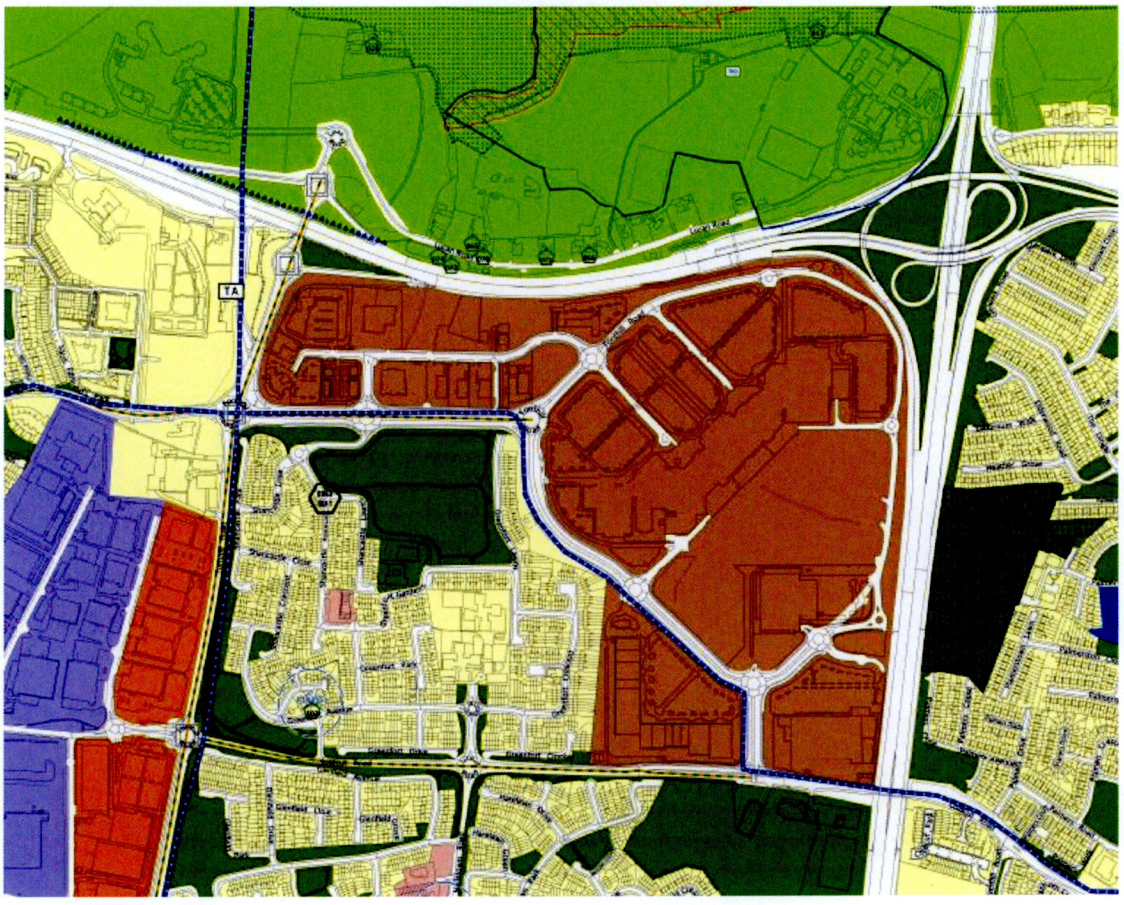
The proposed development will consist of modifications to the self-storage facility and ground floor cafe permitted by South Dublin County Council under Reg. Ref. SD21A/0284.

The proposed modifications will comprise:

- An increase in the Gross Floor Area (GFA) from 8,008 sq m. to 19,673 sq m. as a result of an increase in the total number of internal floors from 4 to 7 no. levels, extension of the basement and an increase in building length along the northwest corner of the building;
- An increase in the overall building height of 1.5m;
- Minor internal layout alterations;
- Minor alterations to the roof layout;
- Elevational changes including alterations to the external north and west façade and an increase in depth of canopy on the south façade;
- Relocation and reconfiguration of the car parking and provision of reserved bay for larger vehicles. Inclusion of an additional 5 no. EV spaces (10 no. in total). There is no proposed change to the overall number of permitted car parking spaces;
- Provision of 20 no. covered bicycle parking spaces;
- Alterations to internal access road and landscaping;
- Provision of additional landscaping; and
- All associated and ancillary site works.



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 REGEN	To facilitate enterprise and/or residential-led regeneration subject to a development framework or plan for the area incorporating phasing and infrastucture delivery.
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 2022 - 2028 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 (GDSDS), 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. Lastly, in order to maximise the effect of SuDS measures on the site, gullies and road runoff have been designed to flow into certain SuDS measures, where possible, before ultimately discharging into the drainage network. This provided an extra step in the treatment train for a large portion of surface water runoff across the site.

2.0 EXISTING SITE SERVICES

Murphy Matson O'Sullivan (MMOS) Consulting Engineers were requested by Barkhill Limited to undertake a study of the existing services within and in the immediate vicinity of the 3no. sites, Lots 1, 2 & 3 at Liffey Valley in Dublin 22. A report was produced on 9th of September 2019. The site which is the subject of this planning application forms part of Lot 2 of the original masterplan.

The Local Road to the east of the subject site has not been taken in charge by South Dublin County Council, and the detail of Foul and Surface water drainage in this road and within the surrounding area is therefore not indicated on the Irish Water/SDCC existing record drawings.

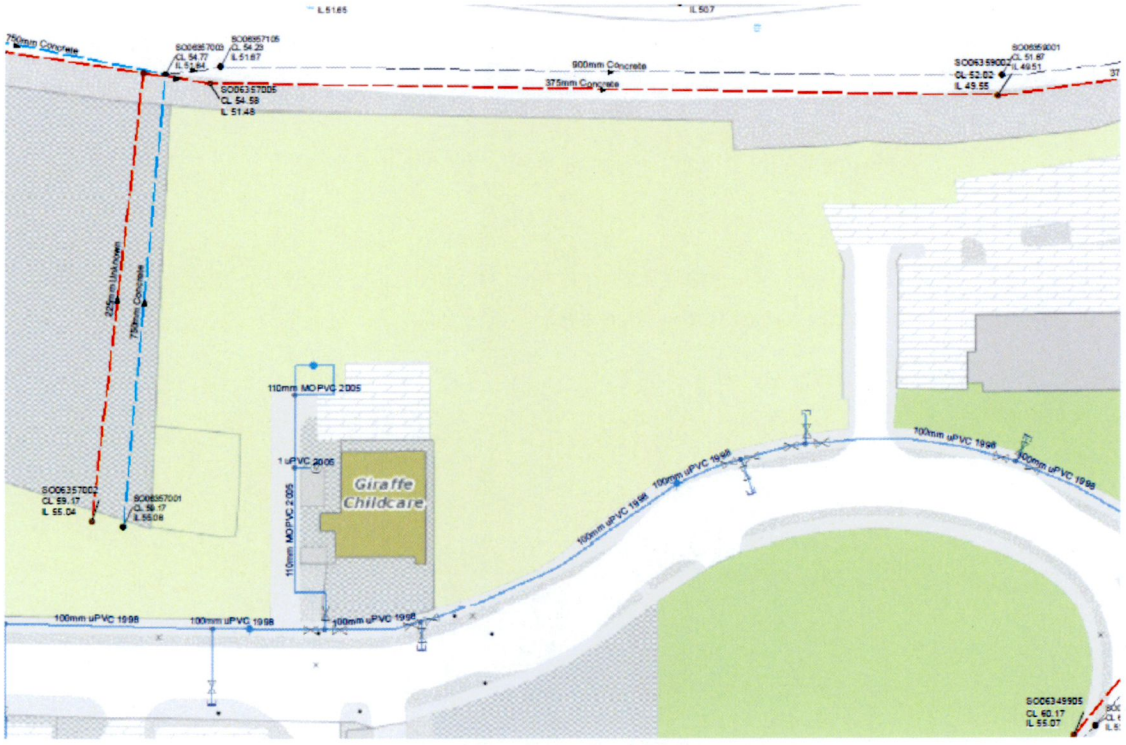


Figure 3 - Irish Water Drainage Records

The above-mentioned report compiled by MMOS Consulting Engineers indicates that there is existing drainage and watermain services adjacent to the proposed development. Please refer to Appendix C and the below Figure for details:

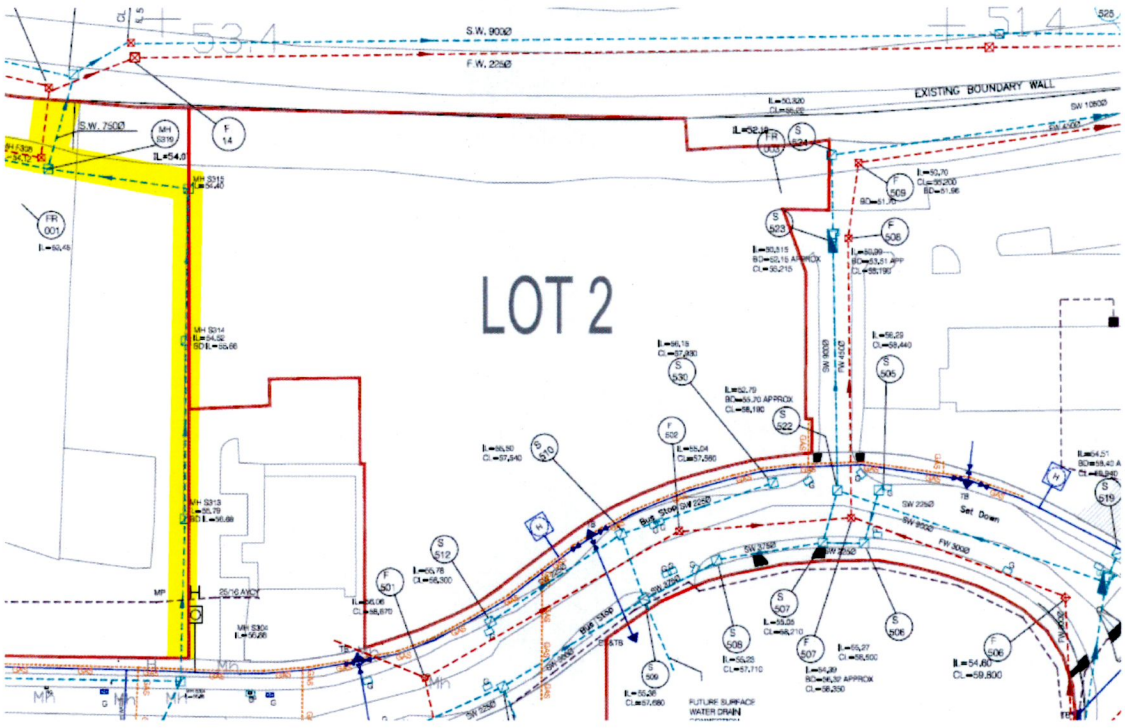


Figure 4 - Existing Site Services – Lot 2 MMOS Report

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

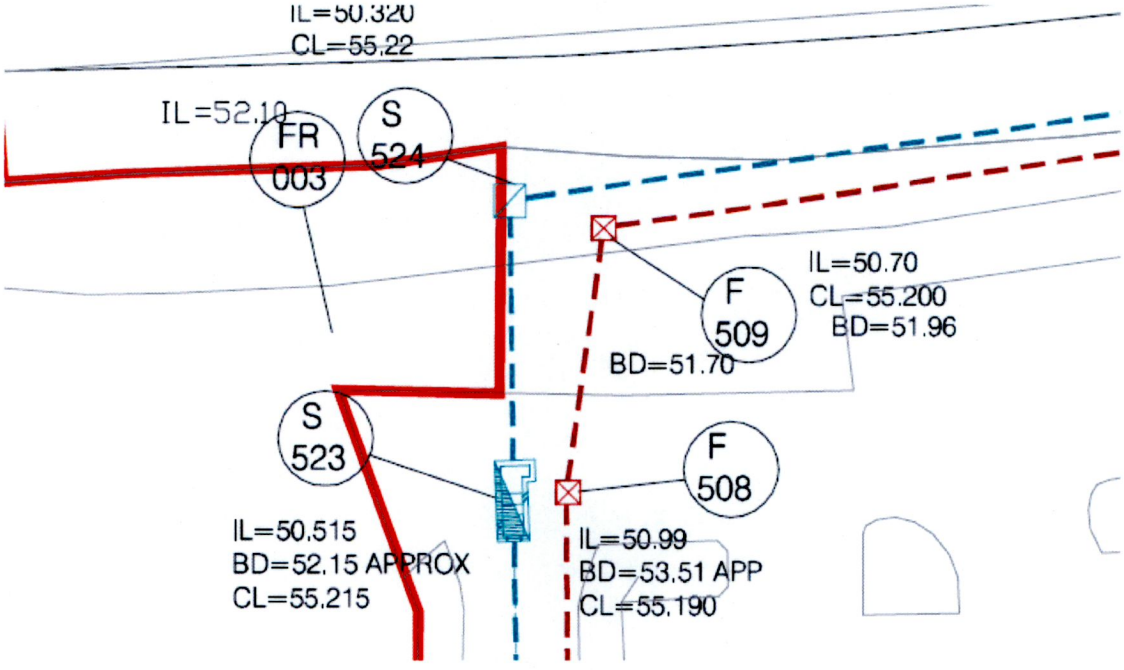


Figure 5 - Proposed Surface Water Connection Point

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.

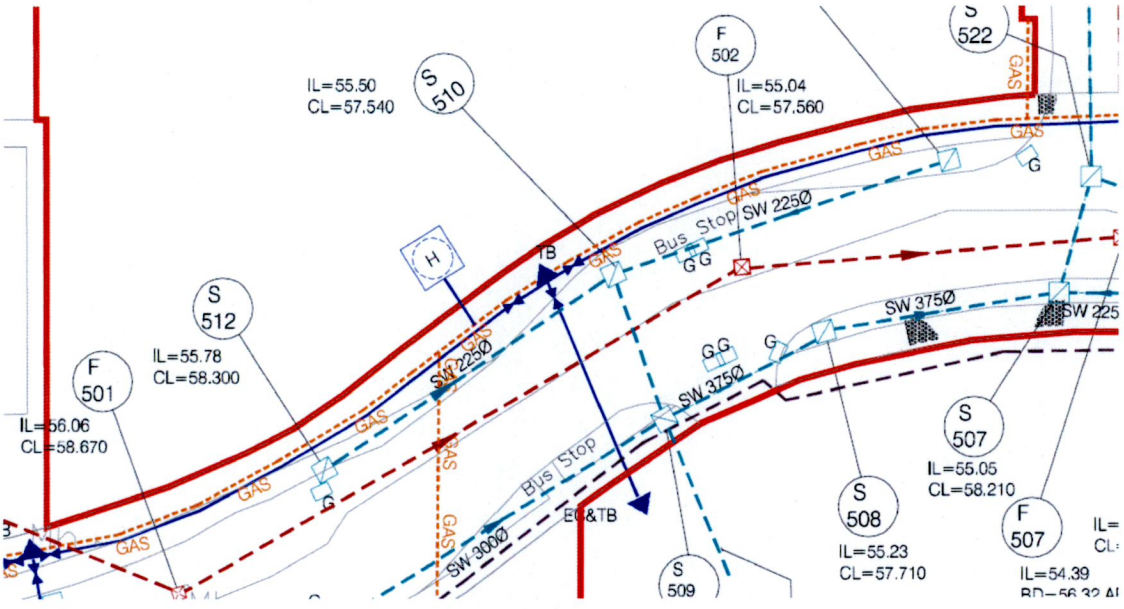


Figure 6 - Proposed Foul Water and Watermain Connection Point

Please refer to GDCL Drawing No. P2005-C-301 for details.

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

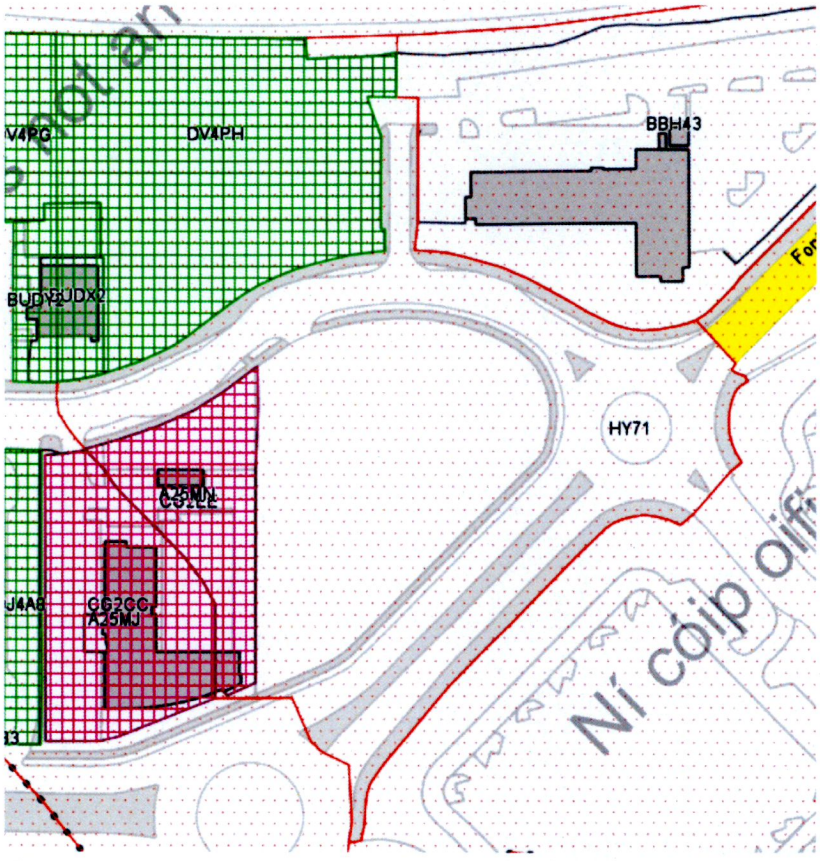


Figure 7 - Extract from Land Direct Website (landdirect.ie)

3.0 SURFACE WATER DRAINAGE

3.1 Attenuation Strategy

Surface water attenuation system will be provided using an off-line Stormtech MC3500 attenuation system. The attenuation facility will be located within the road to the north of the site. 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 444.48m^3.

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 $M5_{60}/M5^{2d}$ = 0.28

$M5_{60}$ = 16.5mm

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^2)	Runoff Coeff.	Effective Area (m^2)
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	220	0.50	110.0
Gardens	-	0.30	0.0
Verges		0.15	0.0
Parks	-	0.15	0.0
Public Open Space	804	0.10	80.4
Effective Catchment Area (Impermeable)	0.573	Hectares	
Effective Catchment Runoff Coefficient	0.79		

Table 1 - Catchment Characteristics

The Greater Dublin Strategic Drainage Study (GDSDS) 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 greenfield 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:

Interception storage required **= 5730m^2 x 0.8 x 0.005 = 22.92 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) = 467m² x 0.15 x 0.4 = 28.02m³

Interception storage provided (Permeable Paving) = 232.7m² x 0.50 x 0.3 = 34.91m³

Interception storage provided (Swale Filter Drain) = 126.8m x 0.5² x 0.4 = 12.68m³

Interception storage provided (Green Roof) = 570.83m² x 0.1 x 0.35 = 19.97 m³

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-310 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-310.

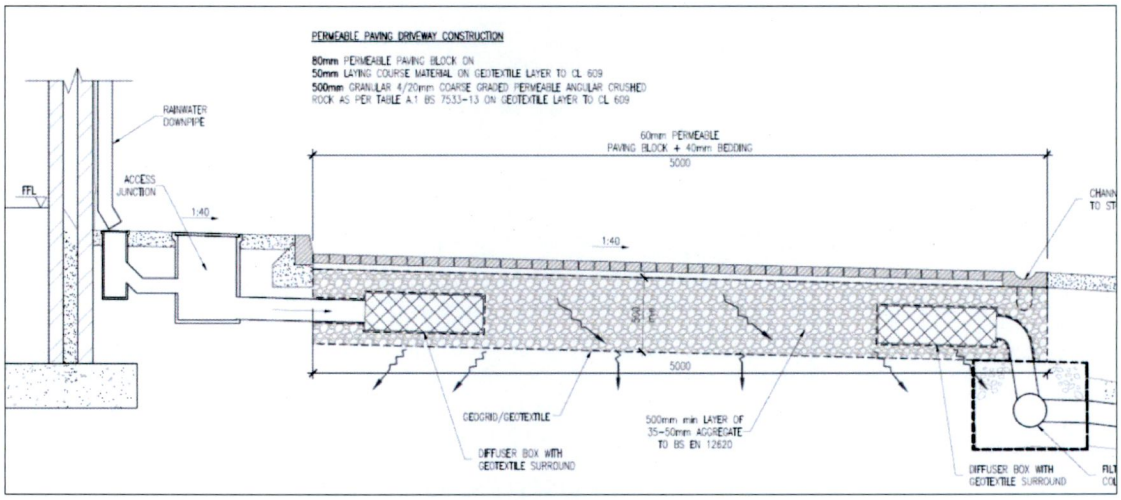


Figure 8: Typical Section through Permeable Paving

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-301, 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 GDSDS. Treatment volume required for the development is summarised in below:

Treatment storage required **= 5730m^2 x 0.8 x 0.015 = 68.76m^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-310 for details.

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

Treatment storage provided (Stormtech Stone Base)	**= 467m² x 0.15 x 0.4**	**= 28.02m³**
Treatment storage provided (Permeable Paving Base)	**= 232.7m² x 0.50 x 0.3**	**= 34.91m³**
Treatment storage provided (Swale Filter Drain)	**= 126.8m x 0.5² x 0.4**	**= 12.68m³**
Interception storage provided (Green Roof)	**= 570.83m² x 0.1 x 0.35**	**= 19.97 m³**

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 collected by downpipes from the roof and road gullies within the tarmacadam 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 GDSDS (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.

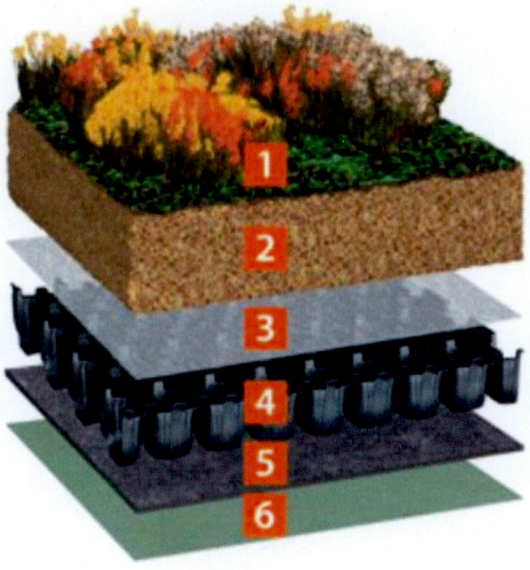


***Figure 9** - Typical Extensive Green Roof*

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 MC3500 attenuation tank proposed for this development is 50-75 years.

Figure 10 - Typical Cellular Storage (Stormtech) Installation

Permeable Paving: Run-off from these permeable areas is allowed to infiltrate to the sub-soil and provide attenuation, storage and soakage for run-off generated by adjacent impermeable surfaces. The site currently comprises a mix of tarmacadam and concrete surfacing around the existing building. The current proposals include replacing the existing paving within the landholder ownership with permeable paving. Given that the site is currently greenfield in nature and provides no attenuation, the introduction of permeable paving will reduce surface water runoff. The expected service life of permeable paving is 30 years, after which the paviours become impermeable and would need to be replaced.

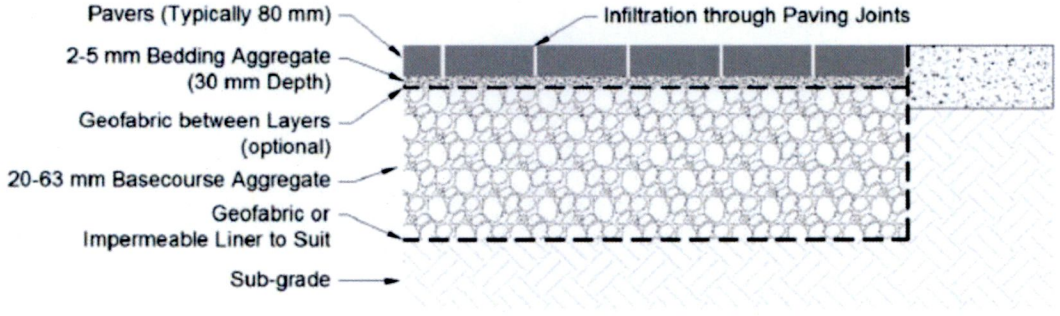


***Figure 11** - Typical Permeable Paving Detail*

Tree Pits: Tree pits provide storage of storm water runoff through the use of structural soils or proprietary crate systems. Soils and geotextiles that make up the construction of tree pits

remove silts and particulates that may be present in runoff water. The expected service life of a typical tree pit is 30 years.

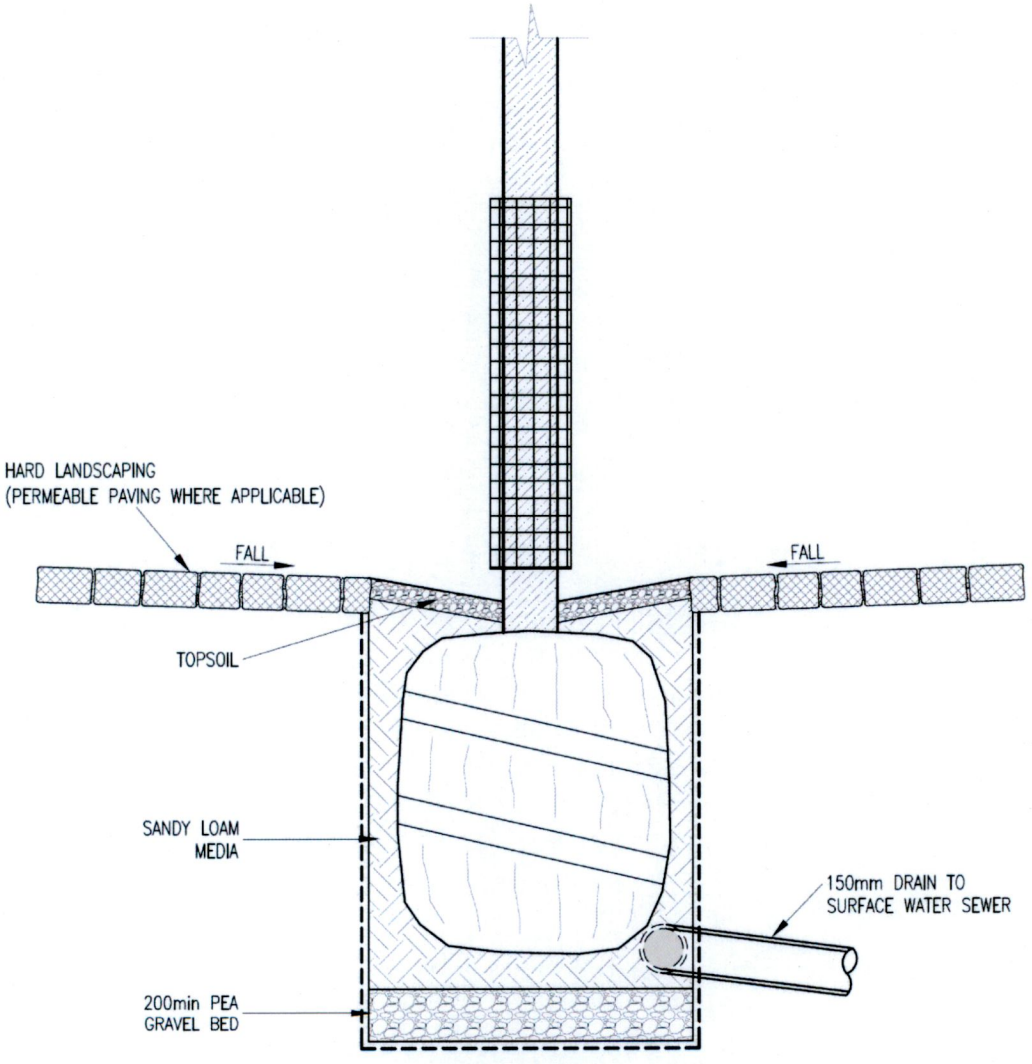


Figure 12 - Typical Tree Pit Installation

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 aassess 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

Table 5 - Permeable Paving Maintenance Schedule

SUDS Element	Maintenance		
Permeable Paving	Maintenance period	Maintenance Task	Frequency
	Regular	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or as required, based on site specific observations of clogging or manufacturer's recommendations.
	Occasional	Removal of weeds	As required
	Remedial work	Remediation work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users	As required

	Monitoring	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
		Monitor inspection chambers	Annually

Table 6 - Tree Pit Maintenance Schedule

SUDS Element	Maintenance		
Tree Pit	Maintenance period	Maintenance Task	Frequency
	Regular	Brushing and vacuuming (standard cosmetic sweep over tree pit surface)	Once a year, after autumn leaf fall, or as required, based on site specific observations of clogging or manufacturer's recommendations.
	Occasional	Removal of weeds	As required
	Remedial work	Remediation work to any soil depressions, which might compromise the integrity of the tree pit.	As required
	Monitoring	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
		Monitor connections to inspection chambers	Annually

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 30th 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 7 – 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 30th 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.

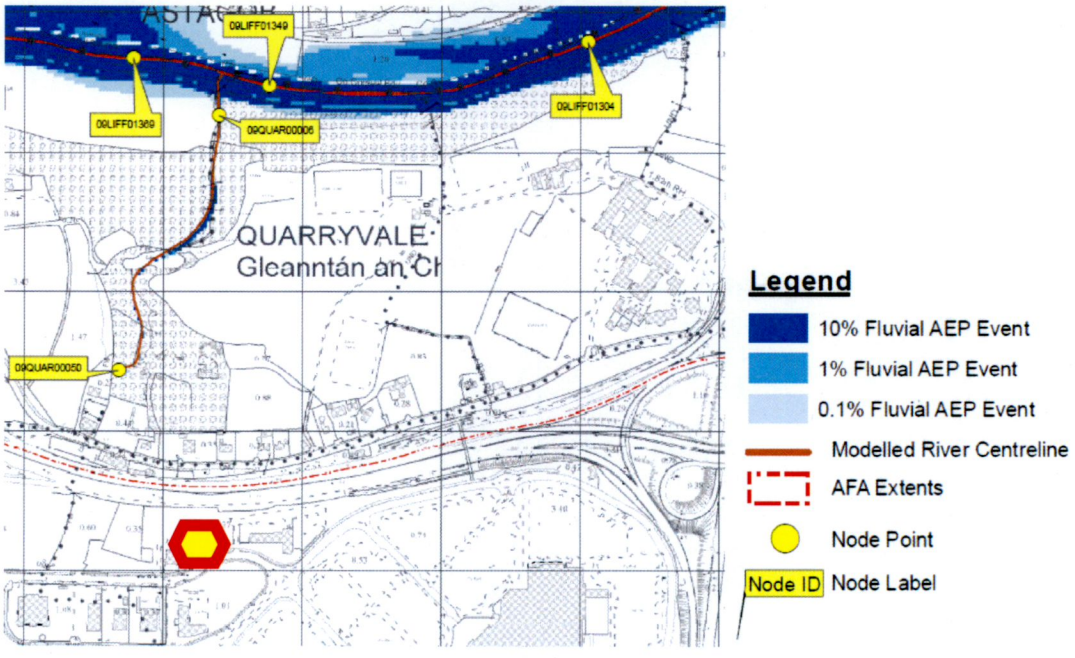


Figure 13 - Floodinfo.ie showing OPW Flood Mapping

The Strategic Flood Risk Assessment for South Dublin County Council Development Plan 2022-2028 Fluvial Flood Zone Mapping was consulted and indicated that there was no risk of Fluvial Flooding.

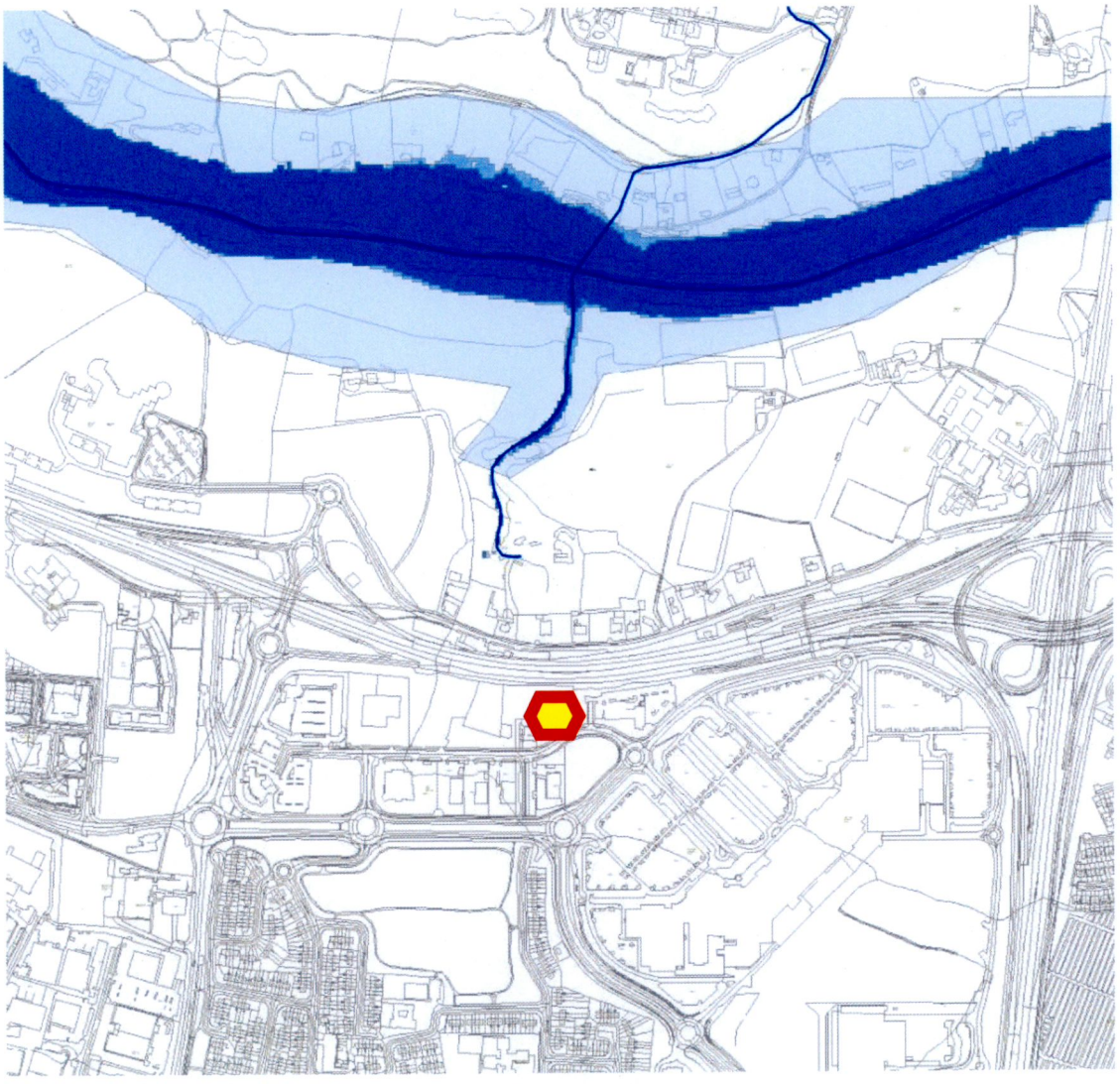
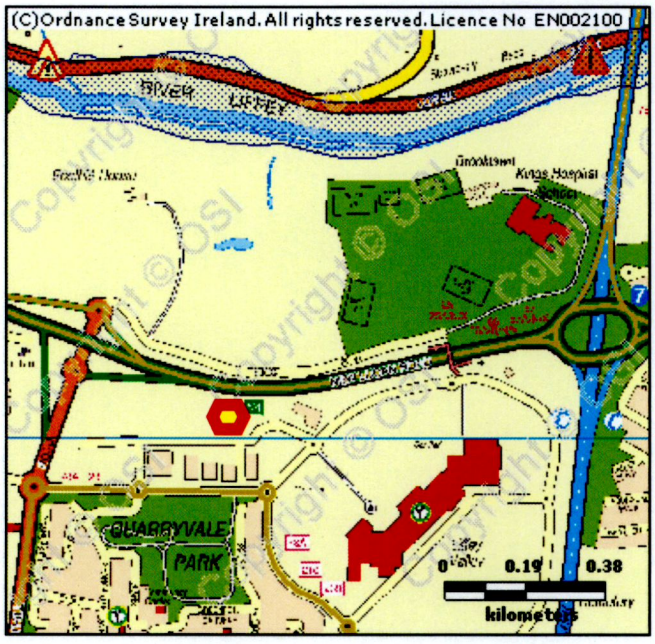


Figure 14 - South Dublin County Development Plan 2022-2028 Fluvial Flood Zone Map 2 Extract

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. Thier purpose and scope is explained in the Glossary.

Figure 15 - 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

Uisce Éireann
Bosca OP 448
Oifig Sheachadta na
Cathrach Theas
Cathair Chorcaí

Irish Water
PO Box 448,
South City
Delivery Office,
Cork City.

www.water.ie

13 May 2020

Dear Alan Fitzsimons,

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**. 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**. For further information, visit **www.water.ie/connections.**

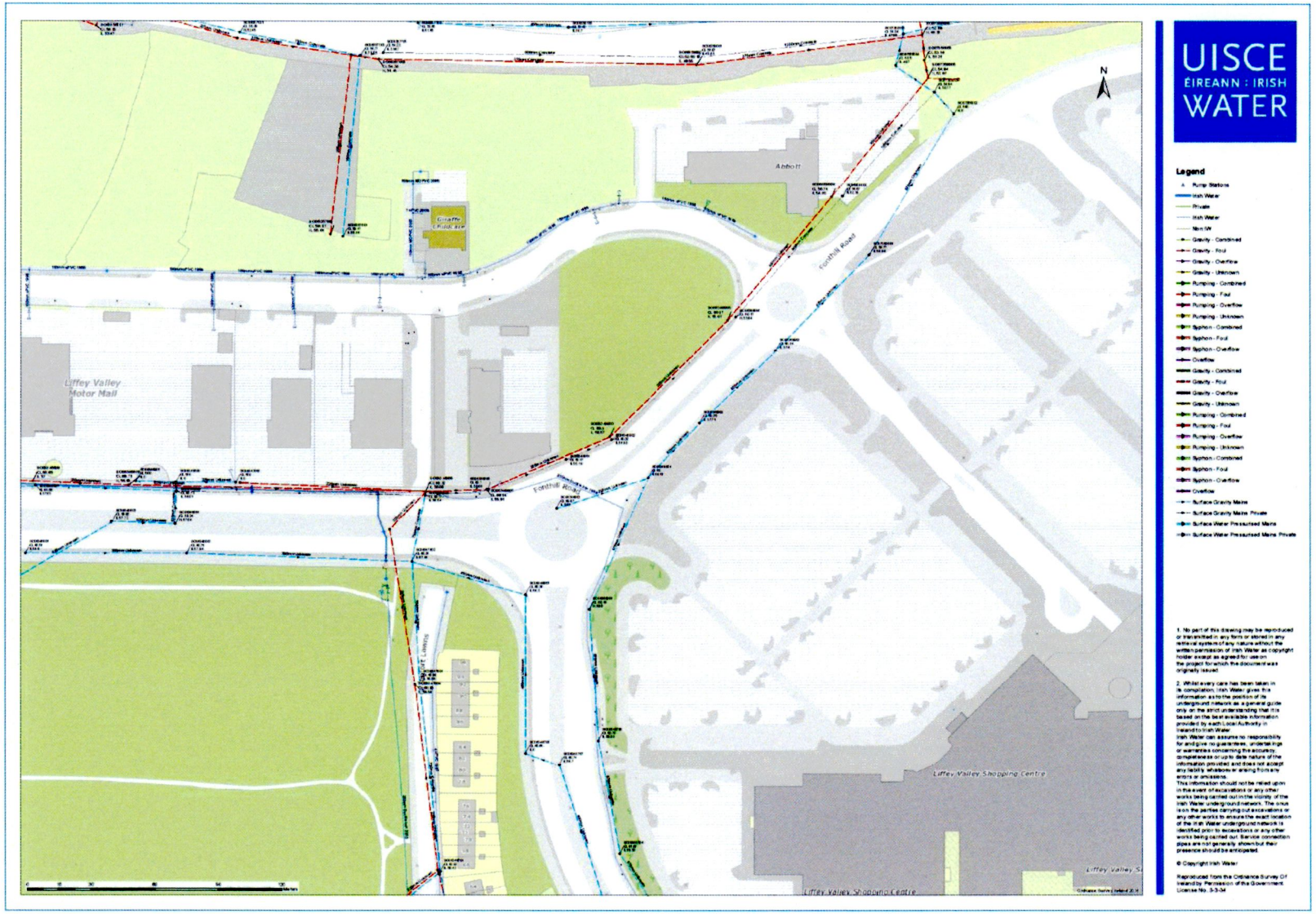
Yours sincerely,

Maria O'Dwyer

Connections and Developer Services

APPENDIX B

Irish Water Services Records



UISCE ÉIREANN : IRISH WATER

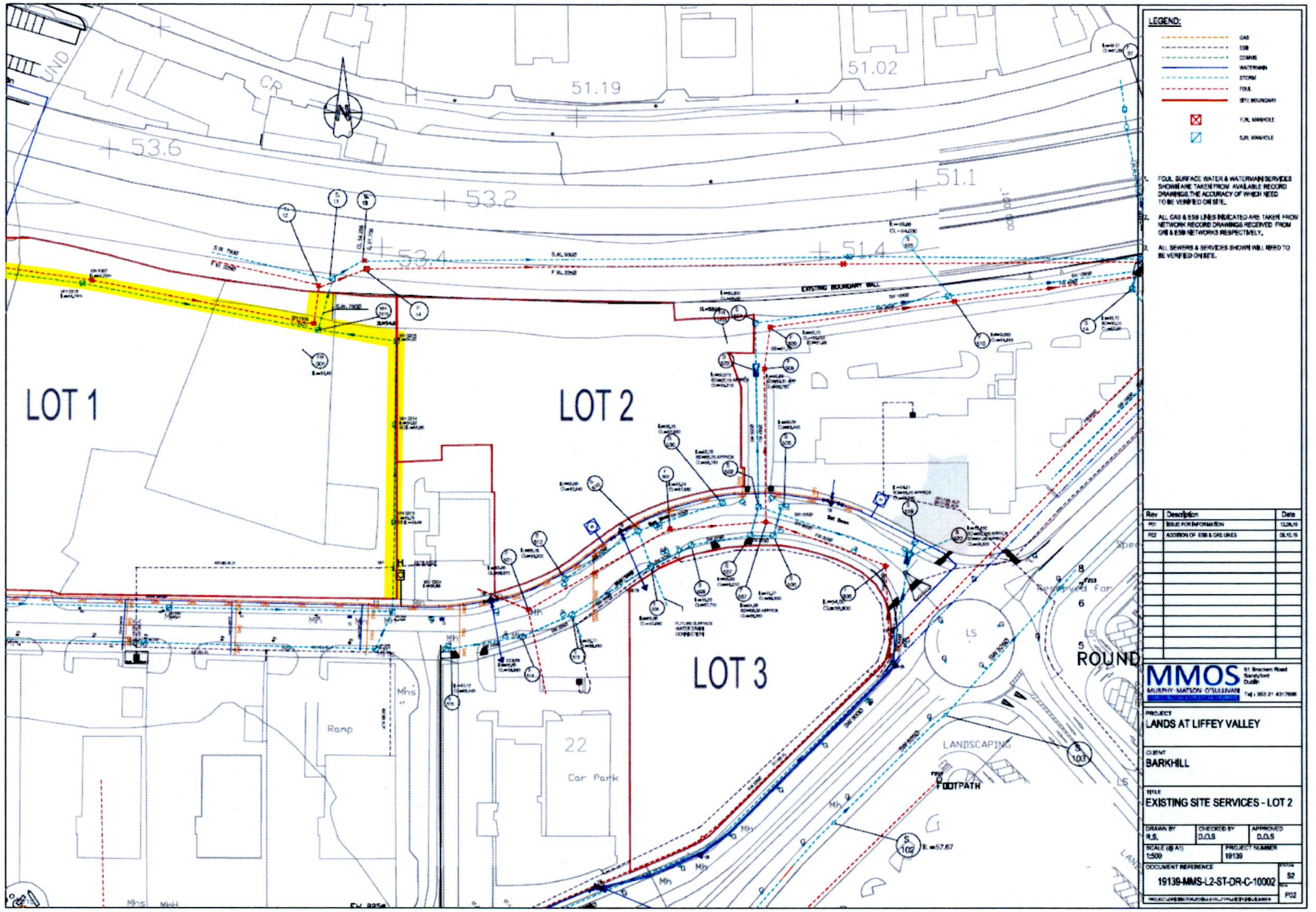
Legend

- Pump Stations
- Irish Water
- Private
- Irish Water
- Non IW
- Gravity - Combined
- Gravity - Foul
- Gravity - Overflow
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Overflow
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Syphon - Overflow
- Overflow
- Gravity - Combined
- Gravity - Foul
- Gravity - Overflow
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Overflow
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Syphon - Overflow
- Overflow
- Surface Gravity Mains
- Surface Gravity Mains Private
- Surface Water Pressurised Mains
- Surface Water Pressurised Mains Private

APPENDIX C

Existing Site Services

by Murphy Matson O'Sullivan


LOT 1
LOT 2
LOT 3
51.19
51.02
53.6
53.2
53.4
51.1
51.4
EXISTING BOUNDARY WALL
Ramp
22
Car Park
LANDSCAPING
FOOTPATH
ROUND
LEGEND:
GAS
ESB
COMMS
WATERMAIN
STORM
FOUL
SITE BOUNDARY
F/R. MANHOLE
S/R. MANHOLE
1. FOUL, SURFACE WATER & WATERMAIN SERVICES SHOWN ARE TAKEN FROM AVAILABLE RECORD DRAWINGS, THE ACCURACY OF WHICH NEED TO BE VERIFIED ON SITE.
2. ALL GAS & ESB LINES INDICATED ARE TAKEN FROM NETWORK RECORD DRAWINGS RECEIVED FROM GNI & ESB NETWORKS RESPECTIVELY.
3. ALL SEWERS & SERVICES SHOWN WILL NEED TO BE VERIFIED ON SITE.
Rev | Description | Date
P01 | ISSUE FOR INFORMATION | 12.09.19
P02 | ADDITION OF ESB & GAS LINES | 08.10.19
MMOS
MURPHY MATSON O'SULLIVAN
51 Bracken Road
Sandyford
Dublin
Tel: + 353 21 431 7688
PROJECT
LANDS AT LIFFEY VALLEY
CLIENT
BARKHILL
TITLE
EXISTING SITE SERVICES - LOT 2
DRAWN BY
R.S.
CHECKED BY
D.O.S
APPROVED
D.O.S
SCALE (@ A1)
1:500
PROJECT NUMBER
19139
DOCUMENT REFERENCE
19139-MMS-L2-ST-DR-C-10002
S2
P02

APPENDIX D

Surface Water Attenuation Calculations

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

	Interval		Years												
DURATION	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 hours	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

Qbar Calculation
Using IOH Report 124 for Sites < 25 km²

Catchment Name
Liffey Valley

[1] $Q_{bar} = 0.00108 * (AREA)^{0.89}(SAAR)^{1.17}(SOIL)^{2.17}$

Estimation of QBAR from IOH Report 124 for catchments less than 25 km² 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^2 — Area of the Catchment (km^2)

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

SOIL = 0.30

Soil Type Expressed as a Percentage	Soil 1	Soil 2	Soil 3	Soil 4	Soil 5
	0	100	0	0	0
SOIL Value	0.15	0.30	0.40	0.45	0.50

$M5_{60}$ = 16.5 mm

$M5_{2day}$ = 59.6 mm

Ratio $M5_{60}/M5_{2d}$ = **0.277**

Soil index value (SPR) calculated from Flood Studies Report Vol V Fig I 4.18(1) - The Classification of Soils from Winter Rainfall Acceptance Rate .

Flood Return Event	[5]Growth Factor	Permitted Flow (l/s)
1	0.85	1.3
QBAR	1	1.5
10	1.67	2.5
30	2.1	3.2
50	2.33	3.5
100	2.6	3.9
200	2.85	4.3
1000	3.5	5.3

[4]QBar from Site with Factorial Error Allowance

r^2 =	0.847
n =	71
fse =	1.651

Q'_{bar} = 2.48 l/s

(With Allowance for the standard factorial error)

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

Q_{bar} = 0.00004 cumecs/Ha

Q_{bar} = 2.1 l/s/Ha

$Q_{bar[rural]}$ = 1.5 l/s

Catchment Characteristics			
Liffey Valley	**Area (m^2)**	**Runoff Coeff.**	**Effective Area (m^2)**
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	220	0.50	110.0
Gardens	-	0.30	0.0
Verges		0.15	0.0
Parks	-	0.15	0.0
Public Open Space	804	0.10	80.4

Effective Catchment Area (Impermeable) **0.573** Hectares

Effective Catchment Runoff Coefficient **0.79**

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	0.277	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	Area (ha)	T of E (mins)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
Depth/Area 1	0.573	4.00	54.900	1.538	84.335	1.600

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	0.277	Additional Storage (m³/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 %)
100	10	0	0

Node Depth/Area 1 Offline Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Loop to Node		Sump Available	✓
Invert Level (m)	53.211	Product Number	CTL-SHE-0058-1500-1000-1500
Design Depth (m)	1.000	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.5	Min Node Diameter (mm)	1200

Node Depth/Area 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	53.300
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.67	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	0.0	0.0	0.001	700.0	0.0	1.140	700.0	0.0	1.150	0.0	0.0

Results for 100 year +10% CC Critical Storm Duration. Lowest mass balance: 98.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
2160 minute winter	Depth/Area 1	2100	54.226	0.926	11.7	440.6084	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m^3)
2160 minute winter	Depth/Area 1	Hydro-Brake®	1.5	189.7

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 (Input)

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	21.265	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	80.155	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	23.650	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				
						0	2.000	54.250	225
12	59334.164	-64984.447	55.000	1.122	1200		1	2.000	53.953	225
									
						0	2.001	53.878	300
11	59337.011	-64984.598	54.900	1.041	1200		1	2.001	53.859	300
									
						0	2.002	53.859	300
10	59417.156	-64985.863	54.850	1.071	1200		1	2.002	53.779	300
									
						0	2.003	53.779	300
9	59377.097	-65053.945	58.450	1.550	1200				
						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	56.522	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	53.700	300
4	59435.434	-64991.915	55.000	1.538	1200	1	1.004	53.462	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 (m³/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	15.535	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	15.535	60.0	225	Circular	58.250	56.250	1.775	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	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[1]	150 litres	Unit Consumption Allowance[3]	10 %
Average Occupancy Ratio[2]	2.7 person/3 bed unit	DWF Peak Factor[4]	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[2] (PE)	0	0	0	0	0

Residential Dry Weather Flow(DWF) Volume[5] 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[5] (PE)	0	84	0	0	0	0
Average Usage(litres per person/day)[9]	25	50	60	50	350	60
Daily Usage(/)	0	4200	0	0	0	0

Commercial Dry Weather Flow(DWF) Volume[5] 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[6]	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[7]	Max Concentration[8]	Average Conc[7]	Max Conc[8]	Average Conc[7]	Max Conc[8]	Average Conc[7]	Max Conc[8]
BOD(mg/l)		BOD(kg/day)		BOD(kg/day)		BOD(kg/day)	
168.0	422.0	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[3]
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

gdcl CONSULTING ENGINEERS

DRAWING NO. **CALCULATIONS BY** **CHECKED BY** **DATE**

POST DEVELOPMENT DEMAND

Per-Capita Consumption[1] 150 litres/person/day

Average Occupancy Ratio[2] 2.7 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[5] (PE)	0	0	0	0	0

Average Residential Demand[6] 0 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[5] (PE)	0	84	0	0	0	0
Average Usage(litres per person/day)	25	50	60	50	350	60
Daily Usage(/)	0	4200	0	0	0	0

Average Commercial Demand[6] 4,200 l/day

Average Day/Week Demand Factor[3] 1.25

Peak Demand Factor[4] 5

WATER DEMAND SUMMARY	Residential	Commercial	Total
Average Daily Demand	0.00 l/s	0.05 l/s	0.05 l/s
Average Day/Peak Week Demand[7]	0.00 l/s	0.06 l/s	0.06 l/s
Peak Hour Water Demand[8]	0.000 l/s	0.304 l/s	0.304 l/s

Notes:

1. Per-Capita Consumption 150l/person/day as per Irish Water Code of Practice - (3.7.2)
2. Average Occupancy ratio of 2.7 persons per dwelling from Irish Water Code of Practice - (3.7.2)
3. Average Day/Week Demand Factor is 1.25 as per Irish Water Code of Practice - (3.7.2)
4. Peak Demand Factor is 5 as per Irish Water Code of Practice - (3.7.2)
5. Average Occupancy(or PE-Population Equivalent) = No. of Residential Units X Average Occupancy Ratio
6. Average Domestic Demand = Average Occupancy X Per-Capita Consumption
7. Average Day/Peak Week Demand = Average Daily Domestic Demand X Average Day/Week Demand Factor
8. 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

2022 - 2028 Zoning Objectives - Map 2

South Dublin 2022-2028
County Development Plan

SCALE 1:5,000

Land Use Planning and Transportation Department

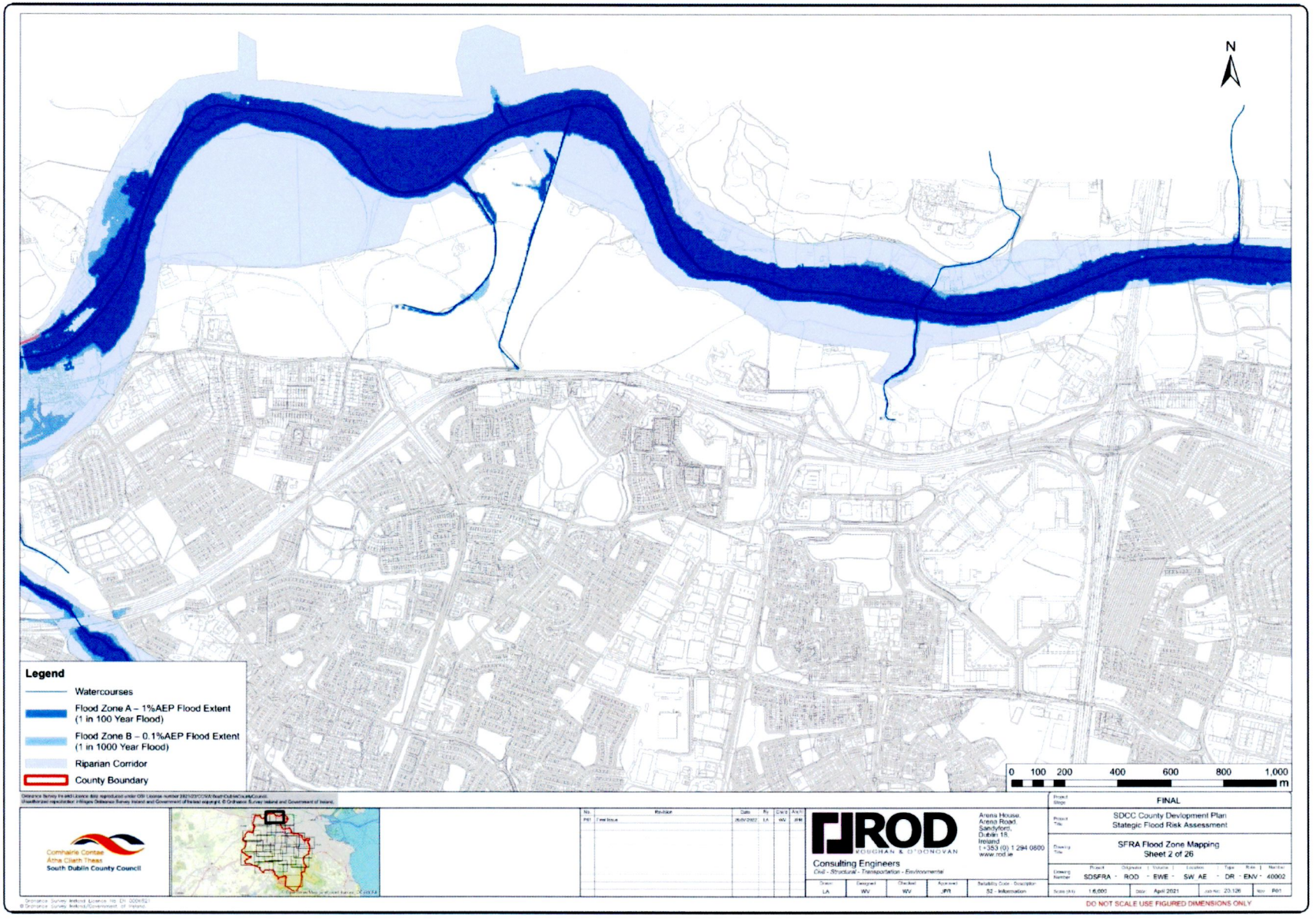
Nick Mulhern
BA, MRUP, MAUP
Director

Hazel Craigie
MSc, MIEI, IRPI
Senior Planner

Map 2

APPENDIX J

South Dublin County Development Plan 2022 - 2028 Strategic Flood Risk Assessment Fluvial Flood Zone Mapping



Comhairle Contae Átha Cliath Theas
South Dublin County Council

ROD
VOUGHAN & O'DONOVAN
Consulting Engineers
Civil - Structural - Transportation - Environmental

Arena House,
Arena Road,
Sandyford,
Dublin 18,
Ireland
t +353 (0) 1 294 0800
www.rod.ie

FINAL

SDCC County Development Plan
Strategic Flood Risk Assessment

SFRA Flood Zone Mapping
Sheet 2 of 26

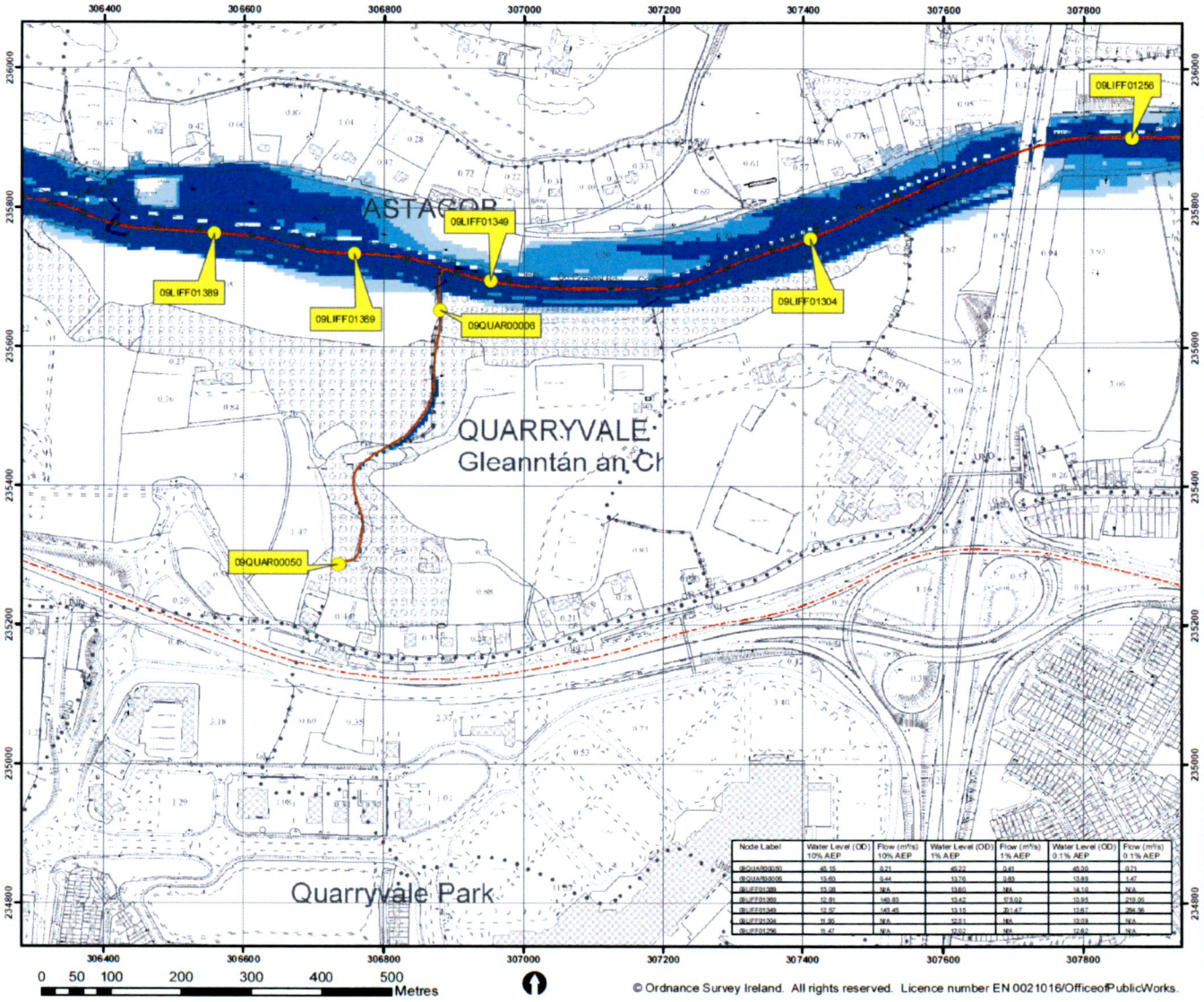
Drawing Number: SDSFRA - ROD - EWE - SW AE - DR - ENV - 40002

Scale (A1): 1:6,000 | Date: April 2021 | Job No: 20.126 | Rev: P01

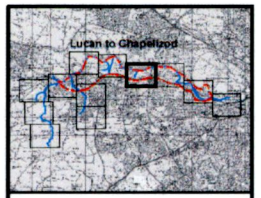
DO NOT SCALE USE FIGURED DIMENSIONS ONLY

APPENDIX K

CFRAMS Flood Mapping



Node Label	Water Level (OD) 10% AEP	Flow (m³/s) 10% AEP	Water Level (OD) 1% AEP	Flow (m³/s) 1% AEP	Water Level (OD) 0.1% AEP	Flow (m³/s) 0.1% AEP
09QUAR00050	45.15	8.21	45.22	9.41	45.30	9.71
09QUAR00006	13.03	9.44	13.76	9.83	13.83	9.47
09LIFF01389	13.08	N/A	13.80	N/A	14.19	N/A
09LIFF01369	12.81	140.83	13.42	173.02	13.95	213.05
09LIFF01349	12.57	143.45	13.15	201.47	13.67	264.96
09LIFF01304	11.96	N/A	12.51	N/A	13.09	N/A
09LIFF01256	11.47	N/A	12.02	N/A	12.62	N/A



IMPORTANT USER NOTE:
THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.

Legend

- 10% Fluvial AEP Event
- 1% Fluvial AEP Event
- 0.1% Fluvial AEP Event
- Modelled River Centreline
- AFA Extents
- Node Point
- Node ID Node Label

FINAL

REV:	NOTE:	DATE:

EASTERN CFRAM STUDY

OPW

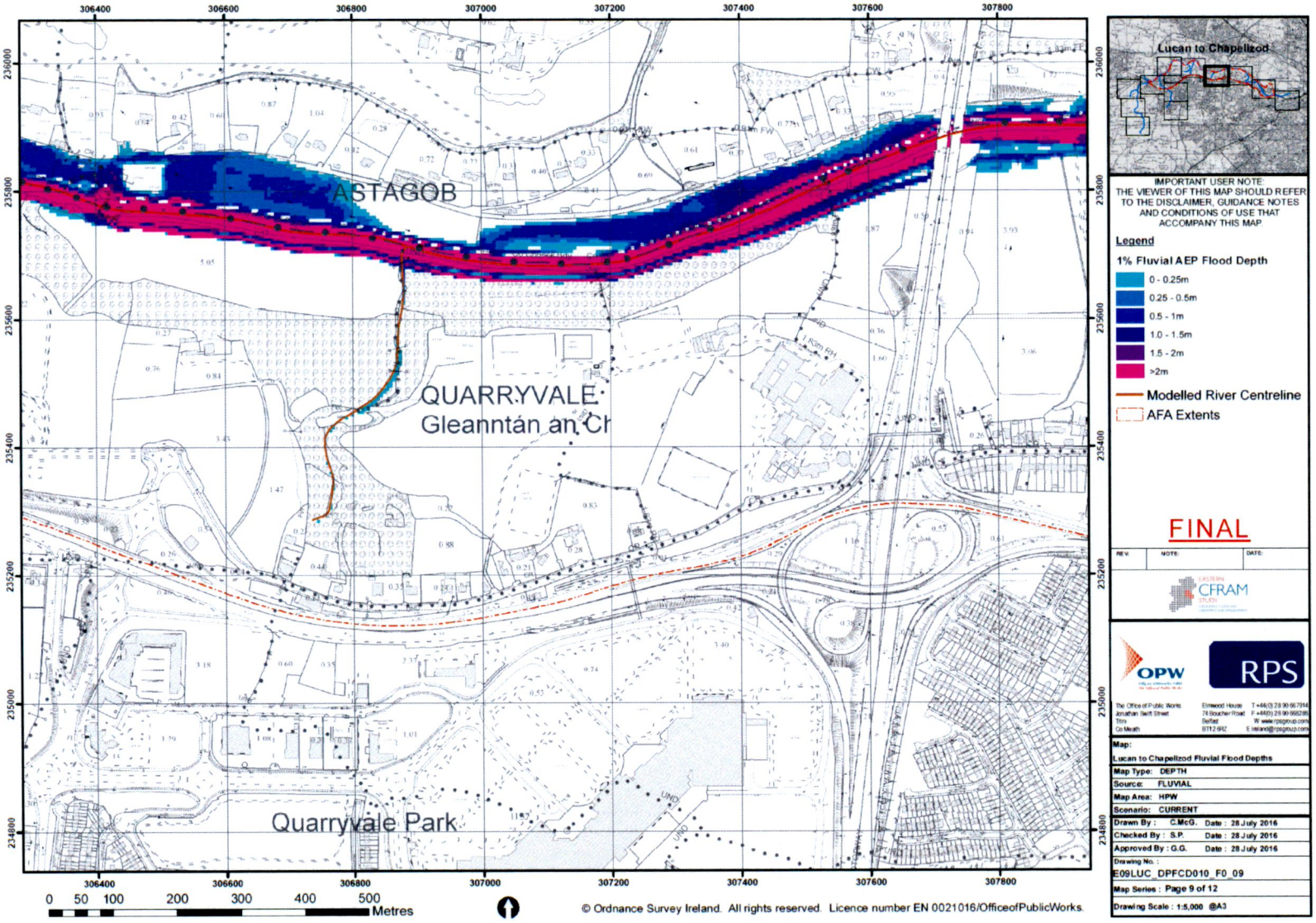
RPS

The Office of Public Works
Jonathan Swift Street
Trim
Co Meath

Elmwood House
74 Boucher Road
Belfast
BT12 6RZ

T +44(0) 28 90 667914
F +44(0) 28 90 668288
W www.pegroup.com
E mireland@pegroup.com

Map:	Lucan to Chapelizod Fluvial Flood Extents
Map Type:	EXTENT
Source:	FLUVIAL
Map Area:	HPW
Scenario:	CURRENT
Drawn By :	C.C. Date : 27 July 2016
Checked By :	S.P. Date : 27 July 2016
Approved By :	G.G. Date : 27 July 2016
Drawing No. :	E09LUC_EXFCD_F0_09
Map Series :	Page 9 of 12
Drawing Scale :	1:5,000 @ A3



APPENDIX L

OPW National Flood Hazard Mapping

Summary Report

OPW *National Flood Hazard Mapping*

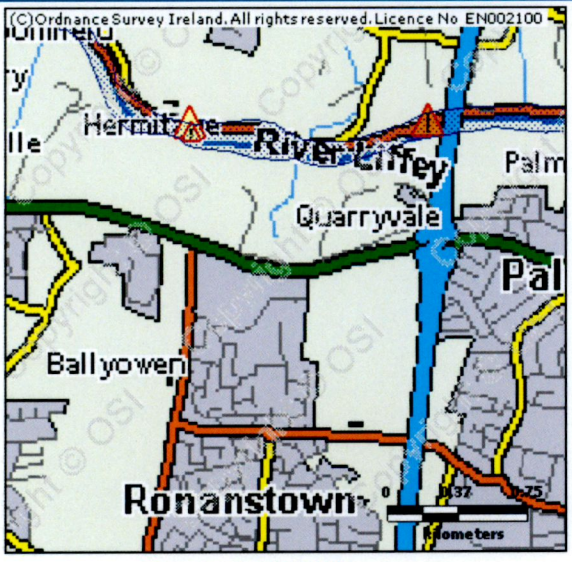
Summary Local Area Report

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



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. Thier purpose and scope is explained in the Glossary.

7 Results

1. Liffey Lower - Dec 1954
County: Kildare, Dublin
Start Date: 08/Dec/1954
Flood Quality Code:2
Additional Information: Reports (4) Press Archive (2) More Mapped Information

2. Liffey Sommerton Rd Luttrellstown Golf C Oct 2004
County: Dublin
Start Date: 26/Oct/2004
Flood Quality Code:4
Additional Information: Reports (1) More Mapped Information

3. Liffey R109 at the Strawberry Beds Nov 2002
County: Dublin
Start Date: 13/Nov/2002
Flood Quality Code:3
Additional Information: Reports (2) More Mapped Information

4. Liffey Strawberry Beds June 1993
County: Dublin
Start Date: 10/Jun/1993
Flood Quality Code:2
Additional Information: Photos (1) Reports (1) Press Archive (1) More Mapped Information

5. Beech Row Ronanstown Recurring
County: Dublin
Start Date:
Flood Quality Code:3

Report Produced: 22-Apr-2020 21:45

Additional Information: Reports (2) More Mapped Information

6. Palmerston Mill Lane Recurring

Start Date:

County: Dublin

Flood Quality Code:4

Additional Information: Reports (1) More Mapped Information

7. Lucan St Edmonsbury Road Recurring

Start Date:

County: Dublin

Flood Quality Code:4

Additional Information: Reports (1) More Mapped Information