Project

Mixed Use Development at Chadwicks, Santry Avenue, Dublin 9

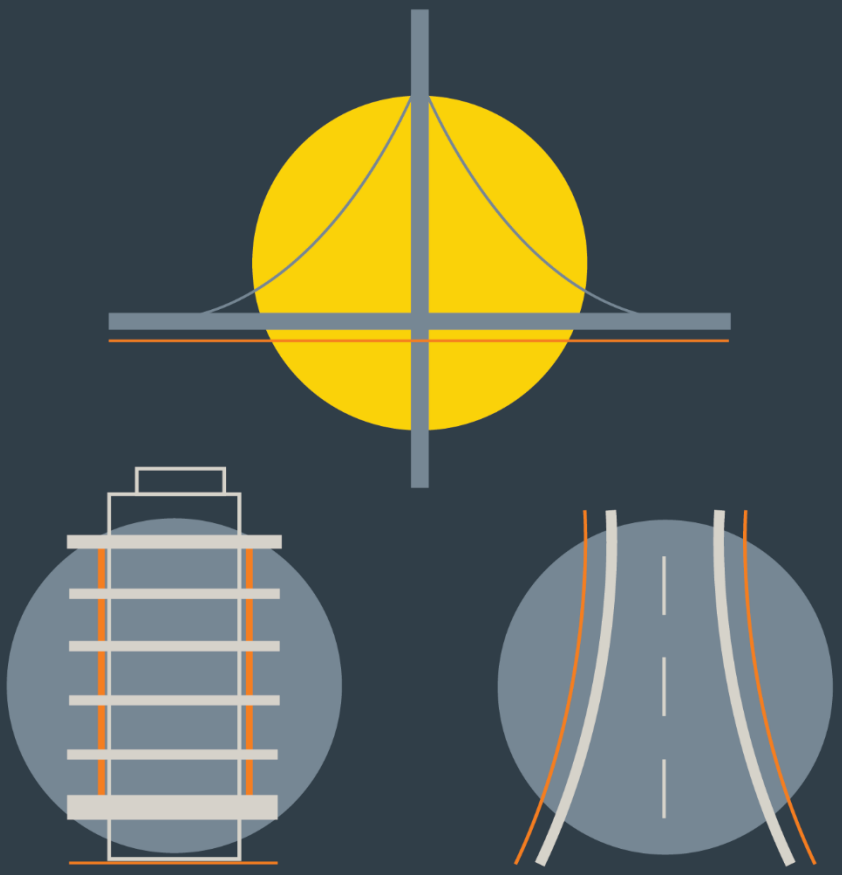
Report Title

Engineering Services Report

Client

Dwyer Nolan Ltd

INFRASTRUCTURE



DBFL CONSULTING ENGINEERS

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Author: Daniel Hodnett

Checked by: Laura Mc Loughlin

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DBFL Consulting Engineers

Registered Office
Ormond House
Upper Ormond Quay
Dublin 7 Ireland D07 W704

+353 1 400 4000
info@dbfl.ie
www.dbfl.ie

Cork Office
14 South Mall
Cork Ireland
T12 CT91

+353 21 202 4538
info@dbfl.ie
www.dbfl.ie

Waterford Office
Suite 8b The Atrium
Maritana Gate Canada Street
Waterford Ireland X91 W028

+353 51 309 500
info@dbfl.ie
www.dbfl.ie

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1. INTRODUCTION

DBFL Consulting Engineers were commissioned by the applicant to prepare an Engineering Services Report (ESR) for a strategic housing development (SHD) on a site measuring c.1.5 hectares located at the junction of Santry Avenue and Swords Road, Santry, Dublin 9. The development site is bounded to the north by Santry Avenue, to the east by Swords Road, to the south by the permitted Santry Place development (granted under Dublin City Council Ref's. 2713/17 & 2737/19), and to the west by the Santry Avenue Industrial Estate.

The proposed development provides for 350no. apartments comprised of 113no. 1 bed, 218no. 2 bed & 19no. 3 bed dwellings in 4no. blocks. The proposed development also provides for 5no. commercial/retail units located at ground floor level facing onto Santry Avenue and Swords Road, a community use unit on the ground floor of Block E, and a residential amenity unit at ground floor level located between Blocks A and D.

The development will consist of the following:

- Demolition of the existing buildings on site (measuring c. 4,196.8m2). Construction of 350no. 1, 2 & 3 bed apartments in 4no. blocks (Blocks A&B; C&D; E&F and G) as follows:

- Block A is a 7 to 14 storey block consisting of 59no. apartments with 2no. commercial units located on the ground floor. Adjoining same is Block B, which is a 7 storey block consisting of 38no. apartments with 2no. commercial units and a refuse storage area on the ground floor.

- Block C is a 7 storey block consisting of 55no. apartments with 2no. refuse storage areas on the ground floor. Adjoining same is Block D, which is a 7 to 10 storey block consisting of 51no. apartments with commercial unit/café on the ground floor.

- Block E is a 7 to 10 storey block consisting of 58no. apartments with a community use unit, switchroom, substation and a refuse storage area on the ground floor.Adjoining same is Block F, which is a 7 storey block consisting of 55no. apartments with a refuse storage area and bicycle storage area on the ground floor.

- Block G is a 7 storey block consisting of 34no. apartments with a refuse storage area and bicycle storage area on the ground floor.

- The development also provides for a residential amenity unit at ground floor level located between Blocks A and D.

The development includes for a basement level car park accommodating 173no. car parking spaces and 719no. bicycle parking spaces with internal access to same provided from Blocks A, B, C, D, E & F. 36no. surface level car parking spaces are also catered for (including 4no. car club spaces & 5no. set down spaces) along with 58no. surface level bicycle parking spaces.

Vehicular access to the proposed development will be via two proposed access points: (i) on Santry Avenue in the north-west of the site and (ii) off Swords Road in the south-east of the site, as permitted under the adjoining development at Santry Place (Ref.2713/17).

The proposed development provides for open spaces and communal open space, hard and soft landscaping & boundary treatments. Private open spaces are provided as terraces at ground floor level of each block and balconies at all upper levels.

The proposed development also provides for all associated site development works above and below ground, bin & bicycle storage, plant (M&E), sub-stations, public lighting, servicing, signage, surface water attenuation facilities.

The aim of this report is to provide information on the calculations, estimates and assumptions used to design the foul sewers, surface water sewers, surface water attenuation and SUDs systems, watermains and road access for the proposed development.

Figure 1.1 – Site Location, Santry Avenue, Dublin 9 (Extract Google Maps)

2 FOUL SEWERS

2.1 Existing Services

There is an existing 300mm diameter public foul sewer located on the Swords Road (R104) to the east of the site.

As part of Irish Water Connection Reference, No: CDS19003221 a 225mm diameter foul sewer has been constructed within the previously approved mixed-use development (Planning Ref: 2713/17 & 2737/19) to the south of the site. This foul sewer has been constructed from the development site boundary across Swords Road and connected to the existing 300mm diameter public foul sewer noted above under a Connection Agreement with Irish Water.

Any existing private foul infrastructure present onsite will be grubbed up and removed.

See Appendix A for existing Irish Water services records.

2.2 Proposed Services

The foul sewerage from this development is proposed to discharge via gravity by means of a new 225mm diameter sewer outfalling to a manhole constructed as part of the previously approved proposed mixed-use development (Planning Ref: 2713/17 & 2737/19) to the south of this development. This will negate the requirement for any construction outside of the site boundary and minimise any disruption to the public. The new sewer will be designed and constructed in accordance with Irish Water Code of Practice and Standard Detail requirements.

A Pre-Connection Enquiry was submitted to Irish Water CDS20003546 and subsequent confirmation of feasibility letter states that connection is feasible subject to upgrades (see appendix I for Irish Water correspondence). The Applicant will enter into conversation with Irish Water to progress required works following receipt of Planning Approval.

The foul water design was submitted to Irish Water to ensure compliance with Irish Water codes of practice and has received design acceptance. (see appendix I for Irish Water correspondence).

Foul sewage in apartment blocks located over the basement will be drained on separate systems via 150mm diameter pipes slung from the underside of basement roof slabs and adjacent to the basement walls. Service pipes from individual properties will project through ground floor slabs and connect into the slung drainage system which in turn will connect by

gravity to the proposed external foul drainage system.

Any surface water from the basement car park generated by incidental run-off/spillage will drain through an underground system of collector pipes, gullies and ACO drains which in turn will pass through a petrol interceptor prior to discharging into a foul pumping well located under the basement. The run-off will then be pumped via a rising main which will connect to the gravity foul drainage system for the site at ground level via an outfall manhole in accordance with the requirements of the Greater Dublin Strategic Drainage Study (GDSDS) and Irish Water.

Foul sewers have been designed and will be constructed in accordance with the Irish Water's 'Standard Details for Wastewater Infrastructure' and 'Code of Practice for Wastewater Infrastructure'. In addition, the foul sewers have been designed to Building Regulations and specifically in accordance with the principles and methods set out in EN 752:2008 and DOE 'Recommendations for Site Development Works'. HR Wallingford 'Tables for the hydraulic design of pipes, sewers and channels' and Water UK/WRc 'Sewers for Adoption – 6th Edition' have been applied. Values for roughness of uPVC pipes were obtained from Wallingford "Tables for the Hydraulic Design of Pipes, Sewers and Channels" and Wavin sewer systems catalogue.
Foul sewers were sized using the EN752:2008 method in MICRODRAINAGE where:

$$Q = kDU\sqrt{\sum DU}$$

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

(i) Discharge units (DU)	3 per housing unit (6 litre cistern)
(ii) Unit Consumption Allowance	10%
(iii) EN 752 Frequency Factor (*k*DU)	0.5
(iv) Pipe Ks	1.5 mm (concrete) 0.6mm (uPVC for flow>0.5D) 0.15mm (uPVC for flow<0.5D)
(v) Minimum velocity	0.75 m/s (self-cleansing vel. Partial flow) 0.6m/s (full flow)
(vi) Maximum velocity	3 m/s(vi) Minimum gradients:

No. of Houses	Minimum Pipe Gradient
1-9	150mm dia. @ 1:60 or self-cleansing gradient (private connection)
10-20	150mm dia. self-cleansing gradient
>20	Min 225mm dia. 1 DN or self-cleansing gradient

Using Irish Water parameters, the peak flow from the site is calculated as 8.339 l/s, however using the EN752 method in MICRODRAINAGE the peak flow is 17.8 l/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). Standard drainage details will be in accordance with the Greater Dublin Regional Code of Practice for Drainage Works and Irish Water Standard Details for Wastewater Infrastructure.

Please see drawing 200060-DBFL-FW-ST-DR-C-1021 for details of the proposed foul sewer design.

See Appendix B for Foul Sewerage Calculations.

3 Surface Water

3.1 Existing Services

There is an existing 225mm diameter public surface water sewer located on the Swords Road (R104) to the east of the site.

A surface water network is currently under construction within the previously approved proposed mixed-use development (Planning Ref: 2713/17 & 2737/19) to the south of the proposed development. This system contains an attenuation system, hydrobrake and petrol interceptor on the outfall surface water sewer. This outfall sewer discharges to the existing 225mm diameter sewer noted above. A connection to the public sewer has been made at the junction of the Swords Road with Schoolhouse Lane under permission of Dublin City Council. This connection has been approved under Planning Ref: 2713/17 & 2737/19.

Any existing private infrastructure present onsite will be grubbed up and removed.

See Appendix A for existing Irish Water services records.

3.2 Proposed Services

The surface water drainage from this development is proposed to discharge, following attenuation and hydrobrake flow control device, via a new 225mm diameter surface water sewer to a manhole constructed as part of the previously approved mixed-use development (Planning Ref: 2713/17 & 2737/19) to the south of this development.

The location of the proposed connection/outfall point will be on the existing 225mm surface water sewer constructed for the mixed-use development (Planning Ref: 2713/17 & 2737/19), following the installed hydrobrake and before the petrol interceptor. The petrol interceptor, placed under the aforementioned planning reference, has been designed to accommodate the combined permitted discharge rate from both of this development and the development located to the south (Planning Ref: 2713/17 & 2737/19). The proposed petrol interceptor 'Kinspan' NSBE010 bypass petrol interceptor class 1 is designed to accommodate a flow rate of 10 l/s. The combined permissible discharge rate from both this development and neighbouring development (Planning Ref: 2713/17 & 2737/19) is 8.9l/s. This proposed connection location will negate the requirement for any construction outside of the site boundary and minimise any disruption to the public.

Surface water management for the proposed development is designed to comply with the 'Greater Dublin Strategic Drainage Study (GDSDS) Regional Drainage Policies Technical

Document – Volume 2, New Developments, 2005' and the 'Greater Dublin Regional Code of Practice for Drainage Works, V6.0 2005'. CIRIA Design Manuals C753, C697 and C609 have also been used to design the surface water drainage system within the site.

The GDSDS guidelines require the following main 4 main criteria to be provided by the development's surface water design;

- Criterion 1: River Water Quality Protection – satisfied by providing interception storage and treatment of run-off within the SuDS features e.g. green roofs and permeable paving and on-line cellular storage attenuation systems.

- Criterion 2: River Regime Protection – satisfied by attenuating run-off with flow control device prior to discharge to the outfall.

- Criterion 3: Level of Service (flooding) for the site – satisfied by the site being outside the 1000 year coastal and fluvial flood levels. Pluvial flood risk addressed by development designed to accommodate a 100-year storm as per GDSDS. Planned flood routing for storms greater than 100-year level considered in design and development run-off contained within site.

- Criterion 4: River flood protection – attenuation provided within the SuDS features e.g. permeable paving construction and on-line cellular storage attenuation systems.

3.3 SuDS

It is proposed to use a sustainable urban drainage system (SuDS) approach to stormwater management throughout the site, the overall strategy 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 and allow for the maximum collection of rainwater for re-use 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 and this has been achieved by the current proposals.

SuDS are a requirement of Dublin City Council under their 'Regional Code of Practice for Drainage Works' and 'The Greater Dublin Strategic Drainage Study'. Additionally, these systems are recommended under the 2009 guidelines, 'The Planning System and Flood Risk Management'.

There are a number of SuDS features proposed which have been designed in accordance with CIRIA documents C753, C697 and C609 as follows:

- Extensive Green Roofs: A planted roof area with low growing, low maintenance plants consisting of self-sustaining mosses, sedums, succulents, herbs or grasses over a drainage layer and waterproofing membrane. Extensive green roofs provide ecological, aesthetic and amenity benefits and intercept, treat and retain rainfall, reducing the volume of runoff and attenuation of peak flows. Extensive roofs are usually only accessed for maintenance.
- Intensive Green Roofs: Planted, accessible podium areas with high amenity benefits which include planters or trees over a drainage layer and waterproofing membrane which provide similar benefits to extensive green roofs.
- Catchpit Manhole: Catchpit manholes collect silt and debris from the surface water drainage system to prevent blockages and help ensure proper function and reduced maintenance of treatment and storage systems downstream of the catchpit manhole. Catchpit manholes are easily accessible and simple to clean. For these reasons catchpit manholes are recommended to reduce risk of system flooding due to blockages and help the surface water system perform optimally.
- Permeable Pavement: Porous surfacing (paving block or open graded material) which can treat rainwater, at source, and allow infiltration through to an underlying porous sub-base where water can be stored within the voids of the sub-base before being slowly released to the drainage collection system through natural flow via the porous medium.

  As well as reducing the amount of run-off from the surface, permeable paving will slow down the rate of runoff from the pavement in extreme rainfall events contributing to attenuation of flows. In addition, permeable paving will increase the quality of water which is intercepted by the system through filtration, biodegradation, pollutant adsorption and settlement and retention of solids, also the reduction in peak flows to the outfall will enhance settlement and biodegradation of pollutants.
- Petrol Interceptor: A proprietary oil/water separator which prevents hazardous chemical and petroleum products from entering watercourses and public sewers. There are 2no. petrol interceptors purposed for the development. One is proposed within the basement of the building for treating incidental run off and before discharge to the proposed foul drainage network. A second has been constructed as part of mixed-use development (Planning Ref: 2713/17 & 2737/19).

Refer to Drawing 200060-DBFL-SW-ST-DR-C-1011 for Surface Water Layout.

3.3.1 Long Term Storage

In addition to limiting the runoff rate through attenuation (see below), the GDSDS requires that runoff volume from the site is limited in extreme events. The objective is to match the runoff volume discharged to the downstream receiving public surface water network after development to that which occurred prior to development. This volume is calculated by comparing the 100year 6hour event for 'pre' and 'post' development and is referred to as "Long-Term Storage".

Where long-term storage is provided, this has a direct effect on the permissible site discharge rate from the site, as explained further forward.

Due to the large extent of development within the site it is **not** proposed to provide long-term storage, this effects the permissible site discharge and resulting attenuation volumes required.

3.3.2 Site Investigation

A ground investigation was carried out on the neighbouring development(Planning Ref: 2713/17 & 2737/19 by GII, in January 2019. The site investigation report has been included as part of this planning application under separate cover. The investigation consisted of the following.

- 3no. trial pit to a maximum depth of 3.1 mbgl;
- 3no. cable percussion boreholes to a maximum depth of 1o mbgl;
- 1no. rotary core boreholes to a maximum of 9.7 mbgl;

From the observed boreholes and trial pits, the surfacing is reinforce concrete up to 0.3 mbgl. Granular fill was encountered beneath the concrete to a depth of 0.4-1.0 mbgl. Made ground deposits (described as sandy gravelly Clay with occasional cobbles and contained rare fragments of plastic and plywood) were encountered beneath the fill material to a variable depths between 0.7-3.4 mbgl. Deposits described as low permeability stiff sandy gravelly Clay were encountered beneath the Made Ground up to depths of 10 mbgl.

Perched water was encountered in one of the three boreholes conducted.

A full site investigation will be undertaken prior to construction and following grant of planning approval, the basement design/construction will take the findings into account.

A Hydrogeological Impact Assessment was completed for the site by AWN consulting under a separate cover on 18/06/2021. The Hydrogeological Impact Assessment was undertaken to assess the likely impact on the existing water regime during and post construction of a basement within the proposed development. It was found that the proposed basement will have no long term impact on water levels in the overburden or underlying aquifer and no impact on the current water body status. The bedrock water table will not be affected by the excavation works.

3.3.3 Permissible Site Discharge

According to the GDSDS, the method used for determining peak flow rates for small greenfield catchments is the UK *'Institute of Hydrology Report 124, Flood Estimation for Small Catchments'*. This method calculates $QBAR_{rural}$ which is the mean annual flood flow from a rural catchment.

Where long-term storage can be provided or is not necessary, surface water can be discharged at a higher value than $QBAR_{rural}$, this discharge rate ($QBAR_{growth}$) is dependent on the design return period and the corresponding growth factor from the GDSDS Table 6.6. However, if long-term storage cannot be provided on-site the discharge rate from the site should be kept to QBARrural or 2 l/s/ha. This is the case for this development.

The IH124 method calculates $QBAR_{rural}$ which is the mean annual flood flow from a rural catchment. As the subject site area is less than 50 hectares, the calculated QBAR is to be linearly interpolated from the calculated value to produce a reduced allowable outflow based on the actual site area, as per GDSDS section 6.6.1.

$$QBAR_{rural} = 0.00108 \times (Area)^{0.89}(SAAR)1.17(SOIL)^{2.17}$$

where:-

$QBAR_{rural}$ = Mean Annual Flood (m^3/s)
Area = Catchment Area (km^2)
Net Site Area = Area of site which is positively drained (Ha)
SAAR = Standard Average Annual Rainfall (mm)
SOIL = SOIL index from Flood Studies Report

Using data received from Met Eireann for Irish Grid co-ordinates E 316000, N 239000 (site co-ordinates are: E 316679, N 239955), the SAAR is determined as 770mm.

The SOIL value can be determined from the Flood Studies Report - Winter Rainfall Acceptance Maps (WRAP). A more accurate approach is to use the 'The Classification of Soils from Winter

Rainfall Acceptance Rate, Flood Studies Report Table 4.5' to determine soil type and determine the SOIL value from Table 6.7 from the GDSD. The latter method is adopted for this site.

Permissible site discharge for the site has been determined as follows:
Net Site Area= 1.32 Ha (approx.)
SAAR = 770mm
SOIL Value= 0.37 (for soil type 3 from Table 6.7 from the GDSD)

Therefore, the permissible site discharge for the development ($QBAR_{rural}$) is 5.0 l/s.

The surface water discharge will be restricted by means of a hydrobrake flow control device located within a flow control device chamber.

See Appendix C for permissible site discharge calculations.

3.3.4 Surface Water Runoff Coefficients

As a large proportion of runoff is routed through SuDS features these will have an attenuating effect which reduce the rate of stormwater runoff for every rainfall event. Also, SuDS features would reduce the runoff volume through evaporation, transpiration, infiltration and depression storage of the water within each system.

Runoff coefficients have been agreed with DCC for neighbouring mixed-use development (Planning Ref: 2713/17 & 2737/19) and as such are applied as follows:

Roofs –Type 1 (Draining to traditional gullies) = 1.0
Roofs – Green Roofs Intensive = 0.50
Roofs – Green Roofs Extensive = 0.85
Roads and Footpaths - Type 1 (Draining to traditional gullies) = 0.80
Roads and Footpaths - Type 2 (Draining to SuDS features) = 0.70
Permeable paving = 0.5
Grassed Areas = 0.37 (soil type 3 SPR- Flood Studies Report)

3.3.5 Surface Water Attenuation – Design

GDSDS requires flood waters for a 100-year return period to be managed on-site, therefore this return period is adopted for attenuation calculations. Surface water attenuation for the site will be provided by an online attenuation system located in the open space to the south of the site

between blocks C and F. The proposed attenuation system will be an underground 'Pluvial Cube - Double Module' proprietary modular system (or similar approved). This attenuation system is being proposed due to its reduced surface area in comparison to 'Stormtech' proprietary modular arch systems in order to remain within the tight confines of the public open space between blocks C and F. The attenuation system will be tanked. The discharge rate from the attenuation system will be controlled using a Hydro Brake Optimum or equivalent.

The development drainage infrastructure system, including Sustainable Drainage System features (SuDS) with underground attenuation, will be designed such that the catchment will drain to the public surface water network. The surface water runoff from this catchment will be restricted to greenfield runoff rates using a hydrobrake flow control device.

As required by Dublin City Council a climate change allowance of 20% will be applied to the surface water drainage design.

The hydraulic modelling software system 'MicroDrainage' was used to calculate attenuation volumes, using maximum rainfall data from Extreme Rainfall Return Period values produced by Met Eireann to calculate maximum flood volumes for the 1 in 100 year rainfall event.

The MICRODRAINAGE Simulation uses the Wallingford Procedure, time/area full hydrograph methodology, including energy and momentum equations for dynamic analysis of surface water networks. The site drainage network is modelled as one system where all flows, capacities, water levels, surcharged manholes etc are determined throughout the network for each critical storm duration. Therefore, the final combined discharge rate to the stream from the outlet will be kept at (or below) the total permissible discharge rate defined above.

Maximum rainfall data from Extreme Rainfall Return Period values produced by Met Eireann was used to input into MICRODRAINAGE to determine maximum flood volumes. Rainfall data for the site was sourced from an Annual Average Rainfall (AAR) Grid (1981-2010) and a Depth Duration Frequency model produced by Met Éireann (Available from: http://www.met.ie/climate/products03.asp). This data was input into MICRODRAINAGE to determine the maximum flood volume for the 1 in 100-year rainfall event.

SAAR	=	770 mm
Ratio M560/M52d	=	0.275
$M_5$60	=	16.00 mm

The volume of attenuation required within the site is 416 m^3

The volume of attenuation provided within the site is 536 m^3

It should be noted that attenuation volumes required are based on the results of the MICRODRAINAGE hydraulic simulation summary of Critical Results by Maximum Level. Hydrobrake maximum head and discharges are based on results of MICRODRAINAGE hydraulic simulation summary of Critical Results by Maximum Outflow. A minimum freeboard of 400mm has been provided above the 1 in 100-year flood levels to all building floor levels.

Please refer to Appendix D for attenuation calculations.

Please refer to Drawing 200060-DBFL-SW-ST-DR-C-1011 for Surface Water Layout.

3.3.6 Interception Volume

The GDSDS requires that no run-off should directly pass to the receiving network/watercourse for rainfall depths of 5mm, therefore interception 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 as defined in the GDSDS (Appendix E section E2.1.1).

The interception volume attributable to each SuDS feature (green roof etc.) consists of the volume of water that can infiltrate to the ground, what will evaporate into the atmosphere and what can transpirate through plants and vegetation. Additionally, there will some losses of water due to absorption and wetting of stone and soil media.

Each of the SuDS features provided will allow a volume of infiltration/evapo-transpiration to cater for interception storage. This storage will be additional to the attenuation storage required and will allow long-term interception of run-off corresponding to the 5mm rainfall depth mentioned above.

The interception volume required is based on treatment 5mm of rainfall depth from 80% of the runoff from impermeable areas and is 23.3m^3.

An interception volume of 214.3m^3 will be provided.

See Appendix E for Interception Volume calculations.
Refer to Appendix G for SuDS calculations and summary.

3.3.7 Treatment Volume

The GDSDS requires that a "treatment volume" (Vt) be provided in order to prevent any pollutants or sediments discharging into river systems, additionally a 'treatment train' stormwater runoff management system is required. According to CIRIA document C697 the following treatment train approach is necessary:

Roofs – 1 Treatment Stage
Road Areas – 2 Treatment Stages
Paved Areas excluding Roads - 1 Treatment Stage

The treatment volume is based on treatment 15mm of rainfall depth from 80% of the runoff from impermeable areas as defined in the GDSDS (Appendix E section E2.1.2).

All run-off areas will pass through the required number of treatment stages prior to discharging to the downstream outfall. Treatment methods include permeable paving, green roof intensive and extensive, silt trap and petrol interceptor.

The total treatment volume required (as calculated) for the site is 69.91m^3.

A treatment volume of 466.7 m^3 will be provided.

Refer to Appendix F for Treatment Volume calculations.
Refer to Appendix G for SuDS calculations and summary.

3.3.8 Surface Water Sewers

The location of the proposed outfall connection for the proposed development will be on the existing 225mm surface water sewer constructed as part of the neighbouring development (Planning Ref: 2713/17 & 2737/19), after the hydrobrake and before the petrol interceptor as shown on drawing 200060-DBFL-SW-ST-DR-C-1011. The petrol interceptor, to be installed under the aforementioned planning reference, has been designed to accommodate the combined permitted discharge rate from both of this development and the development located to the south (Planning Ref: 2713/17 & 2737/19). A connection to the public sewer has been made and approved by DCC at the junction of the Swords Road with Schoolhouse Lane as part of planning Ref: 2713/17 & 2737/19.

Surface water sewers are designed in MICRODRAINAGE using the Modified Rational Method.

The return period for sizing pipes is based on the following:

- Department of Environment – Recommendations for Site Development Works for Housing Areas (1998), Table 3.1;
- GDSDS – Regional Drainage Policies – Volume 2 – New Development (2005), Section 6.5;
- IS EN 752:2008 - Drain and Sewer Systems Outside Buildings, Table 2;
- Building Regulations (2010) – Section H - Drainage and Wastewater Disposal, Section 1.5.7.

The pipe system was checked for the 5, 30- and 100-year return period where no flooding from manholes was encountered.

The following parameters applied:

Return period	2 year
Time of entry	4 minutes
Pipe Ks	0.6mm (concrete); 0.15mm (uPVC)
Minimum velocity	0.75 m/s
Maximum velocity	3.0 m/s

Effective runoff coefficients for each pipe catchment have been determined based on the runoff characteristics for each surface contributing to flows within the catchment.

The minimum pipe diameter for public surface water sewers is 225mm.

Surface water in apartment blocks will be drained on a separate system via 150mm to 225mm diameter pipes slung from the underside of basement roof slabs and adjacent to basement walls. Rainwater downpipes from roofs will project through the ground floor slab and connect into the slung drainage system which in turn will connect to a gravity network below basement level before connecting to the external drainage system.

Values for roughness of uPVC pipes were obtained from Wallingford "Tables for the Hydraulic Design of Pipes, Sewers and Channels" and Wavin sewer systems catalogue.

Refer to Appendix D for surface water calculations.
Please refer to Drawing 200011-DBFL-SW-ST-DR-C-1011 for Surface Water Layout.

3.3.9 Green Roofs and Amenity

SuDS features should be designed to replicate a natural environment with a visual appeal, promote both public and wildlife usage and promote biodiversity within urban environments. In addition, SuDS features should aim to use water as a resource where possible.

A 66% provision of extensive green roof has been provided for the site. The total roof area and podium area equates to 7,830 m2. The design proposes for 2,472m^2 of extensive green roof coverage on top of buildings and total intensive green roof coverage of the podium of 2,693m^2. Extensive green roofs will be accessible for maintenance via access stairwells and will have external mobile access.

Please refer to Landscape Architect documentation for further detail.

3.3.10 SuDS Maintenance

The SuDS features proposed above for the site will require the following maintenance:

Permeable Paving: Regular brushing and removal of leaves, removal of weeds as necessary. Stabilise and mow contributing and adjacent landscaped areas regularly. Repair any depressions, rutting, cracked or broken blocks considered detrimental to the structural performance or a hazard to users.

Petrol Interceptor: Systems should be inspected every 6 months (or in line with the manufacturer's instructions) to verify the appropriate level of maintenance. Floating debris and solids should be removed and the sump cleaned with a conventional sump vacuum cleaner. Filter media should be replaced and sediments, oils and grease should be removed where required.

Catchpit Manhole: Catchpit manholes collect silt and debris from upstream SuDS features and gullies in the surface water system. Due to large volumes of silt and debris building up in catchpit manhole sumps, it is essential for them to be cleaned regularly. Inadequate maintenance of the catchpit manholes can lead to reduced performance of storage and treatment systems and can cause blockages leading to flooding of the surface water system. It is recommended that suction equipment is used by skilled personnel when cleaning to ensure effective and safe removal of silt and debris from catchpit manholes.

4 WATERMAINS

4.1 Existing Services

There is currently no water supply infrastructure, noted on Irish Water records within the subject site. There is an existing 300mm diameter cast iron public watermain located on the Swords Road adjacent to the proposed site entrance.

Any existing private infrastructure present onsite will be grubbed up and removed.

A Pre-Connection Enquiry was submitted to Irish Water CDS20003546 and subsequent confirmation of feasibility letter states that connection is feasible subject to upgrades (see appendix I for Irish Water correspondence). The Applicant will enter into conversation with Irish Water to progress required works following receipt of Planning Approval.

The watermain design was submitted to Irish Water to ensure compliance with Irish Water codes of practice and has received design acceptance. (see appendix I for Irish Water correspondence).

4.2 Proposed Services

A connection will be made to the existing 300mm diameter cast iron watermain on Swords Road.

A proposed 200mm diameter watermain and new fire hydrants will be provided throughout the site in accordance with Irish Water Code of Practice.

The estimated peak demand from the development will be 10.46 l/s with the average daily demand being 144.601 m^3.

A bulk water meter will be provided at the connection to the site. The proposed distribution system to the communal residential development and commercial units shall facilitate the installation of approved individual meters to each individual unit or business within the development and agreed by Irish Water. See M&E documentation for information.

Please see drawing 200060-DBFL-WM-ST-DR-C-1031 for details of the proposed watermain design.

5 ROADS

5.1 Existing Roads

There is an existing entrance to Chadwicks Building Suppliers from Santry Avenue.

Figure 5.1 – Existing Site Entrance, Santry Avenue, Dublin 9 (Extract Google Maps)

5.2 Site Access Proposals

Access to the development will be from Santry Avenue and also from the carriageway constructed to the south of the site under planning ref 2713/17 & 2737/19. In line with DMURS requirements the entrance can achieve 2.4m x 45m sightlines.

Road infrastructure within the site comprises of a 6.0m access road with parking facilities. This road joins Santry Avenue and the roadway constructed as part of the mixed use development (planning ref: 2713/17 & 2737/19) to the south of the works.

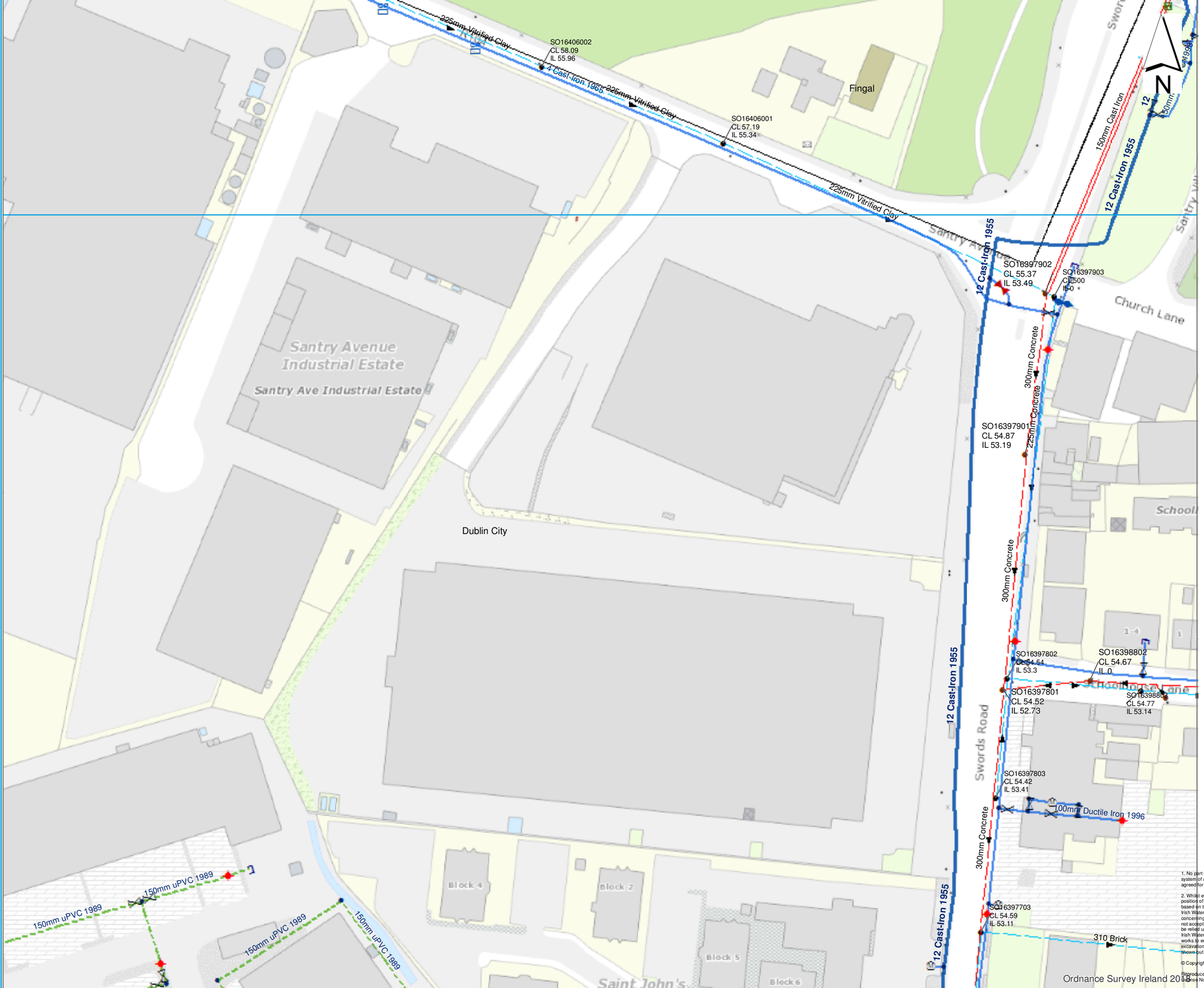
For further information regarding the road layout and design refer to the report under a separate heading - Traffic and Transport Assessment, prepared by DBFL Consulting Engineers.

See Construction Traffic Management Plan completed by CHM under a separate cover EN 6000-000-001 for details on traffic management during construction phase.
Refer to Dwg. No. 200060-DBFL-RD-ST-DR-C-1001 for the Proposed Road Layout.

DBFL CONSULTING ENGINEERS
July 2021

APPENDIX A

Existing Irish Water Services Records



UISCE ÉIREANN : IRISH WATER

Legend

- Bulk Meter
- Unknown Meter ; Other Meter
- Sluice Valve Open
- Sluice Valve Closed
- Double Air Control Valve

Water Hydrants

Hydrant Function

- Fire Hydrant
- Telemetry Kiosk
- Cap
- Other Fittings

Water Distribution Mains

Owned By

- Irish Water
- Private
- Irish Water

Sewer Manholes

Manhole Type

- Standard

Sewer Inlets

Inlet Type

- Catchpit
- Gravity - Foul
- Pumping - Foul

Storm Manholes

Manhole Type

- Standard
- Surface Gravity Mains

a3 - Scale **1:1,000**

Date: 15/03/2019

Meters

0 12.5 25

APPENDIX B

Foul Sewer Calculations

FOUL SEWERAGE DESIGN

Design Criteria for Foul - Unit

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	10
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.000
Calculation Method	EN 752	Maximum Backdrop Height (m)	0.000
Frequency Factor	0.50	Min Design Depth for Optimisation (m)	1.200
Domestic (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	0.75
Domestic Peak Flow Factor	6.00	Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Network Design Table for Foul - Unit

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F1.000	23.743	0.160	148.4	0.000	228.0	0.0	1.500	o	225	Pipe/Conduit	
F1.001	19.517	0.100	195.2	0.000	30.0	0.0	0.600	o	225	Pipe/Conduit	
F1.002	52.555	0.270	194.6	0.000	30.0	0.0	0.600	o	225	Pipe/Conduit	
F1.003	49.632	0.250	198.5	0.000	21.0	0.0	0.600	o	225	Pipe/Conduit	
F1.004	18.747	0.100	187.5	0.000	30.0	0.0	0.600	o	225	Pipe/Conduit	
F1.005	26.438	0.140	188.8	0.000	0.0	0.0	0.600	o	225	Pipe/Conduit	
F2.000	27.034	0.250	108.1	0.000	51.0	0.0	0.600	o	225	Pipe/Conduit	
F1.006	12.000	0.060	200.0	0.000	0.0	0.0	0.600	o	225	Pipe/Conduit	
F3.000	27.176	0.260	104.5	0.000	195.0	0.0	0.600	o	225	Pipe/Conduit	
F1.007	21.507	0.110	195.5	0.000	0.0	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.000	56.070	0.000	0.0	228.0	0.8	72	0.76	0.94	37.4	8.3
F1.001	55.910	0.000	0.0	258.0	0.8	75	0.77	0.93	37.1	8.8
F1.002	55.810	0.000	0.0	288.0	0.8	77	0.78	0.93	37.1	9.3
F1.003	55.540	0.000	0.0	309.0	0.9	79	0.78	0.92	36.8	9.7
F1.004	55.290	0.000	0.0	339.0	0.9	79	0.81	0.95	37.8	10.1
F1.005	55.190	0.000	0.0	339.0	0.9	79	0.81	0.95	37.7	10.1
F2.000	55.970	0.000	0.0	51.0	0.4	43	0.75	1.26	50.0	3.9
F1.006	55.050	0.000	0.0	390.0	1.0	84	0.80	0.92	36.6	10.9
F3.000	56.030	0.000	0.0	195.0	0.7	59	0.93	1.28	50.8	7.7
F1.007	54.990	0.000	0.0	585.0	1.2	93	0.86	0.93	37.0	13.3

Network Design Table for Foul - Unit

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F4.000	27.018	0.230	117.5	0.000	60.0	0.0	0.600	o	225	Pipe/Conduit	
F1.008	44.513	0.230	193.5	0.000	0.0	0.0	0.600	o	225	Pipe/Conduit	
F5.000	2.842	0.020	142.1	0.000	255.0	0.0	0.600	o	225	Pipe/Conduit	
F1.009	14.401	0.080	180.0	0.000	0.0	0.0	0.600	o	225	Pipe/Conduit	
F1.010	24.728	0.460	53.8	0.000	0.0	0.0	0.600	o	225	Pipe/Conduit	
F6.000	18.813	0.160	117.6	0.000	60.0	0.0	0.600	o	225	Pipe/Conduit	
F6.001	54.077	0.320	169.0	0.000	90.0	0.0	0.600	o	225	Pipe/Conduit	
F1.011	13.162	0.070	188.0	0.000	0.0	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F4.000	56.020	0.000	0.0	60.0	0.4	45	0.75	1.21	47.9	4.3
F1.008	54.880	0.000	0.0	645.0	1.3	95	0.87	0.94	37.2	14.0
F5.000	55.430	0.000	0.0	255.0	0.8	68	0.86	1.09	43.5	8.8
F1.009	54.650	0.000	0.0	900.0	1.5	103	0.93	0.97	38.6	16.5
F1.010	54.250	0.000	0.0	900.0	1.5	73	1.46	1.79	71.1	16.5
F6.000	54.270	0.000	0.0	60.0	0.4	45	0.75	1.20	47.9	4.3
F6.001	54.110	0.000	0.0	150.0	0.6	62	0.75	1.00	39.9	6.7
F1.011	53.790	0.000	0.0	1050.0	1.6	109	0.94	0.95	37.8	17.8

Manhole Schedules for Foul - Unit

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
F12	57.200	1.130	Open Manhole	1200	F1.000	56.070	225				
F11	57.150	1.240	Open Manhole	1200	F1.001	55.910	225	F1.000	55.910	225	
F10	57.100	1.290	Open Manhole	1200	F1.002	55.810	225	F1.001	55.810	225	
F9	57.290	1.750	Open Manhole	1200	F1.003	55.540	225	F1.002	55.540	225	
F8	57.140	1.850	Open Manhole	1200	F1.004	55.290	225	F1.003	55.290	225	
F7	56.910	1.720	Open Manhole	1200	F1.005	55.190	225	F1.004	55.190	225	
F6.1	57.100	1.130	Open Manhole	1200	F2.000	55.970	225				
F6	56.930	1.880	Open Manhole	1200	F1.006	55.050	225	F1.005	55.050	225	
								F2.000	55.720	225	670
F5.1	57.150	1.120	Open Manhole	1200	F3.000	56.030	225				
F5	56.820	1.830	Open Manhole	1200	F1.007	54.990	225	F1.006	54.990	225	
								F3.000	55.770	225	780
F4.1	57.150	1.130	Open Manhole	1200	F4.000	56.020	225				
F4	56.800	1.920	Open Manhole	1200	F1.008	54.880	225	F1.007	54.880	225	
								F4.000	55.790	225	910
F3.1	56.560	1.130	Open Manhole	1200	F5.000	55.430	225				
F3	56.490	1.840	Open Manhole	1200	F1.009	54.650	225	F1.008	54.650	225	
								F5.000	55.410	225	760
F2	55.970	1.720	Open Manhole	1200	F1.010	54.250	225	F1.009	54.570	225	320
F1.2	55.400	1.130	Open Manhole	1200	F6.000	54.270	225				
F1.1	55.430	1.320	Open Manhole	1200	F6.001	54.110	225	F6.000	54.110	225	
F1	54.950	1.160	Open Manhole	1200	F1.011	53.790	225	F1.010	53.790	225	
								F6.001	53.790	225	
FF1-F2	54.920	1.200	Open Manhole	1200		OUTFALL		F1.011	53.720	225	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
F12	716622.578	740010.646	716622.578	740010.646	Required	
F11	716624.842	740034.281	716624.842	740034.281	Required	
F10	716606.987	740042.162	716606.987	740042.162	Required	
F9	716575.625	739999.990	716575.625	739999.990	Required	
F8	716545.609	739960.463	716545.609	739960.463	Required	

Manhole Schedules for Foul - Unit

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
F7	716543.766	739941.807	716543.766	739941.807	Required	
F6.1	716572.889	739966.094	716572.889	739966.094	Required	
F6	716570.076	739939.207	716570.076	739939.207	Required	
F5.1	716584.844	739965.036	716584.844	739965.036	Required	
F5	716582.016	739938.008	716582.016	739938.008	Required	
F4.1	716606.232	739962.783	716606.232	739962.783	Required	
F4	716603.421	739935.912	716603.421	739935.912	Required	
F3.1	716647.998	739934.363	716647.998	739934.363	Required	
F3	716647.718	739931.535	716647.718	739931.535	Required	
F2	716661.500	739927.358	716661.500	739927.358	Required	
F1.2	716689.370	739997.267	716689.370	739997.267	Required	
F1.1	716691.560	739978.582	716691.560	739978.582	Required	
F1	716685.951	739924.807	716685.951	739924.807	Required	
FF1-F2	716686.695	739911.659			No Entry	

PIPELINE SCHEDULES for Foul - Unit

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F1.000	o	225	F12	57.200	56.070	0.905	Open Manhole	1200
F1.001	o	225	F11	57.150	55.910	1.015	Open Manhole	1200
F1.002	o	225	F10	57.100	55.810	1.065	Open Manhole	1200
F1.003	o	225	F9	57.290	55.540	1.525	Open Manhole	1200
F1.004	o	225	F8	57.140	55.290	1.625	Open Manhole	1200
F1.005	o	225	F7	56.910	55.190	1.495	Open Manhole	1200
F2.000	o	225	F6.1	57.100	55.970	0.905	Open Manhole	1200
F1.006	o	225	F6	56.930	55.050	1.655	Open Manhole	1200
F3.000	o	225	F5.1	57.150	56.030	0.895	Open Manhole	1200
F1.007	o	225	F5	56.820	54.990	1.605	Open Manhole	1200
F4.000	o	225	F4.1	57.150	56.020	0.905	Open Manhole	1200
F1.008	o	225	F4	56.800	54.880	1.695	Open Manhole	1200
F5.000	o	225	F3.1	56.560	55.430	0.905	Open Manhole	1200
F1.009	o	225	F3	56.490	54.650	1.615	Open Manhole	1200
F1.010	o	225	F2	55.970	54.250	1.495	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F1.000	23.743	148.4	F11	57.150	55.910	1.015	Open Manhole	1200
F1.001	19.517	195.2	F10	57.100	55.810	1.065	Open Manhole	1200
F1.002	52.555	194.6	F9	57.290	55.540	1.525	Open Manhole	1200
F1.003	49.632	198.5	F8	57.140	55.290	1.625	Open Manhole	1200
F1.004	18.747	187.5	F7	56.910	55.190	1.495	Open Manhole	1200
F1.005	26.438	188.8	F6	56.930	55.050	1.655	Open Manhole	1200
F2.000	27.034	108.1	F6	56.930	55.720	0.985	Open Manhole	1200
F1.006	12.000	200.0	F5	56.820	54.990	1.605	Open Manhole	1200
F3.000	27.176	104.5	F5	56.820	55.770	0.825	Open Manhole	1200
F1.007	21.507	195.5	F4	56.800	54.880	1.695	Open Manhole	1200
F4.000	27.018	117.5	F4	56.800	55.790	0.785	Open Manhole	1200
F1.008	44.513	193.5	F3	56.490	54.650	1.615	Open Manhole	1200
F5.000	2.842	142.1	F3	56.490	55.410	0.855	Open Manhole	1200
F1.009	14.401	180.0	F2	55.970	54.570	1.175	Open Manhole	1200
F1.010	24.728	53.8	F1	54.950	53.790	0.935	Open Manhole	1200

PIPELINE SCHEDULES for Foul - Unit

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F6.000	o	225	F1.2	55.400	54.270	0.905	Open Manhole	1200
F6.001	o	225	F1.1	55.430	54.110	1.095	Open Manhole	1200
F1.011	o	225	F1	54.950	53.790	0.935	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F6.000	18.813	117.6	F1.1	55.430	54.110	1.095	Open Manhole	1200
F6.001	54.077	169.0	F1	54.950	53.790	0.935	Open Manhole	1200
F1.011	13.162	188.0	FF1-F2	54.920	53.720	0.975	Open Manhole	1200

Free Flowing Outfall Details for Foul - Unit

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
F1.011	FF1-F2	54.920	53.720	53.110	1200	0

Simulation Criteria for Foul - Unit

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model		FSR	Profile Type Summer
Return Period (years)		5	Cv (Summer) 0.750
Region	Scotland and Ireland		Cv (Winter) 0.840
M5-60 (mm)		16.000	Storm Duration (mins) 30
Ratio R		0.275	

TITLE		**Job Reference**	
Santry Place Mixed Use Development, Santry, Dublin 9		200060	
SUBJECT		**Calc. Sheet No.**	
Post-Development Wastewater Hydraulic Load - Irish Water - Residential		1	
DRAWING NUMBER	**Calculations by**	**Checked by**	**Date**
200060-DBFL-FW-ST-DR-C-1021	DCH	LMCL	10/05/2021

Foul Drainage

Housing Units	350	no.
Dry Weather Flow (DWF)[1]	150	litres/person/day
Average Occupancy Ratio[2]	2.7	person/unit
Total Site Occupancy (i.e. population)	945	person
Total Daily Wastewater Discharge + 10% Unit Consumption Allowance[3]	155,925	l/day
Peak Flow Factor[4]	4.5	

Post Development Average Discharge	**1.805**	l/s
Post Development Peak Discharge[5]	**8.121**	l/s

Foul Sewer Organic Loading

	Average Concentration[6]	Maximum Concentration[7]
BOD (mg/l)	168	422
SS (mg/l)	163	435
N (mg/l)	40.6	78.6
P (mg/l)	7.1	15.5
COD (mg/l)	389	1000

Notes:

1. Dry Weather Flow (DWF) is 150 litres/person/day from the Irish Water "Code of Practice for Wastewater Infrastructure".
2. Occupancy ratio of 2.7 persons per dwelling from Irish Water Code of Practice for Wastewater Infrastructure.
3. The unit consumption allowance is 10% in accordance with the Irish Water "Code of Practice for Wastewater Infrastructure".
4. The Peak Flow factor is taken as 6 times Dry Weather Flow (0 to 750 population), 4.5 DWF for 751 to 1000 and 3.0 DWF for 1001 to 5000
5. The peak discharge is equal to the Total Wastewater Discharge multiplied by the peak flow factor, expressed in litres/second.
6. The average concentrations of wastewater parameters taken from EPA "Wastewater Treatment Manuals, Treatment Systems for Small Communities, Business, Leisure Centres and Hotels".
7. 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".

TITLE	Job Reference
Santry Place Mixed Use Development, Santry, Dublin 9	200060
SUBJECT	**Calc. Sheet No.**
Post-Development Wastewater Hydraulic Load - Irish Water - Retail	1

DRAWING NUMBER	Calculations by	Checked by	Date
200060-DBFL-FW-SP-DR-C-1021	DCH	LMCL	20/08/2020

Foul Drainage

Retail Outlets

Retail space	855	m^2
Staff[1]	57	no.
Dry Weather Flow (DWF)[2]	50	litres/person/day
Total Daily Wastewater Discharge + 10% Unit Consumption Allowance[3]	3,136	l/day
Peak Flow Factor[4]	6	
Post Development Average Discharge	**0.036**	l/s
Post Development Peak Discharge[5]	**0.218**	l/s

Foul Sewer Organic Loading

	Average Concentration[6]	Maximum Concentration[7]
BOD (mg/l)	168	422
SS (mg/l)	163	435
N (mg/l)	40.6	78.6
P (mg/l)	7.1	15.5
COD (mg/l)	389	1000

Notes:

1. Assumed employment density of $15m^2$ for retail in accordance with "Employment Density Guidance (Volume 3).
2. Dry Weather Flow (DWF) is 50 litres/person/day for Staff taken from Irish Water "Code of Practice for Wastewater Infrastructure".
3. The unit consumption allowance is 10% in accordance with the Irish Water Code of Practice for Wastewater Infrastructure.
4. The Peak Flow factor is taken as 6 times Dry Weather Flow (0 to 750 population), 4.5 DWF for 751 to 1000 and 3.0 DWF for 1001 to 5000.
5. The peak discharge is equal to the Total Wastewater Discharge multiplied by the peak flow factor, expressed in litres/second.
6. The average concentrations of wastewater parameters taken from EPA "Wastewater Treatment Manuals, Treatment Systems for Small Communities, Business, Leisure Centres and Hotels".
7. 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 C

Permissible Site Discharge Calculations

PROJECT			JOB REF.
Proposed Mixed use Development at Swords Road, Santry, Dublin 9. Phase 2			200060
SUBJECT			**Calc. Sheet No.**
Surface Water Calculations - Permissible Site Discharge			1
Drawing ref.	**Calculations by**	**Checked by**	**Date**
200060-INFO1	DCH	LMCL	04/05/2021

PERMISSIBLE SURFACE WATER DISCHARGE CALCULATIONS

Site Area

What is the net catchment area? **1.32** Hectares (ha) Site is Less than 50 Hectares

Pre-Development Catchment Soil Characteristics

Are there different soil types present on the pre-developed site? No

Catchment This refers to the entire site area	1	
Area	1.32	Hectares (ha)
Drainage Group	2	Class
Depth to Impermeable Layers	2	Class
Permeability Group above Impermeable Layers	2	Class
Slope (o)	1	Class
SOIL Type	**3**	From FSR Table
[1]**SOIL Index**	0.40	

SOIL	SOIL Value	SPR
1	0.15	0.10
2	0.30	0.30
3	0.40	0.37
4	0.45	0.47
5	0.50	0.53

Site SOIL Index Value **0.40**

Site SPR Value **0.37**

Post-Development Catchment Characteristics

Is the development divided into sub-catchments? No

What is the overall site area for catchment? 1.32 Hectares (ha)

Catchment 1	Area (m^2)	Runoff Coeff.	Effective Area (m^2)
Roofs - Type 1 (Traditional)	2665	1.00	2665.0
Roofs - Type 2 (Draining to SUDS features)	0	0.70	0.0
Green Roofs Intensive(6-10cm depth)	2693	0.50	1346.5
Roads and Footpaths - Type 1 (Draining to gullies)	350	0.80	280.0
Roads and Footpaths - Type 2 (Draining to Suds features)	1532	0.70	1072.4
Paved Areas	0	0.80	0.0
Permeable Paving	1279	0.50	639.5
Green Roofs Extensive	2472	0.85	2101.2
Grassed Areas	2244	0.37	830.3
Public Open Space - Non Contributary	2514	0.37	930.2

Include Public Open Space in Effective Catchment Area? No Assumed open space area does not drain to surface water network

Effective Catchment Area **8934.9** m^2

Effective Catchment Runoff Coefficient **0.68**

Long-Term Storage

Is long-term Storage provided? No

Permissible Site Discharge

What is the Standard Average Annual Rainfall (SAAR)? 770.0 mm From Met Eireann, Co-ordinates 316000/239000

Is the overall site area less than 50 hectares? Yes

[5]$QBAR_{Rural}$ calculated for 50 ha and linearly interpolated for area of site 5.0 Litres/sec

[7]Site Discharge = **5.0** Litres/sec

Notes and Formulae

1. SOIL index value calculated from Flood Studies Report - The Classification of Soils from Winter Rainfall Acceptance Rate (Table 4.5).
2. SPR value calculated from GDSDS - Table 6.7.
3. Rainfall depth for 100 year return period, 6 hour duration with additional 10% for climate change.
4. Long-term storage Vol_{xs} (m^3) = Rainfall.Area.10.[(PIMP/100)(0.8.α)+(1-PIMP/100)(β.SPR)-SPR]. (GDSDS Section 6.7.3).
   Where long-term storage cannot be provided on-site due to ground conditions, Total Permissible Outflow is to be kept to $QBAR_{(Rural)}$.
5. Total Permissible Outflow - $QBAR_{(Rural)}$ calculated in accordance with GDSDS - Regional Drainage Policies
   (Volume 2 - Chapter 6), i.e. $QBAR(m3/s)=0.00108x(Area)^{0.89}(SAAR)^{1.17}(SOIL)^{2.17}$ - For catchments greater than 50 hectares in area. Flow rates are linearly interpolated for areas samller than 50hectares.
6. Where Total Permissible Outflow is less than 2.0l/s and not achievable, use 2.0 l/s or closest value possible.
7. QBAR multiplied by growth factors of 0.85 for 1 year, 2.1 for 30 year and 2.6 for 100 year return period events, from GDSDS Figure C2.

PROJECT			JOB REF.
Proposed Mixed use Development at Swords Road, Santry, Dublin 9.			200060
SUBJECT			**Calc. Sheet No.**
Surface Water Calculations - Soil Characteristics from FSR			4
Drawing ref.	**Calculations by**	**Checked by**	**Date**
200060-INFO1	LMCL	LMCL	04-May-21

Table 4.4 Classification of soil factors.

Property		Classes
A Drainage group	1	Rarely waterlogged within 60 cm at any time (well and moderately well drained)
	2	Commonly waterlogged within 60 cm during winter (imperfect and poor)
	3	Commonly waterlogged within 60 cm during winter and summer (very poorly drained)
B Depth to 'impermeable' layers	1	>80 cm
	2	80–40 cm
	3	<40 cm
C Permeability group (above 'impermeable' layers or to 80 cm)	1	Rapid
	2	Medium
	3	Slow
D Slope	1	0–2°
	2	2–8°
	3	>8°

Having decided all four parameters, Table 4.5 was used to reach the index of 'winter rain acceptance'.

Table 4.5 The classification of soils by winter rain acceptance rate from soil survey data.

Drainage class Group	Depth to impermeable layer (cm)	Slope classes								
		0 - 2°			2 - 8°			>8°		
		Permeability rates above impermeable layers								
		Rapid (1)	Medium (2)	Slow (3)	Rapid (1)	Medium (2)	Slow (3)	Rapid (1)	Medium (2)	Slow (3)
1	>80	1			1			1	2	3
	40 - 80					2		3		4
	<40	—	—	—	—	—	—	—	—	—
2	>80	2		3		4		—		
	40 - 80									
	<40	3								
3	>80					5		—		
	40 - 80							—		
	<40									

Winter rain acceptance indices: 1, very high; 2, high; 3, moderate; 4, low; 5, very low.
Upland peat and peaty soils are in Class 5. Urban areas are unclassified.

1. Soil index (SPR) value calculated from Flood Studies Report - The Classification of Soils from Winter Rainfall Acceptance Rate (Table 4.5).

APPENDIX D

Surface Water and Attenuation Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	2	PIMP (%)	68
M5-60 (mm)	16.000	Add Flow / Climate Change (%)	0
Ratio R	0.275	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	150	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	0.75
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	69.495	0.450	154.4	0.220	4.00	0.0	0.600	o	300	Pipe/Conduit	
S1.001	43.112	0.220	196.0	0.043	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.002	54.762	0.270	202.8	0.211	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.003	23.414	0.120	195.1	0.024	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.000	11.461	0.270	42.4	0.005	4.00	0.0	0.600	o	225	Pipe/Conduit	
S1.004	60.713	0.300	202.4	0.117	0.00	0.0	0.600	o	300	Pipe/Conduit	
S3.000	57.493	0.290	198.3	0.077	4.00	0.0	0.600	o	225	Pipe/Conduit	
S1.005	24.621	0.080	307.8	0.054	0.00	0.0	0.600	o	375	Pipe/Conduit	
S4.000	13.356	0.070	190.8	0.150	4.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	48.40	4.92	55.600	0.220	0.0	0.0	0.0	1.26	89.3	28.9
S1.001	46.22	5.56	55.150	0.263	0.0	0.0	0.0	1.12	79.1	32.9
S1.002	43.74	6.39	54.930	0.475	0.0	0.0	0.0	1.10	77.8	56.2
S1.003	42.80	6.74	54.660	0.498	0.0	0.0	0.0	1.12	79.3	57.8
S2.000	51.60	4.09	55.520	0.005	0.0	0.0	0.0	2.01	80.1	0.7
S1.004	40.53	7.65	54.540	0.620	0.0	0.0	0.0	1.10	77.9	68.1
S3.000	47.97	5.04	54.530	0.077	0.0	0.0	0.0	0.92	36.8	10.0
S1.005	39.64	8.05	54.240	0.751	0.0	0.0	0.0	1.03	113.5	80.6
S4.000	51.01	4.24	54.230	0.150	0.0	0.0	0.0	0.94	37.5	20.7

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.006	24.239	0.070	346.3	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.007	28.217	0.180	156.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.008	9.157	0.060	152.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.006	38.75	8.47	54.160	0.900	0.0	0.0	0.0	0.97	106.9	94.5
S1.007	50.15	4.45	54.090	0.000	4.9	0.0	0.0	1.04	41.4	4.9
S1.008	49.59	4.60	53.910	0.000	4.9	0.0	0.0	1.06	42.0	4.9

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S9	57.100	1.500	Open Manhole	1200	S1.000	55.600	300				
S8	57.050	1.900	Open Manhole	1200	S1.001	55.150	300	S1.000	55.150	300	
S7	57.270	2.340	Open Manhole	1200	S1.002	54.930	300	S1.001	54.930	300	
S6	57.140	2.480	Open Manhole	1200	S1.003	54.660	300	S1.002	54.660	300	
S5.1	57.050	1.530	Open Manhole	1200	S2.000	55.520	225				
S5	56.780	2.240	Open Manhole	1200	S1.004	54.540	300	S1.003	54.540	300	
								S2.000	55.250	225	635
S4.1	55.850	1.320	Open Manhole	1200	S3.000	54.530	225				
S4	56.440	2.200	Open Manhole	1350	S1.005	54.240	375	S1.004	54.240	300	
								S3.000	54.240	225	
S3.1	57.200	2.970	Open Manhole	1200	S4.000	54.230	225				
SATTN.	57.200	3.040	Open Manhole	1350	S1.006	54.160	375	S1.005	54.160	375	
								S4.000	54.160	225	
S3	56.330	2.240	Open Manhole	1350	S1.007	54.090	225	S1.006	54.090	375	
S2	56.300	2.390	Open Manhole	1200	S1.008	53.910	225	S1.007	53.910	225	
SS1-P1	55.960	2.110	Open Manhole	1200		OUTFALL		S1.008	53.850	225	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S9	716670.281	740011.768	716670.281	740011.768	Required	
S8	716606.574	740039.510	716606.574	740039.510	Required	
S7	716580.789	740004.959	716580.789	740004.959	Required	
S6	716548.177	739960.912	716548.177	739960.912	Required	
S5.1	716534.261	739938.928	716534.261	739938.928	Required	
S5	716545.706	739937.626	716545.706	739937.626	Required	
S4.1	716663.296	739924.898	716663.296	739924.898	Required	
S4	716606.114	739930.873	716606.114	739930.873	Required	

Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S3.1	716624.799	739962.723	716624.799	739962.723	Required	
SATTN.	716614.798	739953.871	716614.798	739953.871	Required	
S3	716621.438	739930.617	716621.438	739930.617	Required	
S2	716649.492	739927.685	716649.492	739927.685	Required	
SS1-P1	716656.894	739922.304			No Entry	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	300	S9	57.100	55.600	1.200	Open Manhole	1200
S1.001	o	300	S8	57.050	55.150	1.600	Open Manhole	1200
S1.002	o	300	S7	57.270	54.930	2.040	Open Manhole	1200
S1.003	o	300	S6	57.140	54.660	2.180	Open Manhole	1200
S2.000	o	225	S5.1	57.050	55.520	1.305	Open Manhole	1200
S1.004	o	300	S5	56.780	54.540	1.940	Open Manhole	1200
S3.000	o	225	S4.1	55.850	54.530	1.095	Open Manhole	1200
S1.005	o	375	S4	56.440	54.240	1.825	Open Manhole	1350
S4.000	o	225	S3.1	57.200	54.230	2.745	Open Manhole	1200
S1.006	o	375	SATTN.	57.200	54.160	2.665	Open Manhole	1350
S1.007	o	225	S3	56.330	54.090	2.015	Open Manhole	1350
S1.008	o	225	S2	56.300	53.910	2.165	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	69.495	154.4	S8	57.050	55.150	1.600	Open Manhole	1200
S1.001	43.112	196.0	S7	57.270	54.930	2.040	Open Manhole	1200
S1.002	54.762	202.8	S6	57.140	54.660	2.180	Open Manhole	1200
S1.003	23.414	195.1	S5	56.780	54.540	1.940	Open Manhole	1200
S2.000	11.461	42.4	S5	56.780	55.250	1.305	Open Manhole	1200
S1.004	60.713	202.4	S4	56.440	54.240	1.900	Open Manhole	1350
S3.000	57.493	198.3	S4	56.440	54.240	1.975	Open Manhole	1350
S1.005	24.621	307.8	SATTN.	57.200	54.160	2.665	Open Manhole	1350
S4.000	13.356	190.8	SATTN.	57.200	54.160	2.815	Open Manhole	1350
S1.006	24.239	346.3	S3	56.330	54.090	1.865	Open Manhole	1350
S1.007	28.217	156.8	S2	56.300	53.910	2.165	Open Manhole	1200
S1.008	9.157	152.6	SS1-P1	55.960	53.850	1.885	Open Manhole	1200

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.008	SS1-P1	55.960	53.850	53.850	1200	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0	Number of Offline Controls 0	Number of Time/Area Diagrams 0
Number of Online Controls 1	Number of Storage Structures 1	Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	5	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.000	Storm Duration (mins)	30
Ratio R	0.275		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S3, DS/PN: S1.007, Volume (m³): 5.7

Unit Reference	MD-SHE-0102-4900-1149-4900
Design Head (m)	1.149
Design Flow (l/s)	4.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	102
Invert Level (m)	54.090
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.149	4.9	Kick-Flo®	0.717	3.9
Flush-Flo™	0.339	4.9	Mean Flow over Head Range	-	4.3

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	3.4	0.800	4.1	2.000	6.3	4.000	8.8	7.000	11.5
0.200	4.7	1.000	4.6	2.200	6.6	4.500	9.3	7.500	11.9
0.300	4.9	1.200	5.0	2.400	6.9	5.000	9.8	8.000	12.2
0.400	4.9	1.400	5.4	2.600	7.2	5.500	10.2	8.500	12.6
0.500	4.8	1.600	5.7	3.000	7.7	6.000	10.7	9.000	12.9
0.600	4.5	1.800	6.0	3.500	8.3	6.500	11.1	9.500	13.3

Storage Structures for Storm

Cellular Storage Manhole: SATTN., DS/PN: S1.006

Invert Level (m) 54.260 Safety Factor 1.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	525.0	0.0	0.400	525.0	0.0	0.800	525.0	0.0
0.100	525.0	0.0	0.500	525.0	0.0	0.900	525.0	0.0
0.200	525.0	0.0	0.600	525.0	0.0	1.075	525.0	0.0
0.300	525.0	0.0	0.700	525.0	0.0	1.076	0.0	0.0

Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	16.000
Region	Scotland and Ireland	Ratio R	0.275
Cv (Summer)	0.750		
Cv (Winter)	0.840		

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	100
Climate Change (%)	20

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S1.000	S9	15 Winter	100	+20%	100/15 Summer				56.991	1.091	0.000
S1.001	S8	15 Winter	100	+20%	100/15 Summer				56.825	1.375	0.000
S1.002	S7	15 Winter	100	+20%	100/15 Summer				56.678	1.448	0.000
S1.003	S6	15 Winter	100	+20%	100/15 Summer				56.096	1.136	0.000
S2.000	S5.1	15 Winter	100	+20%	100/15 Winter				55.786	0.041	0.000
S1.004	S5	15 Winter	100	+20%	100/15 Summer				55.787	0.947	0.000
S3.000	S4.1	720 Winter	100	+20%	100/15 Summer				55.088	0.333	0.000
S1.005	S4	720 Winter	100	+20%	100/15 Summer				55.088	0.473	0.000
S4.000	S3.1	720 Winter	100	+20%	100/15 Summer				55.086	0.631	0.000
S1.006	SATTN.	720 Winter	100	+20%	100/15 Winter				55.085	0.550	0.000
S1.007	S3	120 Winter	100	+20%	100/15 Summer				55.361	1.046	0.000
S1.008	S2	8640 Winter	100	+20%					53.966	-0.169	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S9	0.78			66.4	FLOOD RISK	
S1.001	S8	0.82			60.9	FLOOD RISK	
S1.002	S7	1.47			108.2	SURCHARGED	
S1.003	S6	1.61			112.9	SURCHARGED	

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S2.000	S5.1	0.04			2.6	SURCHARGED	
S1.004	S5	1.81			134.1	SURCHARGED	
S3.000	S4.1	0.08			3.0	SURCHARGED	
S1.005	S4	0.29			28.5	SURCHARGED	
S4.000	S3.1	0.19			6.0	SURCHARGED	
S1.006	SATTN.	0.19			17.4	SURCHARGED	
S1.007	S3	0.13			4.9	SURCHARGED	
S1.008	S2	0.14			4.9	OK	

APPENDIX E

Surface Water Interception Calculations

PROJECT			JOB REF.
Proposed Mixed use Development at Swords Road, Santry, Dublin 9.			200060
SUBJECT			**Calc. Sheet No.**
Surface Water Calculations - Infiltration Volume			3
Drawing ref.	**Calculations by**	**Checked by**	**Date**
200060-INFO1	DCH	LMCL	04-May-21

SURFACE WATER CALCULATIONS

Site Area

Total Site Area =	1.32	Hectares (ha)

Interception Volume (Post-Development)

Impermeable Area =	0.58	Hectares (ha)
Rainfall Depth =	5	mm
[1]**Interception Volume =**	23.3	m^3

Notes

1. Interception Volume (m^3) = Impermeable Area (ha) x 5mm x 10 (GDSDS Section 6.3.1.2.1). For sites where a pond is applicable.

80% runoff from impermeable areas assumed.

APPENDIX F

Surface Water Treatment Calculations

PROJECT			JOB REF.
Proposed Mixed use Development at Swords Road, Santry, Dublin 9.			200060
SUBJECT			**Calc. Sheet No.**
Surface Water Calculations - Treatment Volume			2
Drawing ref.	**Calculations by**	**Checked by**	**Date**
200060-INFO1	DCH	LMCL	04-May-21

SURFACE WATER CALCULATIONS

Site Area

Total Site Area =	1.32	Hectares (ha)

Treatment Volume (Post-Development)

Impermeable Area =	0.583	Hectares (ha)
Rainfall Depth =	15	mm
[1]Treatment Volume (Vt) =	69.9	m^3

Notes

1. Treatment Volume Vt (m^3) = Impermeable Area (ha) x 15mm x 10 (GDSDS Section 6.3.1.2.1). For sites where a pond is applicable.

80% runoff from impermeable areas assumed.

APPENDIX G

SUDs summary

TITLE	Job Reference
Santry Place Mixed Use Development Phase2, Santry, Dublin 9	200060
SUBJECT	**Calc. Sheet No.**
Permeable Paving Design	1

DRAWING NUMBER	Calculations by	Checked by	Date
200060-DBFL-SW-ST-DR-C-1011	DCH	LMCL	12.05.21

FLAT SITES

INPUT DATA

Pavement Area (A)	1279.0	m^2
Pavement Perimeter (P)	543.6	m
Sub-base Depth (d)	0.400	m
[1]Sub-base Voids Ratio (η)	0.30	
Sub-base Infiltration Rate per hour	1000	mm/hr
Sub-base Infiltration Rate (k)	0.278	mm/s
Subgrade Infiltration Rate per hour	0.0	mm/hr
Subgrade Infiltration Rate (*f*)	0.000	mm/s

VOLUME (STORAGE AND TREATMENT)

Permeable Paving Storage Volume per m^2	0.120	m^3/m^2
Total Permeable Paving Storage Volume	153.5	m^3

INFILTRATION / INTERCEPTION VOLUME

Approx. Permeable Paving Infiltration per m^2	0.000	$l/s/m^2$
[2]Total Permeable Paving Infiltration Rate	**0.000**	l/s
[3]Total Permeable Paving Infiltration Volume	0.0	m^3

FLOW

Average Distance between Outlet Drains	6.0	m	Assumed one outlet per house
Flow Velocity through Permeable Paving	**0.000038**	m/s	
Trench Retention Time	**44.2**	hr	

Notes:

1 Sub-base material has a void ratio of approximately 30%, source 'BRE Digest 365'.

2 Wetted perimeter assuming 50% of trench depth, source 'BRE Digest 365'.

3 Volume calculated using 6 hour storm event.

4 For Paving on slopes includes infiltration, provide 500mmx500mm trenches at 10m centres along slope with 1000mmx500mm at base of slope. source 'Formpave - Aquaflow Permeable Paving System'.

Table: 1

Material	void Ratio, η
Clean stone	0.40 - 0.50
Uniform gravel	0.30 - 0.40
Graded sand or gravel	0.20 - 0.30
Source: The SUDS manual, Published by CIRIA.	

Table: 2

Pavement Type	Effective Depth (m)
Car-Parking	0.40
Footpath	0.20
Effective Depths are provided from source 'Formpave - Aquaflow Permeable Paving System' and may subject to change as per site requirement.	

Total Permeable Paving Outflow:

$= A \cdot k \cdot i$

where:

A = Cross Sectional Area of Subbase
k = Subbase Infiltration Rate
i = Hydraulic Gradient

Hydraulic gradient has been assumed as the pavement gradient with an additional 250mm fall per 100m length.

Table: 3

Material	Infiltration Rate (m/hr)
Gravel	10 - 1000
Sand	0.1 - 100
Loamy sand	0.01 - 1
Sandy loam	0.05 - 0.5
Loam	0.001 - 0.1
Silt loam	0.0005 - 0.005
Chalk	0.001 - 100
Sandy clay loam	0.001 - 0.01
Silty clay loam	0.00005 - 0.005
Clay	< 0.0001
Till	0.00001 - 0.01
Rock	0.00001 - 1
Cutoff point for most infiltration drainage systems = 0.001 mm/hr Source: Microdrainage	

Total Trench Infiltration:

$= 1/2 \cdot D \cdot L \cdot f$

where:

L = Length
D = Depth to Invert
f = Subgrade infiltration rate

TITLE		**Job Reference**	
Santry Place Mixed Use Development Phase 2, Santry, Dublin 9		200060	
SUBJECT		**Calc. Sheet No.**	
GREEN ROOF DESIGN - Green Roof 2 Intensive (Podium)		1	
DRAWING NUMBER	**Calculations by**	**Checked by**	**Date**
200060-DBFL-SW-ST-DR-C-1011	DCH	LMCL	10/05/2021

INPUT DATA

Green Roof Area (A)	2693.0	m^2
[1]Filter Layer Depth (d)	0.250	m
[1]Filter Layer Voids Ratio (η)	30.0	%

TREATMENT VOLUME

[2]Treatment Volume (V_T)	202.0	m^3

EVAPOTRANSPIRATION / INTERCEPTION VOLUME

[3]Evapotranspiration Rate per Day	5.00	mm/day	
Evapotranspiration Volume	13.5	m^3	
Interception Volume in Permeable Podium Build-up	202.0	m^3	**Provided Interception Volume**

Notes:

1 Filter Bed depth typically between 0.15 and 0.35m. This consists of the substrate and drainage layer.

2 Treatment Volume Vt (m^3) = Green Roof Area (m^2) x d x η

3 Assumed 2mm evaporation and 3mm transpiration.

TITLE		**Job Reference**	
Santry Place Mixed Use Development Phase 2, Santry, Dublin 9		200060	
SUBJECT		**Calc. Sheet No.**	
GREEN ROOF DESIGN - Green Roof 1 Extensive		1	
DRAWING NUMBER	**Calculations by**	**Checked by**	**Date**
200060-DBFL-SW-ST-DR-C-1011	DCH	LMCL	10/05/2021

INPUT DATA

Green Roof Area (A)	2472.0	m^2
[1]Filter Layer Depth (d)	0.150	m
[1]Filter Layer Voids Ratio (η)	30.0	%

TREATMENT VOLUME

[2]Treatment Volume (V_T)	111.2	m^3

EVAPOTRANSPIRATION / INTERCEPTION VOLUME

[3]Evapotranspiration Rate per Day	5.00	mm/day
Evapotranspiration Volume	12.4	m^3

Notes:

1 Filter Bed depth typically between 0.15 and 0.35m. This consists of the substrate and drainage layer.

2 Treatment Volume Vt (m^3) = Green Roof Area (m^2) x d x η

3 Assumed 2mm evaporation and 3mm transpiration.

TITLE		Job Reference	
Santry Place Mixed Use Development phase 2, Santry, Dublin 9		200060	
SUBJECT		Calc. Sheet No.	
Interception/Treatment Volume Summary		1	
DRAWING NUMBER	**Calculations by**	**Checked by**	**Date**
200011-DBFL-SW-ST-DR-C-1011	DCH	LMCL	11/05/2021

INPUT DATA

Interception Volume Required	23.30	m^3
Treatment Volume Required	69.91	m^3

Catchment	**Interception Volumes**		**Treatment Volumes**	
Permeable Paving	0.0	m^3	153.5	m^3
Green Roof Extensive	12.4	m^3	111.2	m^3
Green Roof Intensive	202.0		202.0	
Total Volumes Provided	214.3	m^3	466.7	m^3
Check Provided Volumes are greater than Required Volumes	PASS		PASS	

APPENDIX H

Watermain Calculations

TITLE		Job Reference	
Santry Place Mixed Use Development, Santry Dublin 9.		200060	
SUBJECT		**Calc. Sheet No.**	
Post-Development Water Demand for Irish Water - Residential		1	
DRAWING NUMBER	**Calculations by**	**Checked by**	**Date**
200060-DBFL-WM-ST-DR-C-1031	DCH	LMCL	10/05/2021

DEMAND

Housing Units	350	no.
Daily Demand per person[1]	150	litres/person/day
Average Occupancy Ratio[2]	2.7	person/unit
Total Site Occupancy	945	people
Average Daily Demand	141,750	l/day
Average Day in Peak Week[3]	177,188	l/day
Normal Length of Day[4]	24	hours
Peak Factor[5]	5.0	

Post Development Peak Water Demand[6]	**10.254**	l/s
Post Development Average Water Demand	**1.641**	l/s
Normal Demand[7]	**1.641**	l/s

Notes:

1. Daily demand per person is 150 litres/person/day from the Irish Water Code of Practice for Wastewater Infrastructure.
2. Occupancy ratio of 2.7 persons per dwelling from Irish Water Pre-Connection Enquiry Form (PCEF Rev 2).
3. Average Day in Peak Week is 1.25 times the average daily demand.
4. Assumed normal demand is the total daily demand during the normal length of day.
5. Peak Factor for pipe sizing from Irish Water Code of Practice for Waster Infratructure .
6. Peak Factor multiplied by Average Day in Peak Week flow.
7. Normal demand is the total daily demand during the normal length of day.
8. Fire flow is required at 25l/s as per B.S. 5306-1:1976.

TITLE			Job Reference
Santry Place Mixed Use Development , Santry, Dublin 9			200060
SUBJECT			**Calc. Sheet No.**
Post-Development Water Demand for Irish Water-Retail			1
DRAWING NUMBER	**Calculations by**	**Checked by**	**Date**
200060-DBFL-WM-SP-DR-C-1031	DCH	LMCL	20/08/2020

DEMAND

Retail Outlets

Retail space	855	m^2
Staff[1]	57	no.
Daily Demand per person[2]	50	litres/person/day
Average Daily Demand	2,851	l/day
Average Day in Peak Week[3]	3,563	l/day
Normal Length of Day[4]	12	hours
Peak Factor[5]	5.0	

Post Development Peak Water Demand[6]	**0.206**	l/s
Post Development Average Water Demand	**0.033**	l/s
Normal Demand[7]	**0.066**	l/s

Notes:

1. Assumed employment density of 15m² for retail in accordance with "Employment Density Guidance (Volume 3).
2. Daily Demand per person is 50 litres/person/day for Staff taken from Irish Water "Code of Practice for Wasterwater Infrastructure".
3. Average Day in Peak Week is 1.25 times the average daily demand.
4. Assumed normal demand is the total daily demand during the normal length of day.
5. Peak Factor 5 from irish water code of practice for water infrastructure.
6. Peak Factor multiplied by Average Day in Peak Week flow
7. Normal demand is the total daily demand during the normal length of day.
8. Fire flow is required at 25l/s as per B.S. 5306-1:1976.

APPENDIX I

Irish Water Correspondence

Daniel Hodnett

DBFL Consulting Engineers, Ormond House
Ormond Quay Upper, Dublin 7
Dublin
D07W7704

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

2 October 2020

Re: CDS20003546 pre-connection enquiry - Subject to contract | Contract denied

Connection for Multi/Mixed Use Development of 353 unit(s) at Santry Place Mixed Use Development, Swords Road, Dublin 9, Co. Dublin

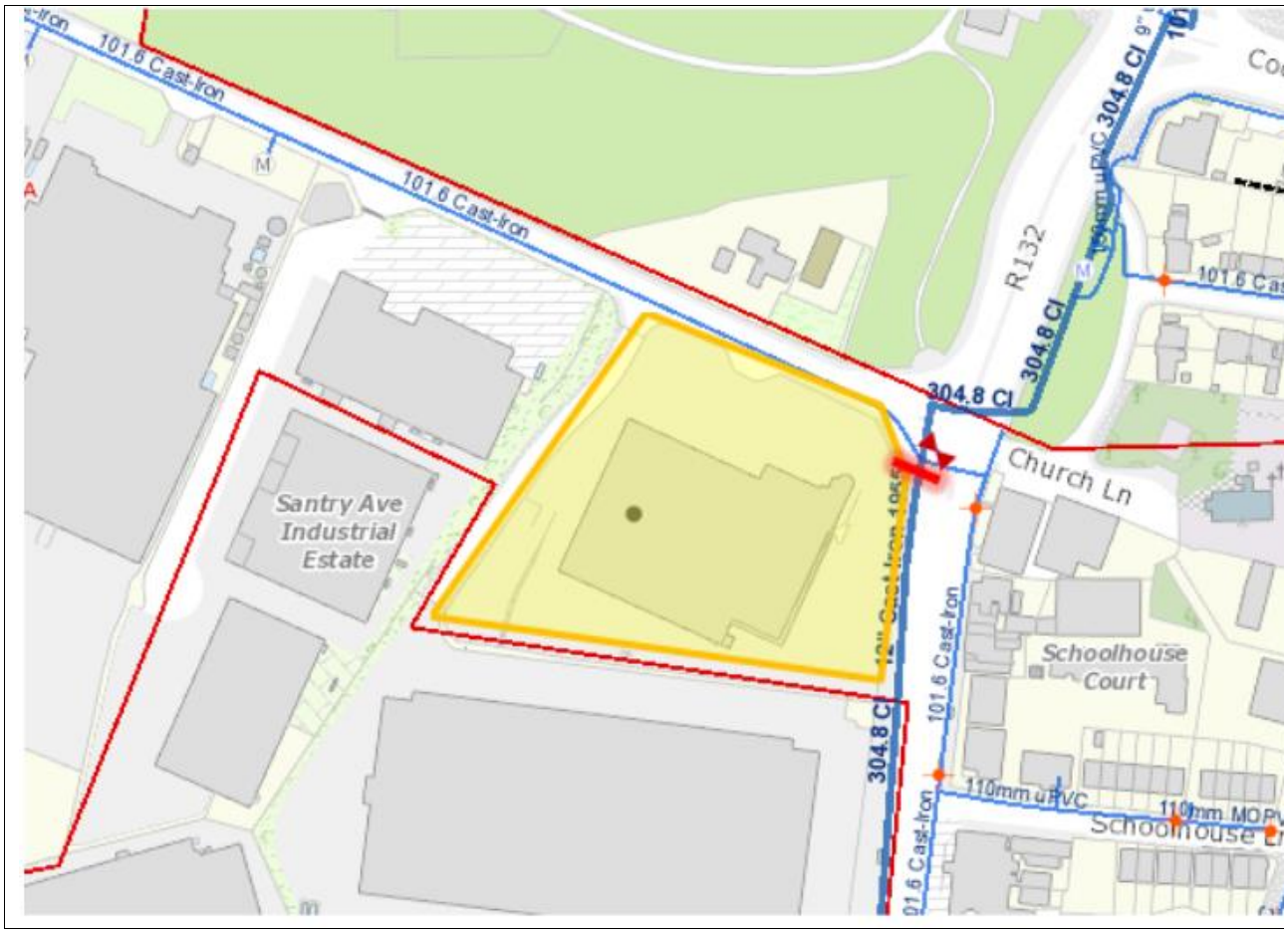
Dear Sir/Madam,

Irish Water has reviewed your pre-connection enquiry in relation to a Water & Wastewater connection at Santry Place Mixed Use Development, Swords Road, Dublin 9, Co. Dublin (the **Premises**). Based upon the details you have provided with your pre-connection enquiry and on our desk top analysis of the capacity currently available in the Irish Water network(s) as assessed by Irish Water, we wish to advise you that your proposed connection to the Irish Water network(s) can be facilitated at this moment in time.

SERVICE	**OUTCOME OF PRE-CONNECTION ENQUIRY** **THIS IS NOT A CONNECTION OFFER. YOU MUST APPLY FOR A CONNECTION(S) TO THE IRISH WATER NETWORK(S) IF YOU WISH TO PROCEED.**
Water Connection	Feasible subject to upgrades
Wastewater Connection	Feasible subject to upgrades
SITE SPECIFIC COMMENTS	
Water Connection	In order to accommodate the proposed connection to Irish Water water network at the Premises the following works are required: Connection main – Approx. 20m of new 200mm ID pipe main has to be laid to connect the site development to the existing 12" CI main. As shown below (See red dashed-line in figure). Connection main will have a bulk meter installed. On site storage for the average day peak week demand rate of the commercial section for 24 hour period. This separate storage is required to supply this demand and will have a re-fill time of 12 hours.

	Irish Water currently does not have any plans to extend its network in this area. Should you wish to progress with the connection you will be required to fund this upgrades.
Wastewater Connection	There are capacity constraints in the downstream network. In order to provide capacity for the development the Sandry Pumping Station will need to be redirected to the North Fringe Sewer catchment via an already laid rising main on Northwood Ave. However there are connection and other works remaining. This works are not on the Capital Investment Program and would need to be funded by the developer. If you wish to proceed please contact Irish Water to provide you a scope of the required works.
Strategic Housing Development	Irish Water notes that the scale of this development dictates that it is subject to the Strategic Housing Development planning process. In advance of submitting your full application to An Bord Pleanala for assessment, you must have reviewed this development with Irish Water and received a Statement of Design Acceptance in relation to the layout of water and wastewater services.
The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this development shall comply with the Irish Water Connections and Developer Services Standard Details and Codes of Practice that are available on the Irish Water website. Irish Water reserves the right to supplement these requirements with Codes of Practice and these will be issued with the connection agreement.	

The map included below outlines the current Irish Water infrastructure adjacent to your site:



Reproduced from the Ordnance Survey of Ireland by Permission of the Government. License No. 3-3-34

Whilst every care has been taken in its compilation Irish Water gives this information as to the position of its underground network as a general guide only on the strict understanding that it is based on the best available information provided by each Local Authority in Ireland to Irish Water. Irish Water can assume no responsibility for and give no guarantees, undertakings or warranties concerning the accuracy, completeness or up to date nature of the information provided and does not accept any liability whatsoever arising from any errors or omissions. This information should not be relied upon in the event of excavations or any other works being carried out in the vicinity of the Irish Water underground network. The onus is on the parties carrying out excavations or any other works to ensure the exact location of the Irish Water underground network is identified prior to excavations or any other works being carried out. Service connection pipes are not generally shown but their presence should be anticipated.

General Notes:

1) The initial assessment referred to above is carried out taking into account water demand and wastewater discharge volumes and infrastructure details on the date of the assessment. **The availability of capacity may change at any date after this assessment.**
2) This feedback does not constitute a contract in whole or in part to provide a connection to any Irish Water infrastructure. All feasibility assessments are subject to the constraints of the Irish Water Capital Investment Plan.
3) The feedback provided is subject to a Connection Agreement/contract being signed at a later date.

4) A Connection Agreement will be required to commencing the connection works associated with the enquiry this can be applied for at https://www.water.ie/connections/get-connected/
5) A Connection Agreement cannot be issued until all statutory approvals are successfully in place.
6) Irish Water Connection Policy/ Charges can be found at https://www.water.ie/connections/information/connection-charges/
7) Please note the Confirmation of Feasibility does not extend to your fire flow requirements.
8) Irish Water is not responsible for the management or disposal of storm water or ground waters. You are advised to contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges
9) To access Irish Water Maps email datarequests@water.ie
10) All works to the Irish Water infrastructure, including works in the Public Space, shall have to be carried out by Irish Water.

If you have any further questions, please contact Marko Komso from the design team on 022 54611 or email mkomso@water.ie For further information, visit **www.water.ie/connections.**

Yours sincerely,

Maria O'Dwyer

Connections and Developer Services

Daniel Hodnett
DBFL Consulting Engineers,
Ormond House
Ormond Quay Upper, Dublin 7
Dublin
D07W7704

26 May 2021

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

Re: Design Submission for Santry Place Mixed Use Development, Swords Road, Dublin 9, Co. Dublin (the "Development")
(the "Design Submission") / Connection Reference No: CDS20003546

Dear Daniel Hodnett,

Many thanks for your recent Design Submission.

We have reviewed your proposal for the connection(s) at the Development. Based on the information provided, which included the documents outlined in Appendix A to this letter, Irish Water has no objection to your proposals.

This letter does not constitute an offer, in whole or in part, to provide a connection to any Irish Water infrastructure. Before you can connect to our network you must sign a connection agreement with Irish Water. This can be applied for by completing the connection application form 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 (CRU)(https://www.cru.ie/document_group/irish-waters-water-charges-plan-2018/).

You the Customer (including any designers/contractors or other related parties appointed by you) is entirely responsible for the design and construction of all water and/or wastewater infrastructure within the Development which is necessary to facilitate connection(s) from the boundary of the Development to Irish Water's network(s) (the "**Self-Lay Works**"), as reflected in your Design Submission. Acceptance of the Design Submission by Irish Water does not, in any way, render Irish Water liable for any elements of the design and/or construction of the Self-Lay Works.

If you have any further questions, please contact your Irish Water representative:
Name: Dario Alvarez
Email: dalvarez@water.ie

Yours sincerely,

Yvonne Harris

Yvonne Harris
Head of Customer Operations

Appendix A

Document Title & Revision

- [200060-DBFL-FW-ST-DR-C-7000]
- [200060-DBFL-FW-ST-DR-C-7001]
- [200060-DBFL-WM-ST-DR-C-7000]

Standard Details/Code of Practice Exemption: N/A

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

Notwithstanding any matters listed above, the Customer (including any appointed designers/contractors, etc.) is entirely responsible for the design and construction of the Self-Lay Works. Acceptance of the Design Submission by Irish Water will not, in any way, render Irish Water liable for any elements of the design and/or construction of the Self-Lay Works.

MAIN PLAN
INSET A
SEE MAIN PLAN FOR CONTINUATION
SEE INSET A FOR CONTINUATION
NEW FOUL CONNECTION TO EXISTING PUBLIC FOUL SEWER. NEW MANHOLE TO BE CONSTRUCTED ON EXISTING LINE.
225 DIA. FOUL @ 1:179
EX.FMH CL.54.54 IL.52.81
BLOCK A
BLOCK B
BLOCK C
BLOCK D
BLOCK E
BLOCK G
FFL:57.20
FFL:55.50
LOADING
GO CAR
SET DOWN
F1 CL 54.95 IL 53.79
F1.1 CL 55.43 IL 54.11
F1.2 CL 55.40 IL 54.27
F2 CL 55.57 IL 54.25
F3 CL 56.49 IL 54.65
F3.1 CL 56.56 IL 55.43
F4 CL 56.80 IL 54.88
F4.1 CL 57.15 IL 56.02
F5 CL 56.82 IL 54.99
F5.1 CL 57.15 IL 56.03
F6 CL 56.93 IL 55.05
F6.1 CL 57.10 IL 55.97
F7 CL 56.91 IL 55.19
F8 CL 57.14 IL 55.29
F9 CL 57.29 IL 55.54
F10 CL 57.10 IL 55.81
F11 CL 57.15 IL 55.91
F12 CL 57.20 IL 56.07
INTERNAL FOUL DRAINAGE FOR COMMERCIAL UNITS TO BE CONFIRMED BY ARCHITECT.
INTERNAL FOUL DRAINAGE FOR RESIDENTIAL UNITS TO BE CONFIRMED BY ARCHITECT.
INTERNAL FOUL DRAINAGE FOR RESIDENTIAL UNITS TO BE CONFIRMED BY ARCHITECT. UNITS LOCATED OVER BASEMENT AREA TO BE DRAINED VIA SLUNG DRAINAGE.
INTERNAL FOUL DRAINAGE FOR RESIDENTIAL AMENITY BUILDING TO BE CONFIRMED BY ARCHITECT. UNITS LOCATED OVER BASEMENT AREA TO BE DRAINED VIA SLUNG DRAINAGE.
FOUL SLUNG DRAINAGE CONNECTION. REFER TO M&E DRAWINGS FOR SLUNG DRAINAGE DESIGN & INVERT LEVEL.
DUCTILE IRON RISING MAIN FROM BASEMENT PUMPING STATION TO OUTFALL MANHOLE.
FOUL CONNECTION TO EXISTING MANHOLE CONSTRUCTED AS PART OF NEIGHBOURING DEVELOPMENT (PLANNING REF. 2713/17 & 2737/19).
225 DIA. FOUL @ 1:182

ON ORIGINAL

0 5 10 15 20 25 30 40 50mm

NOTES:

1. ALL DIMENSIONS AND LEVELS IN METRES, EXCEPT IF NOTED OTHERWISE.
2. ALL LEVELS TO **MALIN HEAD** DATUM.
3. CO-ORDINATE SYSTEM IS: **IRISH TRANSVERSE MERCATOR.**
4. REFER TO ARCHITECTS PLAN LAYOUTS FOR SITE BOUNDARY / CLIENT OWNERSHIP BOUNDARY / WORKS BOUNDARY.

FOUL WATER:

1. FOUL SEWER PIPE MATERIAL SHALL BE uPVC WHICH IS IN ACCORDANCE WITH SECTION 3.13 OF THE WASTEWATER CODE OF PRACTICE.
2. TYPICAL SERVICE LAYOUT DISTANCES (HORIZONTALLY AND VERTICALLY) AS PER DETAIL STD-WW-05.
3. ALL FOUL MANHOLE DETAILS ARE TO BE CONSTRUCTED IN ACCORDANCE WITH STANDARD DETAILS STD-WW-09, STD-WW-10, STD-WW-11 AND STD-WW-12.
4. TRENCH DETAILS ARE TO BE CONSTRUCTED IN ACCORDANCE WITH STD-WW-07, STD-WW-08 AND STD-W-13.
5. DRAIN CONNECTIONS FROM BUILDINGS TO BE MINIMUM 150mmø U.N.O. @ 1:100.
6. ALL MAIN SEWERS WITH LESS THAN 1.2m COVER UNDER ROADS AND 0.9m COVER UNDER GRASSED AREAS AND FOOTPATHS TO BE SURROUNDED IN 150mm CONCRETE.
7. MANHOLES, AJS AND SERVICE COVERS LOCATED IN BLOCK PAVED OR PAVING SLAB AREAS ARE TO HAVE RECESSED COVERS TO RECEIVE PAVINGS TO MATCH ADJACENT PAVING MATERIALS.
8. ALL COVERS IN PUBLIC AREAS TO BE IS EN 124 D400 UNLESS NOTED OTHERWISE & NON-LOCKABLE.
9. REFER TO DRAWING 200060-DBFL-FW-ST-DR-C-3021 FOR FOUL SEWER LONGITUDINAL SECTIONS.
10. ALL WORKS TO BE UNDERTAKEN IN ACCORDANCE WITH
    - IRISH WATER CONNECTION AND DEVELOPER SERIES STANDARD DETAILS
    - TII SPECIFICATION FOR ROADWORKS
    - GREATER DUBLIN CODE OF PRACTICE FOR DRAINAGE WORKS RECOMMENDATIONS FOR SITE DEVELOPMENT WORKS
11. CE CERTIFICATION TO BE PROVIDED FOR ALL PRODUCTS COVERED BY THE EU CONSTRUCTION PRODUCTS REGULATION (NO.305/2011-CPR).
12. ALL MATERIALS PROPOSED FOR USE ON SITE TO BE APPROVED PRIOR TO ARRIVAL ON SITE.
13. LEVELS AND POSITIONS OF ALL EXISTING SERVICES TO BE CONFIRMED ON SITE PRIOR TO CONSTRUCTION.
14. ALL FOUL INSPECTION CHAMBER DETAILS ARE TO BE CONSTRUCTED IN ACCORDANCE WITH STANDARD DETAILS STD-WW-13.

LEGEND

ROAD EDGE
FOOTPATH EDGE
ROAD CENTRELINE
PROPOSED BUILDING
PROPOSED BASEMENT
FFL 99.99 — FINISHED FLOOR LEVEL

PROPOSED SERVICES:

225ø FS 1:999 — FOUL WATER SEWER
F99 CL 99.99 IL 99.99 — FOUL WATER MANHOLE
DUCTILE IRON RISING MAIN

EXISTING NEIGHBORING SITE INFRASTRUCTURE:

225ø 1:999 — FOUL WATER SEWER
P1-F99 CL 99.99 IL 99.99 — FOUL WATER MANHOLE

EXISTING PUBLIC SERVICES:

EX. 225ø FS — FOUL SEWER
EX.F99 CL.99.99 IL.99.99 — FOUL SEWER MANHOLE

rev	date	description	by	chkd.
P01	07/05/21	ISSUED TO IW FOR COMMENTS	DCH	LMCL

client approval: A - Approved; B - Approved with comments; C - Do not use

suitability: S2 - INFORMATION | issue purpose: PLANNING

DBFL Consulting Engineers
Civil, Structural & Transportation Engineering
www.dbfl.ie

DUBLIN OFFICE: Ormond House, Upper Ormond Quay, Dublin 7. D07 W704
PHONE +353 1 400 4000

CORK OFFICE: 14 South Mall, Cork. T12 CT91
PHONE +353 21 2024538

WATERFORD OFFICE: Suite 8b The Atrium, Maritana Gate, Canada Street, Waterford. X91 W028
PHONE +353 51 309 500

project ref.
MIXED USE DEVELOPMENT-HEITON BUCKLY. SWORDS ROAD, SANTRY.

drawing title
FOUL WATER LAYOUT

client
DWYER NOLAN DEVELOPMENTS

designed by	author	scale	sheet size
LMCL	DCH	1:250	A1

drawing no. 200060-DBFL-FW-ST-DR-C-7000 | revision P01

ON ORIGINAL

0 5 10 15 20 25 30 40 50mm

NOTES:

1. ALL DRAWINGS TO BE CHECKED BY CONTRACTOR ON SITE AND ENGINEER INFORMED OF DISCREPANCIES BEFORE WORK COMMENCES
2. ALL LEVELS ARE IN METRES AND ARE RELATED TO ORDNANCE DATUM
3. CONTRACTOR SHALL SATISFY HIMSELF AS TO THE ACCURACY OF PAVEMENT LEVELS ON SITE PRIOR TO COMMENCEMENT OF WORKS ON SITE
4. MANHOLE COVER LEVELS ARE TO CONFORM WITH FINISHED ROAD AND PATH LEVELS
5. WHERE COVER TO PIPE IS LESS THAN 1200mm (ROAD/PATH/VERGE) OR 900mm (OPEN SPACE) SURROUND PIPE IN MINIMUM 150mm CONCRETE
6. PUBLIC FOUL WATER SEWERS TO HAVE MINIMUM 750mm COVER

KEY

PROPOSED GROUND PROFILE

MH Name	F12	F11	F10	F9	F8	F7	F6	F5	F4	F3	F2
PN	F1.000	F1.001	F1.002	F1.003	F1.004	F1.005	F1.006	F1.007	F1.008	F1.009	
Dia (mm)	225	225	225	225	225	225	225	225	225	225	
Slope (1:X)	148.4	195.2	194.6	198.5	187.5	188.8	200.0	195.5	193.5	180.0	
Cover Level (m)	57.200	57.150	57.100	57.290	57.140	56.910	56.930	56.820	56.800	56.490	55.970
Invert Level (m)	56.070	55.910 55.910	55.810 55.810	55.540 55.540	55.290 55.290	55.190 55.190	55.050 55.050	54.990 54.990	54.880 54.880	54.650 54.650	54.570
Length (m)	23.743	19.517	52.555	49.632	18.747	26.438	12.000	21.507	44.513	14.401	

MH Name	F2	F1	FF1-F2
PN	F1.010	F1.011	
Dia (mm)	225	225	
Slope (1:X)	53.8	188.0	
Cover Level (m)	55.970	54.950	54.920
Invert Level (m)	54.250	53.790 53.790	53.720
Length (m)	24.728	13.162	

MH Name	F6.1	F6
PN	F2.000	
Dia (mm)	225	
Slope (1:X)	108.1	
Cover Level (m)	57.100	56.930
Invert Level (m)	55.970	55.720
Length (m)	27.034	

MH Name	F5.1	F5
PN	F3.000	
Dia (mm)	225	
Slope (1:X)	104.5	
Cover Level (m)	57.150	56.820
Invert Level (m)	56.030	55.770
Length (m)	27.176	

MH Name	F4.1	F4
PN	F4.000	
Dia (mm)	225	
Slope (1:X)	117.5	
Cover Level (m)	57.150	56.800
Invert Level (m)	56.020	55.790
Length (m)	27.018	

MH Name	F3.1	F3
PN	F5.000	
Dia (mm)	225	
Slope (1:X)	142.1	
Cover Level (m)	56.560	56.490
Invert Level (m)	55.430 55.410	
Length (m)	2.842	

MH Name	F1.2	F1.1	F1
PN	F6.000	F6.001	
Dia (mm)	225	225	
Slope (1:X)	117.6	169.0	
Cover Level (m)	55.400	55.430	54.950
Invert Level (m)	54.270	54.110 54.110	53.790
Length (m)	18.813	54.077	

P01	07/05/21	ISSUED TO IW FOR COMMENTS	DCH	LMCL
rev	date	description	by	chkd.

client approval: A - Approved; B - Approved with comments; C - Do not use

suitability: S2 - INFORMATION

issue purpose: PLANNING

DBFL Consulting Engineers
Civil, Structural & Transportation Engineering
www.dbfl.ie

DUBLIN OFFICE Ormond House, Upper Ormond Quay, Dublin 7, Ireland.
PHONE +353 1 400 4000

WATERFORD OFFICE Unit 2, The Chandlery, 1-2 O' Connell Street, Waterford, Ireland.
PHONE +353 51 309 500

project ref.

MIXED USE DEVELOPMENT-HEITON BUCKLY. SWORDS ROAD, SANTRY.

drawing title

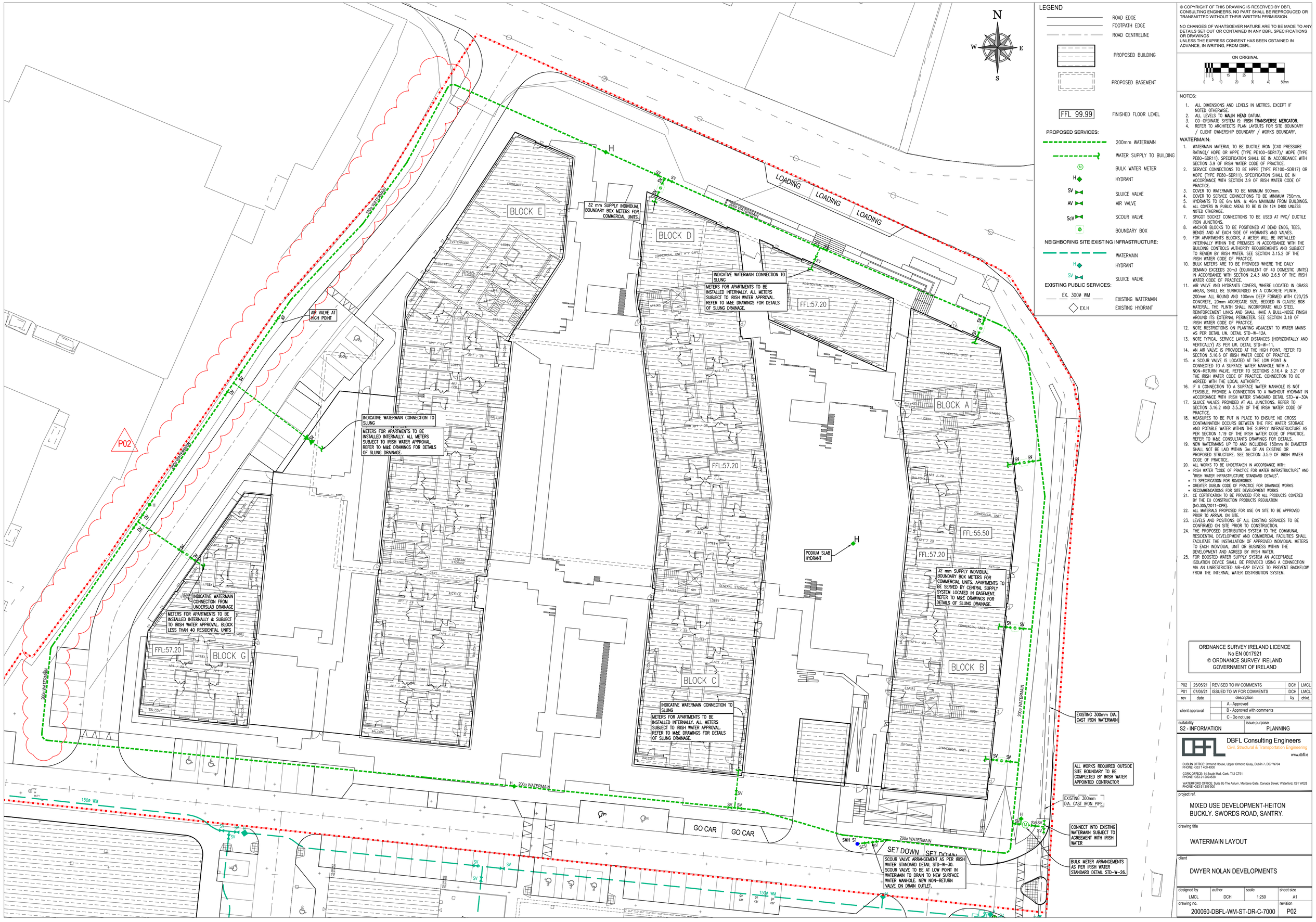
FOUL WATER LONGSECTION

client

DWYER NOLAN DEVELOPMENTS

designed by	author	scale	sheet size
LMCL	DCH	AS SHOWN	A1

drawing no. 200060-DBFL-FW-ST-DR-C-7001 | revision P01



ON ORIGINAL

0 5 10 15 20 25 30 40 50mm

NOTES:

1. ALL DIMENSIONS AND LEVELS IN METRES, EXCEPT IF NOTED OTHERWISE.
2. ALL LEVELS TO **MALIN HEAD** DATUM.
3. CO-ORDINATE SYSTEM IS: **IRISH TRANSVERSE MERCATOR.**
4. REFER TO ARCHITECTS PLAN LAYOUTS FOR SITE BOUNDARY / CLIENT OWNERSHIP BOUNDARY / WORKS BOUNDARY.

WATERMAIN:

1. WATERMAIN MATERIAL TO BE DUCTILE IRON (C40 PRESSURE RATING)/ HDPE OR HPPE (TYPE PE100-SDR17)/ MDPE (TYPE PE80-SDR11). SPECIFICATION SHALL BE IN ACCORDANCE WITH SECTION 3.9 OF IRISH WATER CODE OF PRACTICE.
2. SERVICE CONNECTIONS TO BE HPPE (TYPE PE100-SDR17) OR MDPE (TYPE PE80-SDR11). SPECIFICATION SHALL BE IN ACCORDANCE WITH SECTION 3.9 OF IRISH WATER CODE OF PRACTICE.
3. COVER TO WATERMAIN TO BE MINIMUM 900mm.
4. COVER TO SERVICE CONNECTIONS TO BE MINIMUM 750mm.
5. HYDRANTS TO BE 6m MIN. & 46m MAXIMUM FROM BUILDINGS.
6. ALL COVERS IN PUBLIC AREAS TO BE IS EN 124 D400 UNLESS NOTED OTHERWISE.
7. SPIGOT SOCKET CONNECTIONS TO BE USED AT PVC/ DUCTILE IRON JUNCTIONS.
8. ANCHOR BLOCKS TO BE POSITIONED AT DEAD ENDS, TEES, BENDS AND AT EACH SIDE OF HYDRANTS AND VALVES.
9. FOR APARTMENTS BLOCKS, A METER WILL BE INSTALLED INTERNALLY WITHIN THE PREMISES IN ACCORDANCE WITH THE BUILDING CONTROLS AUTHORITY REQUIREMENTS AND SUBJECT TO REVIEW BY IRISH WATER. SEE SECTION 3.15.2 OF THE IRISH WATER CODE OF PRACTICE.
10. BULK METERS ARE TO BE PROVIDED WHERE THE DAILY DEMAND EXCEEDS 20m3 (EQUIVALENT OF 40 DOMESTIC UNITS) IN ACCORDANCE WITH SECTION 2.4.3 AND 2.6.5 OF THE IRISH WATER CODE OF PRACTICE.
11. AIR VALVE AND HYDRANTS COVERS, WHERE LOCATED IN GRASS AREAS, SHALL BE SURROUNDED BY A CONCRETE PLINTH, 200mm ALL ROUND AND 100mm DEEP FORMED WITH C20/25 CONCRETE, 20mm AGGREGATE SIZE, BEDDED IN CLAUSE 808 MATERIAL. THE PLINTH SHALL INCORPORATE MILD STEEL REINFORCEMENT LINKS AND SHALL HAVE A BULL-NOSE FINISH AROUND ITS EXTERNAL PERIMETER. SEE SECTION 3.18 OF IRISH WATER CODE OF PRACTICE.
12. NOTE RESTRICTIONS ON PLANTING ADJACENT TO WATER MAINS AS PER DETAIL I.W. DETAIL STD-W-12A.
13. NOTE TYPICAL SERVICE LAYOUT DISTANCES (HORIZONTALLY AND VERTICALLY) AS PER I.W. DETAIL STD-W-11.
14. AN AIR VALVE IS PROVIDED AT THE HIGH POINT. REFER TO SECTION 3.16.6 OF IRISH WATER CODE OF PRACTICE.
15. A SCOUR VALVE IS LOCATED AT THE LOW POINT & CONNECTED TO A SURFACE WATER MANHOLE WITH A NON-RETURN VALVE. REFER TO SECTIONS 3.16.4 & 3.21 OF THE IRISH WATER CODE OF PRACTICE. CONNECTION TO BE AGREED WITH THE LOCAL AUTHORITY.
16. IF A CONNECTION TO A SURFACE WATER MANHOLE IS NOT FEASIBLE, PROVIDE A CONNECTION TO A WASHOUT HYDRANT IN ACCORDANCE WITH IRISH WATER STANDARD DETAIL STD-W-30A
17. SLUICE VALVES PROVIDED AT ALL JUNCTIONS. REFER TO SECTION 3.16.2 AND 3.5.39 OF THE IRISH WATER CODE OF PRACTICE.
18. MEASURES TO BE PUT IN PLACE TO ENSURE NO CROSS CONTAMINATION OCCURS BETWEEN THE FIRE WATER STORAGE AND POTABLE WATER WITHIN THE SUPPLY INFRASTRUCTURE AS PER SECTION 1.19 OF THE IRISH WATER CODE OF PRACTICE. REFER TO M&E CONSULTANTS DRAWINGS FOR DETAILS.
19. NEW WATERMAINS UP TO AND INCLUDING 150mm IN DIAMETER SHALL NOT BE LAID WITHIN 3m OF AN EXISTING OR PROPOSED STRUCTURE. SEE SECTION 3.5.9 OF IRISH WATER CODE OF PRACTICE.
20. ALL WORKS TO BE UNDERTAKEN IN ACCORDANCE WITH:
    - IRISH WATER "CODE OF PRACTICE FOR WATER INFRASTRUCTURE" AND "IRISH WATER INFRASTRUCTURE STANDARD DETAILS".
    - TII SPECIFICATION FOR ROADWORKS
    - GREATER DUBLIN CODE OF PRACTICE FOR DRAINAGE WORKS
    - RECOMMENDATIONS FOR SITE DEVELOPMENT WORKS
21. CE CERTIFICATION TO BE PROVIDED FOR ALL PRODUCTS COVERED BY THE EU CONSTRUCTION PRODUCTS REGULATION (NO.305/2011-CPR).
22. ALL MATERIALS PROPOSED FOR USE ON SITE TO BE APPROVED PRIOR TO ARRIVAL ON SITE.
23. LEVELS AND POSITIONS OF ALL EXISTING SERVICES TO BE CONFIRMED ON SITE PRIOR TO CONSTRUCTION.
24. THE PROPOSED DISTRIBUTION SYSTEM TO THE COMMUNAL RESIDENTIAL DEVELOPMENT AND COMMERCIAL FACILITIES SHALL FACILITATE THE INSTALLATION OF APPROVED INDIVIDUAL METERS TO EACH INDIVIDUAL UNIT OR BUSINESS WITHIN THE DEVELOPMENT AND AGREED BY IRISH WATER.
25. FOR BOOSTED WATER SUPPLY SYSTEM AN ACCEPTABLE ISOLATION DEVICE SHALL BE PROVIDED USING A CONNECTION VIA AN UNRESTRICTED AIR-GAP DEVICE TO PREVENT BACKFLOW FROM THE INTERNAL WATER DISTRIBUTION SYSTEM.

rev	date	description	by	chkd.
P02	25/05/21	REVISED TO IW COMMENTS	DCH	LMCL
P01	07/05/21	ISSUED TO IW FOR COMMENTS	DCH	LMCL

client approval
- A - Approved
- B - Approved with comments
- C - Do not use

suitability: S2 - INFORMATION
issue purpose: PLANNING

DBFL Consulting Engineers
Civil, Structural & Transportation Engineering
www.dbfl.ie

DUBLIN OFFICE: Ormond House, Upper Ormond Quay, Dublin 7, D07 W704
PHONE +353 1 400 4000

CORK OFFICE: 14 South Mall, Cork, T12 CT91
PHONE +353 21 2024538

WATERFORD OFFICE: Suite 8b The Atrium, Maritana Gate, Canada Street, Waterford, X91 W028
PHONE +353 51 309 500

project ref.
MIXED USE DEVELOPMENT-HEITON BUCKLY. SWORDS ROAD, SANTRY.

drawing title
WATERMAIN LAYOUT

client
DWYER NOLAN DEVELOPMENTS

designed by	author	scale	sheet size
LMCL	DCH	1:250	A1

drawing no.: 200060-DBFL-WM-ST-DR-C-7000
revision: P02