Mixed Use Development (LRD), Santry Avenue, Dublin

Engineering Services Report

230146-X-Z-X-XXX-RP-DBFL-CE-0001

INFRASTRUCTURE

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DBFL CONSULTING ENGINEERS

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1 Introduction

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.

Dwyer Nolan Developments Ltd. wishes to apply for permission for a Large-Scale Residential Development (LRD) on this site, 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 west by Santry Avenue Industrial Estate, and to the south by the permitted Santry Place development (granted under Dublin City Council Ref.s. 2713/17 (as extended under Ref. 2713/17/X1), 2737/19 & 4549/22).

The proposed development provides for 321 no. apartments, comprised of 104 no. 1 bed, 198 no. 2 bed, & 19 no. 3 bed dwellings, in 4 no. seven to thirteen storey buildings, over basement level, with 3 no. retail units, a medical suite / GP Practice unit and community/arts & culture space (total c.1,460sq.m), all located at ground floor level, as well as a one storey residential amenity unit, facing onto Santry Avenue, located between Blocks A & D.

The proposed development consists of the following:

Demolition of the existing building on site i.e. the existing Chadwicks Builders Merchants (c. 4,196.8m^2).

Construction of 321 no. 1, 2, & 3 bed apartments, retail units, medical suite / GP Practice, community/arts & culture space, and a one storey residential amenity unit in 4 no. buildings that are subdivided into Blocks A-G as follows:

Block A is a 7-13 storey block consisting of 51 no. apartments comprised of 22 no. 1 bed, 23 no. 2 beds & 6 no. 3 bed dwellings, with 2 no. retail units located on the ground floor (c. 132sq.m & c.172sq.m respectively). Adjoining same is Block B, which is a 7 storey block consisting of 38 no. apartments comprised of 6 no. 1 bed, 26 no. 2 bed, & 6 no. 3 bed dwellings, with 1 no. retail unit (c.164sq.m) and 1 no. medical suite / GP Practice unit located on the ground floor (c. 130sq.m). Refuse storage areas are also provided for at ground floor level.

Block C is a 7 storey block consisting of 53 no. apartments comprised of 14 no. 1 bed & 39 no. 2 bed dwellings. Adjoining same is Block D which is an 8 storey block consisting of 44 no. apartments comprised of 22 no. 1 bed, 15 no. 2 bed, & 7 no. 3 bed dwellings. Ground floor, community/arts & culture space (c. 583sq.m) is proposed in Blocks C & D, with refuse storage area also provided for at ground floor level.

Block E is an 8 storey block consisting of 49 no. apartments comprised of 7 no. 1 bed & 42 no. 2 bed dwellings. A refuse storage area, substation, & switchroom are also provided for at ground floor level. Adjoining same is Block F which is a 7 storey block consisting of 52 no. apartments comprised of 13 no. 1 bed & 39 no. 2 bed dwellings. Ground floor, community/arts & culture space (c.877sq.m) is proposed in Blocks E & F. A refuse storage area, bicycle storage area, substation, & switchroom are also provided for at ground floor level of Blocks E & F.

Block G is a 7 storey block consisting of 34 no. apartments comprised of 20 no. 1 bed & 14 no. 2 bed dwellings. A refuse storage area & bicycle storage area are also provided for at ground floor level.

Construction of a 1 storey residential amenity unit (c. 166.1sq.m) located between Blocks A & D.

Construction of basement level car park (c.5,470.8sq.m), accommodating 161 no. car parking spaces, 10 no. motorbike parking spaces & 672 no. bicycle parking spaces. Internal access to the basement level is provided from the cores of Blocks A, B, C, D, E, & F. External vehicular access to the basement level is from the south, between Blocks B & C. 33 no. car parking spaces & 58 no. bicycle parking spaces are also provided for within the site at surface level.

Public open space of c. 1,791sq.m is provided for between Blocks C-D & E-F. Communal open space is also proposed, located between (i) Blocks E-F & G, (ii) Blocks A-B & C-D, and (iii) in the form of roof gardens located on Blocks A, C, & F and the proposed residential amenity use unit, totalling c.2,986sq.m. The development includes for 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.

Vehicular access to the development will be via 2 no. existing / permitted access points: (i) on Santry Avenue in the north-west of the site (ii) off Swords Road in the south-east of the site, as permitted under the adjoining Santry Place development (Ref. 2713/17).

The development includes 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 etc.

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.

Note, no diversion works of existing Irish Water infrastructure are required to facilitate this proposed development.

A pre-connection enquiry and statement of design acceptance has been submitted to Irish Water under the CDS23007437, the confirmation of feasibility has been received. We await response of the statement of design acceptance letter, this will be forwarded through once received. Please refer to Appendix I for further information.

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 outfall 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 CDS23007437 and confirmation of feasibility letter received. The Applicant will enter into conversation with Irish Water to progress required works following receipt of Planning Approval.

The Developer will enter into a Connection Agreement with Irish Water, post planning, to facilitate the proposed foul connection and any upgrade works that may be required.

Foul sewage in apartment blocks located over the basement will be drained on separate systems via 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 (kDU)	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 8.13 l/s, however using the EN752 method in MICRODRAINAGE the peak flow is 17.1 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 230146-X-92-X-DTM-DR-DBFL-CE-1101_FoulSewerLayout 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 was constructed 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 'Kingspan' 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 discharge rates from the proposed surface water drainage network will be

controlled by a vortex flow control device (hydrobrake or equivalent) and associated attenuation system (Pluvial Cube or equivalent) and Blue/ Green Roofs on apartment roofs and podium.

It should be noted the majority of the apartment roof and podium areas are incorporated Blue and Green Roof systems, accounting for a significant portion of the onsite SUDS strategy as well as the first part of the treatment train for the managing of onsite surface water.

Green Roof systems will capture surface water runoff from apartment roofs prior to being routed to the piped surface water drainage network. This strategy also provides biodiversity benefits.

The drainage reservoir / drainage board within the proposed Blue Roof systems will be used to capture surface water runoff at source from the podium areas, roof-top terraces and roof areas where plant and PV panels are located, prior to being routed to the piped surface water drainage network.

The extent of the of the proposed Green/ Blue Roof systems are shown on DBFL Drawing 230146-X-91-X-DTM-DR-DBFL-CE-1001.

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 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, blue 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, greenroofs, blueroofs 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'.

The sites surface water management infrastructure has been designed in accordance with DCC's Development Plan 2022-2028 Appendix 11 (Blue/ Green Roof Guide) Appendix 12 (SUDS Design & Evaluation Guide) and Appendix 13 (Surface Water Management Guide).

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

- **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.

- **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.
- **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 proposed 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).
- **Green roof system:** 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. The soil build-up will partially absorb some of the initial run-off and once saturated will reduce flow rates through the green roof medium to the outlets and final attenuation storage location.
- **Blue Roofs:** Blue Roofs are designed to hold rainwater at podium level and to release rainwater at a controlled rate via a flow control device. Green Blue roofs that provide attenuation storage are a preference of Dublin City Council as set out in DCC's Green and Blue Roof Design Guide. Blue Roofs for the proposed development are to be of the extensive type and are to be a minimum of 150mm. All necessary safety requirements will be incorporated into the design and construction to ensure safe maintenance can occur. The green roof will provide interception and reduction of flow rates at the beginning of the treatment train. After surface water has passed through the Green Roof medium, it will be stored in Blue Roof storage and discharged via a flow control as per specialist design then conveyed to the proposed attenuation tank before being discharged to the existing drainage infrastructure. Soft landscaped podium/roof areas will have typical soil depths of up to 300mm to facilitate grassed areas, plants, shrubs and trees i.e similar to a deep intensive green roof build up.

Paved areas over podium/ roof will have a free draining material within the build-up and associated drainage board which will reduce the flow rate from these areas slowing run-off at source.

The incorporation of the Blue/ Green systems as noted above aligns with DCC'S Development Plan 2022-2028 Appendix 11 (Blue/ Grenn Roof Guide), Section 2.2, as summarized below.

- Total Roof Area = 4934m^2
  - Blueroof Area = 1775m^2
  - Greenroof Area = 2,098m^2
- Total Green/Blueroof area provide at roof level is 78% (this is greater than DCC's minimum coverage of 70%)
- Additionally, the total area of podium level suitable for the Blueroof system is 2338m^2.

Refer to Appendix G for the breakdown of each of the individual Green/ Blueroofs and the Podium level Blueroofs.

Refer to Drawing 230146-X-91-X-DTM-DR-DBFL-CE-1001_SurfaceWaterLayout.

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 6 hour 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 pits to a maximum depth of 3.1mbgl;

- 3no. cable percussion boreholes to a maximum depth of 10mbgl;
- 1no. rotary core boreholes to a maximum of 9.7mbgl;

From the observed boreholes and trial pits, the surfacing is reinforced concrete up to 0.3mbgl. Granular fill was encountered beneath the concrete to a depth of 0.4-1.0mbgl. 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 depth between 0.7-3.4mbgl. Deposits described as low permeability stiff sandy gravelly Clay were encountered beneath the Made Ground up to depths of 10mbgl.

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 QBARrural 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 QBARrural, this discharge rate (QBARgrowth) 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 QBARrural 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= 1.47 Ha (approx.)

SAAR = 770mm

SOIL Value= 0.40 (for soil type 3 from Table 6.7 from the GDSD)

Therefore, the permissible site discharge for the development ($QBAR_{rural}$) is 5.6 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 reduces 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:

Roads and Footpaths - Type 1 (Draining to traditional gullies) = 0.80

Roofs –Type 1 (Draining to traditional gullies) = 1.0

Permeable Paving = 0.50

Hardstanding = 0.80

Landscaping = 0.37

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 and attenuation provided at roof level in Blue/Green Roof systems and at ground level on podium areas deemed suitable for Blueroof systems designed by ABG Geosynthetics , 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 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
M560	=	16.00 mm

The volume of attenuation required within the site is 360 m^3.

The volume of attenuation provided within the site is 375 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.

As outlined above a portion of the sites overall attenuation is provided by the Blue/ Green Roof system as designed by ABG Geosynthetics. Please refer to the table below for breakdown off each Blue/Green Roof system.

Catchment					
Roof area	Roof type	Area (m^2)	Volume provided (m^3)	System	Discharge (L/Sec)
Podium 1	Blue Podium	734	71.1	E108	0.62
Podium 2	Blue Podium	1369	132.7	E108	1.14
Block A	Blue Roof	299	29	E108	0.36
Block B	Green Roof	249	28.3	EP72	0.25
Block B	Blue Roof	299	29	E108	0.36
Block C	Green Roof	688	78.4	EP72	0.56
Block D	Blue Roof	330	32	E108	0.36
Block E	Blue Roof	365	35.4	E108	0.37
Block F	Green Roof	766	87.3	EP72	0.57
Block G	Blue Roof	341	33	E108	0.37

Table 1.1 – Area breakdown by ABG Systems

Please refer to Appendix D for attenuation calculations and Appendix G for Blue/ Green roof calculations provided by ABG Geosynthetics.

Finished floor levels have been designed to be 400mm above the top of water level within the attenuation.

Please refer to Drawing 230146-X-91-X-DTM-DR-DBFL-CE-1301_SurfaceWaterLayout 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 16.7 m^3.

An interception volume of 74.0 m^3 will be provided.

See Appendix E for Interception Volume calculations.

Refer to Appendix G for SuDS calculations

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 (Blue/Green Roofs).

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 50.1 m^3.

A treatment volume of 148.3 m^3 will be provided.

Refer to Appendix F for Treatment Volume calculations.

Refer to Appendix G for SuDS calculations.

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 230146-X-91-X-DTM-DR-DBFL-CE-1101_SurfaceWaterLayout. 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	5 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 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 230146-X-91-X-DTM-DR-DBFL-CE-1101_SurfaceWaterLayout for Surface Water Layout.

3.3.9 Green Roofs and Blue Roofs

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.

The total roof area of the proposed development amounts to 4,934m^2. Blue and Green roofs have designed to cover as much roof space as is reasonable. This have resulted in a total Green/ Blue roof coverage of 3,873m^2. This equates to approximately a 78% of the roof are covered with this SUDs feature. Additionally, each area of podium that has been deemed suitable for blue roof design has been incorporated also. This has resulted in a podium blue roof design that equates to another 2,338m^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 and statement of design acceptance has been submitted to Irish Water under the CDS23007437, the confirmation of feasibility has been received, as has the statement of design acceptance letter. Please refer to Appendix I for further information.

Note no diversion works of existing Irish Water infrastructure are required to facilitate this proposed development.

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, meters and new fire hydrants will be provided throughout the site in accordance with Irish Water Code of Practice and Standard Details.

The estimated peak demand from the development will be 10.01l/s with the average daily demand being 864.9 m3/day.

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.

Refer to Appendix H for water demand calculations.

Please see drawing 230146-X-93-X-DTM-DR-DBFL-CE-1301_WatermainLayout 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.

Proposed 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.

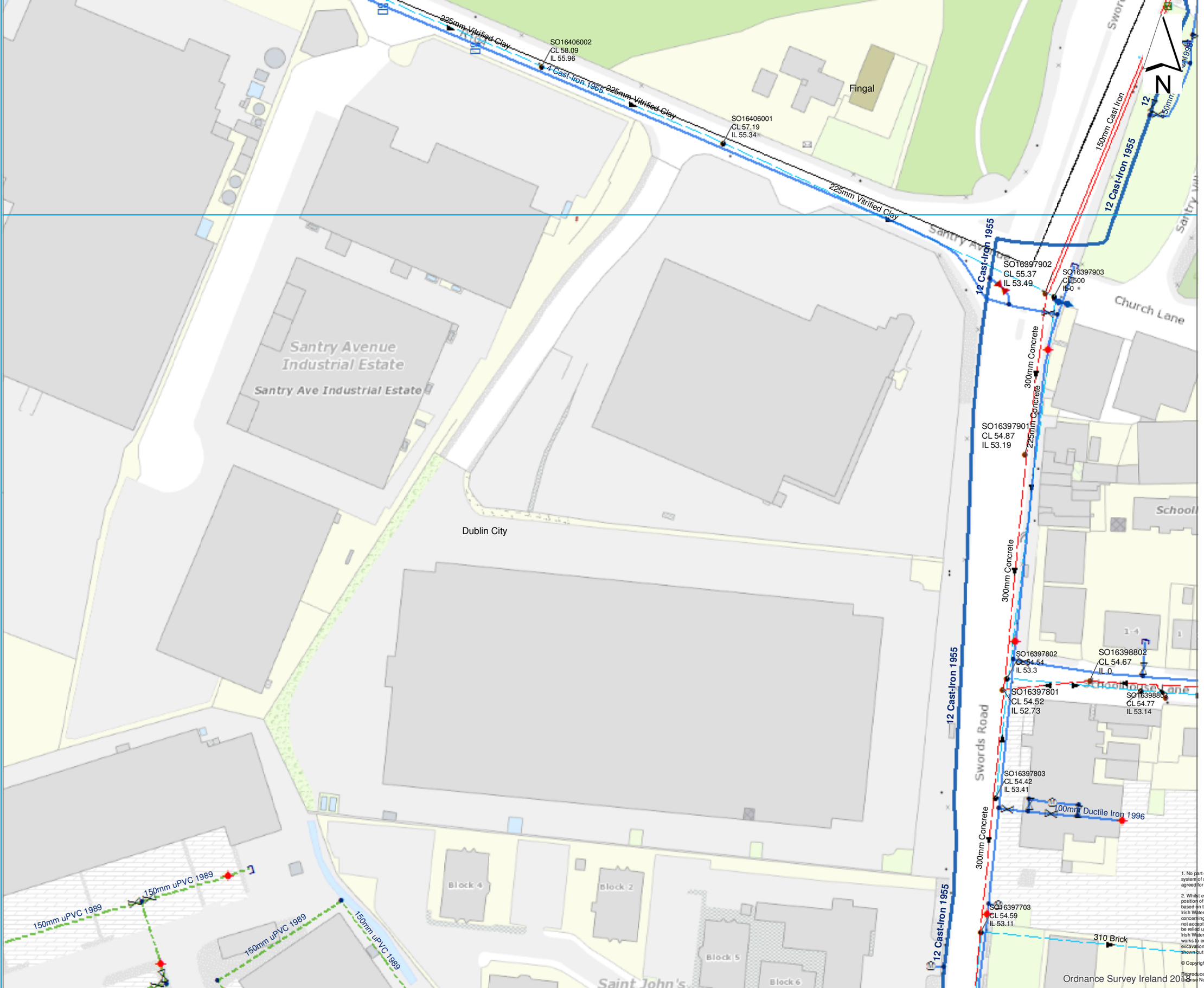
For further information regarding the road layout and design refer to the report under a separate heading - Traffic and Transport Assessment, prepared by DBFL Consulting Engineers.

Refer to Dwg. No. 230146-X-04-X-DTM-DR-DBFL-CE-1301_RoadLayout for the Proposed Road Layout.

DBFL CONSULTING ENGINEERS

February 2024

Appendix A : Existing Irish Water Service 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

CDS Viewer Web Map

UISCE ÉIREANN : IRISH WATER

Print Date: 29/08/2023

Printed by:ArcGIS Web AppBuilder

Water Distribution Network
- Water Treatment Plant
- Water Pump Station
- Storage Cell/Tower
- Dosing Point
- Meter Station
- Abstraction Point
- Telemetry Kiosk

Reservoir
- Potable
- Raw Water

Water Distribution Mains
- Irish Water
- Private

Trunk Water Mains
- Irish Water
- Private

Water Lateral Lines
- Irish Water
- Non IW
- Water Casings
- Water Abandoned Lines
- Boundary Meter
- Bulk/Check Meter
- Group Scheme
- Source Meter
- Waste Meter
- Unknown Meter ; Other Meter
- Non-Return
- PRV
- PSV
- Sluice Line Valve Open/Closed
- Butterfly Line Valve Open/Closed
- Sluice Boundary Valve Open/Closed
- Butterfly Boundary Valve Open/Closed
- Scour Valves
- Single Air Control Valve
- Double Air Control Valve
- Water Stop Valves
- Water Service Connections
- Water Distribution Chambers
- Water Network Junctions
- Pressure Monitoring Point
- Fire Hydrant
- Fire Hydrant/Washout

Water Fittings
- Cap
- Reducer
- Tap
- Other Fittings

Sewer Foul Combined Network
- Waste Water Treatment Plant
- Waste Water Pump station

Sewer Mains Irish Water
- Gravity - Combined
- Gravity - Foul
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Overflow

Sewer Mains Private
- Gravity - Combined
- Gravity - Foul
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Overflow
- Sewer Lateral Lines
- Sewer Casings

Sewer Manholes
- Standard
- Backdrop
- Cascade
- Catchpit
- Bifurcation
- Hatchbox
- Lamphole
- Hydrobrake
- Other; Unknown

Discharge Type
- Outfall
- Overflow
- Soakaway
- Standard Outlet
- Other; Unknown

Cleanout Type
- Rodding Eye
- Flushing Structure
- Other; Unknown

Sewer Inlets
- Catchpit
- Gully
- Standard
- Other; Unknown

Sewer Fittings
- Vent/Col
- Other; Unknown

Storm Water Network

Surface Water Mains
- Surface Gravity Mains
- Surface Gravity Mains Private
- Surface Water Pressurised Mains
- Surface Water Pressurised Mains Private

Inlet Type
- Gully
- Standard
- Other; Unknown

Storm Manholes
- Standard
- Backdrop
- Cascade
- Catchpit
- Bifurcation
- Hatchbox
- Lamphole
- Hydrobrake
- Other; Unknown
- Storm Culverts
- Storm Clean Outs
- Stormwater Chambers

Discharge Type
- Outfall
- Overflow
- Soakaway
- Other; Unknown

Gas Networks Ireland
- Transmission High Pressure Gasline
- Distribution Medium Pressure Gasline
- Distribution Low Pressure Gasline

ESB Networks

ESB HV Lines
- HV Underground
- HV Overhead
- HV Abandoned

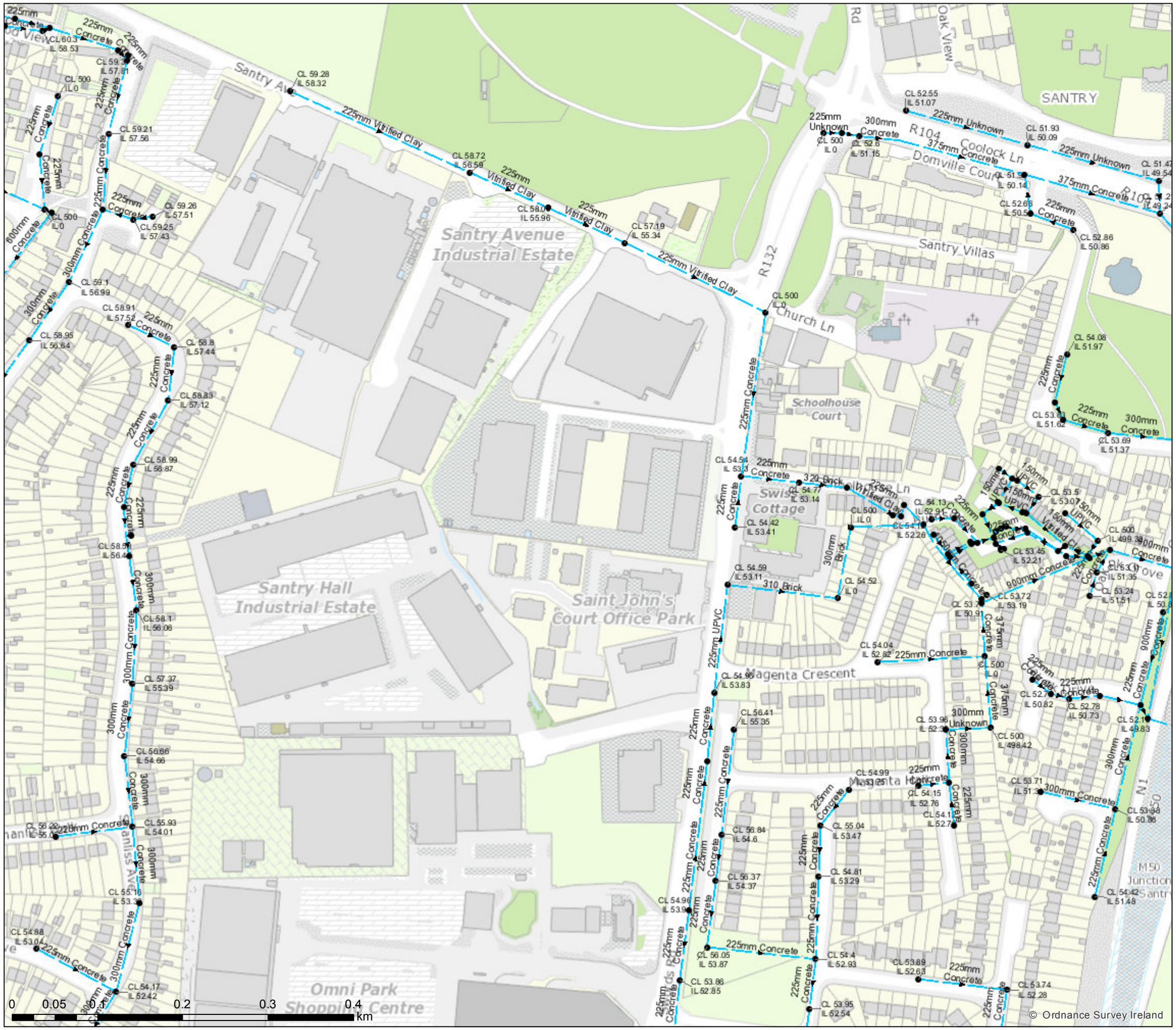
ESB MVLV Lines
- MV Overhead Three Phase
- MV Overhead Single Phase
- LV Overhead Three Phase
- LV Overhead Single Phase
- MVLV Underground
- Abandoned

Non Service Categories
- Proposed
- Under Construction
- Out of Service
- Decommissioned

Water Non Service Assets
- Water Point Feature
- Water Pipe
- Water Structure

Waste Non Service Assets
- Waste Point Feature
- Sewer
- Waste Structure

CDS Viewer Web Map



UISCE ÉIREANN : IRISH WATER

Print Date: 29/08/2023

Printed by:ArcGIS Web AppBuilder

Water Distribution Network
- Water Treatment Plant
- Water Pump Station
- Storage Cell/Tower
- Dosing Point
- Meter Station
- Abstraction Point
- Telemetry Kiosk

Reservoir
- Potable
- Raw Water

Water Distribution Mains
- Irish Water
- Private

Trunk Water Mains
- Irish Water
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- Scour Valves
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- Water Stop Valves
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- Water Distribution Chambers
- Water Network Junctions
- Pressure Monitoring Point
- Fire Hydrant
- Fire Hydrant/Washout

Water Fittings
- Cap
- Reducer
- Tap
- Other Fittings

Sewer Foul Combined Network
- Waste Water Treatment Plant
- Waste Water Pump station

Sewer Mains Irish Water
- Gravity - Combined
- Gravity - Foul
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Overflow

Sewer Mains Private
- Gravity - Combined
- Gravity - Foul
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Overflow
- Sewer Lateral Lines
- Sewer Casings

Sewer Manholes
- Standard
- Backdrop
- Cascade
- Catchpit
- Bifurcation
- Hatchbox
- Lamphole
- Hydrobrake
- Other; Unknown

Discharge Type
- Outfall
- Overflow
- Soakaway
- Standard Outlet
- Other; Unknown

Cleanout Type
- Rodding Eye
- Flushing Structure
- Other; Unknown

Sewer Inlets
- Catchpit
- Gully
- Standard
- Other; Unknown

Sewer Fittings
- Vent/Col
- Other; Unknown

Storm Water Network

Surface Water Mains
- Surface Gravity Mains
- Surface Gravity Mains Private
- Surface Water Pressurised Mains
- Surface Water Pressurised Mains Private

Inlet Type
- Gully
- Standard
- Other; Unknown

Storm Manholes
- Standard
- Backdrop
- Cascade
- Catchpit
- Bifurcation
- Hatchbox
- Lamphole
- Hydrobrake
- Other; Unknown
- Storm Culverts
- Storm Clean Outs
- Stormwater Chambers

Discharge Type
- Outfall
- Overflow
- Soakaway
- Other; Unknown

Gas Networks Ireland
- Transmission High Pressure Gasline
- Distribution Medium Pressure Gasline
- Distribution Low Pressure Gasline

ESB Networks

ESB HV Lines
- HV Underground
- HV Overhead
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ESB MVLV Lines
- MV Overhead Three Phase
- MV Overhead Single Phase
- LV Overhead Three Phase
- LV Overhead Single Phase
- MVLV Underground
- Abandoned

Non Service Categories
- Proposed
- Under Construction
- Out of Service
- Decommissioned

Water Non Service Assets
- Water Point Feature
- Water Pipe
- Water Structure

Waste Non Service Assets
- Waste Point Feature
- Sewer
- Waste Structure

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	23.710	0.160	148.2	0.000	200.0	0.0	0.600	o	225	Pipe/Conduit	
F1.001	19.620	0.100	196.2	0.000	30.0	0.0	0.600	o	225	Pipe/Conduit	
F1.002	52.506	0.270	194.5	0.000	25.0	0.0	0.600	o	225	Pipe/Conduit	
F1.003	49.616	0.250	198.5	0.000	32.0	0.0	0.600	o	225	Pipe/Conduit	
F1.004	19.588	0.100	195.9	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	185.0	0.0	0.600	o	225	Pipe/Conduit	
F1.007	23.165	0.116	200.0	0.000	0.0	0.0	0.600	o	225	Pipe/Conduit	
F4.000	27.083	0.230	117.8	0.000	60.0	0.0	0.600	o	225	Pipe/Conduit	
F1.008	42.856	0.230	186.3	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	200.0	0.7	65	0.82	1.07	42.6	7.8
F1.001	55.910	0.000	0.0	230.0	0.8	73	0.75	0.93	37.0	8.3
F1.002	55.810	0.000	0.0	255.0	0.8	74	0.77	0.93	37.1	8.8
F1.003	55.540	0.000	0.0	287.0	0.8	77	0.77	0.92	36.8	9.3
F1.004	55.290	0.000	0.0	317.0	0.9	79	0.79	0.93	37.0	9.8
F1.005	55.190	0.000	0.0	317.0	0.9	78	0.80	0.95	37.7	9.8
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	368.0	1.0	83	0.80	0.92	36.6	10.6
F3.000	56.030	0.000	0.0	185.0	0.7	58	0.92	1.28	50.8	7.5
F1.007	54.990	0.000	0.0	553.0	1.2	92	0.84	0.92	36.6	12.9
F4.000	56.020	0.000	0.0	60.0	0.4	45	0.75	1.20	47.9	4.3
F1.008	54.874	0.000	0.0	613.0	1.2	93	0.88	0.95	38.0	13.6

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
F5.000	2.842	0.020	142.1	0.000	220.0	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	25.093	0.460	54.6	0.000	0.0	0.0	0.600	o	225	Pipe/Conduit	
F6.000	18.617	0.160	116.4	0.000	50.0	0.0	0.600	o	225	Pipe/Conduit	
F6.001	54.221	0.320	169.4	0.000	80.0	0.0	0.600	o	225	Pipe/Conduit	
F1.011	12.604	0.070	180.1	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)
F5.000	55.430	0.000	0.0	220.0	0.7	66	0.84	1.09	43.5	8.2
F1.009	54.644	0.000	0.0	833.0	1.4	100	0.92	0.97	38.6	15.9
F1.010	54.250	0.000	0.0	833.0	1.4	72	1.44	1.77	70.6	15.9
F6.000	54.270	0.000	0.0	50.0	0.4	43	0.73	1.21	48.2	3.9
F6.001	54.110	0.000	0.0	130.0	0.6	60	0.73	1.00	39.8	6.3
F1.011	53.790	0.000	0.0	963.0	1.6	105	0.94	0.97	38.6	17.1

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	1.926	Open Manhole	1200	F1.008	54.874	225	F1.007	54.874	225	
								F4.000	55.790	225	916
F3.1	56.560	1.130	Open Manhole	1200	F5.000	55.430	225				
F3	56.490	1.846	Open Manhole	1200	F1.009	54.644	225	F1.008	54.644	225	
								F5.000	55.410	225	766
F2	55.970	1.720	Open Manhole	1200	F1.010	54.250	225	F1.009	54.564	225	314
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	740011.380	716622.578	740011.380	Required	
F11	716625.068	740034.959	716625.068	740034.959	Required	
F10	716607.100	740042.840	716607.100	740042.840	Required	
F9	716575.719	740000.743	716575.719	740000.743	Required	
F8	716545.609	739961.308	716545.609	739961.308	Required	
F7	716543.766	739941.807	716543.766	739941.807	Required	

Manhole Schedules for Foul - Unit

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
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	716607.922	739962.783	716607.922	739962.783	Required	
F4	716605.080	739935.849	716605.080	739935.849	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	716689.849	739997.009	716689.849	739997.009	Required	
F1.1	716692.070	739978.525	716692.070	739978.525	Required	
F1	716686.441	739924.597	716686.441	739924.597	Required	
FF1-F2	716685.385	739912.037			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	54.874	1.701	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	54.644	1.621	Open Manhole	1200
F1.010	o	225	F2	55.970	54.250	1.495	Open Manhole	1200
F6.000	o	225	F1.2	55.400	54.270	0.905	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	23.710	148.2	F11	57.150	55.910	1.015	Open Manhole	1200
F1.001	19.620	196.2	F10	57.100	55.810	1.065	Open Manhole	1200
F1.002	52.506	194.5	F9	57.290	55.540	1.525	Open Manhole	1200
F1.003	49.616	198.5	F8	57.140	55.290	1.625	Open Manhole	1200
F1.004	19.588	195.9	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	23.165	200.0	F4	56.800	54.874	1.701	Open Manhole	1200
F4.000	27.083	117.8	F4	56.800	55.790	0.785	Open Manhole	1200
F1.008	42.856	186.3	F3	56.490	54.644	1.621	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	54.564	1.181	Open Manhole	1200
F1.010	25.093	54.6	F1	54.950	53.790	0.935	Open Manhole	1200
F6.000	18.617	116.4	F1.1	55.430	54.110	1.095	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)
F6.001	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)
F6.001	54.221	169.4	F1	54.950	53.790	0.935	Open Manhole	1200
F1.011	12.604	180.1	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

TITLE		Job Reference	
Santry Place Mixed Use Development, Santry, Dublin 9		230146	
SUBJECT		**Calc. Sheet No.**	
Post-Development Wastewater Hydraulic Load - Irish Water - Residential		4	
DRAWING NUMBER	**Calculations by**	**Checked by**	**Date**
230146-X-92-X-DTM-DR-DBFL-CE-1201	RSP	SVC	15.02.24

Foul Drainage

Housing Units	321	no.
Dry Weather Flow (DWF)[1]	150	litres/person/day
Average Occupancy Ratio[2]	2.7	person/unit
Total Site Occupancy (i.e. population)	867	person
Total Daily Wastewater Discharge + 10% Unit Consumption Allowance[3]	143,006	l/day
Peak Flow Factor[4]	4.5	

Post Development Average Discharge	**1.655**	l/s
Post Development Peak Discharge[5]	**7.448**	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		230146	
SUBJECT		**Calc. Sheet No.**	
Post-Development Wastewater Hydraulic Load - Irish Water - Retail		5	
DRAWING NUMBER	**Calculations by**	**Checked by**	**Date**
230146-X-92-X-DTM-DR-DBFL-CE-1201	RSP	SVC	15.02.24

Foul Drainage

Retail Outlets

Retail space	468	m^2
Staff[1]	31	no.
Dry Weather Flow (DWF)[2]	50	litres/person/day
Total Daily Wastewater Discharge + 10% Unit Consumption Allowance[3]	1,716	l/day
Peak Flow Factor[4]	6	
Post Development Average Discharge	**0.020**	l/s
Post Development Peak Discharge[5]	**0.119**	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".

TITLE		Job Reference	
Santry Place Mixed Use Development, Santry, Dublin 9		230146	
SUBJECT		**Calc. Sheet No.**	
Post-Development Wastewater Hydraulic Load - Irish Water		6	
DRAWING NUMBER	**Calculations by**	**Checked by**	**Date**
230146-X-92-X-DTM-DR-DBFL-CE-1201	RSP	SVC	15.02.24

Foul Drainage

Medical Suite	130	m^2
Staff[1]	13	no.
Dry Weather Flow (DWF)[2]	90	litres/person/day
Total Daily Wastewater Discharge + 10% Unit Consumption Allowance[3]	1,287	l/day
Peak Flow Factor[4]	6	
Pre Development Average Discharge	**0.015**	l/s
Pre Development Peak Discharge[5]	**0.089**	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 $90m^2$ for warehouse 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".

TITLE		Job Reference	
Santry Place Mixed Use Development, Santry, Dublin 9		230146	
SUBJECT		**Calc. Sheet No.**	
Post-Development Wastewater Hydraulic Load - Irish Water - Retail		5	
DRAWING NUMBER	**Calculations by**	**Checked by**	**Date**
230146-X-92-X-DTM-DR-DBFL-CE-1201	RSP	SVC	15.02.24

Foul Drainage

Community Area

Retail space	1489	m^2
Staff[1]	124	no.
Dry Weather Flow (DWF)[2]	50	litres/person/day
Total Daily Wastewater Discharge + 10% Unit Consumption Allowance[3]	6,825	l/day
Peak Flow Factor[4]	6	
Post Development Average Discharge	**0.079**	l/s
Post Development Peak Discharge[5]	**0.474**	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			230146
SUBJECT			**Calc. Sheet No.**
Surface Water Calculations - Permissible Site Discharge			1
Drawing ref.	**Calculations by**	**Checked by**	**Date**
230146-INFO1	RSP	LMCL	15.02.24

PERMISSIBLE SURFACE WATER DISCHARGE CALCULATIONS

Site Area

What is the net catchment area? **1.47** 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	1.47	Hectares (ha)
Drainage Group	2	Class
Depth to Impermeable Layers	2	Class
Permeability Group above Impermeable Layers	2	Class
Slope [6]	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? 1.47 Hectares (ha)

Catchment 1	Area (m^2)	Runoff Coeff.	Effective Area (m^2)
Roads Type 1 - (Draining to Gullies)	181	0.80	144.8
Roofs - Type 1 (Traditional)	1363	1.00	1363.0
Permeable Paving	1266	0.50	633.0
Hardstanding	2261	0.90	2034.9
Public Open Space - Non Contributary	3707	0.37	1371.6

*For Blueroof/ Greenroof + Podium areas see calculations produced by ABG

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

Effective Catchment Area **4175.7** m^2

Effective Catchment Runoff Coefficient **0.82**

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 5.6 Litres/sec

[7]Site Discharge = **5.6** 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.			230146
SUBJECT			**Calc. Sheet No.**
Surface Water Calculations - Soil Characteristics from FSR			4
Drawing ref.	**Calculations by**	**Checked by**	**Date**
230146-INFO1	LMCL	RSP	04-Oct-23

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)	5	PIMP (%)	82
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	0.074	4.00	0.6	0.150	o	300	Pipe/Conduit	
S1.001	43.112	0.220	196.0	0.065	0.00	0.3	0.150	o	300	Pipe/Conduit	
S1.002	54.762	0.270	202.8	0.048	0.00	0.3	0.150	o	300	Pipe/Conduit	
S1.003	23.414	0.120	195.1	0.085	0.00	0.3	0.150	o	300	Pipe/Conduit	
S2.000	11.461	0.270	42.4	0.025	4.00	0.0	0.150	o	225	Pipe/Conduit	
S1.004	60.713	0.300	202.4	0.000	0.00	0.0	0.150	o	300	Pipe/Conduit	
S3.000	57.493	0.290	198.3	0.042	4.00	0.3	0.150	o	300	Pipe/Conduit	
S1.005	24.621	0.080	307.8	0.063	0.00	0.5	0.150	o	300	Pipe/Conduit	
S4.000	14.796	0.070	211.4	0.011	4.00	1.7	0.150	o	225	Pipe/Conduit	
S5.000	13.167	0.100	131.7	0.000	4.00	0.6	0.150	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	60.88	4.79	55.600	0.074	0.6	0.0	0.0	1.46	103.5	12.8
S1.001	58.47	5.35	55.150	0.139	0.9	0.0	0.0	1.30	91.5	22.8
S1.002	55.69	6.06	54.930	0.186	1.2	0.0	0.0	1.27	89.9	29.3
S1.003	54.62	6.36	54.660	0.271	1.5	0.0	0.0	1.30	91.8	41.7
S2.000	64.35	4.08	55.520	0.025	0.0	0.0	0.0	2.37	94.1	4.4
S1.004	52.02	7.16	54.540	0.297	1.5	0.0	0.0	1.27	90.0	43.3
S3.000	61.09	4.74	54.530	0.042	0.3	0.0	0.0	1.29	91.0	7.2
S1.005	50.83	7.56	54.240	0.402	2.3	0.0	0.0	1.03	72.5	57.6
S4.000	63.54	4.24	54.230	0.011	1.7	0.0	0.0	1.04	41.3	3.5
S5.000	63.91	4.17	54.240	0.000	0.6	0.0	0.0	1.32	52.7	0.6

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	0.150	o	300	Pipe/Conduit	
S1.007	28.217	0.180	156.8	0.000	0.00	0.0	0.150	o	225	Pipe/Conduit	
S1.008	9.157	0.040	228.9	0.000	0.00	0.0	0.150	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	49.65	7.98	54.140	0.412	4.6	0.0	0.0	0.96	68.2	60.1
S1.007	62.79	4.39	54.070	0.000	5.6	0.0	0.0	1.21	48.1	5.6
S1.008	62.05	4.54	53.890	0.000	5.6	0.0	0.0	1.00	39.6	5.6

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	300				
S4	56.440	2.200	Open Manhole	1200	S1.005	54.240	300	S1.004	54.240	300	
								S3.000	54.240	300	
S3.1	57.200	2.970	Open Manhole	1200	S4.000	54.230	225				
S10	57.200	2.960	Open Manhole	1200	S5.000	54.240	225				
SATTN.	57.200	3.060	Open Manhole	1800	S1.006	54.140	300	S1.005	54.160	300	20
								S4.000	54.160	225	
								S5.000	54.140	225	
S3	56.330	2.260	Open Manhole	1200	S1.007	54.070	225	S1.006	54.070	300	
S2	56.300	2.410	Open Manhole	1200	S1.008	53.890	225	S1.007	53.890	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	
S3.1	716625.042	739964.547	716625.042	739964.547	Required	

Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S10	716611.247	739966.550	716611.247	739966.550	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	300	S4.1	55.850	54.530	1.020	Open Manhole	1200
S1.005	o	300	S4	56.440	54.240	1.900	Open Manhole	1200
S4.000	o	225	S3.1	57.200	54.230	2.745	Open Manhole	1200
S5.000	o	225	S10	57.200	54.240	2.735	Open Manhole	1200
S1.006	o	300	SATTN.	57.200	54.140	2.760	Open Manhole	1800
S1.007	o	225	S3	56.330	54.070	2.035	Open Manhole	1200
S1.008	o	225	S2	56.300	53.890	2.185	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	1200
S3.000	57.493	198.3	S4	56.440	54.240	1.900	Open Manhole	1200
S1.005	24.621	307.8	SATTN.	57.200	54.160	2.740	Open Manhole	1800
S4.000	14.796	211.4	SATTN.	57.200	54.160	2.815	Open Manhole	1800
S5.000	13.167	131.7	SATTN.	57.200	54.140	2.835	Open Manhole	1800
S1.006	24.239	346.3	S3	56.330	54.070	1.960	Open Manhole	1200
S1.007	28.217	156.8	S2	56.300	53.890	2.185	Open Manhole	1200
S1.008	9.157	228.9	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): 4.2

Unit Reference	MD-SHE-0104-5600-1500-5600
Design Head (m)	1.500
Design Flow (l/s)	5.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	104
Invert Level (m)	54.070
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)	1.500	5.6	Kick-Flo®	0.924	4.5
Flush-Flo™	0.453	5.6	Mean Flow over Head Range	-	4.9

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	3.5	0.800	5.1	2.000	6.4	4.000	8.9	7.000	11.6
0.200	5.0	1.000	4.6	2.200	6.7	4.500	9.4	7.500	12.0
0.300	5.4	1.200	5.0	2.400	7.0	5.000	9.9	8.000	12.3
0.400	5.6	1.400	5.4	2.600	7.2	5.500	10.3	8.500	12.7
0.500	5.6	1.600	5.8	3.000	7.7	6.000	10.8	9.000	13.0
0.600	5.5	1.800	6.1	3.500	8.3	6.500	11.2	9.500	13.4

Storage Structures for Storm

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

Invert Level (m) 54.140 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	375.0	0.0	0.900	375.0	0.0	1.800	0.0	0.0
0.100	375.0	0.0	1.000	375.0	0.0	1.900	0.0	0.0
0.200	375.0	0.0	1.001	0.0	0.0	2.000	0.0	0.0
0.300	375.0	0.0	1.200	0.0	0.0	2.100	0.0	0.0
0.400	375.0	0.0	1.300	0.0	0.0	2.200	0.0	0.0
0.500	375.0	0.0	1.400	0.0	0.0	2.300	0.0	0.0
0.600	375.0	0.0	1.500	0.0	0.0	2.400	0.0	0.0
0.700	375.0	0.0	1.501	0.0	0.0	2.500	0.0	0.0
0.800	375.0	0.0	1.700	0.0	0.0			

Appendix E : Surface Water Interception Calculations

PROJECT			JOB REF.
Proposed Mixed use Development at Swords Road, Santry, Dublin 9.			230146
SUBJECT			**Calc. Sheet No.**
Surface Water Calculations - Infiltration Volume			3
Drawing ref.	**Calculations by**	**Checked by**	**Date**
230146-INFO1	RSP	LMCL	15.02.24

SURFACE WATER CALCULATIONS

Site Area

Total Site Area =	1.47	Hectares (ha)

Interception Volume (Post-Development)

Impermeable Area =	0.42	Hectares (ha)
Rainfall Depth =	5	mm
[1]Interception Volume =	16.7	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.			230146
SUBJECT			**Calc. Sheet No.**
Surface Water Calculations - Treatment Volume			2
Drawing ref.	**Calculations by**	**Checked by**	**Date**
230146-INFO1	RSP	LMCL	15.02.24

SURFACE WATER CALCULATIONS

Site Area

Total Site Area =	1.47	Hectares (ha)

Treatment Volume (Post-Development)

Impermeable Area =	0.418	Hectares (ha)
Rainfall Depth =	15	mm
[1]Treatment Volume (Vt) =	50.1	m^3

Notes

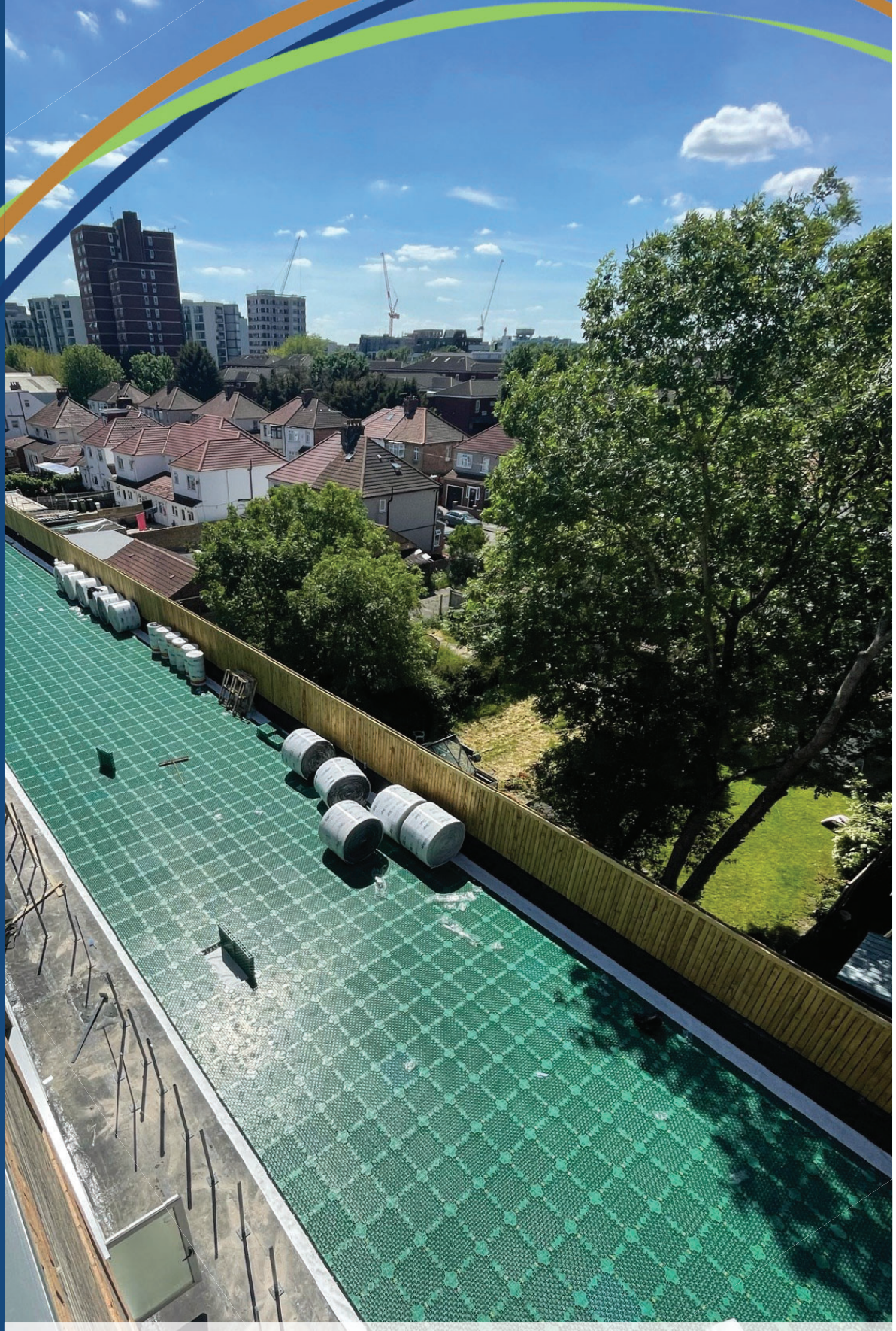
1. Treatment Volume Vt (m^3) = Impermeable Area (ha) x 15mm x 10 (GDSDS Section 6.3.1.2.1). For sites where a pond is applicable.

80% runoff from impermeable areas assumed.

Appendix G : SuDS Summary

ABG blueroof

DESIGN CALCULATION REPORT



Project name: Sandford Rd

Project ID: SandRanelagh

Calculated by: SH

Date: 21.04.23

abg creative geosynthetic engineering

Blue Roof Systems

Traditional rainwater drainage systems are designed to allow water to be discharged from the roof of a building as quickly as possible. However, as pressure on water management within new developments becomes more critical and waterproofing systems evolve and improve, this principle is increasingly being challenged.

Blue roofs are designed to temporarily attenuate rainwater during storm events and then gradually release the water at a controlled rate following the storm to help prevent localised flooding. Designed and implemented correctly, they can form an integral source control and attenuation element to satisfy Sustainable Drainage System (SuDS) requirements on modern developments.

Blue roofs are rated as one of the most sustainable techniques in CIRIA's SuDS hierarchy, based on their contribution to reducing the risk of flooding and pollution, and their positive impact on the local landscape & wildlife ecosystems when combined with a green roof finish.

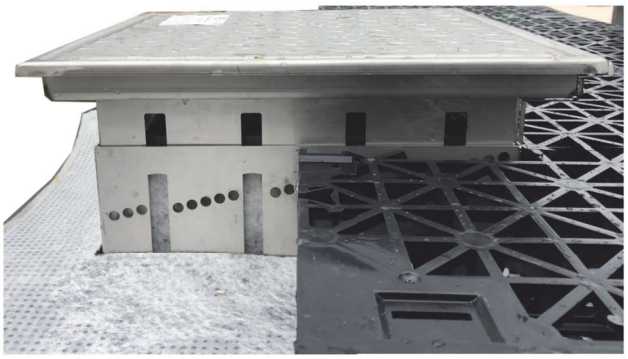
Legislation change, advancements in roofing and the need for sustainability in an evolving construction industry, means Blue Roofs are now becoming a first choice solution for new developments. Implementing effective SuDS

demands that water falling on a development is not simply channeled into stormwater drains and discharged into overburdened local sewer and river systems. **ABG blueroof** is designed to mimic the process found in nature whereby water is attenuated, treated and filtered at a controlled rate using the patented **ABG blueroof** Restrictor Chamber. With land at a premium, Blue Roofs also allow the developer to maximise usage of any site, especially in city centre developments where underground storage systems are expensive and unsustainable to construct.

Blue Roofs are not just limited to the roof areas, they are versatile and are used extensively on podium deck and amenity spaces. ABG's development in product design and expertise in geosynthetics means a multitude of surface finishes can be achieved and a wide range of traffic requests accommodated.

ABG blueroof

ABG blueroof provides temporary attenuation within the roof or podium deck construction of a development. Utilising space in this way means that the attenuation capacity required to meet SuDS best practice can be met.



ABG blueroof comprises an attenuation and drainage void within the roof structure and a patented stormwater management system designed to release the attenuated water at a controlled discharge rate as agreed in the planning phase.

- Storage capacity calculated to match storm duration
- Designed to match one in a hundred year storm events
- Additional allowance made for the effects of climate change
- **ABG blueroof** can be designed to operate across multiple roof areas or cascade from higher to lower roof areas
- Stored water is released at a controlled rate into the sewer system or used as grey water.

The system can be used to address different climactic environments. In the UK, the primary concern is to mitigate the impact of storms. Rainwater is stored for up to twenty four hours before being gradually released into the surface water management system.

In regions or countries with extremely low rainfall, the Blue Roof stores rainwater to be harvested for use in irrigation or grey water processes. In intermediate regions, the blue roof provides both stormwater attenuation and complements the supply of water for irrigation.

Under normal rainfall events, the roof will drain like a normal flat roof, and the patented stormwater management system only comes into effect during a storm event. The built in overflow provides a factor of safety in the event a storm occurs that exceeds that which it has been designed for.

About ABG

ABG is a market leader in the design, development, manufacture and technical support of high performance geosynthetic systems for use in a wide range of civil engineering, environmental and sustainable building projects.

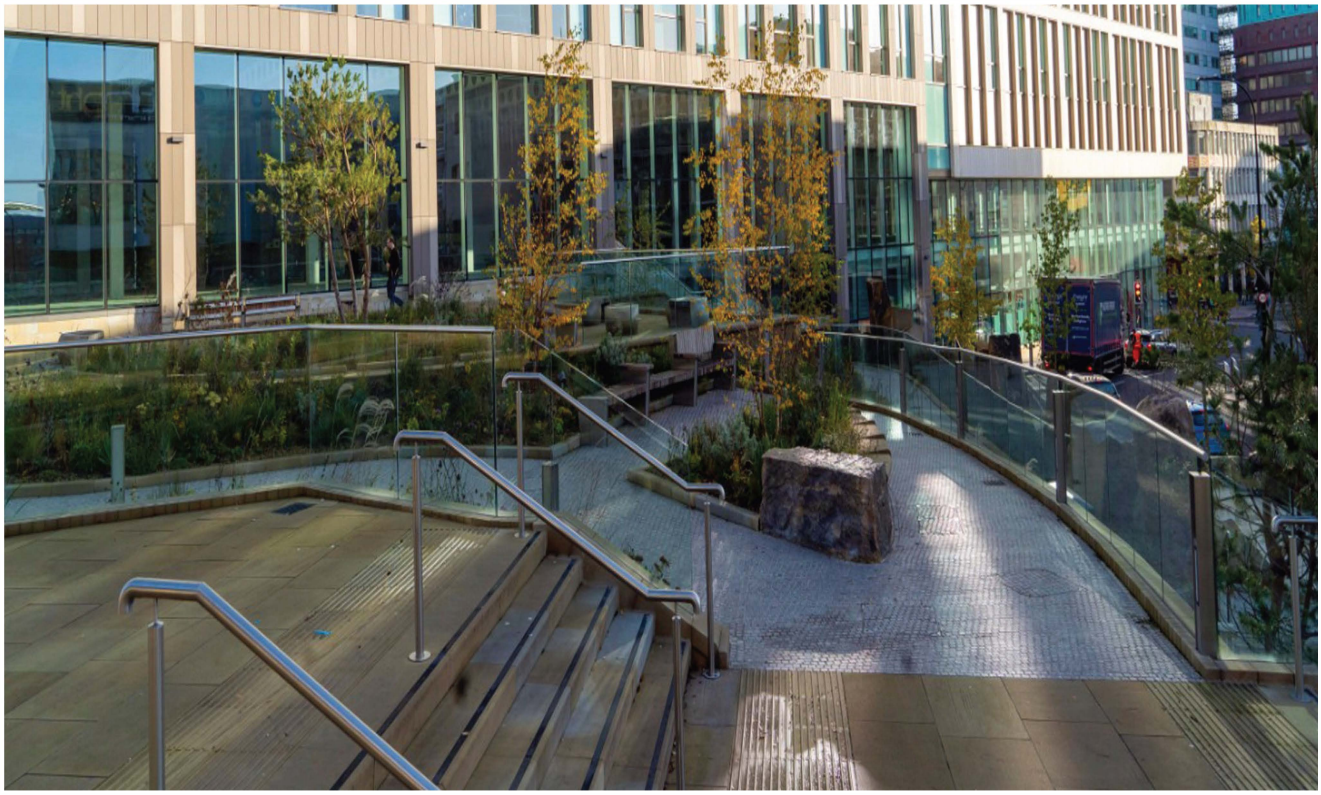
Formed in 1988, based in Meltham, in the heart of the Pennines, ABG have developed an excellent reputation for developing quality products and delivering outstanding service. The ability for rapid product development ensures that the most innovative, up to date and cost effective solution can be found for many engineering problems.

ABG's involvement in roof drainage extends to over thirty years and we have a complete range of products developed specifically for use in this technically demanding application.

ABG are one of the leading proponents of Blue Roof systems in the UK, with a patented design for **ABG blueroof** and over 15 years experience of installing the system.

Technical support is provided by our trained and experienced staff, many of whom are Chartered Civil Engineers. This extensive support extends to full design, design validation, feasibility studies, cost advice and advice on meeting regulatory requirements.

Part of this technical support includes developing and driving knowledge within our active markets, including working with both international and local regulatory bodies on developing guidance and best practice in the use of innovative geosynthetics to solve complex engineering issues.



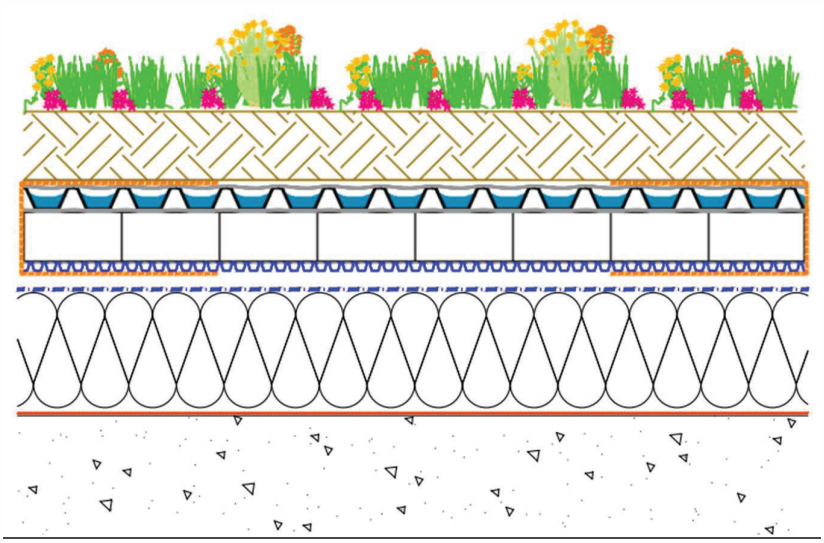
ABG blueroof System

ABG blueroof System Build Ups

System 1: ABG blueroof VF HD 72

Surface Finishes: Green Roof

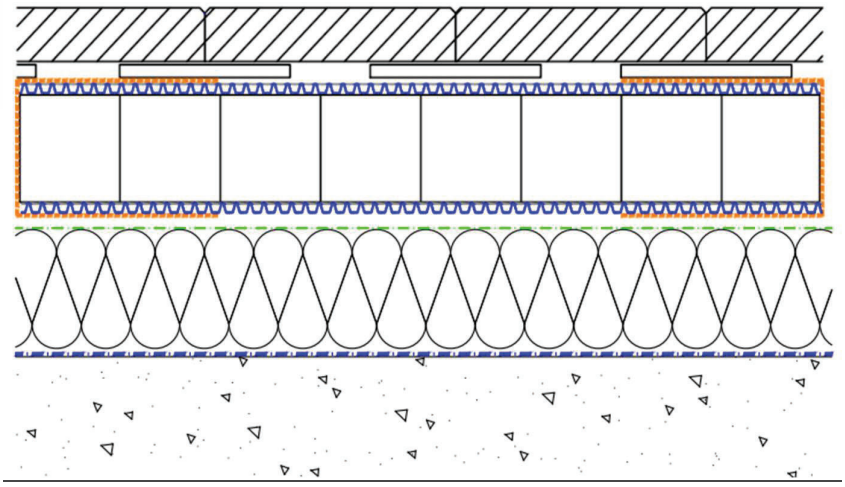
Roof Type: Warm



System 2: ABG blueroof VF HD 108

Surface Finishes: Hard & Soft Landscaping

Roof Type: Inverted



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1. DEFINITIONS

'Consultant' means ABG Geosynthetics Ltd and its legal successors. 'Client' means the person, firm, company or organisation for whom the Consultant is performing the Services. 'Agreement' means the contract referred to in Clause 2. 'Services' means the services to be performed by the Consultant in accordance with the proposal from the Consultant. 'Project' means the project or works for which the Client has commissioned the Services.

2. GENERAL

Unless and until a formal agreement is entered into, the Client's acceptance of the proposal for Services from the Consultant or a request for some or all the Services to be performed by the Consultant, shall constitute a binding
contract between the Client and the Consultant which contract will be subject to any terms and conditions contained or referred to in the aforementioned proposal and these terms and conditions. In the event of any conflict, the terms and conditions in the proposal shall prevail over these terms and conditions. The Agreement so formed shall supersede all previous understandings, commitments or agreements whether written or oral between the Client and the Consultant relating to the subject matter hereof. No person or entity shall have any rights in relation to this Agreement, whether as third parties or otherwise, save the parties to this Agreement. Should any term or condition of this Agreement be held to be unenforceable or invalid by the courts of any jurisdiction to which it is subject then such term or condition shall be disregarded and the remaining terms and conditions shall remain in full force and effect.

3. PERFORMANCE OF SERVICES AND SCOPE

The Consultant shall perform the Services using the degree of skill care and diligence to be expected from a consultant experienced in the provision of services of similar scope size and complexity. The Consultant shall use reasonable endeavours to complete the Services within the time or programme agreed but shall not be responsible for any delay beyond the reasonable control of the Consultant.

The fee contained in the proposal is for the scope of services as defined therein. If not already contained in the proposal the Consultant and the Client shall agree as an initial activity an integrated project services programme to
include the activities of all the parties to the Project relevant to the Services to be supplied by the Consultant. The
aforesaid programme shall show the key dates for final information and the delivery of such to the Consultant so as to enable the Consultant to carry out the services in an efficient once through manner to achieve the programme delivery dates for the Services.

The Consultant provides various services including Design and Product use advice which is distinct from a Design Service. The Design Service may or may not attract a fee.

Where the Consultant's services are of an advisory nature and dependent upon the degree of information and release thereof by the Client then the Client agrees that any reliance placed on the services by the Client shall take due account of such constraints.

4. CONFIDENTIALITY AND INTELLECTUAL PROPERTY RIGHTS

i. The Consultant and the Client shall keep confidential all information pertaining to the Services.

ii. Copyright for all reports, documents and the like produced by the Consultant in the performance of the Services
shall remain vested with the Consultant but the Consultant shall grant an irrevocable royalty free license to the Client to use such reports, documents and the like for any purpose in connection with the Project.

5. LIABILITY

i. The Consultant shall be liable to pay compensation to the Client arising out of or in connection with this
Agreement only if a breach of the duty of care in Clause 3 is established against the Consultant.

ii. Notwithstanding any other term to the contrary in this Agreement or any related document and whether the cause of action for any claim arises under or in connection with the Agreement in contract or in tort, in negligence or for breach of statutory duty or otherwise the Consultant shall have no liability to the Client in respect of any claim for loss or damage arising from acts of war or terrorism or arising from flooding, burst water mains or failed drainage or arising from any incidence of toxic mould or asbestos but otherwise in relation to any cause of action as aforesaid the total liability of the Consultant in the aggregate for all claims shall be limited to a sum equivalent to ten (10) times the fee payable under this Agreement or £50,000, whichever is the lesser, or such other sum as may be expressly stated in the Consultant's proposal, and further but without prejudice to the aforesaid limit of liability any such liability of the Consultant shall be limited to such sum or sums as it would be just and equitable for the Consultant to pay having regard to the Consultant's responsibility for the same and on the basis that all other parties appointed or to be appointed by the Client to perform related services in connection with the Project shall be deemed to have provided undertakings on terms no less onerous than this Agreement and shall be deemed to have paid to the Client such contribution as it would be just and equitable for them to pay having regard to their responsibility for any loss or damage and providing that it shall be deemed that such other parties have not limited or excluded their liability to the Client for such loss or damage in any way which may be prejudicial to the Consultant's liability under this clause. Nothing in this clause shall operate to exclude or limit the Consultant's liability for death or personal injury.

iii. The Client shall indemnify and keep indemnified the Consultant from and against all claims, demands,
proceedings, damages, costs and expenses arising out of or in connection with this Agreement or the Project
arising from acts of terrorism or arising otherwise in excess of the liability of the Consultant under this
Agreement or which may be made in respect of events occurring after the expiry of the period of liability stated
in this Agreement.

iv. No action or proceedings under or in connection with this Agreement shall be commenced against the Consultant after the expiry of one year from completion of the Services.

v. ABG Geosynthetics Ltd is not responsible for consequential, indirect or incidental losses.

6. INSURANCE

The Consultant shall arrange Professional Indemnity Insurance cover for the amount stated in Clause 5(ii). The Consultant will use all reasonable endeavours to maintain Professional Indemnity Insurance cover for the period stated in 5(iv) above, providing such insurance remains available to the Consultant at commercially reasonable rates.

7. CLIENT'S OBLIGATIONS

The Client shall supply, without charge and in such time so as not to delay or disrupt the performance of the Consultant in carrying out the Services, all necessary and relevant information, in his possession or available to him from his other agents or consultants and all necessary approvals or consents. Any deviation on any information from the proposal shall be confirmed in writing and any attendant consequential fees will be forwarded for approval by the Client before any changes are made. The Consultant shall not be liable for any consequential delays on site. Every reasonable effort will be made to mitigate against delays, however no liability for losses and costs will be accepted. The approval or consent by the Client to the Services shall not relieve the Consultant from any liability under this Agreement. All work undertaken by the Consultant must be ratified and signed off by the Client.

8. PAYMENT

i. The Client shall pay the Consultant for the Services in accordance with the proposal and this Agreement. If the Consultant performs any additional services or if the Services are delayed or disrupted for reasons beyond the
reasonable control of the Consultant then the Consultant shall be entitled to such additional fees as are fair and

reasonable in the circumstances. The Consultant may render an invoice at monthly intervals for services properly performed. The agreed invoice, or in the event of a dispute the undisputed element, shall be paid within 28 days of receipt of the invoice by the Client. Any invoice paid after this period will attract interest at 3% above the base rate of the central bank of the country of the currency of payment along with any collection costs which may occur.

ii. The Client shall not withhold any payment of any sum or part of a sum due to the Consultant under this Agreement by reason of claims or alleged claims against the Consultant unless the amount to be withheld has been agreed between the Client and the Consultant as due to the Client or such sum arises from an award in adjudication, arbitration or litigation in favour of the Client and arises under or in connection with the Agreement. Save as aforesaid all rights of set off at common law, in equity or otherwise which the Client may otherwise be entitled to exercise are hereby expressly excluded.

9. TERMINATION

If a party is in breach of a material term of this Agreement and despite written notice from the other party fails to remedy such breach within 30 days or such other period as may be agreed between the parties, then the other party shall be entitled to terminate this Agreement forthwith. The Consultant may seek to recoup costs incurred for works completed prior to termination.

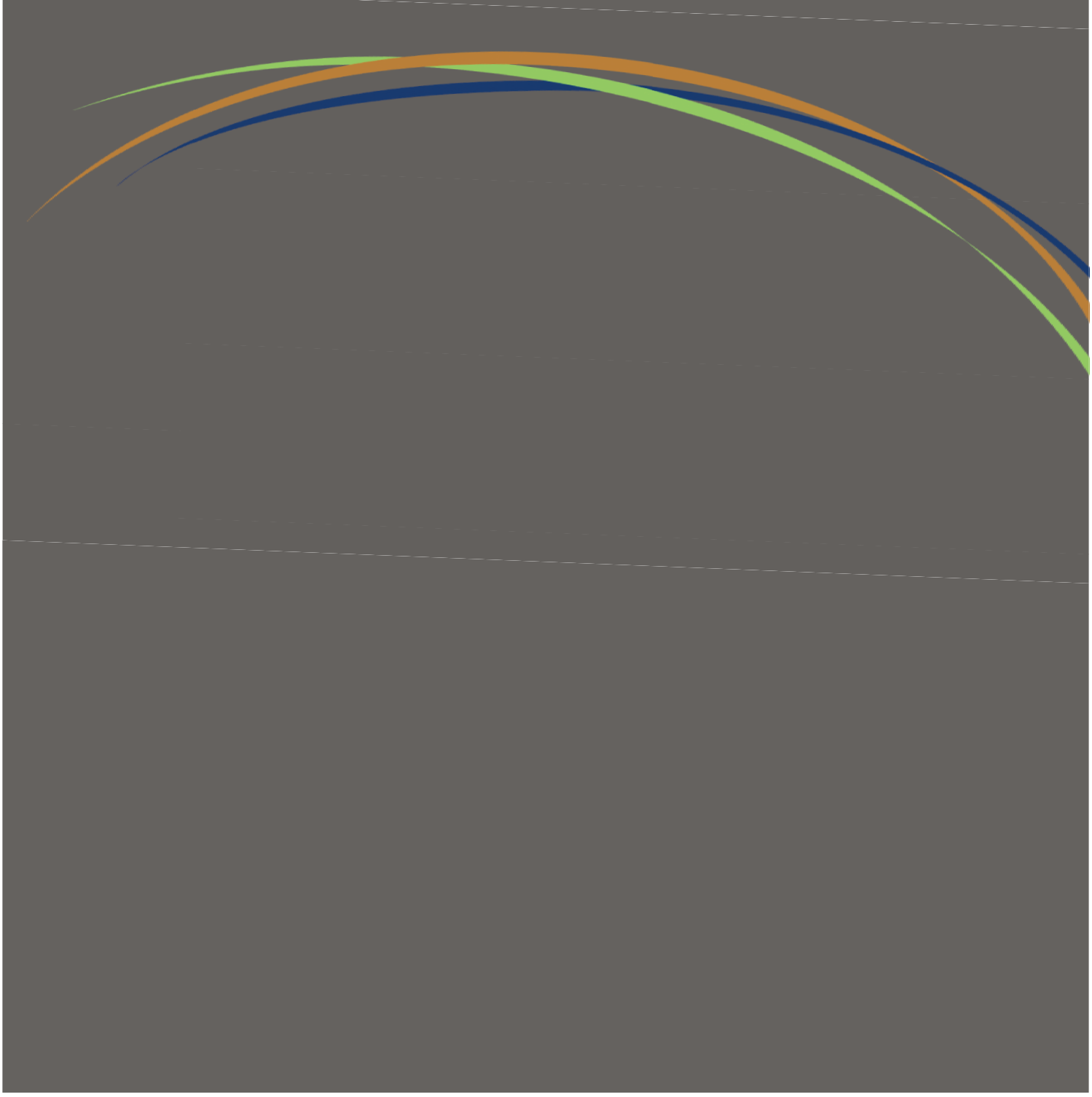
10. DISPUTE RESOLUTION

Any dispute between the parties that cannot be settled by mutual agreement shall be referred for final settlement to the arbitration of a person agreed between the parties or failing such agreement appointed upon the application of either party by the President of the Chartered Institute of Arbitrators and the said arbitration shall be carried out in accordance with the Construction Industry Model Arbitration Rules 1998 or such other version current at the time of the referral under this clause. Where the Agreement is subject to a governing law other than that of England and Wales then any dispute between the parties that cannot be settled by mutual agreement shall be finally settled by arbitration in accordance with the UNCITRAL Arbitration Rules by one arbitrator appointed in compliance with the said Rules. In either case such rules as appropriate are deemed to be incorporated into this Agreement by reference.

11. COMPLIANCE WITH LAWS

This Agreement shall be governed by and construed in accordance with the law of England and Wales unless stated otherwise in the proposal for services from the Consultant.

Changes to the above terms and conditions will only be considered if agreed in writing as part of the appointment process prior to ABG Geosynthetics commencing work.



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BLUE ROOF PRELIMINARY DESIGN

Swords Road Santry, Dublin - Block A Blue

Prepared for:	DBFL		
ABG Project ID:		Calculator version:	1.21
Issue status:	PRELIMINARY	Revision:	1.00
Designed by:	MH	Checked by:	
Design date:	19/02/2024	Check date:	

Brief:

Catchment area, attenuation area, location, discharge limit and design rainfall event taken from email and attachments sent by Ryan Parkes-DBFL Consulting Engineers (Ryan.Parkes@dbfl.ie) on 19/02/2024. A minimum of 2 blueroof attenuation chambers required.

Technical

Input Parameters - Rainfall Information (Custom)			
Return period:	100 years		*As supplied by Client*
Allowance for Climate Change:	20 %		*As supplied by Client*
Rainfall Data Source:	Met Éireann		*Assumed*
Rainfall Data Location:	Easting: 316688	Northing: 239955	*Irish Grid*

Input Parameters - Roof Information			
Catchment area:	333 m^2		*As supplied by Client*
Storage area:	299 m^2		*As supplied by Client*
Maximum allowable runoff:	0.36 l/s		*As supplied by Client*
Blue roof system:	ABG blueroof VF HD 108mm		*Proposed*

Output - Rainfall Calculation

Duration	Rainfall (l/s/m^2)	Storage Required (l/m^2)	Time to Empty	Restricted Outflow (l/s)
5 mins	0.0564	21	9 hours and 20 minutes	0.18
10 mins	0.0394	29	12 hours and 20 minutes	0.22
15 mins	0.0309	34	14 hours and 0 minutes	0.23
30 mins	0.0191	41	16 hours and 10 minutes	0.26
1 hour	0.0118	49	18 hours and 30 minutes	0.29
2 hours	0.0073	57	20 hours and 50 minutes	0.31
4 hours	0.0045	66	22 hours and 50 minutes	0.34
6 hours	0.0034	69	23 hours and 50 minutes	0.35
12 hours	**0.0021**	**71**	**24 hours and 10 minutes**	**0.35**
24 hours	0.0013	61	21 hours and 50 minutes	0.32
48 hours	0.0007	30	12 hours and 30 minutes	0.22
72 hours	0.0005	12	5 hours and 10 minutes	0.12

Total storage required: 21.3m^3 **Total storage provided: 29m^3**

Half empty time: 5 hours and 30 minutes.

Notes:

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BLUE ROOF PRELIMINARY DESIGN

Swords Road Santry, Dublin - Block B Blue

Prepared for:	DBFL		
ABG Project ID:		Calculator version:	1.21
Issue status:	PRELIMINARY	Revision:	1.00
Designed by:	MH	Checked by:	
Design date:	19/02/2024	Check date:	

Brief:

Catchment area, attenuation area, location, discharge limit and design rainfall event taken from email and attachments sent by Ryan Parkes-DBFL Consulting Engineers (Ryan.Parkes@dbfl.ie) on 19/02/2024. A minimum of 2 blueroof attenuation chambers required.

Technical

Input Parameters - Rainfall Information (Custom)			
Return period:	100 years		*As supplied by Client*
Allowance for Climate Change:	20 %		*As supplied by Client*
Rainfall Data Source:	Met Éireann		*Assumed*
Rainfall Data Location:	Easting: 316688	Northing: 239955	*Irish Grid*

Input Parameters - Roof Information			
Catchment area:	333 m^2		*As supplied by Client*
Storage area:	299 m^2		*As supplied by Client*
Maximum allowable runoff:	0.36 l/s		*As supplied by Client*
Blue roof system:	ABG blueroof VF HD 108mm		*Proposed*

Output - Rainfall Calculation

Duration	Rainfall (l/s/m^2)	Storage Required (l/m^2)	Time to Empty	Restricted Outflow (l/s)
5 mins	0.0564	21	9 hours and 20 minutes	0.18
10 mins	0.0394	29	12 hours and 20 minutes	0.22
15 mins	0.0309	34	14 hours and 0 minutes	0.23
30 mins	0.0191	41	16 hours and 10 minutes	0.26
1 hour	0.0118	49	18 hours and 30 minutes	0.29
2 hours	0.0073	57	20 hours and 50 minutes	0.31
4 hours	0.0045	66	22 hours and 50 minutes	0.34
6 hours	0.0034	69	23 hours and 50 minutes	0.35
12 hours	**0.0021**	**71**	**24 hours and 10 minutes**	**0.35**
24 hours	0.0013	61	21 hours and 50 minutes	0.32
48 hours	0.0007	30	12 hours and 30 minutes	0.22
72 hours	0.0005	12	5 hours and 10 minutes	0.12

Total storage required: 21.3m^3 **Total storage provided: 29m^3**

Half empty time: 5 hours and 30 minutes.

Notes:

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BLUE ROOF PRELIMINARY DESIGN

Swords Road Santry, Dublin - Block B Green

abg creative geosynthetic engineering

Technical

Prepared for:	DBFL		
ABG Project ID:		Calculator version:	1.21
Issue status:	PRELIMINARY	Revision:	1.00
Designed by:	MH	Checked by:	
Design date:	19/02/2024	Check date:	

Brief:

Catchment area, attenuation area, location, discharge limit and design rainfall event taken from email and attachments sent by Ryan Parkes-DBFL Consulting Engineers (Ryan.Parkes@dbfl.ie) on 19/02/2024. A minimum of 2 blueroof attenuation chambers required.

Input Parameters - Rainfall Information (Custom)			
Return period:		100 years	*As supplied by Client*
Allowance for Climate Change:		20 %	*As supplied by Client*
Rainfall Data Source:		Met Éireann	*Assumed*
Rainfall Data Location:	Easting: 316688	Northing: 239955	*Irish Grid*

Input Parameters - Roof Information		
Catchment area:	277 m^2	*As supplied by Client*
Storage area:	249 m^2	*As supplied by Client*
Maximum allowable runoff:	0.25 l/s	*As supplied by Client*
Blue roof system:	ABG blueroof VF HD 129mm	*Proposed*

Output - Rainfall Calculation

Duration	Rainfall (l/s/m^2)	Storage Required (l/m^2)	Time to Empty	Restricted Outflow (l/s)
5 mins	0.0564	21	11 hours and 40 minutes	0.12
10 mins	0.0394	29	15 hours and 30 minutes	0.14
15 mins	0.0309	34	17 hours and 20 minutes	0.16
30 mins	0.0191	41	20 hours and 10 minutes	0.17
1 hour	0.0118	49	23 hours and 0 minutes	0.19
2 hours	0.0073	58	26 hours and 10 minutes	0.21
4 hours	0.0045	67	28 hours and 50 minutes	0.23
6 hours	0.0034	72	30 hours and 20 minutes	0.24
12 hours	**0.0021**	**77**	**31 hours and 30 minutes**	**0.25**
24 hours	0.0013	71	30 hours and 10 minutes	0.24
48 hours	0.0007	43	20 hours and 50 minutes	0.18
72 hours	0.0005	23	12 hours and 30 minutes	0.13

Total storage required: 19.2m^3 **Total storage provided: 28.3m^3**

Half empty time: 5 hours and 30 minutes.

Notes:

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BLUE ROOF PRELIMINARY DESIGN

Swords Road Santry, Dublin - Block C Green

Prepared for:	DBFL		
ABG Project ID:		Calculator version:	1.21
Issue status:	PRELIMINARY	Revision:	1.00
Designed by:	MH	Checked by:	
Design date:	19/02/2024	Check date:	

Brief:

Catchment area, attenuation area, location, discharge limit and design rainfall event taken from email and attachments sent by Ryan Parkes-DBFL Consulting Engineers (Ryan.Parkes@dbfl.ie) on 19/02/2024. A minimum of 2 blueroof attenuation chambers required.

Technical

Input Parameters - Rainfall Information (Custom)			
Return period:	100 years		*As supplied by Client*
Allowance for Climate Change:	20 %		*As supplied by Client*
Rainfall Data Source:	Met Éireann		*Assumed*
Rainfall Data Location:	Easting: 316688	Northing: 239955	*Irish Grid*

Input Parameters - Roof Information			
Catchment area:	765 m^2		*As supplied by Client*
Storage area:	688 m^2		*As supplied by Client*
Maximum allowable runoff:	0.56 l/s		*As supplied by Client*
Blue roof system:	ABG blueroof VF HD 129mm		*Proposed*

Output - Rainfall Calculation

Duration	Rainfall (l/s/m^2)	Storage Required (l/m^2)	Time to Empty	Restricted Outflow (l/s)
5 mins	0.0564	21	14 hours and 20 minutes	0.26
10 mins	0.0394	29	19 hours and 10 minutes	0.31
15 mins	0.0309	34	21 hours and 50 minutes	0.34
30 mins	0.0191	41	25 hours and 20 minutes	0.38
1 hour	0.0118	50	29 hours and 10 minutes	0.42
2 hours	0.0073	59	33 hours and 10 minutes	0.46
4 hours	0.0045	69	37 hours and 10 minutes	0.50
6 hours	0.0034	75	39 hours and 10 minutes	0.52
12 hours	**0.0021**	**83**	**41 hours and 50 minutes**	**0.55**
24 hours	0.0013	82	41 hours and 40 minutes	0.55
48 hours	0.0007	58	32 hours and 40 minutes	0.46
72 hours	0.0005	39	24 hours and 20 minutes	0.37

Total storage required: 56.9m^3 **Total storage provided: 78.4m^3**

Half empty time: 9 hours and 0 minutes.

Notes:

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BLUE ROOF PRELIMINARY DESIGN

Swords Road Santry, Dublin - Block D Blue

Prepared for:	DBFL		
ABG Project ID:		Calculator version:	1.21
Issue status:	PRELIMINARY	Revision:	1.00
Designed by:	MH	Checked by:	
Design date:	19/02/2024	Check date:	

Brief:

Catchment area, attenuation area, location, discharge limit and design rainfall event taken from email and attachments sent by Ryan Parkes-DBFL Consulting Engineers (Ryan.Parkes@dbfl.ie) on 19/02/2024. A minimum of 2 blueroof attenuation chambers required.

Technical

Input Parameters - Rainfall Information (Custom)			
Return period:	100 years		*As supplied by Client*
Allowance for Climate Change:	20 %		*As supplied by Client*
Rainfall Data Source:	Met Éireann		*Assumed*
Rainfall Data Location:	Easting: 316688	Northing: 239955	*Irish Grid*

Input Parameters - Roof Information			
Catchment area:	367 m^2		*As supplied by Client*
Storage area:	330 m^2		*As supplied by Client*
Maximum allowable runoff:	0.36 l/s		*As supplied by Client*
Blue roof system:	ABG blueroof VF HD 108mm		*Proposed*

Output - Rainfall Calculation

Duration	Rainfall (l/s/m^2)	Storage Required (l/m^2)	Time to Empty	Restricted Outflow (l/s)
5 mins	0.0564	21	10 hours and 20 minutes	0.18
10 mins	0.0394	29	13 hours and 40 minutes	0.22
15 mins	0.0309	34	15 hours and 30 minutes	0.23
30 mins	0.0191	41	17 hours and 50 minutes	0.26
1 hour	0.0118	49	20 hours and 30 minutes	0.29
2 hours	0.0073	58	23 hours and 0 minutes	0.31
4 hours	0.0045	66	25 hours and 30 minutes	0.34
6 hours	0.0034	71	26 hours and 30 minutes	0.35
12 hours	**0.0021**	**74**	**27 hours and 20 minutes**	**0.36**
24 hours	0.0013	66	25 hours and 20 minutes	0.34
48 hours	0.0007	35	16 hours and 0 minutes	0.24
72 hours	0.0005	17	8 hours and 10 minutes	0.15

Total storage required: 24.4m^3 **Total storage provided: 32m^3**

Half empty time: 6 hours and 40 minutes.

Notes:

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BLUE ROOF PRELIMINARY DESIGN

Swords Road Santry, Dublin - Block E Blue

Prepared for:	DBFL		
ABG Project ID:		Calculator version:	1.21
Issue status:	PRELIMINARY	Revision:	1.00
Designed by:	MH	Checked by:	
Design date:	19/02/2024	Check date:	

Brief:

Catchment area, attenuation area, location, discharge limit and design rainfall event taken from email and attachments sent by Ryan Parkes-DBFL Consulting Engineers (Ryan.Parkes@dbfl.ie) on 19/02/2024. A minimum of 2 blueroof attenuation chambers required.

Technical

Input Parameters - Rainfall Information (Custom)			
Return period:	100 years		*As supplied by Client*
Allowance for Climate Change:	20 %		*As supplied by Client*
Rainfall Data Source:	Met Éireann		*Assumed*
Rainfall Data Location:	Easting: 316688	Northing: 239955	*Irish Grid*

Input Parameters - Roof Information			
Catchment area:	406 m^2		*As supplied by Client*
Storage area:	365 m^2		*As supplied by Client*
Maximum allowable runoff:	0.37 l/s		*As supplied by Client*
Blue roof system:	ABG blueroof VF HD 108mm		*Proposed*

Output - Rainfall Calculation

Duration	Rainfall (l/s/m^2)	Storage Required (l/m^2)	Time to Empty	Restricted Outflow (l/s)
5 mins	0.0564	21	11 hours and 20 minutes	0.18
10 mins	0.0394	29	15 hours and 10 minutes	0.22
15 mins	0.0309	34	17 hours and 0 minutes	0.23
30 mins	0.0191	41	19 hours and 50 minutes	0.26
1 hour	0.0118	49	22 hours and 40 minutes	0.29
2 hours	0.0073	58	25 hours and 40 minutes	0.32
4 hours	0.0045	67	28 hours and 20 minutes	0.34
6 hours	0.0034	72	29 hours and 40 minutes	0.35
12 hours	**0.0021**	**76**	**31 hours and 0 minutes**	**0.36**
24 hours	0.0013	71	29 hours and 20 minutes	0.35
48 hours	0.0007	42	20 hours and 10 minutes	0.26
72 hours	0.0005	22	11 hours and 50 minutes	0.18

Total storage required: 27.9m^3 **Total storage provided: 35.4m^3**

Half empty time: 8 hours and 0 minutes.

Notes:

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BLUE ROOF PRELIMINARY DESIGN

Swords Road Santry, Dublin - Block F Green

Prepared for:	DBFL		
ABG Project ID:		Calculator version:	1.21
Issue status:	PRELIMINARY	Revision:	1.00
Designed by:	MH	Checked by:	
Design date:	19/02/2024	Check date:	

Brief:

Catchment area, attenuation area, location, discharge limit and design rainfall event taken from email and attachments sent by Ryan Parkes-DBFL Consulting Engineers (Ryan.Parkes@dbfl.ie) on 19/02/2024. A minimum of 2 blueroof attenuation chambers required.

Technical

Input Parameters - Rainfall Information (Custom)			
Return period:	100 years		*As supplied by Client*
Allowance for Climate Change:	20 %		*As supplied by Client*
Rainfall Data Source:	Met Éireann		*Assumed*
Rainfall Data Location:	Easting: 316688	Northing: 239955	*Irish Grid*

Input Parameters - Roof Information			
Catchment area:	852 m^2		*As supplied by Client*
Storage area:	766 m^2		*As supplied by Client*
Maximum allowable runoff:	0.57 l/s		*As supplied by Client*
Blue roof system:	ABG blueroof VF HD 129mm		*Proposed*

Output - Rainfall Calculation

Duration	Rainfall (l/s/m^2)	Storage Required (l/m^2)	Time to Empty	Restricted Outflow (l/s)
5 mins	0.0564	21	15 hours and 50 minutes	0.26
10 mins	0.0394	29	21 hours and 30 minutes	0.31
15 mins	0.0309	34	24 hours and 10 minutes	0.34
30 mins	0.0191	41	28 hours and 10 minutes	0.38
1 hour	0.0118	50	32 hours and 30 minutes	0.42
2 hours	0.0073	59	37 hours and 0 minutes	0.46
4 hours	0.0045	70	41 hours and 30 minutes	0.50
6 hours	0.0034	76	44 hours and 0 minutes	0.53
12 hours	0.0021	85	47 hours and 20 minutes	0.56
24 hours	**0.0013**	**86**	**47 hours and 50 minutes**	**0.56**
48 hours	0.0007	64	39 hours and 10 minutes	0.48
72 hours	0.0005	46	30 hours and 50 minutes	0.40

Total storage required: 66.3m³ **Total storage provided: 87.3m³**

Half empty time: 11 hours and 20 minutes.

Notes:

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BLUE ROOF PRELIMINARY DESIGN

Swords Road Santry, Dublin - Block G Blue

Prepared for:	DBFL		
ABG Project ID:		Calculator version:	1.21
Issue status:	PRELIMINARY	Revision:	1.00
Designed by:	MH	Checked by:	
Design date:	19/02/2024	Check date:	

Brief:

Catchment area, attenuation area, location, discharge limit and design rainfall event taken from email and attachments sent by Ryan Parkes-DBFL Consulting Engineers (Ryan.Parkes@dbfl.ie) on 19/02/2024. A minimum of 2 blueroof attenuation chambers required.

Technical

Input Parameters - Rainfall Information (Custom)			
Return period:		100 years	*As supplied by Client*
Allowance for Climate Change:		20 %	*As supplied by Client*
Rainfall Data Source:		Met Éireann	*Assumed*
Rainfall Data Location:	Easting: 316688	Northing: 239955	*Irish Grid*

Input Parameters - Roof Information			
Catchment area:		379 m^2	*As supplied by Client*
Storage area:		341 m^2	*As supplied by Client*
Maximum allowable runoff:		0.37 l/s	*As supplied by Client*
Blue roof system:		ABG blueroof VF HD 108mm	*Proposed*

Output - Rainfall Calculation

Duration	Rainfall (l/s/m^2)	Storage Required (l/m^2)	Time to Empty	Restricted Outflow (l/s)
5 mins	0.0564	21	10 hours and 40 minutes	0.18
10 mins	0.0394	29	14 hours and 10 minutes	0.22
15 mins	0.0309	34	16 hours and 0 minutes	0.23
30 mins	0.0191	41	18 hours and 30 minutes	0.26
1 hour	0.0118	49	21 hours and 10 minutes	0.29
2 hours	0.0073	58	23 hours and 50 minutes	0.31
4 hours	0.0045	67	26 hours and 20 minutes	0.34
6 hours	0.0034	71	27 hours and 30 minutes	0.35
12 hours	**0.0021**	**75**	**28 hours and 30 minutes**	**0.36**
24 hours	0.0013	68	26 hours and 40 minutes	0.34
48 hours	0.0007	37	17 hours and 20 minutes	0.25
72 hours	0.0005	19	9 hours and 20 minutes	0.16

Total storage required: 25.5m^3 **Total storage provided: 33m^3**

Half empty time: 7 hours and 10 minutes.

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BLUE ROOF PRELIMINARY DESIGN

Swords Road Santry, Dublin - Podium 1 Blue

Prepared for:	DBFL		
ABG Project ID:		Calculator version:	1.21
Issue status:	PRELIMINARY	Revision:	1.00
Designed by:	MH	Checked by:	
Design date:	19/02/2024	Check date:	

Brief:

Catchment area, attenuation area, location, discharge limit and design rainfall event taken from email and attachments sent by Ryan Parkes-DBFL Consulting Engineers (Ryan.Parkes@dbfl.ie) on 19/02/2024. A minimum of 2 blueroof attenuation chambers required.

Technical

Input Parameters - Rainfall Information (Custom)			
Return period:		100 years	*As supplied by Client*
Allowance for Climate Change:		20 %	*As supplied by Client*
Rainfall Data Source:		Met Éireann	*Assumed*
Rainfall Data Location:	Easting: 316688	Northing: 239955	*Irish Grid*

Input Parameters - Roof Information			
Catchment area:		816 m^2	*As supplied by Client*
Storage area:		734 m^2	*As supplied by Client*
Maximum allowable runoff:		0.62 l/s	*As supplied by Client*
Blue roof system:		ABG blueroof VF HD 108mm	*Proposed*

Output - Rainfall Calculation

Duration	Rainfall (l/s/m^2)	Storage Required (l/m^2)	Time to Empty	Restricted Outflow (l/s)
5 mins	0.0564	21	13 hours and 20 minutes	0.29
10 mins	0.0394	29	18 hours and 0 minutes	0.35
15 mins	0.0309	34	20 hours and 20 minutes	0.38
30 mins	0.0191	41	23 hours and 40 minutes	0.43
1 hour	0.0118	50	27 hours and 20 minutes	0.47
2 hours	0.0073	59	31 hours and 0 minutes	0.52
4 hours	0.0045	69	34 hours and 40 minutes	0.57
6 hours	0.0034	75	36 hours and 40 minutes	0.59
12 hours	**0.0021**	**81**	**38 hours and 50 minutes**	**0.62**
24 hours	0.0013	80	38 hours and 20 minutes	0.61
48 hours	0.0007	54	29 hours and 20 minutes	0.50
72 hours	0.0005	35	20 hours and 50 minutes	0.39

Total storage required: 59.8m³ **Total storage provided: 71.1m³**

Half empty time: 11 hours and 20 minutes.

Notes:

1. This document contains an estimate which has been prepared by ABG Ltd and is illustrative only and not a detailed design.
2. Further details on the theories used in this estimate are available upon request from ABG. The values given are indicative and correspond to nominal results obtained in our laboratories and testing institutes. In line with our policy of continuous improvement the right is reserved to make changes without notice at any time.
3. This estimate is specific to the characteristics of ABG products and may not be applicable to other products.
4. The copyright in this document belongs to ABG Ltd.
5. The estimate given in this report is based on the stated parameters as per the brief. If these parameters are not correct or have changed, ABG should be contacted to provide a revised estimate.
6. No guarantee or liability can be drawn from the information in this report.
7. Final determination of the suitability of any information is the sole responsibility of the user. ABG will be pleased to discuss the use of this or any other product but responsibility for selection of a material and its application in any specific project remains with the user.

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www.abgltd.com

BLUE ROOF PRELIMINARY DESIGN

Swords Road Santry, Dublin - Podium 2 Blue

Prepared for:	DBFL		
ABG Project ID:		Calculator version:	1.21
Issue status:	PRELIMINARY	Revision:	1.00
Designed by:	MH	Checked by:	
Design date:	19/02/2024	Check date:	

Brief:

Catchment area, attenuation area, location, discharge limit and design rainfall event taken from email and attachments sent by Ryan Parkes-DBFL Consulting Engineers (Ryan.Parkes@dbfl.ie) on 19/02/2024. A minimum of 4 blueroof attenuation chambers required.

Technical

Input Parameters - Rainfall Information (Custom)			
Return period:	100 years		*As supplied by Client*
Allowance for Climate Change:	20 %		*As supplied by Client*
Rainfall Data Source:	Met Éireann		*Assumed*
Rainfall Data Location:	Easting: 316688	Northing: 239955	*Irish Grid*

Input Parameters - Roof Information			
Catchment area:	1522 m^2		*As supplied by Client*
Storage area:	1369 m^2		*As supplied by Client*
Maximum allowable runoff:	1.14 l/s		*As supplied by Client*
Blue roof system:	ABG blueroof VF HD 108mm		*Proposed*

Output - Rainfall Calculation

Duration	Rainfall (l/s/m^2)	Storage Required (l/m^2)	Time to Empty	Restricted Outflow (l/s)
5 mins	0.0564	21	14 hours and 10 minutes	0.53
10 mins	0.0394	29	19 hours and 0 minutes	0.65
15 mins	0.0309	34	21 hours and 20 minutes	0.70
30 mins	0.0191	41	24 hours and 50 minutes	0.78
1 hour	0.0118	49	28 hours and 30 minutes	0.86
2 hours	0.0073	59	32 hours and 20 minutes	0.95
4 hours	0.0045	69	36 hours and 0 minutes	1.04
6 hours	0.0034	75	38 hours and 0 minutes	1.08
12 hours	**0.0021**	**82**	**40 hours and 20 minutes**	**1.13**
24 hours	0.0013	80	40 hours and 0 minutes	1.12
48 hours	0.0007	55	31 hours and 0 minutes	0.92
72 hours	0.0005	36	22 hours and 30 minutes	0.73

Total storage required: 111.7m³ **Total storage provided: 132.7m³**

Half empty time: 11 hours and 40 minutes.

Notes:

1. This document contains an estimate which has been prepared by ABG Ltd and is illustrative only and not a detailed design.
2. Further details on the theories used in this estimate are available upon request from ABG. The values given are indicative and correspond to nominal results obtained in our laboratories and testing institutes. In line with our policy of continuous improvement the right is reserved to make changes without notice at any time.
3. This estimate is specific to the characteristics of ABG products and may not be applicable to other products.
4. The copyright in this document belongs to ABG Ltd.
5. The estimate given in this report is based on the stated parameters as per the brief. If these parameters are not correct or have changed, ABG should be contacted to provide a revised estimate.
6. No guarantee or liability can be drawn from the information in this report.
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www.abgltd.com

TITLE		**Job Reference**	
Santry Place Mixed Use Development Phase 2, Santry, Dublin 9		230146	
SUBJECT		**Calc. Sheet No.**	
Permeable Paving Design		1	
DRAWING NUMBER	**Calculations by**	**Checked by**	**Date**
230146-X-91-X-DTM-DR-DBFL-CE-1101	RSP	LMCL	15.02.24

FLAT SITES

INPUT DATA

Pavement Area (A)	1236.0	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	5.0	mm/hr
Subgrade Infiltration Rate (f)	0.0014	mm/s

VOLUME (STORAGE AND TREATMENT)

Permeable Paving Storage Volume per m^2	0.120	m^3/m^2
Total Permeable Paving Treatment Volume	**148.3**	m^3

INFILTRATION / INTERCEPTION VOLUME

Approx. Permeable Paving Infiltration per m^2	0.002	$l/s/m^2$	
[2]**Total Permeable Paving Infiltration Rate**	1.883	l/s	
[3]Additional Reservoir Storage below Outlet Invert	0.005	m	Reservoir will empty in less than 18 hours
[4]**Total Permeable Paving Interception Volume**	**74.0**	m^3	

FLOW

Average Distance between Outlet Drains	6.0	m
Flow Velocity through Permeable Paving	0.000038	m/s
Trench Retention Time	44.2	hr

TITLE	Job Reference
Santry Place Mixed Use Development Phase 2, Santry, Dublin 9	230146
SUBJECT	**Calc. Sheet No.**
Permeable Paving Design	1

DRAWING NUMBER	Calculations by	Checked by	Date
230146-X-91-X-DTM-DR-DBFL-CE-1101	RSP	LMCL	15.02.24

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 of reservoir for total permeable paving area infiltrates to ground over 18 hours

4 Volume calculated using 6 hour storm event.

5 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

Appendix H : Watermain Calculation

TITLE		Job Reference
Santry Place Mixed Use Development, Santry Dublin 9.		230146
SUBJECT		**Calc. Sheet No.**
Post-Development Water Demand for Irish Water - Residential		1
DRAWING NUMBER	**Calculations by**	**Checked by**	**Date**
230146-X-93-X-DTM-DR-DBFL-CE-1301	RSP	LMCL	15.02.24

DEMAND

Housing Units	321	no.
Daily Demand per person[1]	150	litres/person/day
Average Occupancy Ratio[2]	2.7	person/unit
Total Site Occupancy	867	people
Average Daily Demand	130,005	l/day
Average Day in Peak Week[3]	162,506	l/day
Normal Length of Day[4]	24	hours
Peak Factor[5]	5.0	

Post Development Peak Water Demand[6]	**9.404**	l/s
Post Development Average Water Demand	**1.505**	l/s
Normal Demand[7]	**1.505**	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			230146
SUBJECT			**Calc. Sheet No.**
Post-Development Water Demand for Irish Water-Retail			2
DRAWING NUMBER	**Calculations by**	**Checked by**	**Date**
230146-X-93-X-DTM-DR-DBFL-CE-1301	RSP	SVC	15.02.24

DEMAND

Retail Outlets

Retail space	468	m^2
Staff[1]	31	no.
Daily Demand per person[2]	50	litres/person/day
Average Daily Demand	1,560	l/day
Average Day in Peak Week[3]	1,950	l/day
Normal Length of Day[4]	12	hours
Peak Factor[5]	5.0	

Post Development Peak Water Demand[6]	**0.113**	l/s
Post Development Average Water Demand	**0.018**	l/s
Normal Demand[7]	**0.036**	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.

TITLE			Job Reference
Santry Place Mixed Use Development, Santry, Dublin 9			230146
SUBJECT			**Calc. Sheet No.**
Post-Development Water Demand - Irish Water - Warehouse			3
DRAWING NUMBER	**Calculations by**	**Checked by**	**Date**
230146-X-93-X-DTM-DR-DBFL-CE	RSP	SVC	15.02.24

DEMAND

Medical Suite	130	m^2
Staff[1]	13.0	no.
Daily Demand per person[2]	50	litres/person/day
Average Daily Demand	650	l/day
Average Day in Peak Week[3]	813	l/day
Normal Length of Day[4]	12	hours
Peak Factor[5]	5.0	

Pre Development Peak Water Demand[6]	**0.047**	l/s
Pre Development Average Water Demand	**0.008**	l/s
Normal Demand[7]	**0.015**	l/s

Notes:

1. Assumed employment density of 90m^2 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.

TITLE			Job Reference
Santry Place Mixed Use Development , Santry, Dublin 9			230146
SUBJECT			**Calc. Sheet No.**
Post-Development Water Demand for Irish Water-Retail			2
DRAWING NUMBER	**Calculations by**	**Checked by**	**Date**
230146-X-93-X-DTM-DR-DBFL-CE-1301	RSP	SVC	15.02.24

DEMAND

Community Area

Retail space	1483	m^2
Staff[1]	124	no.
Daily Demand per person[2]	50	litres/person/day
Average Daily Demand	6,179	l/day
Average Day in Peak Week[3]	7,724	l/day
Normal Length of Day[4]	12	hours
Peak Factor[5]	5.0	

Post Development Peak Water Demand[6]	**0.447**	l/s
Post Development Average Water Demand	**0.072**	l/s
Normal Demand[7]	**0.143**	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 Confirmation of Feasibility Letter and Statement of Design Acceptance

CONFIRMATION OF FEASIBILITY

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

Uisce Éireann
PO Box 448
South City
Delivery Office
Cork City

www.water.ie

Ryan Parkes

DBFL Construction Engineering
Ormond House
Upper Ormond Quay
Dublin 7
Co. Dublin
D07W704

27 February 2024

Our Ref: CDS23007437 Pre-Connection Enquiry
Santry Place Mixed Use Development, Santry, Dublin

Dear Applicant/Agent,

We have completed the review of the Pre-Connection Enquiry.

Uisce Éireann has reviewed the pre-connection enquiry in relation to a Water & Wastewater connection for a Multi/Mixed Use Development of 320 unit(s) at Santry Place Mixed Use Development, Santry, Dublin (the **Development)**.

Based upon the details provided we can advise the following regarding connecting to the networks;

- **Water Connection** - Feasible without infrastructure upgrade by Uisce Éireann
- **Wastewater Connection** - Feasible Subject to upgrades
-
- In order to accommodate the proposed connection, Santry PS Flow Diversion Project has to be completed prior the connection. The Project is scheduled to be completed in Q1/2028 (this may be subject to change)

This letter does not constitute an offer, in whole or in part, to provide a connection to any Uisce Éireann infrastructure. Before the Development can be connected to our network(s) you must submit a connection application and be granted and sign a connection agreement with Uisce Éireann.

As the network capacity changes constantly, this review is only valid at the time of its completion. As soon as planning permission has been granted for the Development, a completed connection application should be submitted. The connection application is available at www.water.ie/connections/get-connected/

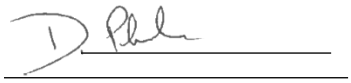
Where can you find more information?

- **Section A -** What is important to know?
- **Section B -** Details of Uisce Éireann's Network(s)

This letter is issued to provide information about the current feasibility of the proposed connection(s) to Uisce Éireann's network(s). This is not a connection offer and capacity in Uisce Éireann's network(s) may only be secured by entering into a connection agreement with Uisce Éireann.

For any further information, visit **www.water.ie/connections**, **email newconnections@water.ie** or contact 1800 278 278**.**

Yours sincerely,



Dermot Phelan
Connections Delivery Manager

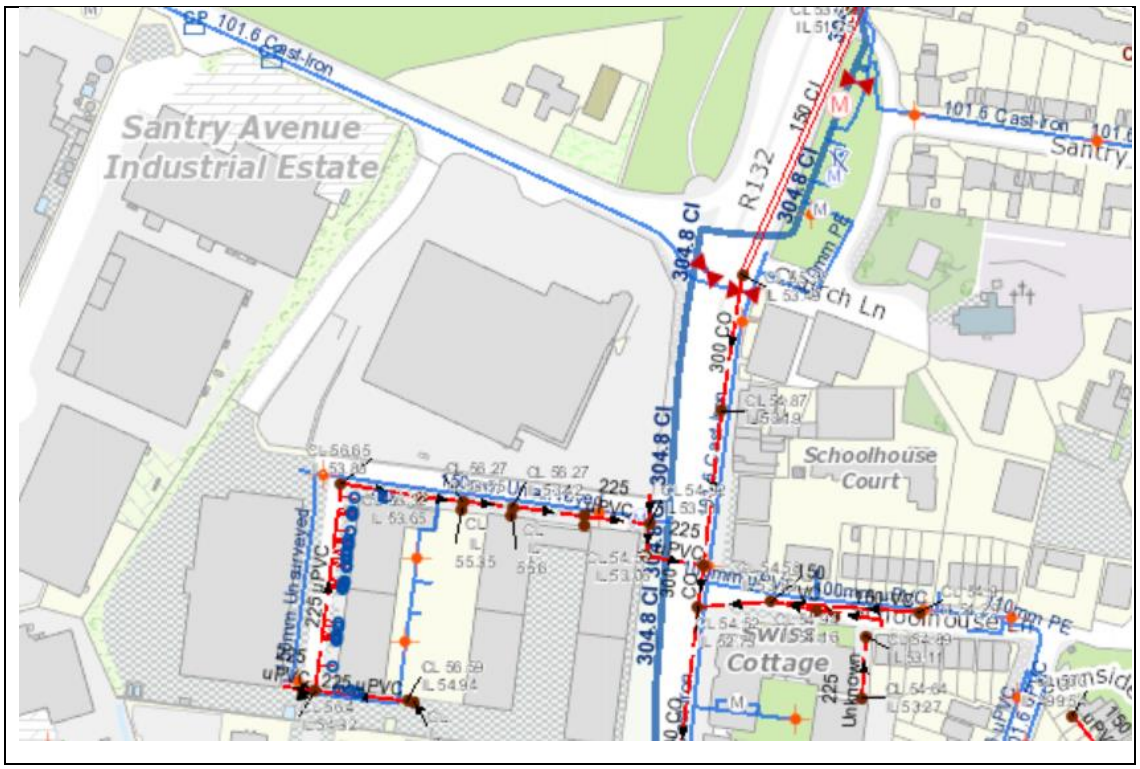
Section A - What is important to know?

What is important to know?	Why is this important?
Do you need a contract to connect?	• Yes, a contract is required to connect. This letter does not constitute a contract or an offer in whole or in part to provide a connection to Uisce Éireann's network(s). • Before the Development can connect to Uisce Éireann's network(s), you must submit a connection application and be granted and sign a connection agreement with Uisce Éireann.
When should I submit a Connection Application?	• A connection application should only be submitted after planning permission has been granted.
Where can I find information on connection charges?	• Uisce Éireann connection charges can be found at: https://www.water.ie/connections/information/charges/
Who will carry out the connection work?	• All works to Uisce Éireann's network(s), including works in the public space, must be carried out by Uisce Éireann*. *Where a Developer has been granted specific permission and has been issued a connection offer for Self-Lay in the Public Road/Area, they may complete the relevant connection works
Fire flow Requirements	• The Confirmation of Feasibility does not extend to fire flow requirements for the Development. Fire flow requirements are a matter for the Developer to determine. • **What to do?** - Contact the relevant Local Fire Authority
Plan for disposal of storm water	• The Confirmation of Feasibility does not extend to the management or disposal of storm water or ground waters. • **What to do?** - Contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges.
Where do I find details of Uisce Éireann's network(s)?	• Requests for maps showing Uisce Éireann's network(s) can be submitted to: datarequests@water.ie

What are the design requirements for the connection(s)?	• The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this Development shall comply with ***the Uisce Éireann Connections and Developer Services Standard Details and Codes of Practice,*** available at www.water.ie/connections
Trade Effluent Licensing	• Any person discharging trade effluent** to a sewer, must have a Trade Effluent Licence issued pursuant to section 16 of the Local Government (Water Pollution) Act, 1977 (as amended). • More information and an application form for a Trade Effluent License can be found at the following link: https://www.water.ie/business/trade-effluent/about/ **trade effluent is defined in the Local Government (Water Pollution) Act, 1977 (as amended)

Section B – Details of Uisce Éireann's Network(s)

The map included below outlines the current Uisce Éireann infrastructure adjacent the Development: To access Uisce Éireann Maps email datarequests@water.ie



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Note: The information provided on the included maps as to the position of Uisce Éireann's underground network(s) is provided as a general guide only. The information is based on the best available information provided by each Local Authority in Ireland to Uisce Éireann.

Whilst every care has been taken in respect of the information on Uisce Éireann's network(s), Uisce Éireann assumes no responsibility for and gives no guarantees, undertakings or warranties concerning the accuracy, completeness or up to date nature of the information provided, nor does it accept any liability whatsoever arising from or out of any errors or omissions. This information should not be solely relied upon in the event of excavations or any other works being carried out in the vicinity of Uisce Éireann's underground network(s). The onus is on the parties carrying out excavations or any other works to ensure the exact location of Uisce Éireann's underground network(s) 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.

Ryan Parkes
DBFL Construction Engineering
Ormond House
Upper Ormond Quay
Dublin 7
D07W704

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Bosca OP 448
Oifig Sheachadta na
Cathrach Theas
Cathair Chorcaí

Uisce Éireann
PO Box 448
South City
Delivery Office
Cork City

www.water.ie

28 March 2024

Re: Design Submission for Santry Place mixed use, Development, Santry Dublin 9, (the "Development")
(the "Design Submission") / Connection Reference No: CDS23007437

Dear Ryan Parkes,

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, Uisce Éireann has no objection to your proposals.

This letter does not constitute an offer, in whole or in part, to provide a connection to any Uisce Éireann infrastructure. Before you can connect to our network you must sign a connection agreement with Uisce Éireann. This can be applied for by completing the connection application form at www.water.ie/connections. Uisce Éireann'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 Uisce Éireann's network(s) (the "**Self-Lay Works**"), as reflected in your Design Submission. Acceptance of the Design Submission by Uisce Éireann does not, in any way, render Uisce Éireann liable for any elements of the design and/or construction of the Self-Lay Works.

If you have any further questions, please contact your Uisce Éireann representative:
Name: Antonio Garzón Mielgo
Phone: 0874750587
Email: antonio.garzonmielgo@water.ie

Yours sincerely,

Dermot Phelan
Connections Delivery Manager

Appendix A

Document Title & Revision

- 230146-X-92-X-DTM-DR-DBFL-CE-1101_FoulSewerLayout
- 230146-X-92-X-DTM-DR-DBFL-CE-3101_FoulSewerLongsections
- 230146-X-93-X-DTM-DR-DBFL-CE-1201_WatermainLayout

Additional Comments

The design submission will be subject to further technical review at connection application stage.

Uisce Éireann cannot guarantee that its Network in any location will have the capacity to deliver a particular flow rate and associated residual pressure to meet the requirements of the relevant Fire Authority, see Section 1.17 of Water Code of Practice.

While Uisce Éireann notes that the water and wastewater services infrastructure will remain private and not be vested, we have the following comments: all works within landscape areas need to be carried out in accordance with the relevant sections of UÉ Code of Practice and standards. See Section 3.26 Environmental Considerations of the water Code of Practice and details STD-W-12 and STD-W-12A in the water standards for reference.

*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 Uisce Éireann will not, in any way, render Uisce Éireann liable for any elements of the design and/or construction of the Self-Lay Works.

SEE MAIN PLAN FOR CONTINUATION

INSET A

MAIN PLAN

FOUL CONNECTION TO EXISTING MANHOLE SUBJECT TO IRISH WATER APPROVAL.

225 DIA. FOUL @ 1:182

225 DIA. FOUL @ 1:142

225 DIA. FOUL @ 1:179

P1-F2 CL 53.11

P1-F1 CL TBC IL 53.005

F0 CL TBC(54.61m) IL 52.89

EX. 300Ø FS

F10 CL 57.10 IL 55.91

F11 CL 57.15 IL 55.91

F12 CL 57.20 IL 56.07

F9 CL 57.29 IL 55.43

F8 CL 57.14 IL 55.29

F7 CL 56.91 IL 55.19

F6 CL 56.93 IL 55.05

F6.1 CL 57.10 IL 55.97

F5 CL 56.82 IL 54.99

F5.1 CL 57.15 IL 56.03

F4 CL 56.80 IL 54.87

F4.1 CL 57.15 IL 56.02

F3 CL 56.56 IL 55.43

F3.1 CL 56.49 IL 54.64

F2 CL 55.97 IL 54.25

F1 CL 54.95 IL 53.79

F1.1 CL 55.43 IL 54.11

F1.2 CL 55.40 IL 54.27

P1-F5 CL 56.65 IL 53.71

P1-F4 CL 56.27 IL 53.49

P1-F3 CL 55.89 IL 53.22

P1-F2 CL 53.11

BLOCK E FFL:57.20

BLOCK D FFL:57.20

BLOCK F FFL:57.20

BLOCK C FFL:57.20

BLOCK A FFL:55.50

BLOCK B FFL:55.70

BLOCK G FFL:57.20

INTERNAL FOUL DRAINAGE FOR COMMERCIAL 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.

INDICATIVE FOUL SLUNG DRAINAGE CONNECTION. REFER TO M&E DRAWINGS FOR SLUNG DRAINAGE DESIGN & INVERT LEVEL.

INTERNAL FOUL DRAINAGE FOR RESIDENTIAL AMENITY BUILDING TO BE CONFIRMED BY ARCHITECT. UNITS LOCATED OVER BASEMENT AREA TO BE DRAINED VIA SLUNG DRAINAGE.

INTERNAL FOUL DRAINAGE FOR RESIDENTIAL UNITS TO BE CONFIRMED BY ARCHITECT.

DUCTILE IRON RISING MAIN FROM BASEMENT PUMPING STATION TO OUTFALL MANHOLE.

OUTFALL MANHOLE

EXISTING 300mm DIA. CAST IRON PIPE

FOUL CONNECTION TO EXISTING MANHOLE SUBJECT TO IRISH WATER APPROVAL.

SEE INSET A FOR CONTINUATION

go car

SET DOWN

WT

N

ON ORIGINAL

0 5 10 20 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. 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 230146-X-92-X-DTM-OR-DBFL-CE-3101 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
- SITE BOUNDARY

PROPOSED SERVICES:

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

EXISTING PUBLIC SERVICES:

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

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GOVERNMENT OF IRELAND

rev	date	description	by	chkd.
1	29.02.24	REVISED FOR PLANNING	KJL'E	RSP
0	13.10.23	ISSUED FOR INFORMATION	CDC	RSP

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P3 - PLANNING PERMISSION	S - ISSUED

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project ref.

MIXED USE DEVELOPMENT (LRD), SANTRY AVENUE, DUBLIN

drawing title

FOUL LAYOUT PLAN

client

DWYER NOLAN DEVELOPMENTS

designed by	author	scale	sheet size
RSP	CDC	1:250	A1

drawing no. 230146-X-92-X-DTM-DR-DBFL-CE-1101 — revision 1

MH Name		F12	F11	F10	F9	F8	F7	F6	F5	F4	F3	F2
Hor Scale 500 Ver Scale 100 Datum (m)50.000								2.000	3.000	4.000	5.000	
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)		148.2	196.2	194.5	198.5	195.9	188.8	200.0	200.0	186.3	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	54.950 54.950	54.674 54.674	54.644 54.644	54.564
Length (m)		23.710	19.620	52.506	49.616	19.588	26.438	12.000	23.165	42.856	14.401	

MH Name		F2	F1	P1-F2
Hor Scale 500 Ver Scale 100 Datum (m)49.000			1.001	
PN		F1.010	F1.011	
Dia (mm)		225	225	
Slope (1:X)		54.6	180.1	
Cover Level (m)		55.970	54.950	54.920
Invert Level (m)		54.250	53.790 53.790	53.720 53.110
Length (m)		25.093	12.604	

MH Name		F6.1	F6
Hor Scale 500 Ver Scale 100 Datum (m)50.000			1.005
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
Hor Scale 500 Ver Scale 100 Datum (m)50.000			1.006
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
Hor Scale 500 Ver Scale 100 Datum (m)50.000			1.007
PN		F4.000	
Dia (mm)		225	
Slope (1:X)		117.8	
Cover Level (m)		57.150	56.800
Invert Level (m)		56.020	55.790
Length (m)		27.083	

MH Name		F3.1	F3
Hor Scale 500 Ver Scale 100 Datum (m)50.000			1.008
PN		F5.000	
Dia (mm)		225	
Slope (1:X)		142.4	
Cover Level (m)		56.560	56.490
Invert Level (m)		55.430	55.410
Length (m)		2.848	

MH Name		F1.2	F1.1	F1
Hor Scale 500 Ver Scale 100 Datum (m)49.000				1.010
PN		F6.000	F6.001	
Dia (mm)		225	225	
Slope (1:X)		116.4	169.4	
Cover Level (m)		55.400	55.430	54.950
Invert Level (m)		54.270	54.110 54.110	53.790
Length (m)		18.617	54.221	

ON ORIGINAL

0 5 10 20 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

rev	date	description	by	chkd.
1	29.02.24	ISSUED FOR PLANNING	CDC	RSP
0	13.10.23	ISSUED FOR INFORMATION	CDC	RSP

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project ref.

MIXED USE DEVELOPMENT (LRD), SANTRY AVENUE, DUBLIN

drawing title

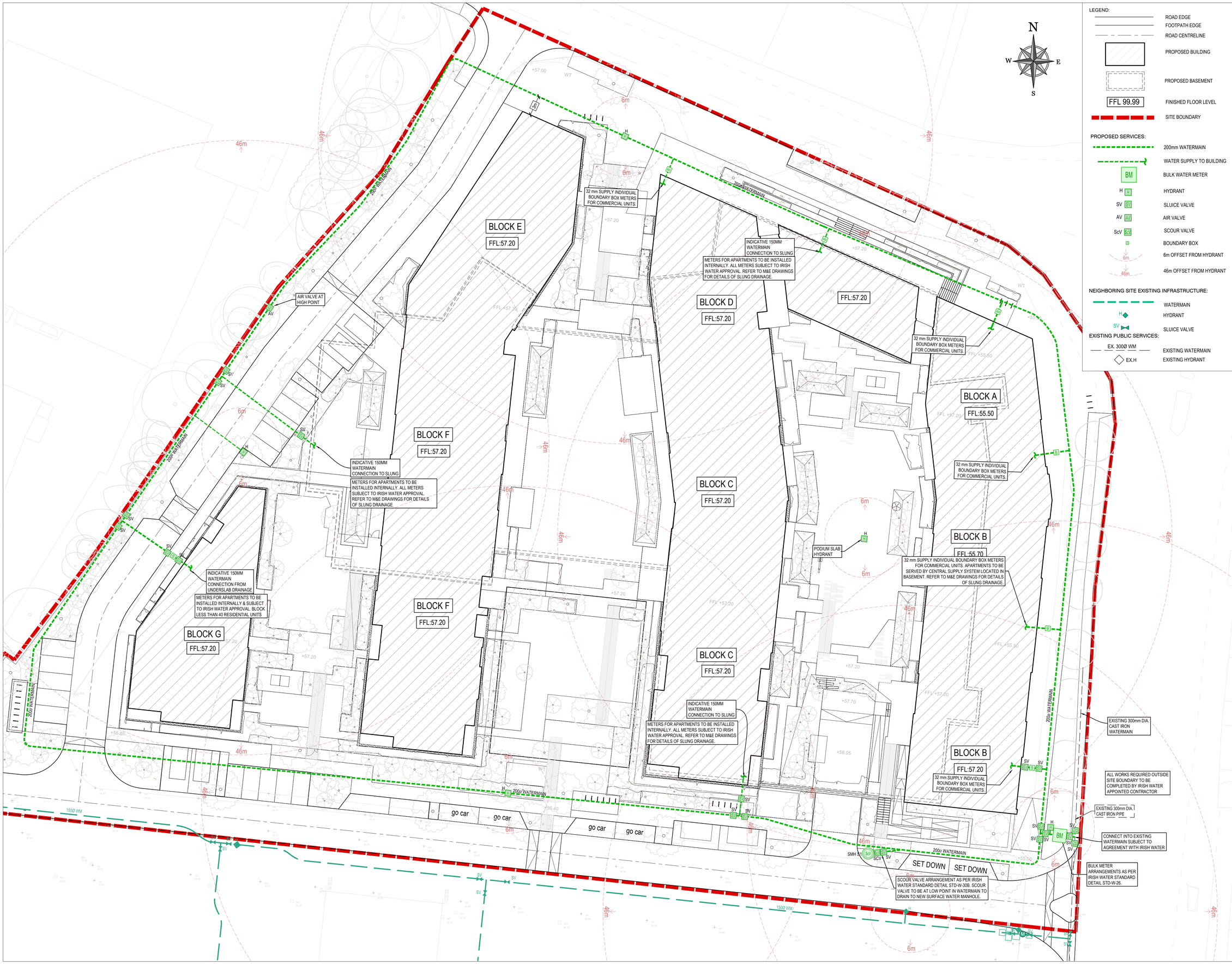
FOUL WATER LONGSECTIONS

client

DWYER NOLAN DEVELOPMENTS

designed by	author	scale	sheet size
RSP	CDC	AS SHOWN	A1

drawing no. 230146-X-92-X-DTM-DR-DBFL-CE-3101 | revision 1



LEGEND:

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

PROPOSED SERVICES:

- 200mm WATERMAIN
- WATER SUPPLY TO BUILDING
- BM — BULK WATER METER
- H — HYDRANT
- SV — SLUICE VALVE
- AV — AIR VALVE
- ScV — SCOUR VALVE
- BOUNDARY BOX
- 6m OFFSET FROM HYDRANT
- 46m OFFSET FROM HYDRANT

NEIGHBORING SITE EXISTING INFRASTRUCTURE:

- WATERMAIN
- HYDRANT
- SLUICE VALVE

EXISTING PUBLIC SERVICES:

- EX. 300Ø WM — EXISTING WATERMAIN
- EX.H — EXISTING HYDRANT

ON ORIGINAL

0 5 10 20 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 HDPE OR HPPE (TYPE PE100-SDR17). 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. ANCHOR BLOCKS TO BE POSITIONED AT DEAD ENDS, TEES, BENDS AND AT EACH SIDE OF HYDRANTS AND VALVES.
8. 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.
9. 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.
10. 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.
11. NOTE RESTRICTIONS ON PLANTING ADJACENT TO WATER MAINS AS PER DETAIL I.W. DETAIL STD-W-12A.
12. NOTE TYPICAL SERVICE LAYOUT DISTANCES (HORIZONTALLY AND VERTICALLY) AS PER I.W. DETAIL STD-W-11.
13. AN AIR VALVE IS PROVIDED AT THE HIGH POINT. REFER TO SECTION 3.16.6 OF IRISH WATER CODE OF PRACTICE.
14. 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.
15. 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
16. SLUICE VALVES PROVIDED AT ALL JUNCTIONS. REFER TO SECTION 3.16.2 AND 3.5.39 OF THE IRISH WATER CODE OF PRACTICE.
17. 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.
18. 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.
19. 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.

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MIXED USE DEVELOPMENT (LRD), SANTRY AVENUE, DUBLIN

drawing title

PROPOSED WATERMAIN LAYOUT

client

DWYER NOLAN DEVELOPMENTS

designed by	author	scale	sheet size
RSP	CDC	1:250	A1

drawing no. 230146-X-93-X-DTM-DR-DBFL-CE-1201 revision 1

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