PUNCH consulting engineers

192232 - Tallaght Public Realm, Belgard Square North environs, South Dublin

Engineering Planning Report

July 2020

Document Control

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Revision	Description	Date	Prepared	Checked	Approved
PL0	Planning Issue	19-03-2020	J.Martin	M.Richardson	M.Richardson

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1 Introduction

This report was prepared to accompany a planning application for the proposed development on a site located at Belgard Square North environs, Tallaght, South Dublin. The site location is shown in Figure Figure 1 and Figure 2 below.

This report deals specifically with the existing surface water drainage and proposed design, while also looking at existing foul water drainage and watermain infrastructure for this application. This report has been prepared with reference to the *"Greater Dublin Regional Code of Practice for Drainage Works"*, and the *"Irish Water Code of Practice for Wastewater Infrastructure"*.

The site measures approximately 1.2 hectares and falls from north to south. It is bisected by Belgard Square North. The area to the north of the road is currently an un-used Brownfield site, bounded by commercial buildings to the east and west, and the Cookstown Road to the north. It consists of vegetation including trees, with some hardstanding areas such as pathways. The area south of the Belgard Square North road is currently in-use as a commercial premises with a car park. There are vehicle and pedestrian access routes running through it. There is a car park to the south, commercial buildings to the west and east. The site is mainly hardstanding with some vegetation such as planting.

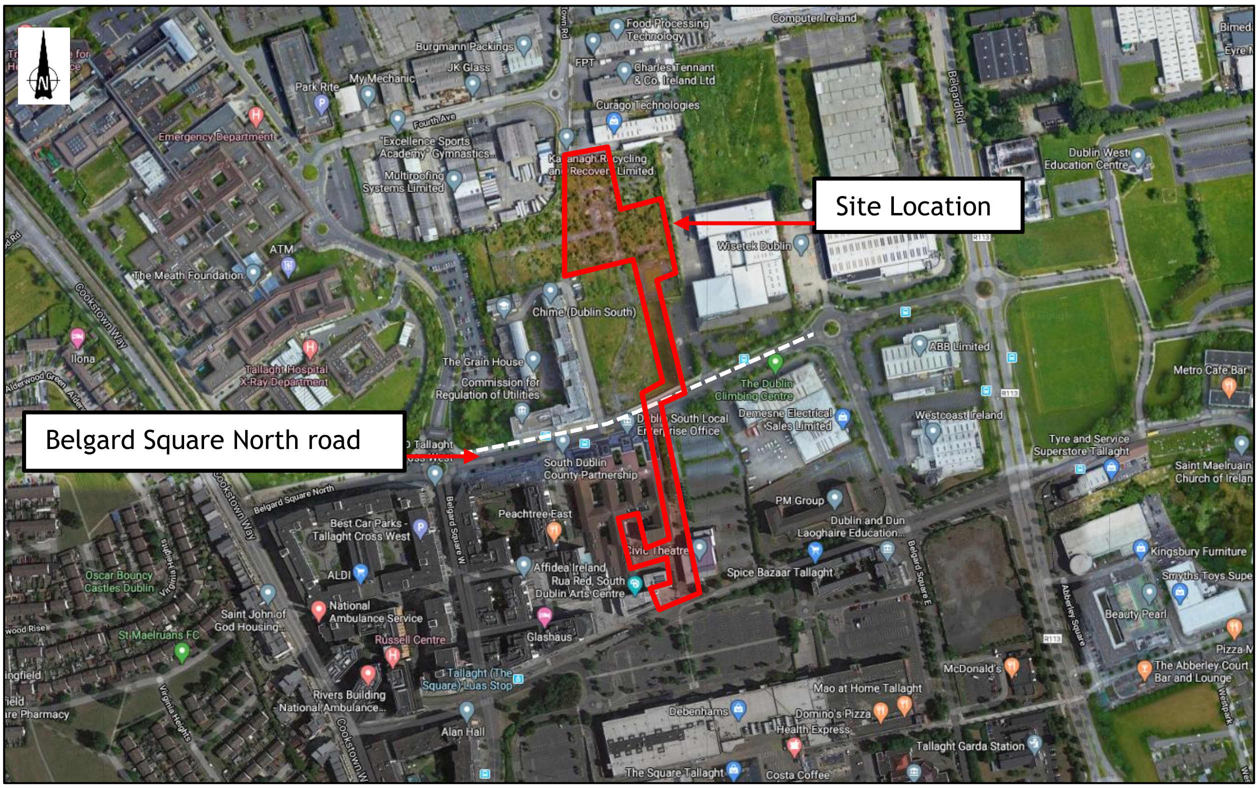

Figure 1: Site Location of the Proposed Development (image courtesy of www.google.com/maps)

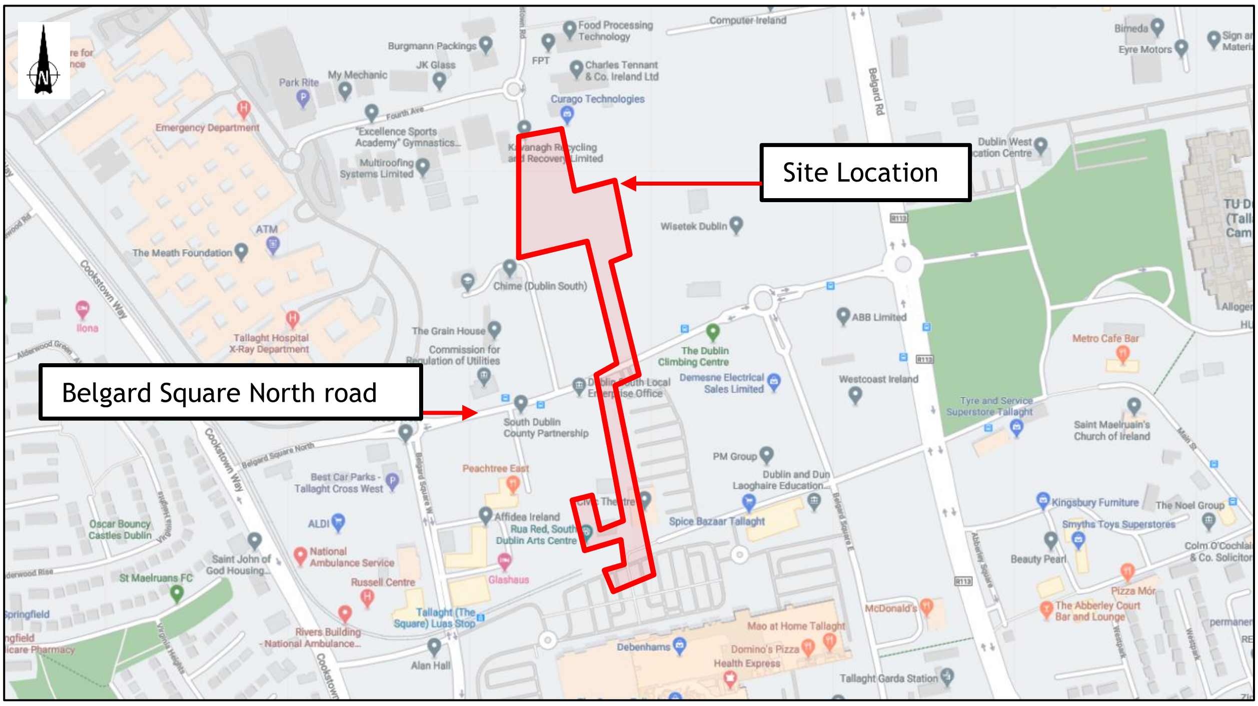

Figure 2: Site Location of the Proposed Development (image courtesy of www.google.com/maps)

1.1 Proposed Development

Public realm works totalling approximately 1.2ha to include proposed new public space at Innovation Square, proposed Pedestrian Crossing on Belgard Cookstown Link Street; proposed new Belgard Square North/Airton East West Pedestrian Link Street; Pedestrian crossings at Belgard Square North and Belgard Cookstown Link Street, redevelopment of County Hall Pedestrian Link; redevelopment and reprofiling of levels within Chamber Square. Proposed works to include the reconfiguration of existing County Council carpark including widening of County Hall Pedestrian Link with additional planting, seating and relocation of wheelchair accessible parking spaces, a new pedestrian crossing and associated amendments to the carpark. Proposed works to include a new advertising totem in Innovation Square extending to a maximum height of 2.4m x 1.5m.

Proposed works to include all ancillary site development and landscaping works, including public lighting, play equipment, furniture and sports equipment, cycle parking, seating, pathways, planting, surface water drainage and boundaries.

The proposed works are outlined in a series of landscape architectural drawings prepared by Dermot Foley Landscape Architects and engineering drawings prepared by PUNCH Consulting Engineers and supplied as part of the planning documentation.

2 Surface Water Drainage

2.1 Existing Surface Water Drainage

2.1.1 Existing Surface Water Drainage - Public records

Based on existing Irish Water records the following surface water sewerage system, described with respect to a central site reference of the Belgard Square North road, is as follows:

- 450mm diameter public surface water sewer of unknown material and age, located to the north west of the site boundary, running along the Cookstown Estate road edge, falling from south to north.
- A public surface water sewer of unknown diameter, material, and age, located centrally within the site boundary, and running along the Belgard Square North road, falling from west to east.
- A public surface water sewer varying in diameter; 225/300/375mm diameter of unknown material, and age, located within the south of the site boundary, and falling from north to south along the eastern boundary
- A 225/300mm public surface water sewer of unknown diameter, material, and age, located in the southern section of the site boundary, falling from west to east and then north to south.
- 375/450mm diameter public surface water sewer of unknown material, located at the southern boundary of the site, falling from west to east along Blessington Road.

Please refer to Appendix A for Irish Water Record drawings illustrating the existing drainage arrangement. An extract is shown in Figure 3 and Figure 4 below. Please also refer to associated PUNCH drainage drawings for further details.

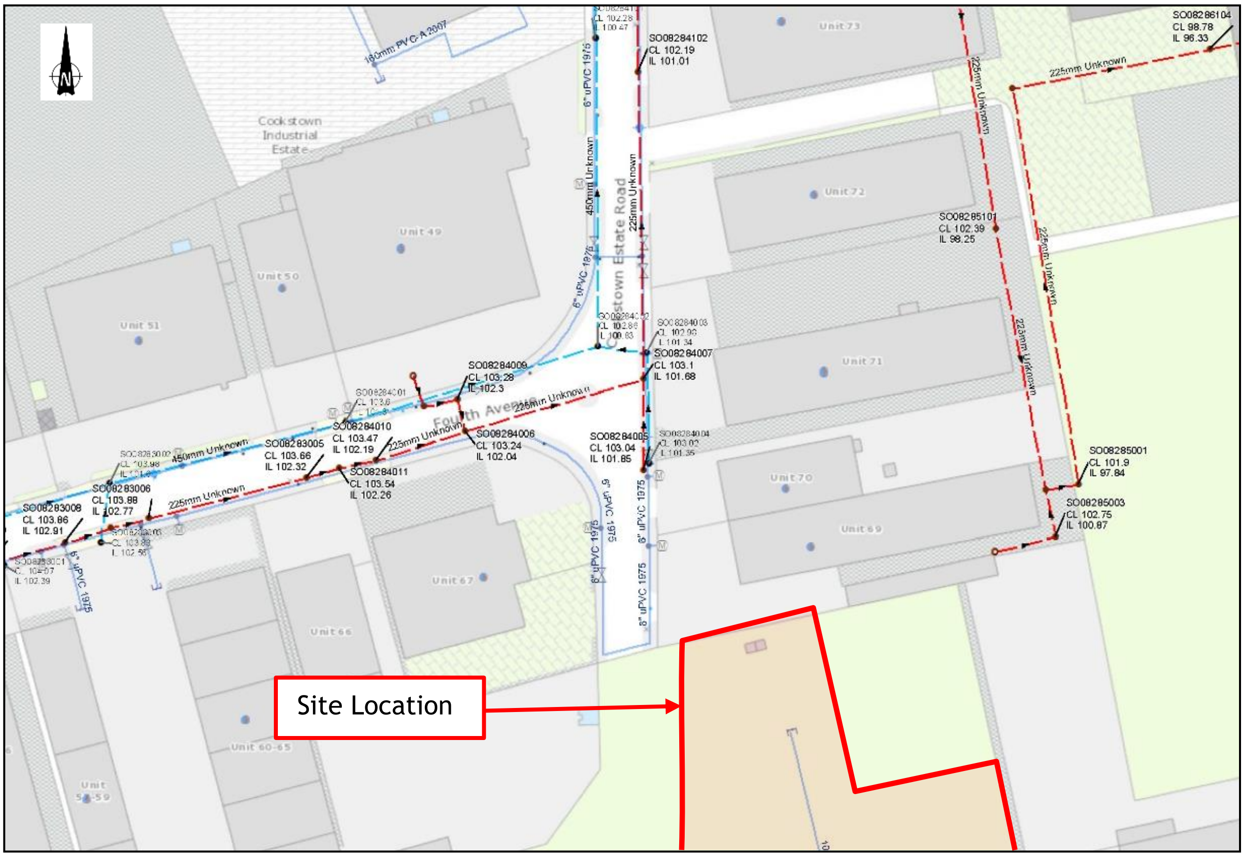

Figure 3: Existing surface water drainage surrounding the site (Extract from Irish Water records)

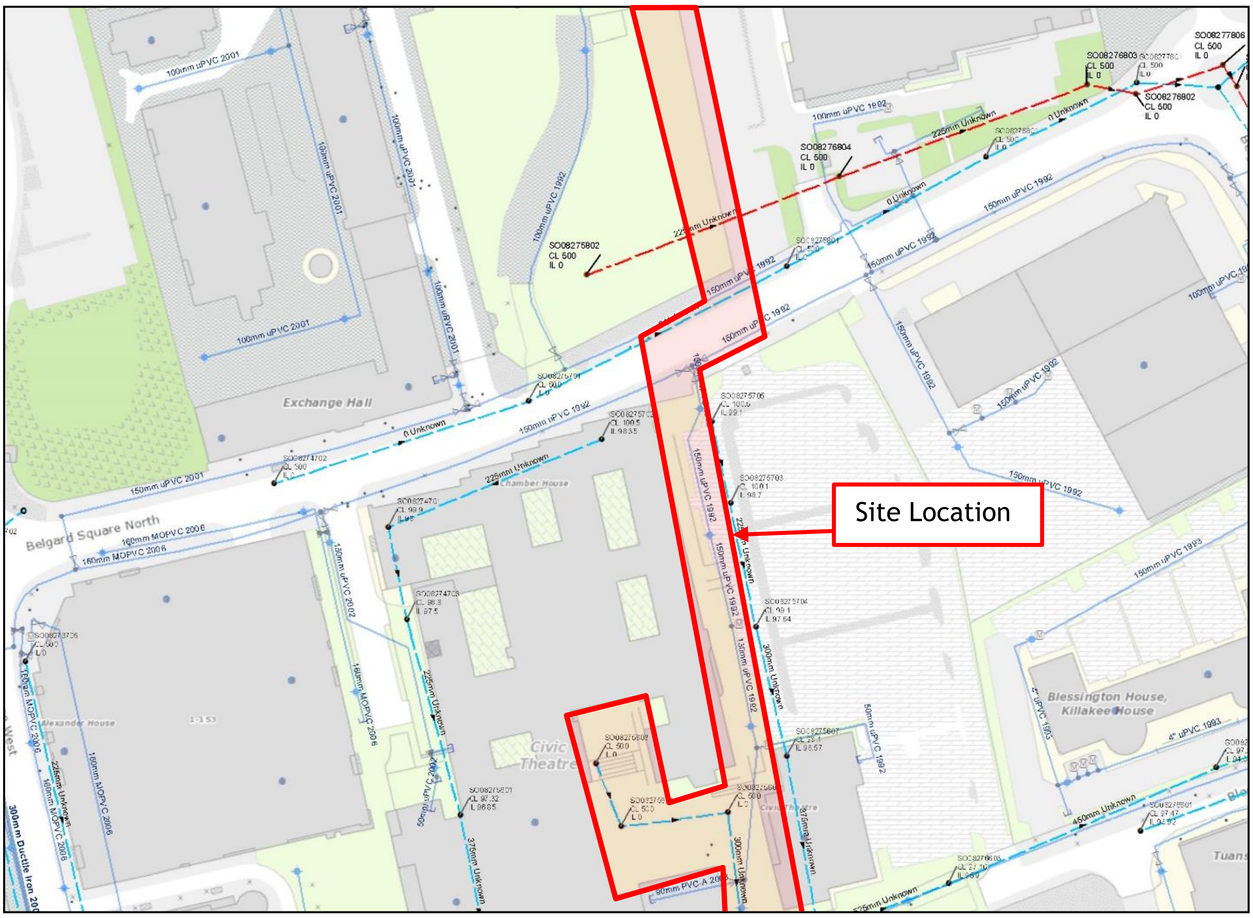

Figure 4: Existing surface water drainage surrounding the site (Extract from Irish Water records)

2.1.2 Existing Surface Water Drainage – Surveys

No survey had been completed at the time of submitting this application.

Surveys are in the process of being completed and will be used for the purposes of tender and construction design. The surveys may require minor design changes to be implemented to facilitate existing conditions. The intent of the design will remain.

2.2 Proposed Surface Water Drainage

2.2.1 General

The proposed surface water drainage system has been designed using Causeway Flow software with reference to the Department of Environment and Local Government's guidance document "Recommendations for Site Development Works for Housing Areas", with guidance taken from the "Greater Dublin Strategic Drainage Study" (GDSDS) and the SDCC's Development Plan, SDCC Strategic Flood Risk Assessment, and CIRIA Publications C644 – "Building Greener".

A new surface water sewer network shall be provided for the proposed development. All surface water run-off from hardstanding areas is designed to be collected by a gravity pipe network.

The site falls from north to south. Run-off from hardstanding areas will be collected and attenuated.

No buildings or covered areas are proposed with this scheme. The design has allowed for the impervious area drained from the adjacent Innovation centre.

The proposed network will discharge to a new surface water manhole constructed on the existing surface water network to the south along Blessington Road. To attenuate the network, 2no. attenuation tanks and 2no. vortex flow controllers are proposed. Tank no.1 will be located to the north of the site with a vortex flow controller to limit outflow. Tank no.2 will be to the south of the site also fitted with a hydraulic vortex flow controller (e.g. Hydrobrake) to limit outflow.

Please refer to section 2.3 for proposed SUDS measures.

The proposed stormwater sewers have been designed using Causeway Flow software. Table 1 describes the stormwater drainage design parameters used and detailed calculations are enclosed in Appendix B.

Table 1: Stormwater Drainage Design Summary

Description	Value
Impervious Site area	1.20 ha
Innovation Centre area	0.24ha
Return period target	Pipe Design 1 in 5 year. Network Design 1 in 30 year + CC. Check 1 in 100 year + CC for flooding.
Climate Change	20%
M5-60	18.7
Ratio R	0.266
Soil type	4 (clayey)
SOIL value	0.45
SAAR	771mm
Flow reduction parameter	Qbar
Qbar value per hectare	7.08 l/s
Controlled Outflow 1	3.5 l/s
Controlled Outflow 2	7.1 l/s
Flow restriction method	Vortex flow controller
Attenuation Storage Volume 1	525m^3
Attenuation Storage Volume 2	255m^3
Infiltration Rate	N/A

2.2.2 Causeway Flow Modelling – General

The proposed surface water drainage system has been designed using Causeway Flow software in accordance with the Department of Environment and Local Government's guidance document "Recommendations for Site Development Works for Housing Areas", with guidance taken from the "Greater Dublin Strategic Drainage Study" (GDSDS) and the South Dublin County Council Development Plan.

The model has analysed a range of storms at the 1% AEP (1 in 100-year return period storm), with a 20% additional rainfall to allow for climate change.

The network has been modelled with the proposed attenuation tank volumes and associated vortex flow controller (e.g. Hydrobrake) outlets included. Two attenuation tanks have been incorporated into the design to make allowance for the site layout. These have been modelled as separate tanks within Causeway Flow at their respective manholes. There are 2 vortex flow controllers proposed, and the vortex flow controllers have been modelled as such in Causeway Flow.

Depths of water in the network model (including pipework, manholes, the attenuation tanks and vortex flow controllers) have been assessed for surcharging and flood risk. The model is established such that a flood risk is identified in the model results if the water rises to within 300mm of the cover level. If the water level rises to a level below this, it is identified as a surcharge within the model results. It is important to note that this warning is given related to proposed ground level at the node (not adjacent floor level).

Causeway includes a design setting called "additional storage". This is included in the software to account for storage volume in the network provided by secondary drainage including access junctions, inspection chambers, service connections etc. This provides additional storage in the network above the storage provided within the attenuation tank and primary drainage network. 20m^3/ha is the standard allowance provided for in Causeway Flow and was utilised for this design.

Please refer to detailed Causeway calculations (inputs and outputs) enclosed in Appendix B for details.

2.2.3 Causeway Flow - Area Contribution

Causeway flow does not allow for different surfaces to contribute to the drainage network at different runoff rates.

Allowance has been made in the design for contribution to drainage from both impervious areas and pervious areas.

Runoff from proposed impervious areas are allowed for at full runoff rate.

Pervious areas have been allowed for in the design and are taken at a SOIL proportionate rate (pervious area x 0.45).

In addition, the proposed surface water design allows for the impervious area associated with the adjacent Innovation centre to the north

The area breakdown can be seen below in Table 2. An extract from the SUDs layout is also included below in Figure 5. The area of each surface finish was taken and the proportionate rate was applied to calculate the area to be used in the design calculations.

Please note that the surface water drainage design allows for the area from the proposed Tallaght Public realm development in addition to area from the adjacent separate 'Innovation Centre Development' to the north. The 'Innovation centre' development is subject to a separate planning application. Please note that this Innovation centre area is indicated in Table 2 below and is shown on PUNCH drawing 192232-003.

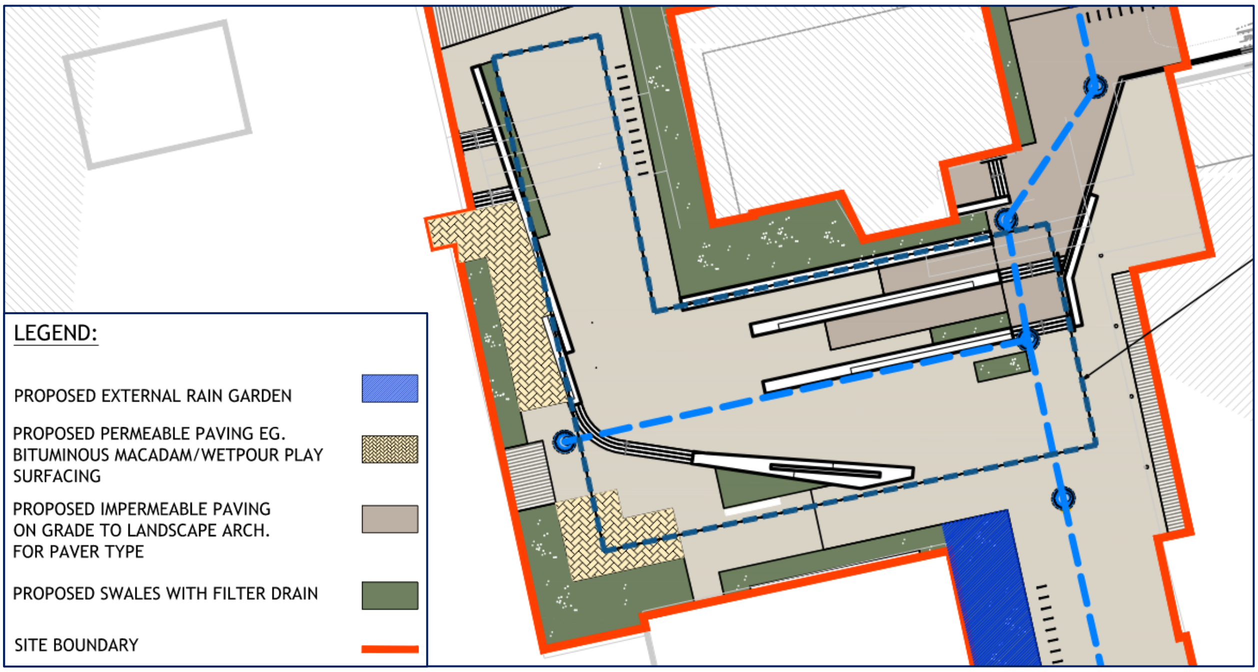

Figure 5: SUDs Layout extract with finish types (PUNCH dwg 192232-003 & 004)

Table 2: Impervious Area Contribution

Description of Area	Actual Area (m^2)	Permeable	Soil Proportionate Value Applied	Equivalent Impervious Area Used (m^2)
Proposed External Rain Garden	405	Yes	0.45	182
Proposed Permeable Paving	1,238	No	1	1,238
Proposed Impermeable Paving	6,815	No	1	6,815
Proposed Swales with Filter Drain	3,574	Yes	0.45	1,608
Innovation Centre Runoff (full impervious assumed)	2,400	No	1	2,400
Total Area used for Qbar calculation	**14,432**		**Total Area used in drainage model**	**12,243**

Please refer to PUNCH Drawings 192232-003 & 004 for the catchment map including area locations and finish types.

2.2.4 Rainfall Data

A value for the SAAR for the site has been obtained from the Met Éireann website. The SAAR value used was 771mm

The following rainfall parameters have been utilised in the Causeway Flow model: M5-60 of 18.7mm and a Ratio (R) of 0.266. These figures have been taken from Met Éireann Rainfall Data, refer to Appendix B for rainfall data sheet.

2.2.5 Geotechnical & Soils

The GSI quaternary map was reviewed and an extract from this map is shown in Figure 6. This indicates the area to be 'Till derived from limestones.'

Based on the above, a soil value of 4 was used for the design which characteristics the soil as 'Clayey, poorly drained'.

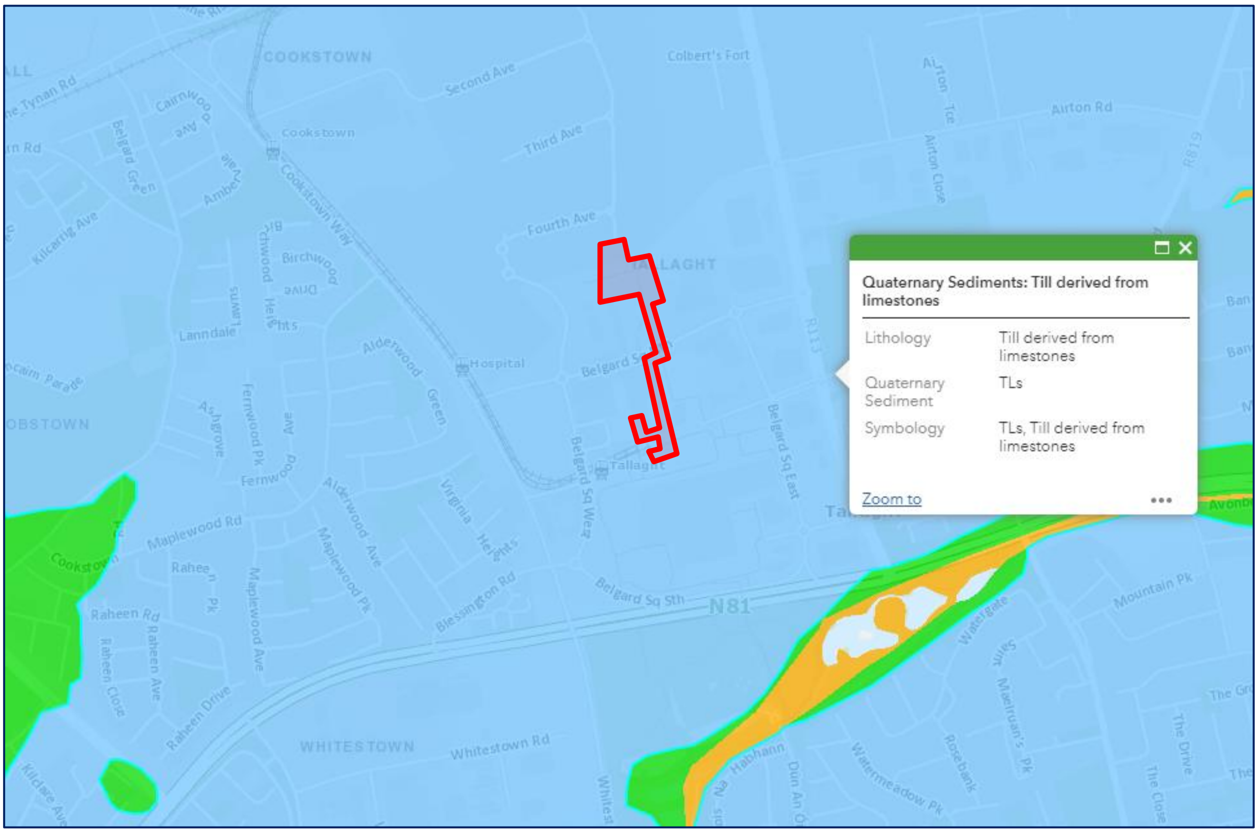

Figure 6: Extract from GSI Quaternary Map

2.2.6 Qbar Calculation

The following values have been used to calculate Qbar:

- SAAR = 771 mm – (refer section 2.2.4 above)
- SOIL = 0.45 – (refer section 2.2.5 above)
- Area of Site (1.20ha) + Area of Innovation Centre (0.24ha) = 1.44ha (refer to Table 2 above)

To establish Qbar for a site less than 50ha, Qbar for 50Ha is calculated, and then proportionately reduced to the actual site area.

Refer below for Qbar calculation:

Qbar for 50Ha:

$$Qbar\ (50Ha) = 0.00108xAREA^{0.89}SAAR^{1.17}SOIL^{2.17}$$

$$Qbar\ (50Ha) = \ 0.00108x0.50^{0.89}771^{1.17}0.45^{2.17} = 245.94l/s$$

Qbar per Hectare:

Proportionate Qbar for 10,000m^2:

$$Qbar\ (site) = \frac{Qbar(50Ha)xSite\ area}{50,000}$$

$$Qbar\ (site) = \frac{245.94x10,000}{500,000} = \ 4.92\ l/s$$

This results in a Qbar value of 4.92 l/s/Ha

Qbar for Impervious Catchment

Proportionate Qbar for 14400m^2:

$$Qbar\ (site) = \frac{Qbar(50Ha)xSite\ area}{500,000}$$

$$Qbar\ (site) = \frac{245.94x14,400}{500,000} = 7.08l/s$$

This results in a Qbar value of 7.1 l/s

2.2.7 Attenuation tanks

It is proposed to attenuate all surface water runoff from impervious areas using 2 attenuation tanks. The attenuation tanks will be located in the northern and southern areas of the site under the hardstanding pedestrian areas and landscape areas. The outlet flow from each attenuation tank will be controlled by a vortex flow controllers.

The attenuation tank has been sized to attenuate the 1:100 year return period storm event, plus 20% climate change. The attenuation tank has been modelled as part of a stormwater drainage network system in Causeway Flow with its discharge limited by a vortex flow controller. The north attenuation tank has a low flow restriction to limit the size of the southern attenuation tank. The north attenuation tank outlet discharges to pipework that discharges to the southern attenuation tank. The southern attenuation tank has its outflow limited to Qbar (7.1l/s). The results of this model require a total attenuation storage volume of 780m^3.

The attenuation tanks proposed are to be a below ground combined arch and gravel system (e.g. stormtech). All surface water from the surface water network will enter and exit the arch system via the isolation row through the system. This arrangement ensures that all debris and silt will not enter the gravel zone and will be restricted to the isolator arch row. If maintenance is ever required to remove silt or debris, a pressure jetting system will be able to clean any debris from this isolator row from the next upstream manhole to the next downstream manhole.

The tanks are to be provided with appropriate strength to allow for trafficked condition above. The attenuation tank is to be lined with an impervious membrane to prevent infiltration to or from the surrounding ground. The impervious liner will prevent any infiltration from surrounding groundwater as it may rise and fall with the seasons.

Please refer to Appendix B for calculations and details of the proposed attenuation systems and associated network.

Please refer to PUNCH Drawing No. 192232-001 & 002 for the proposed location and arrangement of the proposed site drainage and attenuation tanks.

2.3 SUDs Proposals

The proposed development has been assessed in relation to Sustainable Urban Drainage Systems (SuDS). A variety of SuDS measures may be adopted to comply with Council recommendations. All SuDS measures are to be implemented with reference to the UK Suds Manual and South Dublin County Council drainage requirements.

Relatively small volumes of rainwater collected on the respective SuDS devices will enter the public sewer network during typical low intensity storms. This is because the proposed SuDS measures will retain rainwater until it is either used via evapotranspiration in the green areas .

The SuDS processes decrease the impact of the development on the receiving environment by providing amenity and biodiversity in many cases. Regular maintenance of the SuDS proposals is required to ensure they are operating to their optimal level throughout their design life.

The specific measures adopted for the proposed development have been agreed in principle with SDCC and comprise the following:

2.3.1 Permeable Pavements

Significant areas of pedestrian walkways on site are proposed as permeable pavements.

The treatment processes that occurs within permeable pavements include:

I. Filtration of silt and the attached pollutants – the majority of silt is trapped within the top 30mm of the jointing material between the blocks
II. Biodegradation of organic pollutants, such as petrol and diesel within the pavement construction
III. Adsorption of pollutants (pollutants attach or bind to surfaces within the construction) which depends on factors such as texture, aggregate structure and moisture content
IV. Settlement and retention of solids.

CIRIA C753 (The SuDS Manual) notes that regarding interception design of pervious pavements, studies have shown that runoff typically does not occur from pervious pavements for rainfall events up to 5 mm.

Permeable pavements are proposed to be sealed below sue to the impervious nature of the existing soil.

2.3.2 Rain Gardens

A large proportion of pavement surfaces are to runoff overland to rain gardens.

The proposed rain gardens will serve to provide treatment to pavement runoff for low intensity storms. Rainwater will be treated through evapotranspiration within the filter media of the rain garden structure.

These rain gardens are to comprise a landscape area with high permeability soil in the top 900mm depth. A perforated surface water filter drain is to be provided at a low level to drain any excess surface water. Any water that drains through the above-mentioned perforated drainage pipe will subsequently discharge to the main stormwater drainage system.

The detail of rain gardens is to be as per the landscape architects' drawings.

2.3.3 Engineered Swales

A proportion of impervious pavement are to drain to proposed swales. The swales will provide treatment via evapotranspiration within the topsoil layers. Infiltration into the ground below will not be significant due to the highly impermeable clay layers below. The swales will comprise high permeability soils with a filter drain at low level to drain waterlogged conditions.

The proposed swales are to include shallow depth high permeability soil with low grass and planting. A perforated surface water filter drain is to be provided at a low level to drain any excess surface water. Any water that drains through the above-mentioned perforated drainage pipe will subsequently discharge to the main stormwater drainage system.

CIRIA C753 (The SuDS Manual) Table 24.6 notes that regarding interception design of swales, pavements drained by swales can be considered to provide interception, i.e. it can be assumed that there will be zero runoff from the first 5 mm rainfall for 80% of events during the summer and 50% in winter.

The detail of swales are to be as per the landscape architects' drawings.

2.3.4 Attenuation Tank

The proposed drainage layout uses 2no. attenuation tanks which have been sized to reduce the peak runoff from the site. Please refer to section 2.2.7 above.

3 Foul Water Drainage

There are no foul drainage works necessary as part of this development.

All existing foul water sewers within the vicinity of the site will be retained.

4 Watermain Design

There are no watermain necessary as part of this development.

All existing watermains within the vicinity of the site will be retained.

An existing watermain is present within the site boundary. The records state this pipe as being: 100mm uPVC 1992. A wayleave of 5m will be put in place around the pipe for the work.

The full record drawings can be seen in Appendix A

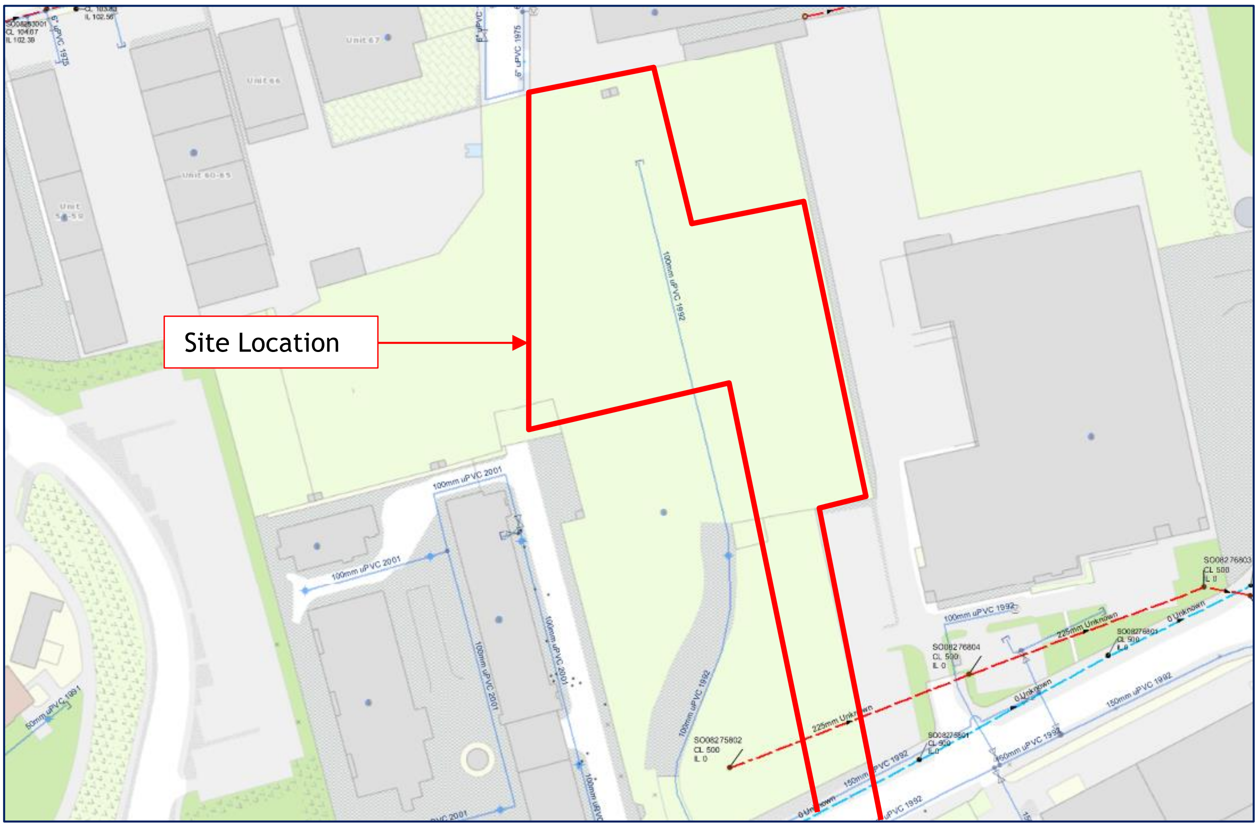

Figure 7: Irish Water Public Records, Northern site boundary

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5 Flooding

A Flood Assessment has been undertaken by PUNCH Consulting Engineers for the development which is outlined in this chapter.

A complete Site Specific Flood Risk assessment has not been undertaken because the site is within a Zone C flood risk area.

Planning guidelines on flood risk and development have been published by the OPW and Department of Environment, Heritage and Local Government (DoEHLG). The below sections summarise how the development's design will be assessed in accordance with the main principles of the guidelines.

5.1 Sequential Approach

The sequential approach makes use of flood zones for river and coastal flooding, as described below:

Zone A – High probability. This zone defines areas with the highest risk of flooding. For river flooding it is defined as more than 1% probability or more than 1 in 100 year, and for coastal flooding it is defined as 0.5% probability or more than 1 in 200 year.

Zone B – Moderate probability. This zone defines areas with a moderate risk of flooding. For river flooding it is defined as 0.1% to 1% probability or between 1 in 100 and 1 in 1,000 years, and for coastal flooding 0.1% and 0.5% probability or between 1 in 200 and 1 in 1,000 years.

Zone C – Low probability. This zone defines areas with a low risk of flooding less than 0.1% probability or less than 1 in 1,000 years.

The flood zones are then to be looked at with the vulnerability of the building proposed;

Highly Vulnerable	– Hospitals, Garda stations, homes, motorways etc.
Less Vulnerable	– Commercial, retail, offices etc.
Water Compatible	– Marina's, green areas

A sequential approach is then taken to assess the most favourable location for the development based on its vulnerability.

Zone A - Water Compatible or Justification Test

Zone B - Less Vulnerable if no other lands are available or highly vulnerable with Justification Test

Zone C - Any development

5.2 Development Sequential Test

5.2.1 Coastal Flood Risk

Coastal flooding results from sea levels which are higher than normal and result in sea water overflowing onto the land. Coastal flooding is influenced by the following three factors which often work in combination: high tide level, storm surges and wave action.

There is no risk associated with coastal flooding for this site as general ground levels for the site are much higher than expected extreme coastal flood levels.

5.2.2 Fluvial Flood Risk

Fluvial flooding is the result of a river exceeding its capacity and excess water spilling out onto the adjacent floodplain.

Preliminary CFRAM mapping (Figure 8) indicates that the proposed development is located in Flood Zone C, and that there is no fluvial flood risk to the site of the proposed development (refer to Appendix C for the full CFRAM map).

Figure 8- Fluvial Flood Map (image taken from CFRAM)

5.2.3 Pluvial Flood Risk

Pluvial flooding is the result of rainfall-generated overland flows which arise before run-off can enter any watercourse or sewer. It is usually associated with high intensity rainfall and typically occurs in the summer months. Pluvial flood risk has not been identified by the Preliminary Flood Risk Assessment (PFRA) mapping as being a risk to this site.

Additionally, the proposed drainage network will alleviate any concerns of pluvial flooding by catering for the 100 year return period plus 20% climate change allowance.

5.2.4 OPW Flood Maps

The OPW Flood Hazard Mapping Website is a record of historic flood events. This database indicates that there is no record of flooding incidents in the area of the proposed development.

5.3 Flood Risk Assessment Conclusions

The site has been assessed with reference to the “The Planning System and Flood Risk Management” Guidelines. As part of the sequential test, the OPW flood hazard maps have been consulted, as have the

Catchment Flood Risk Assessment Maps produced by the OPW. A complete Site Specific Flood Risk assessment has not been undertaken because the site is within a Zone C flood risk area.

In all cases it was found that the development is at low risk of flooding and the development is deemed appropriate within the proposed site location.

6 Roads and Access

This proposal only involves pedestrian route development. Vehicle access to the site will not be permitted during everyday operation.

6.1 Pedestrian Crossings

There are two pedestrian crossings proposed as part of the development. Please refer to landscape architect's documentation for locations. Please refer to PUNCH drawing 192232-005 for a detail layout of the pedestrian crossing arrangement at Belgard square North. The proposed pedestrian crossing at Belgard Square north is to be in accordance with SDCC Roads and Transportation Dept requirements.

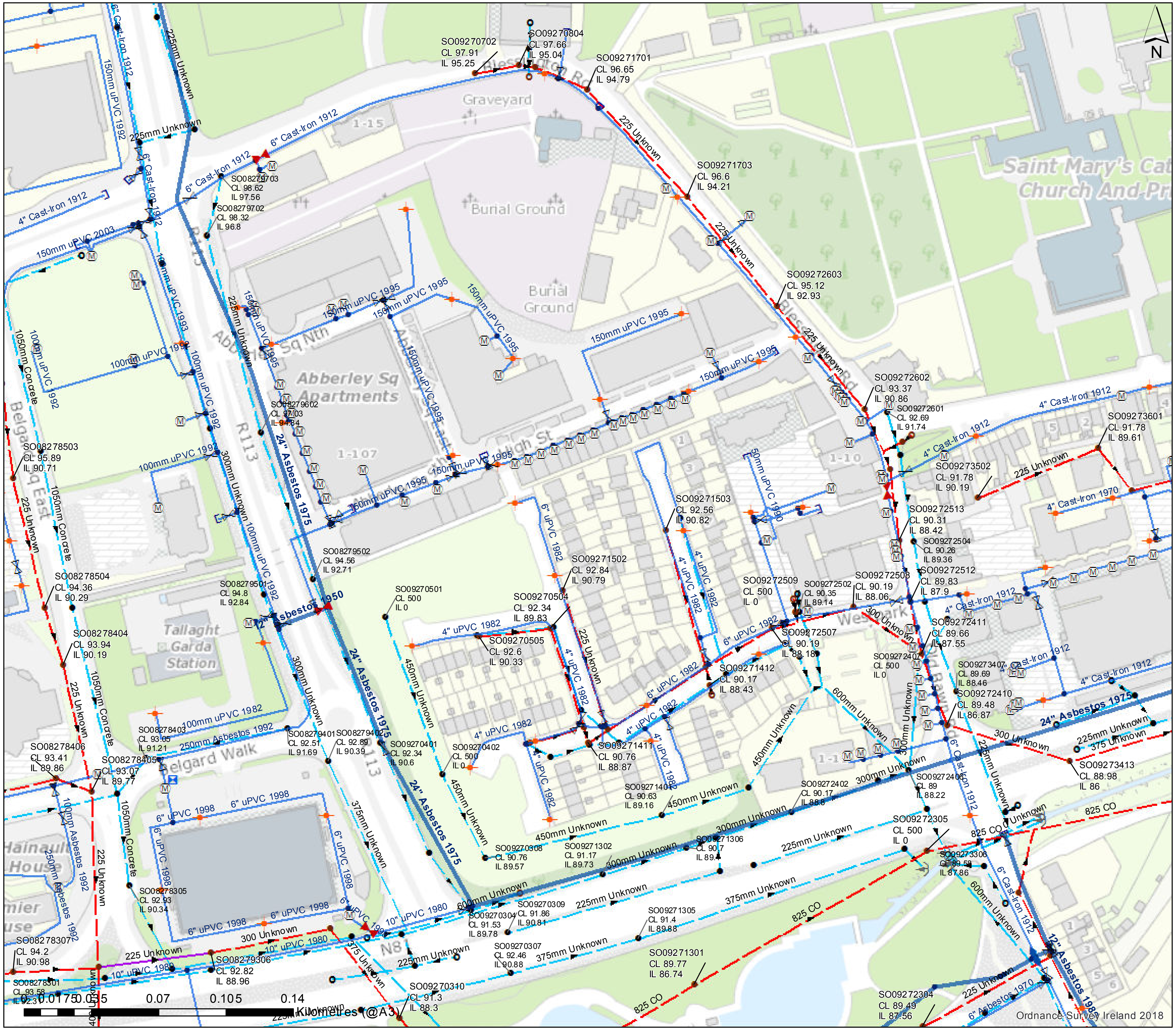
6.2 Proposed Roads & Access

The site is a regeneration project covering a large area so will therefore provide pedestrian access to multiple adjacent properties and areas. It can be accessed by several roads, Cookstown Road to the north, Belgard Square North road bisects the site and a carpark access road borders the area to the south.

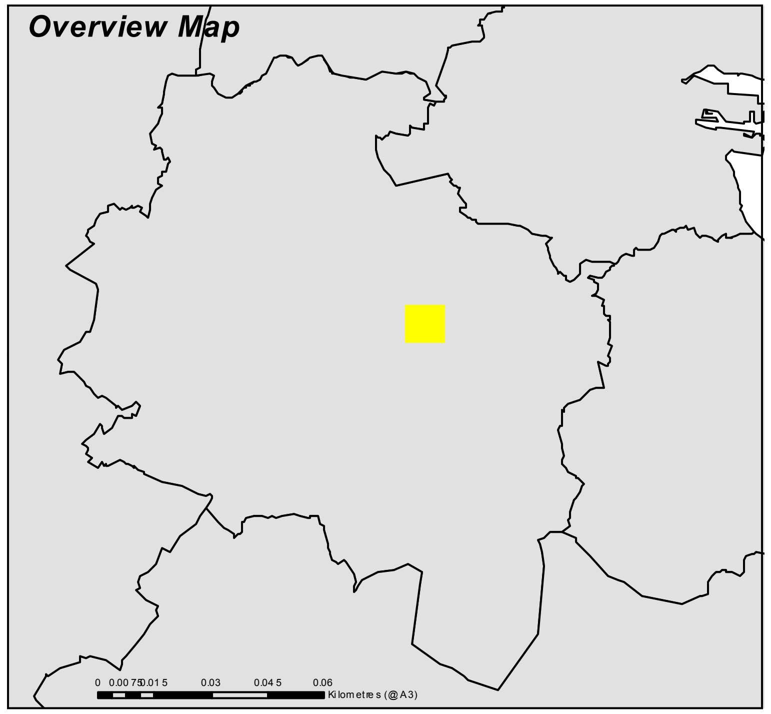
A pedestrian crossing will be provided where the site bisects Belgard Square North.

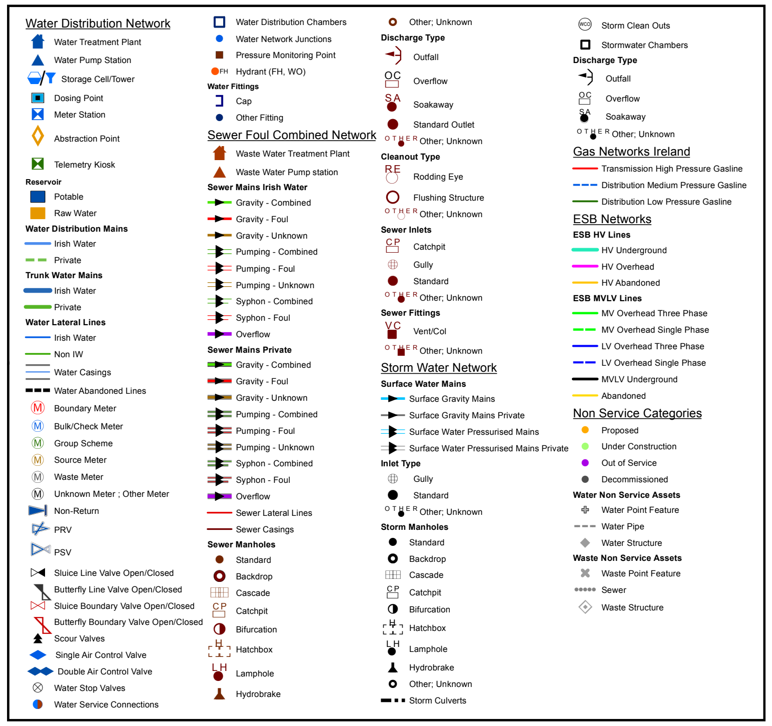
Appendix A Existing Record Drawings

IWGIS Water Utilities Network



Overview Map





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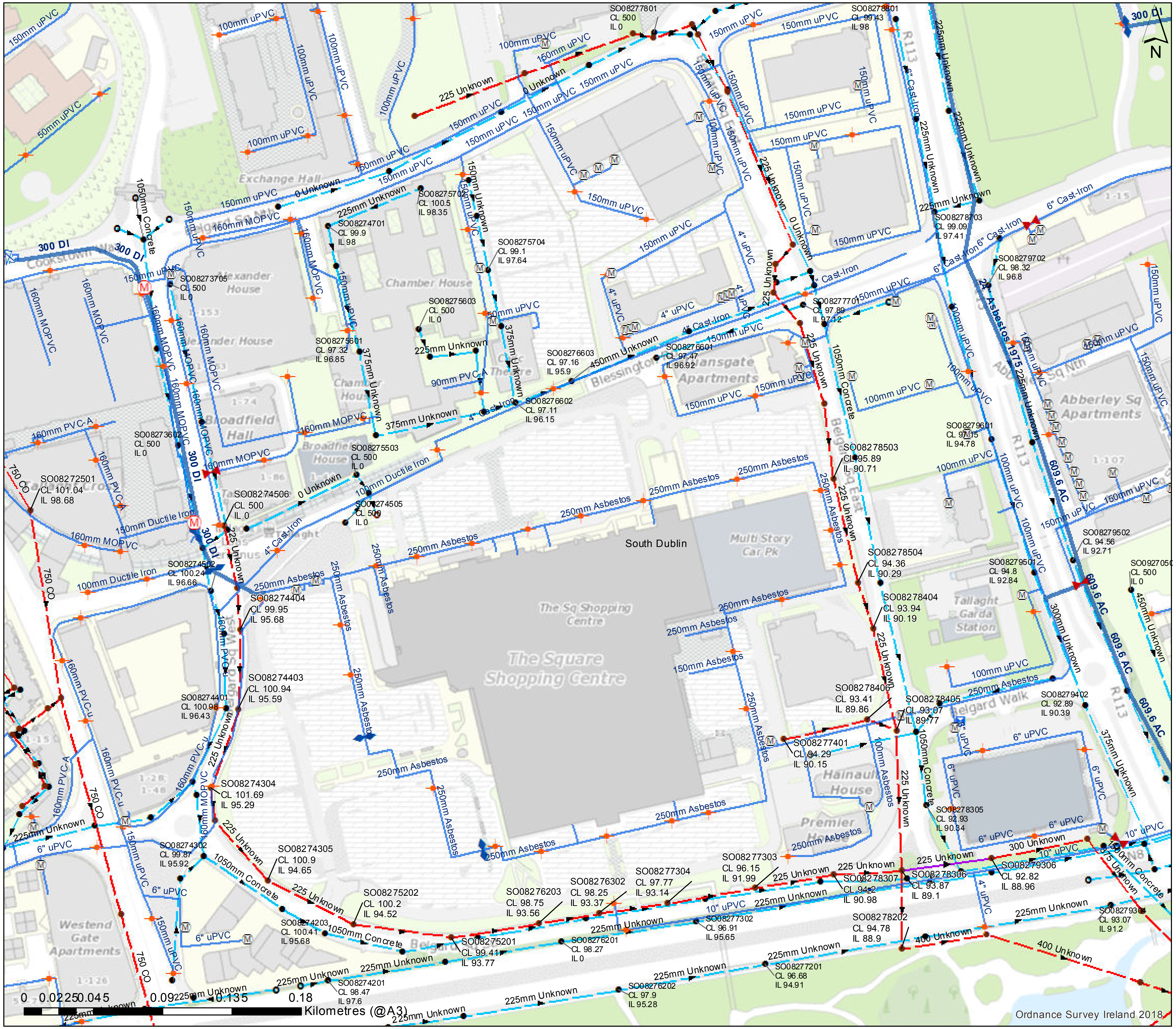
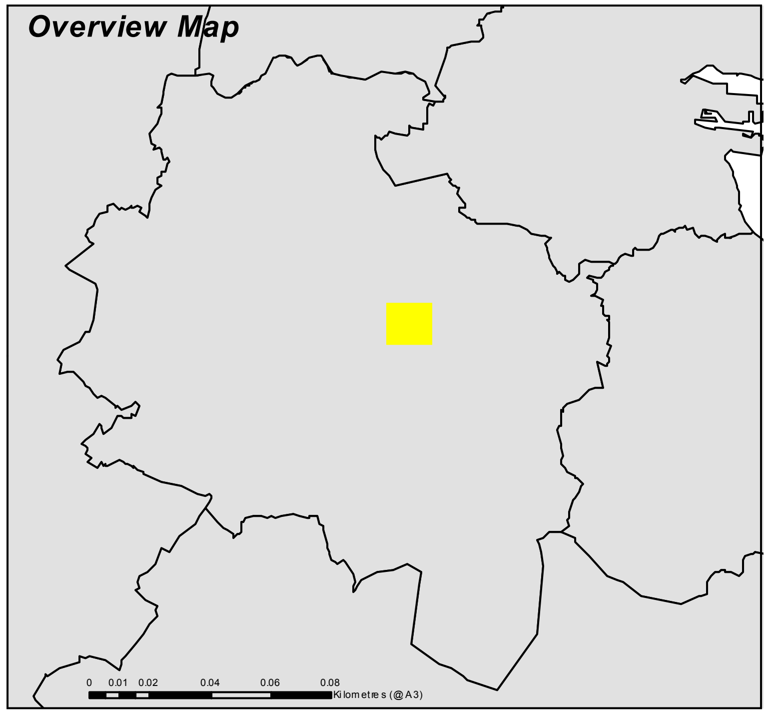
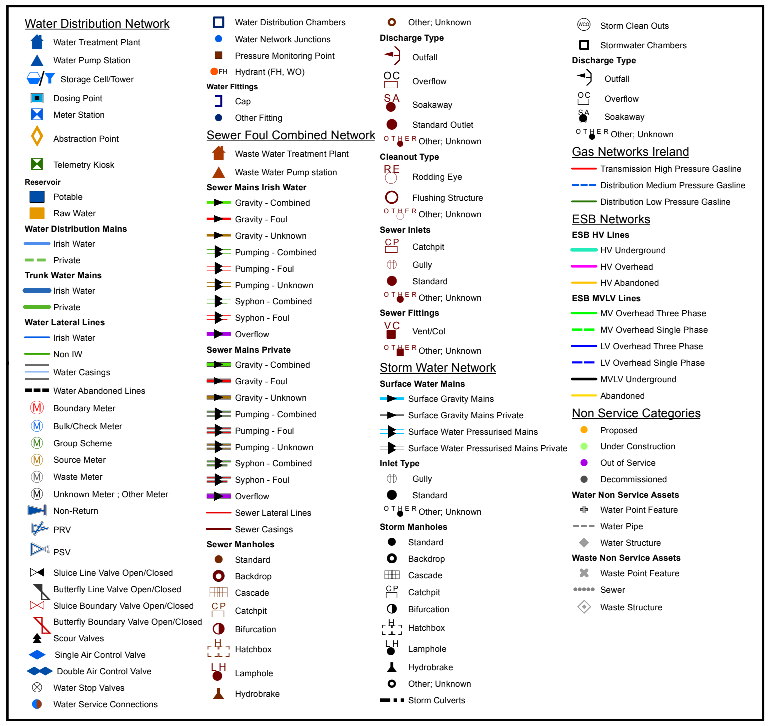
IWGIS Water Utilities Network



Overview Map





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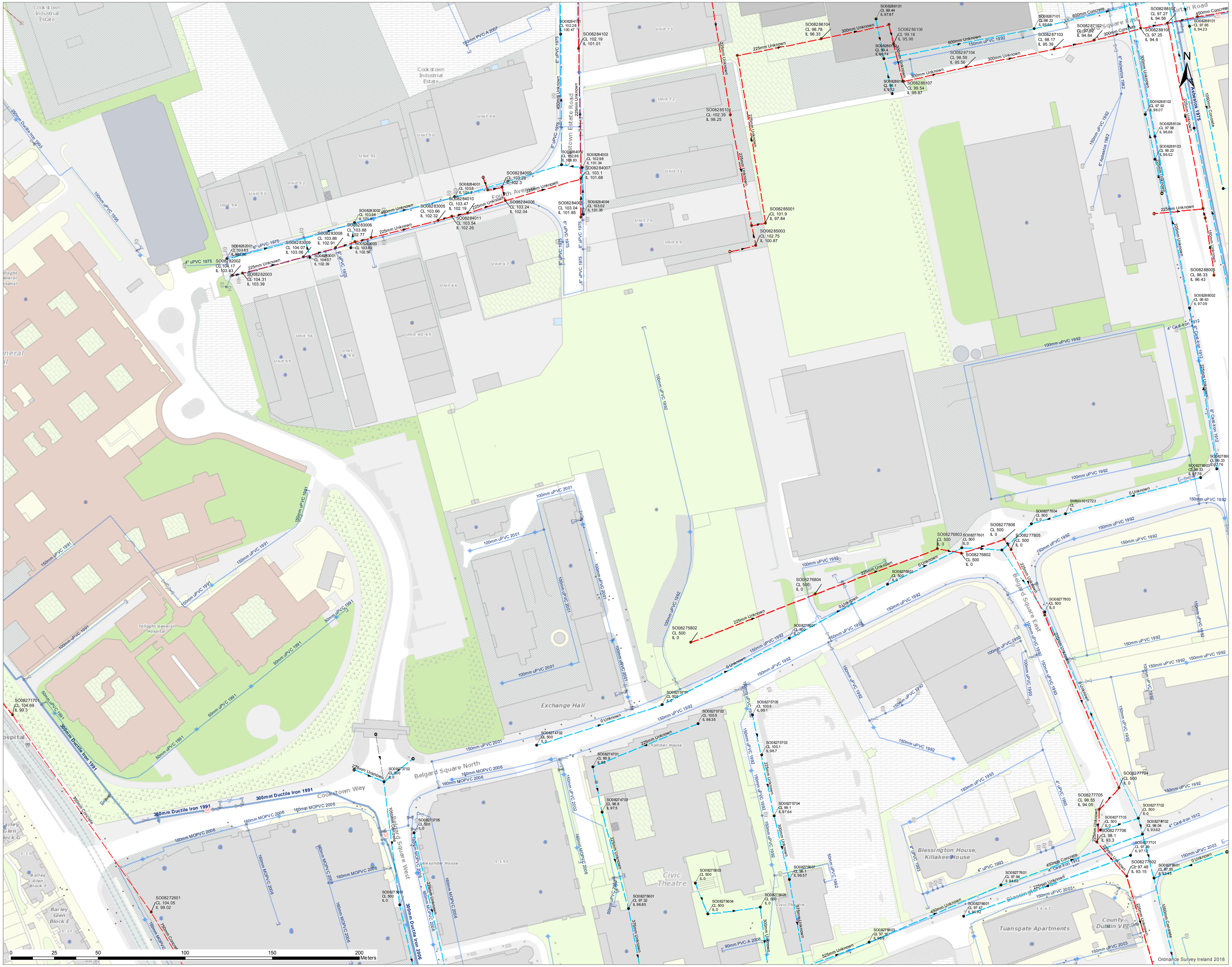
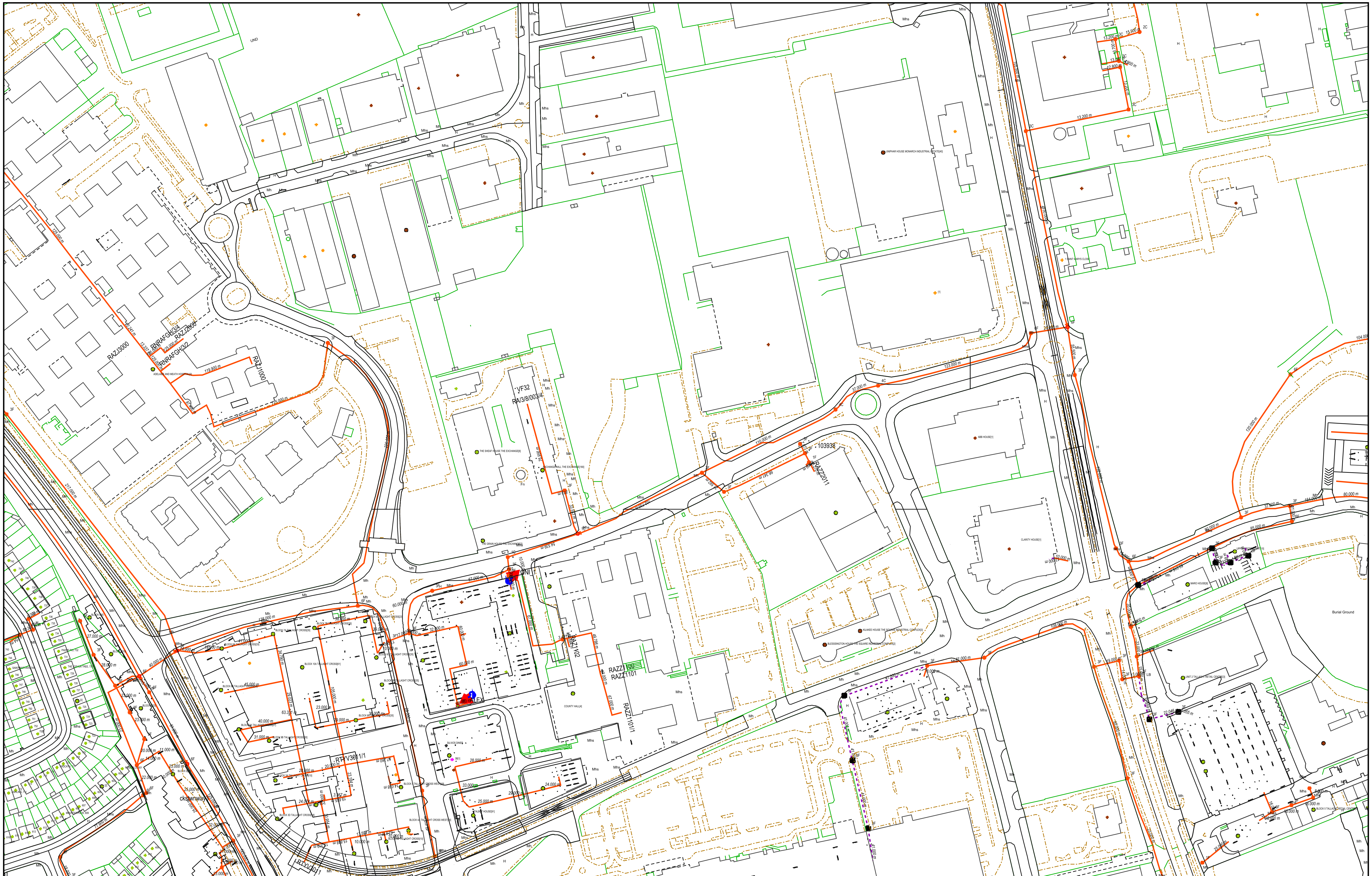


UISCE
ÉIREANN : IRISH
WATER

Legend

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



Unit 7,
Westgate Business Park,
Ballymount,
Dublin 24.

PROJECT NAME

DESIGNED BY:

Produced on: 11/12/2019

@ A3

ESB Networks

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20191218-007_A0

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- GREEN - MV(10KV/20KV) OVERHEAD LINES
- BLUE - LV (400V/230V) OVERHEAD LINES
- CYAN - 38KV & HIGHER VOLTAGE UNDERGROUND CABLE ROUTES
- RED - MV/LV (10KV/20KV/400V/230V) UNDERGROUND CABLE ROUTES

DATE: 18-Dec-2019

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XY COORDINATES DISPLAYED IN IRISH GRID COORDINATE SYSTEM

WARNING

THIS MAP INDICATES THE APPROXIMATE LOCATION OF ESB TRANSMISSION (400KV, 220KV, 110KV, 38KV) AND DISTRIBUTION (20KV, 10KV, 230V/400V) UNDERGROUND CABLES AND OVERHEAD LINES IN THE GENERAL AREA OF THE PROPOSED WORKS. ESB NETWORKS TAKES NO RESPONSIBILITY FOR THE ACCURACY OR COMPLETENESS OF THE MAP. IT IS THE USER'S RESPONSIBILITY TO INDEPENDENTLY VERIFY THE INFORMATION AND THE LOCATION OF UNDERGROUND CABLES AND OVERHEAD LINES. LOW VOLTAGE (230V/400V) SERVICE CABLES (E.G. HOUSE SERVICES, FACTORY/SHOP SERVICES, PUBLIC LIGHTING LAMP SERVICES, ETC) ARE NOT INCLUDED BUT THEIR PRESENCE SHOULD BE ANTICIPATED. THE DEPTHS OF UNDERGROUND CABLES MUST NEVER BE ASSUMED. ADDITIONAL MORE DETAILED INFORMATION IS AVAILABLE FOR HIGH VOLTAGE TRANSMISSION UNDERGROUND CABLES (38KV, 110KV, 220KV, 400KV) FROM THE LOCAL ESB NETWORKS TRANSMISSION REPRESENTATIVE - SEE ATTACHED LIST FOR CONTACT DETAILS OR CALL 1850 372 757. NO WORK SHOULD BE CARRIED OUT IN THE VICINITY OF 38KV OR HIGHER VOLTAGE UNDERGROUND CABLES WITHOUT PRIOR CONSULTATION WITH ESB NETWORKS. BEFORE ANY MECHANICAL EXCAVATION IS UNDERTAKEN, THE ACTUAL LOCATION OF ALL UNDERGROUND ELECTRICITY CABLES MUST BE ESTABLISHED AND VERIFIED ON THE SITE USING:
(A) UP-TO-DATE MAP RECORDS; (B) CABLE LOCATER EQUIPMENT OPERATED IN BOTH POWER AND RADIO MODES;
(C) CAREFUL HAND DIGGING OF TRIAL HOLES USING 'SAFE DIGGING PRACTICE'. REFER ALSO TO 'HSA CODE OF PRACTICE FOR AVOIDING DANGER FROM UNDERGROUND SERVICES'. ESB TAKES NO RESPONSIBILITY FOR AND SHALL BEAR NO LIABILITY, HOWSOEVER ARISING, IN RELATION TO ANY DAMAGE, INJURY/DEATH OR LOSS OF SUPPLY AS A RESULT OF DAMAGE OR INTERFERENCE WITH ITS NETWORKS.

X,Y: 307817, 228322

X,Y: 309093, 228322

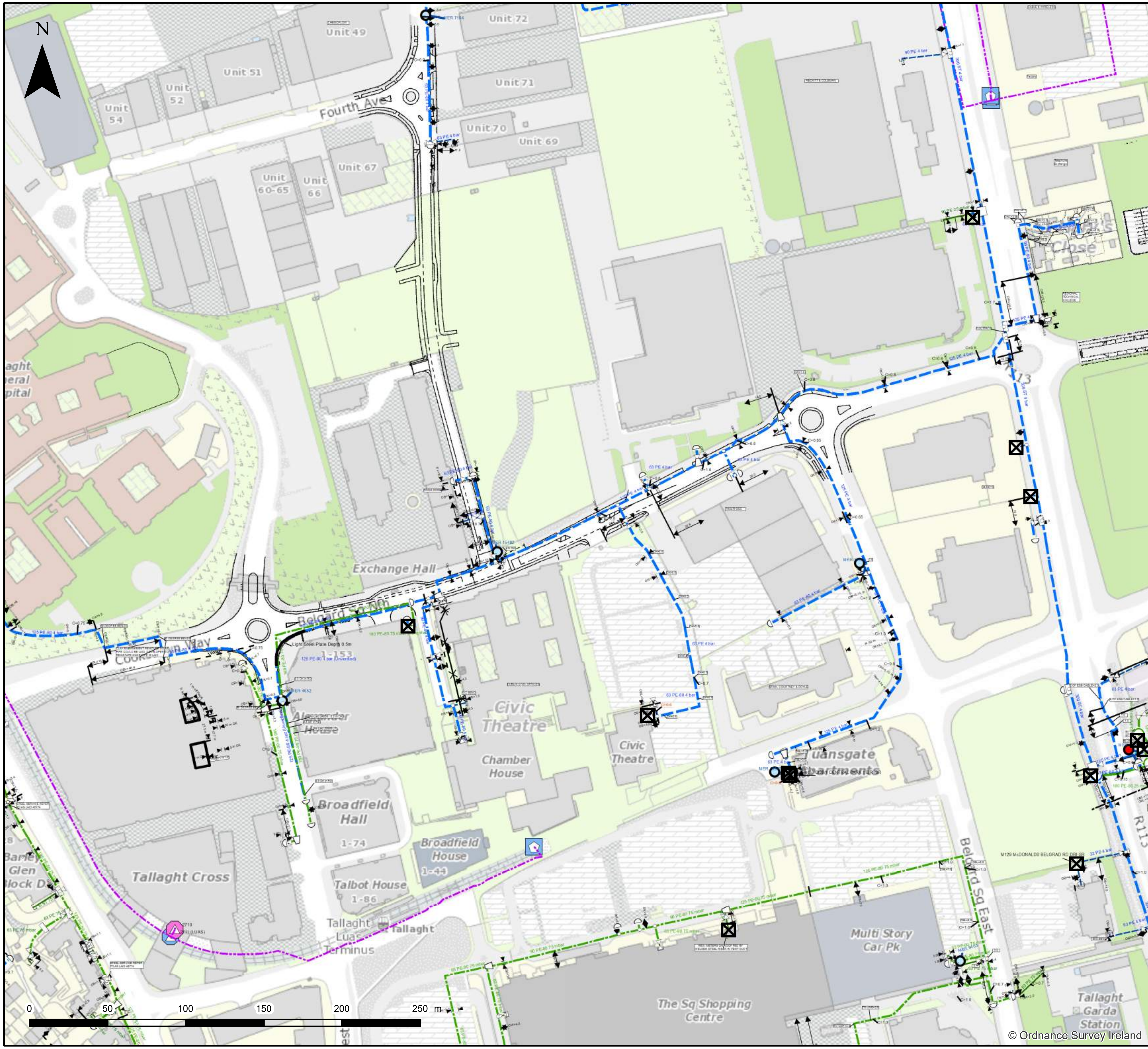
ESB NETWORKS HAS ISSUED THIS MAP AS A PDF DOCUMENT. IF VIEWING A PAPER VERSION OF THIS MAP, THE VIEWER MUST ENSURE THAT IT HAS BEEN PRINTED IN COLOUR TO FIT TO AN A0 (OR LARGER) PAGESIZE AND THAT EACH OF THE COLOURS INDICATED ON THE COLOUR CODE LEGEND ABOVE ARE CLEAR AND DISTINCT FROM EACH OTHER TO MAINTAIN A CORRECT REPRESENTATION OF THE ELECTRICAL NETWORK INFORMATION.

PLEASE NOTE THAT THERE ARE: HIGH VOLTAGE (38KV AND HIGHER VOLTAGES) OVERHEAD LINES AND UNDERGROUND CABLES ON THIS MAP. IF YOU INTEND WORKING, OR UNDERTAKING DEVELOPMENT WITHIN A CORRIDOR EXTENDING 40 METRES ON EITHER SIDE OF ANY HIGH VOLTAGE OVERHEAD LINES OR WITHIN A CORRIDOR EXTENDING 5 METRES ON EITHER SIDE OF ANY HIGH VOLTAGE UNDERGROUND CABLES YOU MUST CONTACT THE DESIGNATED PARTIES IN ADVANCE OF THE WORKS:

FOR HIGH VOLTAGE OVERHEAD LINES: (38KV AND HIGHER VOLTAGES)
CONTACT: ALAN BROWN, ESB TRANSMISSION, KYLEMORE WAY,
DUBLIN 8, D08-E398. PHONE: 087 9273970 EMAIL: ALAN.BROWN@ESB.IE

FOR HIGH VOLTAGE UNDERGROUND CABLES: (38KV AND HIGHER VOLTAGES)
CONTACT: GARETH PAISLEY, ESB TRANSMISSION, KYLEMORE WAY,
DUBLIN 8, D08-E398. PHONE: 087 9374867 EMAIL: GARETH.PAISLEY@ESB.IE

X,Y: 309093, 227476



Important Safety Notice: Damage to gas pipelines can result in serious injury or death. Gas network information is provided as a general guide. The exact location and depth of medium or low pressure distribution gas pipes must be verified on site by carrying out necessary investigations, including, for example, hand digging trial holes along the route of the pipe. Service pipes are not generally shown but their presence should always be anticipated.

High pressure transmission pipelines are shown in red. If a transmission pipeline is identified within 10m of any intended excavations then work must not proceed before GNI has been consulted. The true location and depth of a transmission pipeline must be verified on site by a representative of GNI. Contact can be made through 1850 427 747.

All work in the vicinity of the gas network must be completed in accordance with the current edition of the Health and Safety Authority publication, 'Code of Practice For Avoiding Danger From Underground Services' which is available from the Health and Safety Authority (1890 289 389) or can be downloaded at www.hsa.ie.

Legal Notice: Gas Networks Ireland (GNI) and its affiliates, accept no responsibility for the accuracy of any information contained in this document including data concerning location and technical designation of the gas distribution and transmission network (the"Information"). The Information should not be relied on for accurate distance or depth of cover measurements.

Any representations and warranties, express or implied, are excluded to the fullest extent permitted by law. No liability shall be accepted for any loss or damage including, without limitation,direct, indirect or consequential loss, arising out of or in connection with the use or re-use of the Information.

Aurora Telecom Duct
Aurora Telecom Sub Duct
Aurora Telecom Inserted Gas Pipe

Aurora Telecom Queries - 01-8926166 (Office Hours)
Aurora_Network_Queries@gasnetworks.ie
Aurora Telecom Emergency Only 1850 427399 / 01 2030120

Transmission Pipe (High Pressure)
Transmission Pipe (Construction Issue)
Distribution Pipe (Medium Pressure)
Distribution Pipe (Low Pressure)
Service Pipe (Medium Pressure)
Service Pipe (Low Pressure)
Strategic Pipe (Medium Pressure)
Strategic Pipe (Low Pressure)
Inserted
Abandoned Pipe

C=?	Cover (depth in metres)		Pressure Monitor
	CP Test Point		Protection (Slabbing)
	End Cap		Protection (Sleeve)
	Hot Tap		Reducer
	Installation		Service Terminator
	Valve		Tee
	Mains Verification**		Transition

** Please contact GNI on 1850-427747 for specific information

DIAL BEFORE YOU DIG 1850 42 77 47
In Emergency call 1850 20 50 50

Gas Networks Ireland

GAS NETWORK INFORMATION

Description: Belgard Square North

Location: 708499,727839

Plot Date: 11/12/2019 12:24	Scale: 2500 @ A3
Plotted By: 122	Ref ID: 122_11122019122410

Appendix B Causeway Stormwater Drainage Design Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	5	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	Scotland and Ireland	Connection Type	Level Inverts
M5-60 (mm)	18.700	Minimum Backdrop Height (m)	0.200
Ratio-R	0.266	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Adoptable Manhole Type

Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)
374	1200	749	1500
499	1350	900	1800

>900 Link+900 mm

Max Depth (m)	Diameter (mm)	Max Depth (m)	Diameter (mm)
1.500	1050	99.999	1200

Circular Link Type

Shape	Circular	Auto Increment (mm)	75
Barrels	1	Follow Ground	x

Available Diameters (mm)

100	150	225	300	375	400	450	500	600	750	900

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S1-0	0.096	5.00	103.500	1350	708471.279	728012.253	1.575
S2-0	0.332	5.00	104.000	1350	708422.253	728028.406	1.575
S1-1	0.064	5.00	103.500	1350	708427.724	728002.823	2.500
S3-0	0.074	5.00	101.500	1350	708473.462	727996.319	1.650
S1-2	0.100	5.00	102.500	1350	708430.537	727987.865	2.942
S1-3	0.018	5.00	102.500	1350	708435.582	727962.896	3.112
S1-4			102.000	1350	708464.256	727968.899	2.684
S1-5	0.064	5.00	101.500	1350	708488.683	727974.199	2.246
S1-6	0.082	5.00	101.500	1350	708492.341	727956.561	2.500
S1-7			101.250	1350	708491.413	727927.510	2.333
S1-8	0.098	5.00	101.000	1350	708504.562	727857.952	2.285
S1-9	0.061	5.00	101.000	1350	708491.358	727841.286	2.500
S1-10			99.750	1350	708505.685	727774.239	2.950
S1-11	0.096	5.00	98.500	1350	708517.919	727716.986	1.844
S1-12	0.064	5.00	98.500	1350	708512.080	727705.272	1.931
S4-0	0.105	5.00	98.000	1200	708478.071	727690.848	1.425
S1-13			98.000	1350	708514.339	727688.993	1.546
S1-14			97.400	1200	708518.372	727674.323	1.105
S1-15			97.110	1200	708522.294	727661.243	0.860

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.014	S1-14	S1-15	13.655	0.600	96.300	96.250	0.050	273.1	225	11.00	49.6
1.013	S1-13	S1-14	15.214	0.600	96.454	96.295	0.159	95.7	225	10.71	50.0
1.012	S1-12	S1-13	16.435	0.600	96.569	96.459	0.110	150.0	450	10.52	50.0
4.000	S4-0	S1-13	36.315	0.600	96.575	96.454	0.121	300.0	225	5.81	50.0
1.011	S1-11	S1-12	13.088	0.600	96.656	96.569	0.087	150.0	450	10.36	50.0
1.010	S1-10	S1-11	58.546	0.600	96.800	96.656	0.144	406.6	450	10.22	50.0
1.009	S1-9	S1-10	68.561	0.600	98.500	98.043	0.457	150.0	450	9.25	50.0
1.008	S1-8	S1-9	21.263	0.600	98.715	98.573	0.142	150.0	450	8.56	50.0
1.007	S1-7	S1-8	70.790	0.600	98.917	98.715	0.202	350.4	450	8.35	50.0
1.006	S1-6	S1-7	29.066	0.600	99.000	98.917	0.083	350.2	450	7.25	50.0
1.005	S1-5	S1-6	18.013	0.600	99.254	99.134	0.120	150.0	450	6.81	50.0
1.004	S1-4	S1-5	24.995	0.600	99.316	99.254	0.062	403.2	450	6.63	50.0
1.003	S1-3	S1-4	29.296	0.600	99.388	99.316	0.072	406.9	450	6.21	50.0
1.002	S1-2	S1-3	25.481	0.600	99.558	99.388	0.170	150.0	450	5.72	50.0
1.001	S1-1	S1-2	15.225	0.600	101.000	100.766	0.234	65.0	375	5.47	50.0
3.000	S3-0	S1-2	43.750	0.600	99.850	99.558	0.292	150.0	450	5.44	50.0
1.000	S1-0	S1-1	44.564	0.600	101.925	101.331	0.594	75.0	375	5.35	50.0
2.000	S2-0	S1-1	26.161	0.600	102.425	101.771	0.654	40.0	375	5.15	50.0

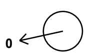
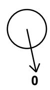
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.014	0.786	31.3	168.6	0.875	0.635	1.254	0.0	225	0.801
1.013	1.337	53.1	169.9	1.321	0.880	1.254	0.0	225	1.361
1.012	1.657	263.6	155.7	1.481	1.091	1.149	0.0	249	1.723
4.000	0.750	29.8	14.2	1.200	1.321	0.105	0.0	109	0.741
1.011	1.657	263.6	147.0	1.394	1.481	1.085	0.0	240	1.701
1.010	1.002	159.3	134.0	2.500	1.394	0.989	0.0	318	1.117
1.009	1.657	263.6	134.0	2.050	1.257	0.989	0.0	227	1.664
1.008	1.657	263.6	125.8	1.835	1.977	0.928	0.0	218	1.637
1.007	1.080	171.8	112.5	1.883	1.835	0.830	0.0	266	1.148
1.006	1.080	171.8	112.5	2.050	1.883	0.830	0.0	266	1.149
1.005	1.657	263.6	101.4	1.796	1.916	0.748	0.0	193	1.552
1.004	1.006	160.0	92.7	2.234	1.796	0.684	0.0	247	1.042
1.003	1.001	159.3	92.7	2.662	2.234	0.684	0.0	247	1.037
1.002	1.657	263.6	90.3	2.492	2.662	0.666	0.0	181	1.509
1.001	2.250	248.5	66.7	2.125	1.359	0.492	0.0	132	1.919
3.000	1.657	263.6	10.0	1.200	2.492	0.074	0.0	59	0.812
1.000	2.094	231.3	13.0	1.200	1.794	0.096	0.0	60	1.147
2.000	2.872	317.2	45.0	1.200	1.354	0.332	0.0	95	2.057

Pipeline Schedule

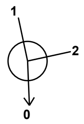
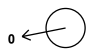
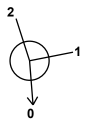
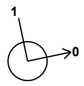
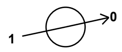
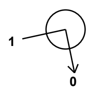
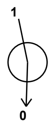
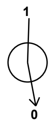
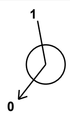
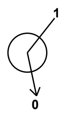
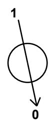
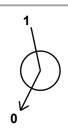
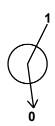
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.014	13.655	273.1	225	Circular	97.400	96.300	0.875	97.110	96.250	0.635
1.013	15.214	95.7	225	Circular	98.000	96.454	1.321	97.400	96.295	0.880
1.012	16.435	150.0	450	Circular	98.500	96.569	1.481	98.000	96.459	1.091
4.000	36.315	300.0	225	Circular	98.000	96.575	1.200	98.000	96.454	1.321
1.011	13.088	150.0	450	Circular	98.500	96.656	1.394	98.500	96.569	1.481
1.010	58.546	406.6	450	Circular	99.750	96.800	2.500	98.500	96.656	1.394
1.009	68.561	150.0	450	Circular	101.000	98.500	2.050	99.750	98.043	1.257
1.008	21.263	150.0	450	Circular	101.000	98.715	1.835	101.000	98.573	1.977
1.007	70.790	350.4	450	Circular	101.250	98.917	1.883	101.000	98.715	1.835
1.006	29.066	350.2	450	Circular	101.500	99.000	2.050	101.250	98.917	1.883
1.005	18.013	150.0	450	Circular	101.500	99.254	1.796	101.500	99.134	1.916
1.004	24.995	403.2	450	Circular	102.000	99.316	2.234	101.500	99.254	1.796
1.003	29.296	406.9	450	Circular	102.500	99.388	2.662	102.000	99.316	2.234
1.002	25.481	150.0	450	Circular	102.500	99.558	2.492	102.500	99.388	2.662
1.001	15.225	65.0	375	Circular	103.500	101.000	2.125	102.500	100.766	1.359
3.000	43.750	150.0	450	Circular	101.500	99.850	1.200	102.500	99.558	2.492
1.000	44.564	75.0	375	Circular	103.500	101.925	1.200	103.500	101.331	1.794
2.000	26.161	40.0	375	Circular	104.000	102.425	1.200	103.500	101.771	1.354

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.014	S1-14	1200	Manhole	Adoptable	S1-15	1200	Manhole	Adoptable
1.013	S1-13	1350	Manhole	Adoptable	S1-14	1200	Manhole	Adoptable
1.012	S1-12	1350	Manhole	Adoptable	S1-13	1350	Manhole	Adoptable
4.000	S4-0	1200	Manhole	Adoptable	S1-13	1350	Manhole	Adoptable
1.011	S1-11	1350	Manhole	Adoptable	S1-12	1350	Manhole	Adoptable
1.010	S1-10	1350	Manhole	Adoptable	S1-11	1350	Manhole	Adoptable
1.009	S1-9	1350	Manhole	Adoptable	S1-10	1350	Manhole	Adoptable
1.008	S1-8	1350	Manhole	Adoptable	S1-9	1350	Manhole	Adoptable
1.007	S1-7	1350	Manhole	Adoptable	S1-8	1350	Manhole	Adoptable
1.006	S1-6	1350	Manhole	Adoptable	S1-7	1350	Manhole	Adoptable
1.005	S1-5	1350	Manhole	Adoptable	S1-6	1350	Manhole	Adoptable
1.004	S1-4	1350	Manhole	Adoptable	S1-5	1350	Manhole	Adoptable
1.003	S1-3	1350	Manhole	Adoptable	S1-4	1350	Manhole	Adoptable
1.002	S1-2	1350	Manhole	Adoptable	S1-3	1350	Manhole	Adoptable
1.001	S1-1	1350	Manhole	Adoptable	S1-2	1350	Manhole	Adoptable
3.000	S3-0	1350	Manhole	Adoptable	S1-2	1350	Manhole	Adoptable
1.000	S1-0	1350	Manhole	Adoptable	S1-1	1350	Manhole	Adoptable
2.000	S2-0	1350	Manhole	Adoptable	S1-1	1350	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
S1-0	708471.279	728012.253	103.500	1.575	1350		0	1.000	101.925	375
S2-0	708422.253	728028.406	104.000	1.575	1350		0	2.000	102.425	375

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
S1-1	708427.724	728002.823	103.500	2.500	1350		1	2.000	101.771	375
							2	1.000	101.331	375
							0	1.001	101.000	375
S3-0	708473.462	727996.319	101.500	1.650	1350					
							0	3.000	99.850	450
S1-2	708430.537	727987.865	102.500	2.942	1350		1	3.000	99.558	450
							2	1.001	100.766	375
							0	1.002	99.558	450
S1-3	708435.582	727962.896	102.500	3.112	1350		1	1.002	99.388	450
							0	1.003	99.388	450
S1-4	708464.256	727968.899	102.000	2.684	1350		1	1.003	99.316	450
							0	1.004	99.316	450
S1-5	708488.683	727974.199	101.500	2.246	1350		1	1.004	99.254	450
							0	1.005	99.254	450
S1-6	708492.341	727956.561	101.500	2.500	1350		1	1.005	99.134	450
							0	1.006	99.000	450
S1-7	708491.413	727927.510	101.250	2.333	1350		1	1.006	98.917	450
							0	1.007	98.917	450
S1-8	708504.562	727857.952	101.000	2.285	1350		1	1.007	98.715	450
							0	1.008	98.715	450
S1-9	708491.358	727841.286	101.000	2.500	1350		1	1.008	98.573	450
							0	1.009	98.500	450
S1-10	708505.685	727774.239	99.750	2.950	1350		1	1.009	98.043	450
							0	1.010	96.800	450
S1-11	708517.919	727716.986	98.500	1.844	1350		1	1.010	96.656	450
							0	1.011	96.656	450
S1-12	708512.080	727705.272	98.500	1.931	1350		1	1.011	96.569	450
							0	1.012	96.569	450

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S4-0	708478.071	727690.848	98.000	1.425	1200				
						0	4.000	96.575	225
S1-13	708514.339	727688.993	98.000	1.546	1350	1	4.000	96.454	225
						2	1.012	96.459	450
						0	1.013	96.454	225
S1-14	708518.372	727674.323	97.400	1.105	1200	1	1.013	96.295	225
						0	1.014	96.300	225
S1-15	708522.294	727661.243	97.110	0.860	1200	1	1.014	96.250	225

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	Scotland and Ireland	Skip Steady State	x
M5-60 (mm)	18.700	Drain Down Time (mins)	240
Ratio-R	0.266	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	20	0	0

Node S1-13 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	96.454	Product Number	CTL-SHE-0132-7100-0450-7100
Design Depth (m)	0.450	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	7.1	Min Node Diameter (mm)	1200

Node S1-6 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	99.000	Product Number	CTL-SHE-0087-3500-1100-3500
Design Depth (m)	1.100	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	3.5	Min Node Diameter (mm)	1200

Node S1-5 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	1.0	Invert Level (m)	99.254
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	500.0	0.0	1.100	500.0	0.0	1.110	0.0	0.0

Node S1-13 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	96.454
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	630.0	0.0	0.400	630.0	0.0	0.410	0.0	0.0

Other (defaults)

Entry Loss (manhole)	0.250	Entry Loss (junction)	0.000	Apply Recommended Losses	x
Exit Loss (manhole)	0.250	Exit Loss (junction)	0.000	Flood Risk (m)	0.300

Approval Settings

Node Size	✓	Maximum Full Bore Velocity (m/s)	3.000
Node Losses	✓	Proportional Velocity	✓
Link Size	✓	Return Period (years)	
Minimum Diameter (mm)	150	Minimum Proportional Velocity (m/s)	0.750
Link Length	✓	Maximum Proportional Velocity (m/s)	3.000
Maximum Length (m)	100.000	Surcharged Depth	✓
Coordinates	✓	Return Period (years)	
Accuracy (m)	1.000	Maximum Surcharged Depth (m)	0.100
Crossings	✓	Flooding	✓
Cover Depth	✓	Return Period (years)	30
Minimum Cover Depth (m)		Time to Half Empty	x
Maximum Cover Depth (m)	3.000	Discharge Rates	✓
Backdrops	✓	1 year (l/s)	
Minimum Backdrop Height (m)		30 year (l/s)	
Maximum Backdrop Height (m)	1.500	100 year (l/s)	
Full Bore Velocity	✓	Discharge Volume	✓
Minimum Full Bore Velocity (m/s)		100 year 360 minute (m³)	

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +20% CC 15 minute summer	345.493	97.763
100 year +20% CC 15 minute winter	242.451	97.763
100 year +20% CC 30 minute summer	237.818	67.294
100 year +20% CC 30 minute winter	166.890	67.294
100 year +20% CC 60 minute summer	165.262	43.674
100 year +20% CC 60 minute winter	109.796	43.674
100 year +20% CC 120 minute summer	104.492	27.614
100 year +20% CC 120 minute winter	69.422	27.614
100 year +20% CC 180 minute summer	81.495	20.972

Rainfall

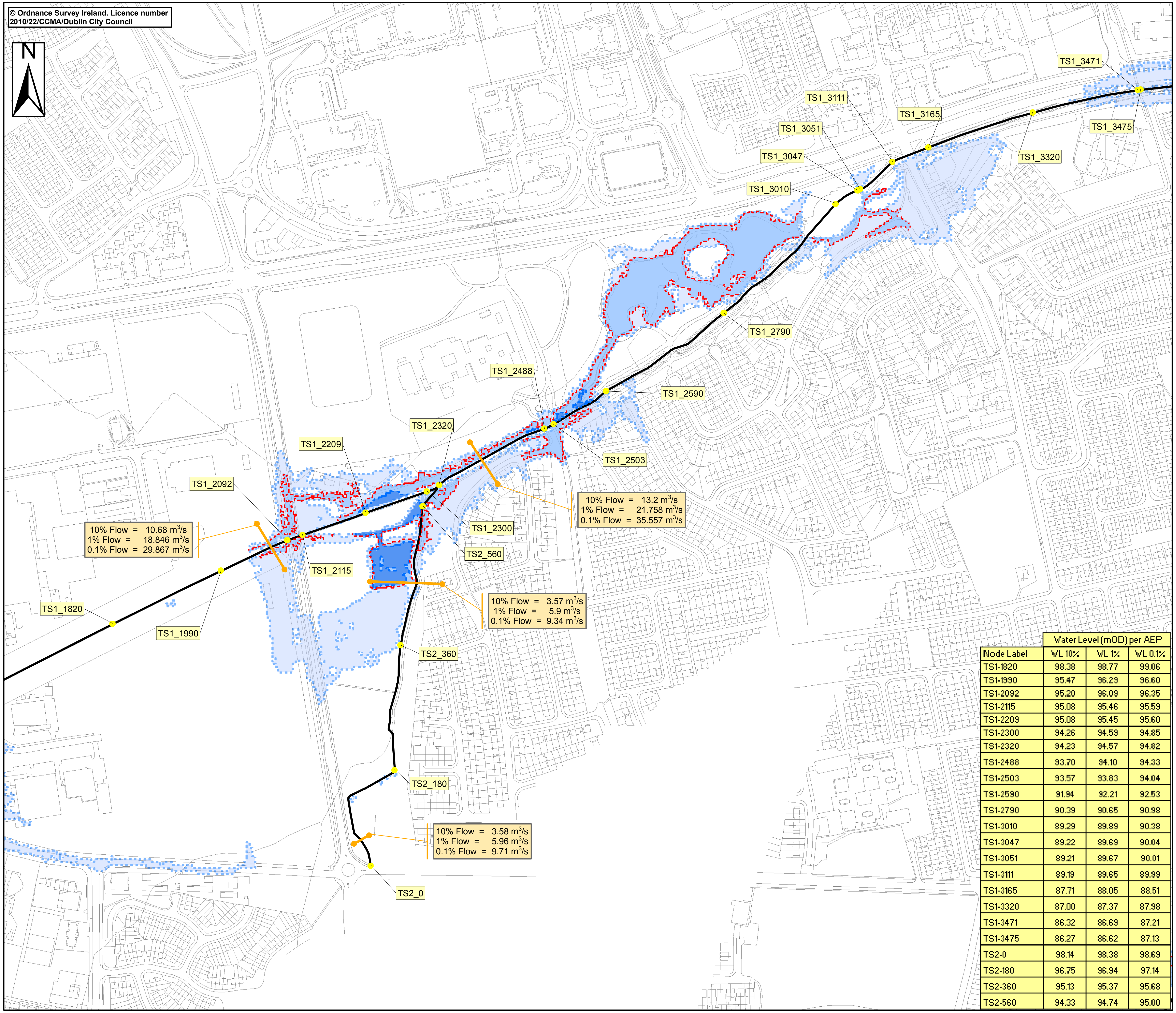
Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +20% CC 180 minute winter	52.974	20.972
100 year +20% CC 240 minute summer	65.125	17.211
100 year +20% CC 240 minute winter	43.267	17.211
100 year +20% CC 360 minute summer	50.505	12.997
100 year +20% CC 360 minute winter	32.830	12.997
100 year +20% CC 480 minute summer	40.249	10.637
100 year +20% CC 480 minute winter	26.740	10.637
100 year +20% CC 600 minute summer	33.274	9.101
100 year +20% CC 600 minute winter	22.735	9.101
100 year +20% CC 720 minute summer	29.893	8.012
100 year +20% CC 720 minute winter	20.090	8.012
100 year +20% CC 960 minute summer	24.878	6.551
100 year +20% CC 960 minute winter	16.479	6.551
100 year +20% CC 1440 minute summer	18.389	4.928
100 year +20% CC 1440 minute winter	12.358	4.928
100 year +20% CC 2160 minute summer	13.391	3.701
100 year +20% CC 2160 minute winter	9.227	3.701
100 year +20% CC 2880 minute summer	11.257	3.017
100 year +20% CC 2880 minute winter	7.566	3.017
100 year +20% CC 4320 minute summer	8.644	2.260
100 year +20% CC 4320 minute winter	5.693	2.260
100 year +20% CC 5760 minute summer	7.190	1.840
100 year +20% CC 5760 minute winter	4.653	1.840
100 year +20% CC 7200 minute summer	6.152	1.569
100 year +20% CC 7200 minute winter	3.971	1.569
100 year +20% CC 8640 minute summer	5.402	1.378
100 year +20% CC 8640 minute winter	3.487	1.378
100 year +20% CC 10080 minute summer	4.841	1.235
100 year +20% CC 10080 minute winter	3.124	1.235

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.84%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1-0	10	102.035	0.110	42.7	0.2925	0.0000	OK
15 minute winter	S2-0	10	102.620	0.195	147.6	1.1001	0.0000	OK
15 minute winter	S1-1	10	101.324	0.324	215.9	0.6297	0.0000	OK
15 minute winter	S3-0	10	100.581	0.731	53.7	1.7007	0.0000	SURCHARGED
15 minute winter	S1-2	10	100.570	1.012	288.4	2.1356	0.0000	SURCHARGED
1440 minute winter	S1-3	1350	100.336	0.948	19.1	1.4663	0.0000	SURCHARGED
1440 minute winter	S1-4	1350	100.336	1.020	18.9	1.4593	0.0000	SURCHARGED
1440 minute winter	S1-5	1350	100.336	1.082	20.6	516.0038	0.0000	SURCHARGED
1440 minute winter	S1-6	1290	100.341	1.341	10.5	2.7978	0.0000	SURCHARGED
960 minute winter	S1-7	960	98.965	0.048	3.8	0.0683	0.0000	OK
15 minute winter	S1-8	11	98.848	0.133	47.1	0.3043	0.0000	OK
15 minute winter	S1-9	11	98.663	0.163	72.0	0.3128	0.0000	OK
15 minute winter	S1-10	11	97.015	0.215	71.7	0.3079	0.0000	OK
15 minute winter	S1-11	11	96.900	0.244	110.4	0.6023	0.0000	OK
960 minute winter	S1-12	765	96.896	0.327	17.3	0.6849	0.0000	OK
15 minute winter	S4-0	10	97.065	0.490	46.7	1.2759	0.0000	SURCHARGED
960 minute winter	S1-13	765	96.896	0.442	19.1	255.7825	0.0000	SURCHARGED
60 minute summer	S1-14	87	96.376	0.081	7.1	0.0911	0.0000	OK
60 minute winter	S1-15	154	96.318	0.068	7.1	0.0000	0.0000	OK

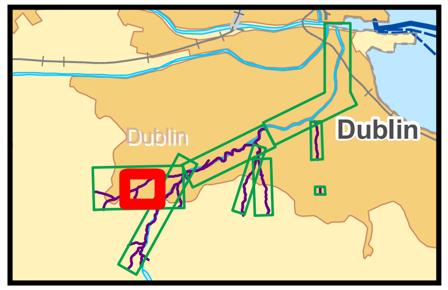
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S1-0	1.000	S1-1	41.6	1.585	0.180	1.1739	
15 minute winter	S2-0	2.000	S1-1	145.8	2.687	0.460	1.4198	
15 minute winter	S1-1	1.001	S1-2	213.9	2.323	0.861	1.3984	
15 minute winter	S3-0	3.000	S1-2	49.8	0.420	0.189	6.9319	
15 minute winter	S1-2	1.002	S1-3	292.5	1.846	1.110	4.0373	
1440 minute winter	S1-3	1.003	S1-4	18.9	0.539	0.118	4.6418	
1440 minute winter	S1-4	1.004	S1-5	18.8	0.656	0.117	3.9603	
1440 minute winter	S1-5	1.005	S1-6	9.8	0.555	0.037	2.8540	
1440 minute winter	S1-6	Hydro-Brake®	S1-7	3.8				
960 minute winter	S1-7	1.007	S1-8	3.8	0.498	0.022	0.6088	
15 minute winter	S1-8	1.008	S1-9	45.7	1.222	0.173	0.7953	
15 minute winter	S1-9	1.009	S1-10	71.7	1.418	0.272	3.4692	
15 minute winter	S1-10	1.010	S1-11	70.6	0.883	0.443	4.7532	
15 minute winter	S1-11	1.011	S1-12	108.4	1.228	0.411	1.1706	
960 minute winter	S1-12	1.012	S1-13	15.5	0.676	0.059	2.3059	
15 minute winter	S4-0	4.000	S1-13	47.2	1.664	1.585	1.0004	
960 minute winter	S1-13	Hydro-Brake®	S1-14	7.1				
60 minute summer	S1-14	1.014	S1-15	7.1	0.649	0.227	0.1493	112.1

Appendix C CFRAM Flood Map



	Water Level (mOD) per AEP		
Node Label	WL 10%	WL 1%	WL 0.1%
TS1-1820	98.38	98.77	99.06
TS1-1990	95.47	96.29	96.60
TS1-2092	95.20	96.09	96.35
TS1-2115	95.08	95.46	95.59
TS1-2209	95.08	95.45	95.60
TS1-2300	94.26	94.59	94.85
TS1-2320	94.23	94.57	94.82
TS1-2488	93.70	94.10	94.33
TS1-2503	93.57	93.83	94.04
TS1-2590	91.94	92.21	92.53
TS1-2790	90.39	90.65	90.98
TS1-3010	89.29	89.89	90.38
TS1-3047	89.22	89.69	90.04
TS1-3051	89.21	89.67	90.01
TS1-3111	89.19	89.65	89.99
TS1-3165	87.71	88.05	88.51
TS1-3320	87.00	87.37	87.98
TS1-3471	86.32	86.69	87.21
TS1-3475	86.27	86.62	87.13
TS2-0	98.14	98.38	98.69
TS2-180	96.75	96.94	97.14
TS2-360	95.13	95.37	95.68
TS2-560	94.33	94.74	95.00

Location Plan:



Legend:

- 10 % AEP Flood Extent (1 in 10 chance in any given year)
- 1 % AEP Flood Extent (1 in 100 chance in any given year)
- 0.1 % AEP Flood Extent (1 in 1000 chance in any given year)
- Defended Area
- High Confidence (<20m) (10% AEP)
- Medium Confidence (<40m) (10% AEP)
- Low Confidence (>40m) (10% and 0.1% AEP)
- High Confidence (<20m) (1% AEP)
- Medium Confidence (<40m) (1% AEP)
- Low Confidence (>40m) (1% AEP)
- River Centreline
- Node Point
- OS_2975 Node Label (refer to table)
- Flow reporting location
- 10% Flow = 1.20 / 1% Flow = 1.56 / 0.1% Flow = 2.17 Peak flow during design flood extent

USER NOTE:

USERS OF THESE MAPS SHOULD REFER TO THE DETAILED DESCRIPTION OF THEIR DERIVATION, LIMITATIONS IN ACCURACY AND GUIDANCE AND CONDITIONS OF USE PROVIDED AT THE FRONT OF THIS BOUND VOLUME. IF THIS MAP DOES NOT FORM PART OF BOUND VOLUME, IT SHOULD NOT BE USED FOR ANY PURPOSE.

Client:

Dublin City / Baile Átha Cliath; South Dublin County Council; Dún Laoghaire-Rathdown County Council; OPW

Project:

DODDER CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT STUDY

Map:

PRESENT DAY TALLAGHT STREAM

Map Type: FLOOD EXTENT

Source: FLUVIAL FLOODING

Map Area: URBAN AREA

Scenario: CURRENT

Drawn By : A.A.B Date : 26 November 2010

Checked By : A.J. Date : 26 November 2010

Approved By : A.G.B Date : 26 November 2010

Figure No. :

TS/EXT/UA/CURS/102

Map Series : Page 2 of 3

Drawing Scale : 1: 5,000 Plot Scale : 1:1 @ A3

0 0.1 0.2 Kilometers

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OPW National Flood Hazard Mapping

Summary Local Area Report

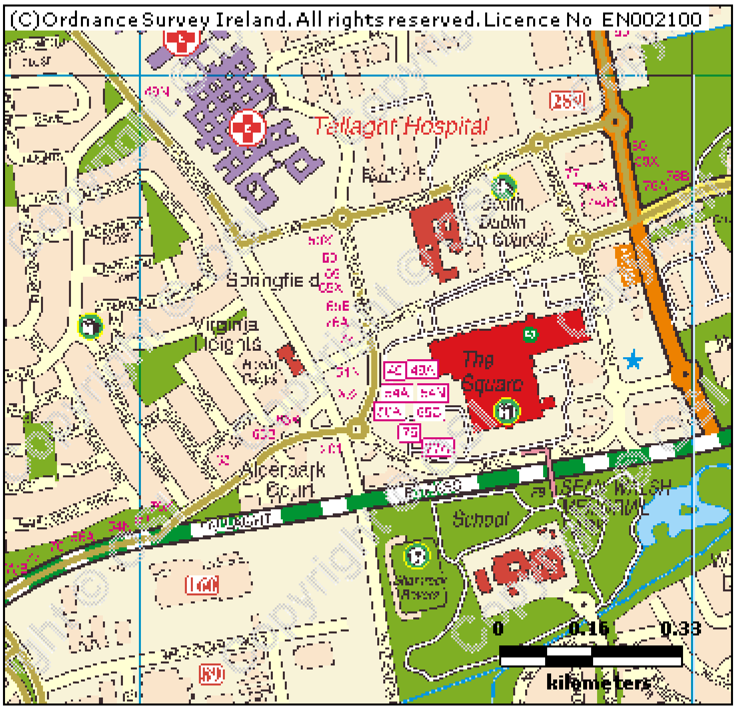
This Flood Report summarises all flood events within 2.5 kilometres of the map centre.

The map centre is in:

County: Dublin

NGR: O 084 274

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



Map Scale 1:13,668

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

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

9 Results

1. Flooding at Knockmore, Tallaght, Co. Dublin on 24th Oct 2011
County: Dublin
Start Date: 24/Oct/2011
Flood Quality Code:3
Additional Information: Reports (1) More Mapped Information

2. Flooding at Tallaght Pass, N81, Dublin 24 on 24th Oct 2011
County: Dublin
Start Date: 24/Oct/2011
Flood Quality Code:2
Additional Information: Reports (1) More Mapped Information

3. Dodder Avonmore Park Nov 2000
County: Dublin
Start Date: 05/Nov/2000
Flood Quality Code:3
Additional Information: Reports (1) More Mapped Information

4. Flooding at Blessington Road, Tallaght, Dublin 24 on 1st May 2012
County: Dublin
Start Date: 05/Jan/2012
Flood Quality Code:2
Additional Information: Reports (1) More Mapped Information

5. Flooding at Bawnlea Crescent and Avenue, Tallaght, Co. Dublin on 24th Oct 2011
County: Dublin
Start Date: 24/Oct/2011
Flood Quality Code:2

Additional Information: Reports (1) More Mapped Information

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6. Flooding at Whitestown Way, Tallaght, Dublin 24 on 24th Oct 2011
County: Dublin

Start Date: 24/Oct/2011
Flood Quality Code:2

Additional Information: Reports (1) More Mapped Information

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7. Dodder Kiltipper Road Nov 2000
County: Dublin

Start Date: 05/Nov/2000
Flood Quality Code:3

Additional Information: Reports (1) More Mapped Information

---

8. Killinarden Stream Jobstown recurring
County: Dublin

Start Date:
Flood Quality Code:4

Additional Information: Reports (1) Press Archive (1) More Mapped Information

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9. Killinarden Stream N81 Jobstown Recurring
County: Dublin

Start Date:
Flood Quality Code:4

Additional Information: Reports (1) Press Archive (1) More Mapped Information