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Engineering Services Report

Proposed Residential Development

Belgard Square, Tallaght, Dublin 24

Client: South Dublin County Council

Job No. C186

July 2020

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ENGINEERING SERVICES REPORT

PROPOSED RESIDENTIAL DEVELOPMENT, BELGARD SQUARE, TALLAGHT, DUBLIN 24

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1.0 INTRODUCTION

Cronin & Sutton Consulting Engineers (CS Consulting) have been commissioned by South Dublin County Council (SDCC) to prepare an Engineering Services Report to accompany a planning application for a residential development at Belgard Square, Tallaght, County Dublin.

This report assesses the proposed development under the following headings:

- Foul Drainage Infrastructure;
- Stormwater Drainage Infrastructure;
- Potable Water Infrastructure.

In preparing this report, CS Consulting has made reference to the following:

- South Dublin County Council Development Plan 2016–2022;
- South Dublin County Council Strategic Flood Risk Assessment, 2016 – 2022;
- Regional Code of Practice For development works, Version 6;
- Irish Waters Code of Practice for Water Infrastructure;
- Irish Waters Code of Practice for Wastewater Infrastructure;
- Greater Dublin Strategic Development Study.

The Engineering Services Report is to be read in conjunction with the engineering drawings and documents submitted by CS Consulting and with the various additional information submitted by the other members of the design team.

2.0 SITE LOCATION AND PROPOSED DEVELOPMENT

2.1 Site Location

The proposed development site is located to the south of Cookstown Road and Fourth Avenue and to the North of Belgard Square North, Tallaght, Co. Dublin. The site is located in the REGEN site zoning in the Tallaght Town Centre Local Area Plan and has a total area of approximately 0.49Ha.

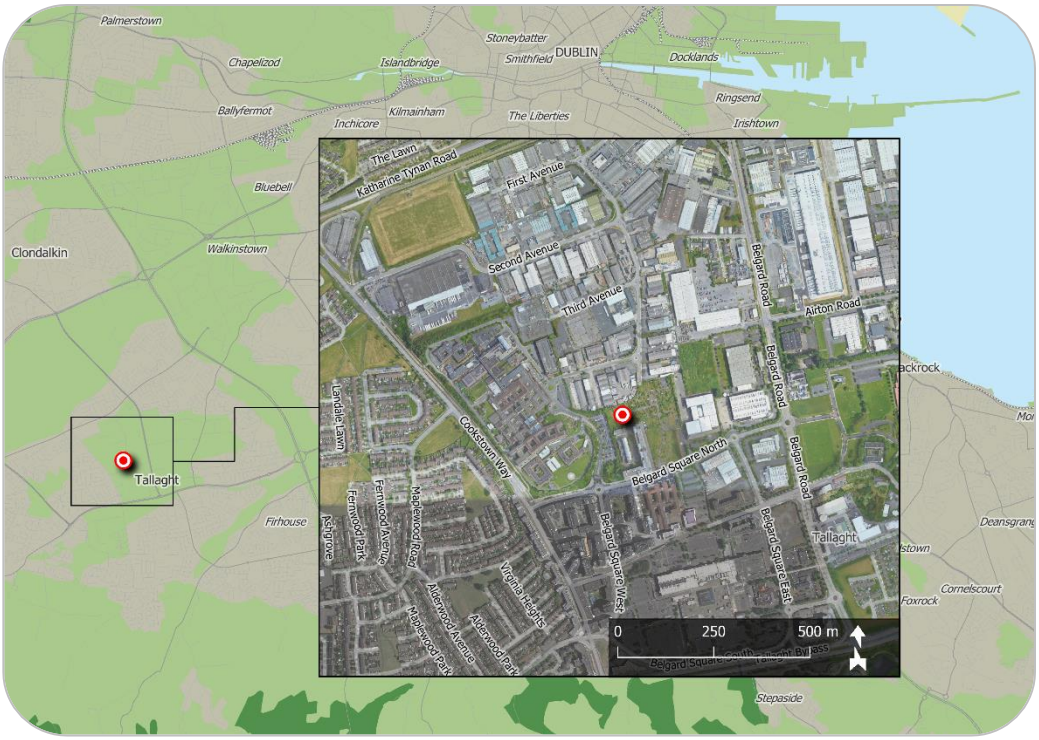

Figure 1 – Location of proposed development site
(*map data & imagery: EPA, OSM Contributors, Google*)

The location of the proposed development site is shown in Figure 1 above; the indicative extents of the development site, as well as relevant elements of the surrounding road network, are shown in more detail in Figure 2.

The site is bounded to the north by an existing industrial area, to the east by a future planned park, to the south by apartment block (Exchange Hall)

and an access road to this apartment block, and to the west by Tallaght Hospital car park.

Figure 2 – Site extents and environs
(*map data & imagery: NTA, GoCar, OSM Contributors, Google*)

2.2 Existing Land Use

The development site is formerly a temporary halting site known as "Maelruan". The site is currently being used as a compound by the Contractor currently carrying out construction works of the Belgard Square to Cookstown link road.

2.3 Proposed Development

The development will consist of the construction of 133no. affordable rental apartments with a community facility (c 11,430m2) in two blocks ranging from six to eight storeys linked by a single storey podium containing a three

storey block with associated balconies/ terrace for each apartment and roof mounted solar panels.

Block A (west- c 5,170m2) accommodates 2 no. studios, 31 no. 1 bed apartments and 28 no. 2 bed apartments.

Block B (east – c 5,900m2) accommodates 1 no. studio, 33 no. 1 bed apartments, 35 no. 2 bed apartments and 1 no. 3 bed apartment.

Block C (podium – 360m2) accommodates 2 no. 3 bed apartments laid out over 3 floors.

The podium accommodates 39 no. car parking spaces which includes 3 no. universal access spaces, 246 no. bicycle spaces, ESB substation and switch room, plant spaces, bins and other stores.

Ancillary site development works include the provision of pedestrian zip link/ greenway, access roadway, footpaths, 26 no. bicycle spaces, hard and soft landscaping, new boundary treatments and a landscaped courtyard at podium level.

3.0 STORMWATER DRAINAGE

3.1 Existing Storm Water Arrangements

Following review of South Dublin County Council's drainage records indicates that there is a stormwater sewer on Belgard Square North which flows towards Belgard Square East and a 450mm diameter stormwater sewer on Fourth Avenue, which runs towards Cookstown Road, from south to north. Please refer to **Appendix A** for the South Dublin County Council's drainage records.

CS Consulting has been informed by South Dublin County Council that a direct link road between Belgard Square North and the Cookstown Road is under construction. The proposed link road shall provide a 225-450mm diameter stormwater sewer. The proposed 450mm diameter stormwater sewer (main sewer) shall be connected into an existing 450mm diameter stormwater sewer located on the access road of the existing block apartments at the southern boundary of the site. The final connection of the existing 450mm diameter stormwater sewer is currently being connected with the stormwater water sewer on Belgard Square North, mentioned as previously, identified as 450mm diameter. The link road application reference number is SD178/0007. This sewer will be in place and commissioned prior to the proposed development being completed.

3.2 Proposed Storm Water Arrangements

In accordance with South Dublin County Council requirements, storm water shall be managed in two phases.

The **first** is to restrict storm water runoff from the proposed development to greenfield runoff rates. The **second** aspect to be included in new applications is to incorporate sustainable urban drainage systems (SuDs) proposals into the scheme. The SuDs concept requires that storm water

quality is improved before disposal and, where applicable, storm water is discharged into the ground on site.

The proposed new storm water drainage arrangements will be designed and carried out in accordance with:

i) The Greater Dublin Strategic Drainage Study Volume 2,
ii) The Greater Dublin Regional Code of Practice for Drainage Works,
iii) BS EN – 752:2008, Drains & Sewer Systems Outside Buildings,
iv) Part H, Building Drainage of The Building Regulation.

The GDSDS & the local authorities Regional Code of Practice for Drainage Works require that four main criteria to be provided by the developer.

- Criterion 1: River Water Quality Protection – satisfied by providing interception storage and treatment of run-off within SUDS features e.g. wetlands or bio-retention areas.
- Criterion 2: River Regime Protection - satisfied by attenuating run-off from the site.
- 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 extreme storm as noted in GDSDS. Planned flood routing for storms greater that 100-year level considered in design and development run-off contained on site.
- Criterion 4: River Flood Protection – attenuation and/or long-term storage provided within the Suds features.

3.3 Proposed Attenuation Arrangements

In accordance with the requirements of South Dublin County Council all new developments are to incorporate the principles of Sustainable Urban

Drainage Systems, (SuDS). The SuDS principles require a two-fold approach to address storm water management on new developments.

The **first** aspect is to reduce any post development run-off to pre-development discharge rates. The development is to retain storm water volumes predicted to be experienced during extreme rainfall events. This is defined as the volume of storm water generated during a 1 in 100 year storm event increased by 10% for predicted climate change factors.

To ensure an accurate calculation of the required attenuation for the site Met Eireann was contacted to provide:

a) The SAAR (Standard Annual Average Rainfall) for the area: 821mm/year.

b) The sliding duration table for the site indicating the 1:100 year rainwater intensities to be used.

c) Soil type value obtained from the Flood Studies Report, (for the subject lands this has been established as soil type 2).

These parameters allow the Q-Bar, greenfield runoff rate, to be calculated. The Q-Bar value for the site is 2.20 l/sec/Ha. As the storm water will connect into a public surface water sewer and the site area being less than 1Ha, 2l/s/Ha is used as the restriction value.

The proposed development is to retain storm water volumes predicted to be experienced during extreme rainfall events. This is defined as the volume of storm water generated during a 1 in 100 year storm event increased by 10% for predicted climate change factors. The total site area of the development site is approximately 0.49Ha and a standard percentage runoff of 100% paved gives an attenuation volume requirement of 543m^3 for the 1 in 100 year storm event. The attenuation volume shall be provided in a concrete attenuation tank located under the podium area sized to

retain storm volumes predicated. See **Appendix B** for the Met Eireann Data and Attenuation Calculation.

Please note that CS Consulting has considered other attenuation system but due to constraints of the size of the subject site and the superstructure to be located above the attenuation system, the concrete attenuation tank is the most suitable option.

The proposed storm water network has been designed using the *WinDes* Micro Drainage Program, to check for suitable capacity in the network to ensure no on flooding takes place for the extreme storm events. See **Appendix C** for *WinDes* design, long section & simulation calculations for the proposed storm water system.

The outfall into the public system will be onto the 450mm diameter stormwater sewer (main sewer) located on the link road under the application reference number SD178/0007. The last public manhole shall be constructed in accordance with Local Authority's requirements and the storm water flow will be restricted by the use of a flow control device to limit the flow to the public system.

Please refer to CS Consulting Drawing **TAL-CSC-ZZ-XX-DR-C-0003 & 0004_Proposed Drainage Layout** for drainage details.

3.4 Proposed Sustainable Urban Drainage System (SuDS) Measures

The **second** aspect is the policy of the Local Authority is to include Sustainable Urban Drainage Systems, SuDS, for all new applications. The aim is to provide an effective system to mitigate the adverse effects of storm water runoff on the environments, through enhanced quality systems and on local infrastructure to aid in preventing downstream flooding. The features proposed shall reduce run-off volumes, pollution concentrations and enhance groundwater recharge and biodiversity.

The proposed SuDS features shall consist of:

a) Green-roof – this allows the roof areas of the proposed block of apartments to use a Sedum type covering to absorb the first 'flush' from rainfall events. Typically, 5-10mm of rain can be retained on the sedum surface. As more intense rain is experienced the green roof can overflow from the roof through down pipes and into the schemes main drainage runs. The use of green roof reduces urban heat island effect (the difference in temperature between urban areas and the surrounding countryside) through absorption of some of this heat and the natural evaporation of water from plants and soil and reduces building's carbon footprint through lowering building running costs. In addition, soft landscaping helps to reduce the risk of flooding by retaining large proportions of annual rainfall and reducing rainwater run-off besides the noise reduction for the building.

b) Low water usage sanitary appliances to reduce the reliance on potable water supplies;

c) Permeable Surface – It is proposed the use of permeable paving at indicated greenway at the south of the subject site. This area shall be directed into tree pits or landscaped areas to allow for local infiltration with an overflow into the main stormwater network.

d) Road gully's will be trapped to allow for the removal of grit and other potentially harmful material entering the storm network;

e) Tree pits - it is proposed the use of tree pits located along the greenway to allow storm water to be directed locally into tree pits for prevent this storm water from entering the main drainage network. As the tree pits can only accommodate relatively small surface areas this proposal cannot be used to drain the site as a

whole but can play an important part in contributing to the overall Suds strategy.

f) Oil Separator - at the end of the storm water network a suitable oil separator (Class 1 Bypass separator) is to be fitted to allow any hydrocarbons which may have built up from on-site traffic to be removed from storm water prior to disposal.

The combination of the above noted elements will allow the proposed development to adhere to the principles of sustainable drainage practices while enhancing overall storm water quality.

3.5 Interception and Treatment Volume

In accordance with the requirements of the Local Authority storm water generated on site is to be dealt with in a combination of systems to aid in the improvement of surface water quality and to ensure that storm water run-off is restricted to its green field discharge rate.

The proposed development shall provide 543m^3 generated during a 1 in 100-year storm event increased by 10% for predicted climate change factors. The method of dealing with storm water requires several stages to be followed to achieve the above. The table set out below gives the volume of storm water and the proposed processes.

Type	**Area (m^2)**	**Retained**	**Overall Vol.(m^3)**	**Process**
Green Roof	1,531	5mm/m^2	7.65^A	Treatment
Permeable Surface	299	105mm/(m^2)	31.39^B	Interception
Tree Pits	394	5mm/(m^2)	1.97^C	Interception & Treatment
Attenuation Tank	N/A	N/A	543^D	Storage

A: based on Area x 5mm of rainfall.

B: based on Area x 105mm a sub-base of 350mm with a void ratio of 0.3, by the area of paving, 299x 0.35 x 0.3 = 31.39m^3.

C: based on roof areas with runoff to the tree pits (394m^2)

D: Attenuation tank has been sized conservatively to be able to retain all predicated storm water from the extreme storm event. This was due to the site having a low soil permeability and there remains the risk that the SuDs systems may be saturated or at capacity when the extreme storm event occurs.

It is proposed that rainwater which lands on the permeable paving shall filter through the paving and into the subsoil beneath. This shall allow the first flush of rainwater to be retained and prevent same from entering the main drainage systems. Notwithstanding same, when an extreme storm event is experienced the excess rainwater will be unable to enter the voids within the permeable paving and will drain onto the tree pits and when overflow into the main storm water system. Please note that the stormwater underneath the permeable surface area only receive the stormwater overflow from the proposed tree pits.

Please refer to CS Consulting Drawing **TAL-CSC-ZZ-XX-DR-C-0016_SUDS** for details of the SuDS systems proposed to be used.

4.0 FOUL DRAINAGE

4.1 Existing Foul Arrangements

Following review of South Dublin County Council's drainage records indicates that there is a 225mm diameter foul sewer at the south-eastern boundary of the subject site, which runs through in lands at the north of Belgard Square North towards Belgard Square East. In addition, there is a 225mm diameter foul sewer at the north of the subject site, which runs west to east on Fourth Avenue and then runs on Cookstown Road, from south to north. Please refer to **Appendix A** for the South Dublin County Council's drainage records.

CS Consulting has been informed by South Dublin County Council that a provision of direct road link between Belgard Square North and the Cookstown Road is on construction, including a provision of a 225mm diameter foul sewer. The proposed link road drainage and watermain layout indicates that the 225mm diameter foul sewer (main sewer) shall be connected into an existing foul manhole located on the access road of the existing block apartments at southern boundary of the subject site.

The same drainage layout shows that the existing manhole, mentioned previously, has a direct connection to the existing 225mm diameter foul sewer at the south-eastern boundary of the subject site noted on above paragraph. The application reference number is SD178/0007.

4.2 Proposed Foul Drainage Arrangements

The proposed development will require a new separate drainage network to collect and convey the effluent generated by the proposed development. The drainage network for the proposed development has been designed in accordance with:

- The Regional Code of Practice Drainage Works,
- The Greater Dublin Strategic Drainage Study,
- Irish Water Code of Practice for Wastewater Infrastructure.

The drainage network for the development will be in accordance with Part H of the Building Regulations and to the requirements and specifications set out in the Irish Water Code of Practice for Wastewater.

4.3 Proposed Effluent Generation

The proposed development is to consist of 133no. apartment units and based on Irish Water guidelines, the foul effluent generated shall be:

⇒ 446l/day per apartment (based on 2.7 persons per apartment x 150l/person/day, + a 10% increase factor).

⇒ 446 l/day/apt x 133 units = 59,318 l/day = 59.32 m3/day;

⇒ 0.687 l/sec Average flow (1 DWF);

⇒ 4.119 l/sec Peak Flow (6 DWF - Population between 0 and 750).

4.4 Proposed Foul Drainage Arrangements

The drainage network for the development will be in accordance with Part H of the Building Regulations and to the requirements and specifications of Irish Water.

All foul effluent generated from the proposed development shall be collected in separate foul pipes and flow under gravity, to the 225mm diameter foul sewer via a new connection. As mentioned previously, this 225mm diameter foul sewer is connected to the 225mm diameter foul sewer on the link road described on Section 4.1.

The proposed foul drainage infrastructure has been designed using the *WinDes* Micro Drainage Program and a copy of the sewer design is included in **Appendix D**.

The proposed drainage infrastructure and routing plan is shown on **TAL-CSC-ZZ-XX-DR-C-0003 & 0004_Proposed Drainage Layout** included with this submission.

4.5 Irish Water Confirmation of Feasibility

A Pre-Connection Enquiry has been submitted to Irish Water based on the foul flows for 140 No. apartment units and we have received a response.

Irish Water has stated on this Confirmation of Feasibility letter that there is no Irish Water wastewater infrastructure adjacent to the site. In addition, Irish Water informed that networks may be through third party infrastructure and/or lands and all relevant wayleave and permissions would need to be obtained by the client.

It is noted that South Dublin County Council has submitted a planning application under Part VIII which consist of provision of direct road link between Belgard Square North and the Cookstown Road is currently on construction. In addition, a 225mm diameter foul sewer has been proposed on this link road and the proposed development shall connect into the 225mm diameter foul sewer. The link road is under application reference number SD178/0007 and is currently on construction.

Please refer to **Appendix E** for a copy of the confirmation of feasibility letter.

5.0 POTABLE WATER

5.1 Existing Potable Water System

Following review of South Dublin County Council's drainage records indicates that there is a 100mm diameter uPVC watermain at the east and at south of the subject site, as part of the existing block apartment. In addition, there is a 6" diameter (150mm) uPVC on Cookstown Road and a 150mm diameter uPVC on Belgard Square North.

CS Consulting has been informed by South Dublin County Council that a direct link road between Belgard Square North and the Cookstown Road is under construction. The proposed link road shall provide an 160mm diameter watermain which has a loop connection with the 6" diameter uPVC on Cookstown Road and the 150mm diameter uPVC on Belgard Square North. It is noted that a spur water, connected with the proposed 160mm diameter watermain located at the link road shall be provided at the access for the proposed residential development as part of the previously mentioned link road. The link road is under application reference number SD178/0007 and is currently under construction. This watermain will be in place and commissioned prior to the proposed development being completed.

Please refer to **Appendix A** for the South Dublin County Council's drainage records.

5.2 Proposed Potable Water System

The proposed development is to consist of 133No. apartment units and based on Irish Water guidelines, the water demand will be:

⇒ 405 l/day per apartment (based on 2.7 persons per unit x 150l/person/day);

⇒ 405 l/day x 133 units = 53,865 l/day = 53.87 m^3/day;

⇒ 0.653 l/sec Average water demand;

⇒ 3.117 l/sec Peak water demand (5 times average water demand).

The proposed development shall have a watermain connection into the watermain currently under construction as part of link road.

The proposed watermain infrastructure and routing plan is shown on **TAL-CSC-ZZ-XX-DR-C-0005 & 0006_Proposed Watermain Layout** included with this submission.

5.3 Irish Water Confirmation of Feasibility

A Pre-Connection Enquiry has been submitted to Irish Water based on the water demand for 140 No. apartment units and we have received a response.

Irish Water has stated that there is no Irish Water water infrastructure adjacent to the site. In addition, Irish Water noted that networks may be required through third party infrastructure and/or lands and all relevant wayleave and permissions would need to be obtained by the client.

It is noted that South Dublin County Council has submitted a planning application under Part VIII which consist of provision of direct link road between Belgard Square North and the Cookstown Road. Construction of same shall include for a spur off the proposed 160mm diameter watermain service the site. These works are currently under construction of the application reference number SD178/0007.

Please refer to **Appendix E** for a copy of the confirmation of feasibility letter.

Appendix A: South Dublin County Council's drainage records.

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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

Ordnance Survey Ireland 2018

0 15 30 60 90 120 Meters

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Appendix B: Attenuation Calculation

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Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 308425, Northing: 227949,

	Interval		Years											
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.6,	3.8,	4.5,	5.6,	6.3,	6.9,	8.8,	11.1,	12.6,	14.8,	16.7,	18.3,	20.7,	22.6,	24.2,	N/A ,
10 mins	3.6,	5.3,	6.3,	7.8,	8.8,	9.6,	12.3,	15.4,	17.5,	20.6,	23.3,	25.5,	28.8,	31.5,	33.7,	N/A ,
15 mins	4.3,	6.3,	7.4,	9.2,	10.4,	11.3,	14.5,	18.1,	20.6,	24.2,	27.4,	29.9,	33.9,	37.0,	39.6,	N/A ,
30 mins	5.6,	8.2,	9.6,	11.8,	13.3,	14.5,	18.5,	23.1,	26.2,	30.6,	34.6,	37.7,	42.5,	46.4,	49.5,	N/A ,
1 hours	7.3,	10.7,	12.5,	15.3,	17.2,	18.7,	23.7,	29.4,	33.2,	38.7,	43.6,	47.4,	53.4,	58.1,	62.0,	N/A ,
2 hours	9.7,	13.9,	16.2,	19.8,	22.2,	24.0,	30.2,	37.4,	42.1,	48.9,	54.9,	59.7,	67.0,	72.7,	77.5,	N/A ,
3 hours	11.3,	16.2,	18.9,	22.9,	25.7,	27.9,	34.9,	43.0,	48.4,	56.1,	62.9,	68.3,	76.5,	83.0,	88.3,	N/A ,
4 hours	12.7,	18.1,	21.1,	25.5,	28.6,	30.9,	38.7,	47.6,	53.5,	61.8,	69.3,	75.1,	84.1,	91.1,	96.9,	N/A ,
6 hours	14.9,	21.2,	24.5,	29.7,	33.1,	35.8,	44.7,	54.8,	61.5,	70.9,	79.3,	85.9,	96.0,	103.9,	110.5,	N/A ,
9 hours	17.5,	24.7,	28.6,	34.4,	38.4,	41.5,	51.6,	63.1,	70.7,	81.4,	90.9,	98.3,	109.7,	118.5,	125.9,	N/A ,
12 hours	19.6,	27.6,	31.9,	38.3,	42.7,	46.1,	57.2,	69.7,	78.0,	89.7,	100.1,	108.1,	120.5,	130.2,	138.2,	N/A ,
18 hours	23.0,	32.2,	37.1,	44.5,	49.5,	53.4,	66.0,	80.3,	89.7,	102.9,	114.6,	123.7,	137.7,	148.5,	157.5,	N/A ,
24 hours	25.7,	35.9,	41.4,	49.5,	55.0,	59.3,	73.1,	88.7,	99.0,	113.4,	126.2,	136.1,	151.3,	163.1,	172.8,	206.9,
2 days	32.5,	44.1,	50.3,	59.2,	65.2,	69.9,	84.7,	101.1,	111.8,	126.7,	139.7,	149.7,	165.0,	176.7,	186.4,	219.9,
3 days	38.0,	50.8,	57.4,	67.1,	73.5,	78.4,	94.1,	111.3,	122.4,	137.8,	151.2,	161.4,	176.9,	188.8,	198.6,	232.2,
4 days	42.8,	56.5,	63.6,	73.9,	80.6,	85.8,	102.3,	120.2,	131.7,	147.5,	161.2,	171.7,	187.5,	199.6,	209.5,	243.5,
6 days	51.3,	66.6,	74.4,	85.7,	93.1,	98.7,	116.4,	135.5,	147.7,	164.3,	178.7,	189.6,	206.0,	218.5,	228.7,	263.5,
8 days	58.7,	75.5,	83.9,	96.0,	103.9,	109.9,	128.7,	148.8,	161.6,	178.9,	193.9,	205.2,	222.1,	235.0,	245.5,	281.1,
10 days	65.6,	83.5,	92.5,	105.4,	113.7,	120.0,	139.8,	160.8,	174.1,	192.1,	207.5,	219.2,	236.7,	249.9,	260.6,	296.9,
12 days	72.0,	91.1,	100.6,	114.1,	122.8,	129.4,	150.0,	171.9,	185.6,	204.2,	220.1,	232.1,	250.0,	263.5,	274.5,	311.5,
16 days	84.0,	105.0,	115.3,	130.0,	139.5,	146.6,	168.7,	192.0,	206.6,	226.2,	242.9,	255.5,	274.2,	288.3,	299.7,	338.1,
20 days	95.1,	117.7,	128.9,	144.6,	154.7,	162.3,	185.7,	210.3,	225.6,	246.1,	263.6,	276.6,	296.1,	310.6,	322.4,	361.9,
25 days	108.1,	132.7,	144.7,	161.6,	172.4,	180.4,	205.3,	231.2,	247.4,	268.9,	287.1,	300.8,	321.0,	336.1,	348.4,	389.1,

NOTES:
N/A Data not available
These values are derived from a Depth Duration Frequency (DDF) Model
For details refer to:
'Fitzgerald D. L. (2007), Estimates of Point Rainfall Frequencies, Technical Note No. 61, Met Eireann, Dublin',
Available for download at www.met.ie/climate/dataproducts/Estimation-of-Point-Rainfall-Frequencies_TN61.pdf

Annual Average Rainfall(mm)

308000	225000	945
308000	226000	879
308000	227000	821
308000	228000	782
308000	229000	756
308000	230000	728

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Project: Tallaght
Project No.: C168
Calculation: Attenuation 100-year
Calcs By: GS
Checked By:
Date: 28.04.2020

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Site Location:	Dublin		
Design Storm Return Period:	100 years		
Climate Change Factor:	10 %		
Soil Type:	2		
Total Site Area:	0.490 ha		
Hardstand Area:	0.490 ha	.....@	100% Impervious
Softstand Area:	0.000 ha	.....@	0% Impervious
Effective Impermeable Area:	0.490 ha		

Allowable Outflow	**Calculate**	
IH124: QBAR = 0.00108 x $AREA^{0.89}$ x $SAAR^{1.17}$ x $SOIL^{2.17}$		
AREA:	0.0049 km^2	
SAAR:	821 mm	
SOIL:	0.3	
QBAR/ha	2.20 l/s/ha	
Allowable Outflow	**2.0 l/s**	Smallest Allowable Discharge Rate

Storage required =	543 m^3	

Duration (min)	Rainfall 100-Year (mm)	Rainfall 100-Year with CCF (mm)	Intensity (mm/hr)	Discharge (Q = 2.71iA) (l/s)	Proposed Runoff (m^3)	Contiguous Land Runoff (m^3)	Total Runoff (m^3)	Allowable Outflow (m^3)	Storage Required (m^3)
5	18.3	20.1	241.6	321	96	0	96	1	96
10	25.5	28.1	168.3	223	134	0	134	1	133
15	29.9	32.9	131.6	175	157	0	157	2	155
30	37.7	41.5	82.9	110	198	0	198	4	195
60	47.4	52.1	52.1	69	249	0	249	7	242
120	59.7	65.7	32.8	44	314	0	314	14	300
180	68.3	75.1	25.0	33	359	0	359	22	338
240	75.1	82.6	20.7	27	395	0	395	29	366
360	85.9	94.5	15.7	21	452	0	452	43	409
540	98.3	108.1	12.0	16	517	0	517	65	452
720	108.1	118.9	9.9	13	568	0	568	86	482
1080	123.7	136.1	7.6	10	650	0	650	130	521
1440	***136.1***	***149.7***	***6.2***	***8***	***716***	***0***	***716***	***173***	***543***
2880	149.7	164.7	3.4	5	787	0	787	346	442
4320	161.4	177.5	2.5	3	849	0	849	518	330
5760	171.7	188.9	2.0	3	903	0	903	691	212
8640	189.6	208.6	1.4	2	997	0	997	1037	-40
11520	205.2	225.7	1.2	2	1079	0	1079	1382	-303
14400	219.2	241.1	1.0	1	1153	0	1153	1728	-575
17280	232.1	255.3	0.9	1	1220	0	1220	2074	-853
23040	255.5	281.1	0.7	1	1344	0	1344	2765	-1421
28800	276.6	304.3	0.6	1	1454	0	1454	3456	-2002
36000	300.8	330.9	0.6	1	1582	0	1582	4320	-2738

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Appendix C: Stormwater *WinDes* Design

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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	Add Flow / Climate Change (%)	0
M5-60 (mm)	16.900	Minimum Backdrop Height (m)	0.000
Ratio R	0.303	Maximum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	50	Min Design Depth for Optimisation (m)	0.000
Foul Sewage (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500
PIMP (%)	100		

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)
1.000	26.044	0.174	150.0	0.031	4.00	0.0	0.600	o	225
1.001	16.654	0.111	150.0	0.020	0.00	0.0	0.600	o	225
1.002	15.463	0.103	150.0	0.010	0.00	0.0	0.600	o	225
1.003	9.086	0.061	150.0	0.018	0.00	0.0	0.600	o	225
1.004	28.759	0.115	250.0	0.036	0.00	0.0	0.600	o	225
2.000	18.484	0.308	60.0	0.011	4.00	0.0	0.600	o	225
2.001	12.193	0.203	60.1	0.031	0.00	0.0	0.600	o	225
1.005	21.981	0.366	60.1	0.058	0.00	0.0	0.600	o	225
3.000	3.476	0.035	100.0	0.048	4.00	0.0	0.600	o	225
1.006	20.003	0.080	250.0	0.067	0.00	0.0	0.600	o	300
4.000	37.453	0.150	249.7	0.016	4.00	0.0	0.600	o	225
1.007	26.768	0.107	250.2	0.015	0.00	0.0	0.600	o	225

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)
1.000	50.00	4.41	101.821	0.031	0.0	0.0	0.0	1.07	42.4	4.2
1.001	50.00	4.67	101.647	0.051	0.0	0.0	0.0	1.07	42.4	6.9
1.002	50.00	4.91	101.536	0.061	0.0	0.0	0.0	1.07	42.4	8.2
1.003	50.00	5.05	101.433	0.078	0.0	0.0	0.0	1.07	42.4	10.6
1.004	50.00	5.63	101.373	0.114	0.0	0.0	0.0	0.82	32.7	15.5
2.000	50.00	4.18	102.000	0.011	0.0	0.0	0.0	1.69	67.3	1.5
2.001	50.00	4.30	101.692	0.042	0.0	0.0	0.0	1.69	67.2	5.7
1.005	50.00	5.85	101.258	0.214	0.0	0.0	0.0	1.69	67.2	29.0
3.000	50.00	4.04	100.800	0.048	0.0	0.0	0.0	1.31	52.0	6.5
1.006	50.00	6.19	100.765	0.329	0.0	0.0	0.0	0.99	70.0	44.6
4.000	50.00	4.76	100.800	0.016	0.0	0.0	0.0	0.82	32.7	2.2
1.007	50.00	4.54	100.548	0.000	2.0	0.0	0.0	0.82	32.7	2.0

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)
SWMH1	102.675	0.854	Open Manhole	1050	1.000	101.821	225				
SWMH2	102.675	1.028	Open Manhole	1050	1.001	101.647	225	1.000	101.647	225	
SWMH3	102.675	1.139	Open Manhole	1050	1.002	101.536	225	1.001	101.536	225	
SWMH4	102.675	1.242	Open Manhole	1050	1.003	101.433	225	1.002	101.433	225	
SWMH5	102.675	1.302	Open Manhole	1050	1.004	101.373	225	1.003	101.373	225	
SWMH6	103.100	1.100	Open Manhole	1050	2.000	102.000	225				
SWMH7	102.900	1.208	Open Manhole	1050	2.001	101.692	225	2.000	101.692	225	
SWMH8	102.800	1.542	Open Manhole	1050	1.005	101.258	225	1.004	101.258	225	
								2.001	101.489	225	231
SWMH9	102.675	1.875	Open Manhole	1200	3.000	100.800	225				
SWMH10	102.675	1.910	Open Manhole	1200	1.006	100.765	300	1.005	100.892	225	51
								3.000	100.765	225	
SWMH11	102.675	1.875	Open Manhole	1200	4.000	100.800	225				
SWMH12	102.675	2.127	Open Manhole	1200	1.007	100.548	225	1.006	100.685	300	212
								4.000	100.650	225	102
EX.S1A	102.137	1.696	Open Manhole	0		OUTFALL		1.007	100.441	225	

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)
1.000	o	225	SWMH1	102.675	101.821	0.629	Open Manhole	1050
1.001	o	225	SWMH2	102.675	101.647	0.803	Open Manhole	1050
1.002	o	225	SWMH3	102.675	101.536	0.914	Open Manhole	1050
1.003	o	225	SWMH4	102.675	101.433	1.017	Open Manhole	1050
1.004	o	225	SWMH5	102.675	101.373	1.077	Open Manhole	1050
2.000	o	225	SWMH6	103.100	102.000	0.875	Open Manhole	1050
2.001	o	225	SWMH7	102.900	101.692	0.983	Open Manhole	1050
1.005	o	225	SWMH8	102.800	101.258	1.317	Open Manhole	1050
3.000	o	225	SWMH9	102.675	100.800	1.650	Open Manhole	1200
1.006	o	300	SWMH10	102.675	100.765	1.610	Open Manhole	1200
4.000	o	225	SWMH11	102.675	100.800	1.650	Open Manhole	1200
1.007	o	225	SWMH12	102.675	100.548	1.902	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)
1.000	26.044	150.0	SWMH2	102.675	101.647	0.803	Open Manhole	1050
1.001	16.654	150.0	SWMH3	102.675	101.536	0.914	Open Manhole	1050
1.002	15.463	150.0	SWMH4	102.675	101.433	1.017	Open Manhole	1050
1.003	9.086	150.0	SWMH5	102.675	101.373	1.077	Open Manhole	1050
1.004	28.759	250.0	SWMH8	102.800	101.258	1.317	Open Manhole	1050
2.000	18.484	60.0	SWMH7	102.900	101.692	0.983	Open Manhole	1050
2.001	12.193	60.1	SWMH8	102.800	101.489	1.086	Open Manhole	1050
1.005	21.981	60.1	SWMH10	102.675	100.892	1.558	Open Manhole	1200
3.000	3.476	100.0	SWMH10	102.675	100.765	1.685	Open Manhole	1200
1.006	20.003	250.0	SWMH12	102.675	100.685	1.690	Open Manhole	1200
4.000	37.453	249.7	SWMH12	102.675	100.650	1.800	Open Manhole	1200
1.007	26.768	250.2	EX.S1A	102.137	100.441	1.471	Open Manhole	0

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	80	0.039	0.031	0.031
1.001	-	-	80	0.025	0.020	0.020
1.002	-	-	80	0.012	0.010	0.010
1.003	-	-	80	0.022	0.018	0.018
1.004	-	-	80	0.045	0.036	0.036
2.000	User	-	100	0.011	0.011	0.011
2.001	User	-	100	0.031	0.031	0.031
1.005	-	-	80	0.072	0.058	0.058
3.000	-	-	80	0.060	0.048	0.048
1.006	User	-	100	0.067	0.067	0.067
4.000	-	-	80	0.020	0.016	0.016
1.007	-	-	100	0.015	0.015	0.015
				Total	Total	Total
				0.419	0.360	0.360

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)
1.007	EX.S1A	102.137	100.441	100.070	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Additional Flow - % of Total Flow	10.000
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	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.900	Storm Duration (mins)	15
Ratio R	0.303		

Online Controls for Storm

Depth/Flow Relationship Manhole: SWMH12, DS/PN: 1.007, Volume (m³): 5.2

Invert Level (m) 100.548

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)
0.200	2.0000	1.400	2.0000	2.600	2.0000	3.800	2.0000	5.000	2.0000
0.400	2.0000	1.600	2.0000	2.800	2.0000	4.000	2.0000	5.200	2.0000
0.600	2.0000	1.800	2.0000	3.000	2.0000	4.200	2.0000	5.400	2.0000
0.800	2.0000	2.000	2.0000	3.200	2.0000	4.400	2.0000	5.600	2.0000
1.000	2.0000	2.200	2.0000	3.400	2.0000	4.600	2.0000	5.800	2.0000
1.200	2.0000	2.400	2.0000	3.600	2.0000	4.800	2.0000	6.000	2.0000

Storage Structures for Storm

Tank or Pond Manhole: SWMH9, DS/PN: 3.000

Invert Level (m) 100.800

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	440.0	0.600	440.0	1.200	440.0	1.800	0.0	2.400	0.0
0.100	440.0	0.700	440.0	1.300	440.0	1.900	0.0	2.500	0.0
0.200	440.0	0.800	440.0	1.400	0.0	2.000	0.0		
0.300	440.0	0.900	440.0	1.500	0.0	2.100	0.0		
0.400	440.0	1.000	440.0	1.600	0.0	2.200	0.0		
0.500	440.0	1.100	440.0	1.700	0.0	2.300	0.0		

Summary of Results for 15 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	SWMH1	102.019	-0.027	0.000	0.31	0.0	12.1	OK
1.001	SWMH2	101.998	0.125	0.000	0.49	0.0	18.5	SURCHARGED
1.002	SWMH3	101.972	0.210	0.000	0.65	0.0	24.3	SURCHARGED
1.003	SWMH4	101.942	0.284	0.000	0.83	0.0	28.9	SURCHARGED
1.004	SWMH5	101.917	0.319	0.000	1.15	0.0	35.2	SURCHARGED
2.000	SWMH6	102.040	-0.185	0.000	0.07	0.0	4.4	OK
2.001	SWMH7	101.819	-0.098	0.000	0.28	0.0	16.4	OK
1.005	SWMH8	101.798	0.315	0.000	1.00	0.0	61.3	SURCHARGED
3.000	SWMH9	100.931	-0.094	0.000	0.08	0.0	2.5	OK
1.006	SWMH10	101.450	0.385	0.000	0.34	0.0	20.9	SURCHARGED
4.000	SWMH11	101.483	0.458	0.000	0.18	0.0	5.6	SURCHARGED
1.007	SWMH12	101.468	0.695	0.000	0.07	0.0	2.0	SURCHARGED

Summary of Results for 30 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	SWMH1	101.897	-0.149	0.000	0.25	0.0	9.7	OK
1.001	SWMH2	101.830	-0.042	0.000	0.41	0.0	15.4	OK
1.002	SWMH3	101.805	0.043	0.000	0.50	0.0	18.8	SURCHARGED
1.003	SWMH4	101.777	0.119	0.000	0.70	0.0	24.3	SURCHARGED
1.004	SWMH5	101.752	0.155	0.000	1.04	0.0	31.7	SURCHARGED
2.000	SWMH6	102.035	-0.190	0.000	0.06	0.0	3.4	OK
2.001	SWMH7	101.765	-0.152	0.000	0.23	0.0	13.3	OK
1.005	SWMH8	101.649	0.166	0.000	0.91	0.0	55.6	SURCHARGED
3.000	SWMH9	100.978	-0.047	0.000	0.14	0.0	4.1	OK
1.006	SWMH10	101.350	0.285	0.000	0.20	0.0	12.4	SURCHARGED
4.000	SWMH11	101.377	0.352	0.000	0.15	0.0	4.6	SURCHARGED
1.007	SWMH12	101.364	0.591	0.000	0.07	0.0	2.0	SURCHARGED

Summary of Results for 45 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	SWMH1	101.889	-0.157	0.000	0.20	0.0	7.7	OK
1.001	SWMH2	101.738	-0.135	0.000	0.33	0.0	12.6	OK
1.002	SWMH3	101.646	-0.116	0.000	0.39	0.0	14.7	OK
1.003	SWMH4	101.615	-0.043	0.000	0.54	0.0	18.7	OK
1.004	SWMH5	101.593	-0.004	0.000	0.88	0.0	26.8	OK
2.000	SWMH6	102.031	-0.194	0.000	0.04	0.0	2.7	OK
2.001	SWMH7	101.757	-0.160	0.000	0.18	0.0	10.5	OK
1.005	SWMH8	101.507	0.024	0.000	0.81	0.0	49.6	SURCHARGED
3.000	SWMH9	101.004	-0.021	0.000	0.09	0.0	2.8	OK
1.006	SWMH10	101.265	0.200	0.000	0.16	0.0	9.7	SURCHARGED
4.000	SWMH11	101.287	0.262	0.000	0.12	0.0	3.7	SURCHARGED
1.007	SWMH12	101.276	0.503	0.000	0.07	0.0	2.0	SURCHARGED

Summary of Results for 60 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	SWMH1	101.882	-0.164	0.000	0.17	0.0	6.5	OK
1.001	SWMH2	101.729	-0.143	0.000	0.28	0.0	10.6	OK
1.002	SWMH3	101.627	-0.134	0.000	0.34	0.0	12.6	OK
1.003	SWMH4	101.549	-0.110	0.000	0.47	0.0	16.3	OK
1.004	SWMH5	101.524	-0.074	0.000	0.78	0.0	23.7	OK
2.000	SWMH6	102.028	-0.197	0.000	0.04	0.0	2.3	OK
2.001	SWMH7	101.751	-0.166	0.000	0.15	0.0	8.9	OK
1.005	SWMH8	101.401	-0.081	0.000	0.72	0.0	44.2	OK
3.000	SWMH9	101.023	-0.002	0.000	0.09	0.0	2.7	OK
1.006	SWMH10	101.209	0.144	0.000	0.13	0.0	8.0	SURCHARGED
4.000	SWMH11	101.227	0.202	0.000	0.11	0.0	3.3	SURCHARGED
1.007	SWMH12	101.218	0.445	0.000	0.07	0.0	2.0	SURCHARGED

Summary of Results for 90 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	SWMH1	101.874	-0.172	0.000	0.13	0.0	5.0	OK
1.001	SWMH2	101.718	-0.154	0.000	0.22	0.0	8.2	OK
1.002	SWMH3	101.614	-0.147	0.000	0.26	0.0	9.7	OK
1.003	SWMH4	101.528	-0.131	0.000	0.36	0.0	12.4	OK
1.004	SWMH5	101.499	-0.099	0.000	0.59	0.0	18.1	OK
2.000	SWMH6	102.025	-0.200	0.000	0.03	0.0	1.7	OK
2.001	SWMH7	101.743	-0.174	0.000	0.12	0.0	6.8	OK
1.005	SWMH8	101.378	-0.105	0.000	0.55	0.0	33.9	OK
3.000	SWMH9	101.049	0.024	0.000	0.09	0.0	2.7	SURCHARGED
1.006	SWMH10	101.126	0.060	0.000	0.10	0.0	6.3	SURCHARGED
4.000	SWMH11	101.139	0.114	0.000	0.08	0.0	2.5	SURCHARGED
1.007	SWMH12	101.132	0.359	0.000	0.07	0.0	2.0	SURCHARGED

Summary of Results for 120 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	SWMH1	101.869	-0.177	0.000	0.10	0.0	4.1	OK
1.001	SWMH2	101.711	-0.161	0.000	0.18	0.0	6.7	OK
1.002	SWMH3	101.606	-0.155	0.000	0.21	0.0	8.0	OK
1.003	SWMH4	101.517	-0.142	0.000	0.30	0.0	10.3	OK
1.004	SWMH5	101.484	-0.114	0.000	0.49	0.0	15.0	OK
2.000	SWMH6	102.023	-0.202	0.000	0.02	0.0	1.4	OK
2.001	SWMH7	101.739	-0.178	0.000	0.10	0.0	5.6	OK
1.005	SWMH8	101.364	-0.118	0.000	0.46	0.0	28.1	OK
3.000	SWMH9	101.068	0.043	0.000	0.17	0.0	5.1	SURCHARGED
1.006	SWMH10	101.178	0.112	0.000	0.08	0.0	5.1	SURCHARGED
4.000	SWMH11	101.195	0.170	0.000	0.07	0.0	2.1	SURCHARGED
1.007	SWMH12	101.245	0.472	0.000	0.07	0.0	2.0	SURCHARGED

Summary of Results for 180 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	SWMH1	101.863	-0.183	0.000	0.08	0.0	3.1	OK
1.001	SWMH2	101.702	-0.170	0.000	0.14	0.0	5.1	OK
1.002	SWMH3	101.597	-0.165	0.000	0.16	0.0	6.1	OK
1.003	SWMH4	101.505	-0.153	0.000	0.23	0.0	7.8	OK
1.004	SWMH5	101.468	-0.130	0.000	0.37	0.0	11.4	OK
2.000	SWMH6	102.019	-0.206	0.000	0.02	0.0	1.1	OK
2.001	SWMH7	101.732	-0.185	0.000	0.07	0.0	4.2	OK
1.005	SWMH8	101.349	-0.133	0.000	0.35	0.0	21.3	OK
3.000	SWMH9	101.090	0.065	0.000	0.09	0.0	2.7	SURCHARGED
1.006	SWMH10	101.137	0.072	0.000	0.07	0.0	4.2	SURCHARGED
4.000	SWMH11	101.144	0.119	0.000	0.05	0.0	1.6	SURCHARGED
1.007	SWMH12	101.142	0.369	0.000	0.07	0.0	2.0	SURCHARGED

Summary of Results for 240 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	SWMH1	101.858	-0.188	0.000	0.06	0.0	2.5	OK
1.001	SWMH2	101.697	-0.175	0.000	0.11	0.0	4.2	OK
1.002	SWMH3	101.590	-0.171	0.000	0.13	0.0	5.0	OK
1.003	SWMH4	101.498	-0.160	0.000	0.18	0.0	6.4	OK
1.004	SWMH5	101.458	-0.140	0.000	0.31	0.0	9.3	OK
2.000	SWMH6	102.016	-0.209	0.000	0.01	0.0	0.9	OK
2.001	SWMH7	101.727	-0.190	0.000	0.06	0.0	3.4	OK
1.005	SWMH8	101.339	-0.144	0.000	0.28	0.0	17.5	OK
3.000	SWMH9	101.105	0.080	0.000	0.22	0.0	6.6	SURCHARGED
1.006	SWMH10	101.207	0.142	0.000	0.06	0.0	3.7	SURCHARGED
4.000	SWMH11	101.239	0.214	0.000	0.04	0.0	1.3	SURCHARGED
1.007	SWMH12	101.268	0.495	0.000	0.07	0.0	2.0	SURCHARGED

Summary of Results for 360 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	SWMH1	101.853	-0.193	0.000	0.05	0.0	1.9	OK
1.001	SWMH2	101.690	-0.182	0.000	0.08	0.0	3.1	OK
1.002	SWMH3	101.584	-0.178	0.000	0.10	0.0	3.7	OK
1.003	SWMH4	101.488	-0.170	0.000	0.14	0.0	4.8	OK
1.004	SWMH5	101.445	-0.152	0.000	0.23	0.0	7.0	OK
2.000	SWMH6	102.012	-0.213	0.000	0.01	0.0	0.7	OK
2.001	SWMH7	101.722	-0.195	0.000	0.04	0.0	2.6	OK
1.005	SWMH8	101.328	-0.155	0.000	0.21	0.0	13.0	OK
3.000	SWMH9	101.123	0.098	0.000	0.20	0.0	5.9	SURCHARGED
1.006	SWMH10	101.236	0.171	0.000	0.05	0.0	3.2	SURCHARGED
4.000	SWMH11	101.247	0.222	0.000	0.03	0.0	1.0	SURCHARGED
1.007	SWMH12	101.295	0.522	0.000	0.07	0.0	2.0	SURCHARGED

Summary of Results for 720 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	SWMH1	101.846	-0.200	0.000	0.03	0.0	1.1	OK
1.001	SWMH2	101.680	-0.193	0.000	0.05	0.0	1.9	OK
1.002	SWMH3	101.572	-0.190	0.000	0.06	0.0	2.2	OK
1.003	SWMH4	101.476	-0.182	0.000	0.08	0.0	2.9	OK
1.004	SWMH5	101.428	-0.170	0.000	0.14	0.0	4.2	OK
2.000	SWMH6	102.007	-0.218	0.000	0.01	0.0	0.4	OK
2.001	SWMH7	101.716	-0.201	0.000	0.03	0.0	1.6	OK
1.005	SWMH8	101.311	-0.172	0.000	0.13	0.0	7.9	OK
3.000	SWMH9	101.123	0.098	0.000	0.13	0.0	3.8	SURCHARGED
1.006	SWMH10	101.239	0.173	0.000	0.04	0.0	2.6	SURCHARGED
4.000	SWMH11	101.244	0.219	0.000	0.02	0.0	0.6	SURCHARGED
1.007	SWMH12	101.296	0.523	0.000	0.07	0.0	2.0	SURCHARGED

Summary of Results for 1440 minute 100 year Winter (Storm)

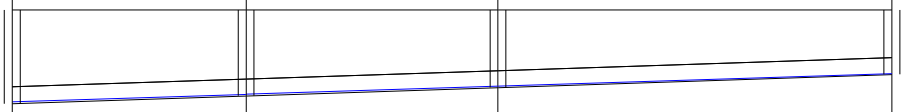
Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

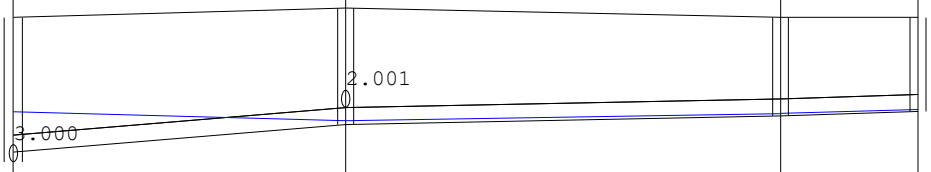
PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	SWMH1	101.840	-0.206	0.000	0.02	0.0	0.7	OK
1.001	SWMH2	101.673	-0.199	0.000	0.03	0.0	1.1	OK
1.002	SWMH3	101.564	-0.198	0.000	0.04	0.0	1.3	OK
1.003	SWMH4	101.465	-0.193	0.000	0.05	0.0	1.7	OK
1.004	SWMH5	101.426	-0.172	0.000	0.08	0.0	2.5	OK
2.000	SWMH6	102.004	-0.221	0.000	0.00	0.0	0.2	OK
2.001	SWMH7	101.709	-0.208	0.000	0.02	0.0	0.9	OK
1.005	SWMH8	101.524	0.042	0.000	0.08	0.0	4.8	SURCHARGED
3.000	SWMH9	101.163	0.138	0.000	0.14	0.0	4.3	SURCHARGED
1.006	SWMH10	101.658	0.592	0.000	0.06	0.0	3.5	SURCHARGED
4.000	SWMH11	101.683	0.658	0.000	0.03	0.0	0.8	SURCHARGED
1.007	SWMH12	101.667	0.894	0.000	0.07	0.0	2.0	SURCHARGED

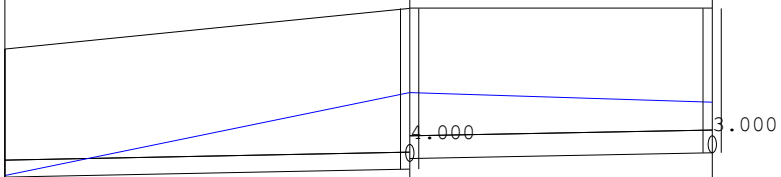
Summary of Results for 2880 minute 100 year Winter (Storm)

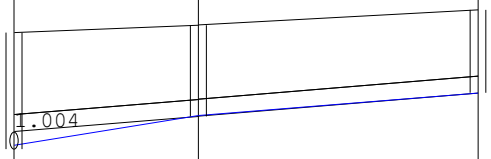
Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

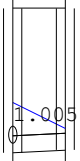
PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	SWMH1	101.832	-0.214	0.000	0.01	0.0	0.4	OK
1.001	SWMH2	101.667	-0.206	0.000	0.02	0.0	0.7	OK
1.002	SWMH3	101.559	-0.202	0.000	0.02	0.0	0.8	OK
1.003	SWMH4	101.459	-0.199	0.000	0.03	0.0	1.1	OK
1.004	SWMH5	101.405	-0.193	0.000	0.05	0.0	1.5	OK
2.000	SWMH6	102.003	-0.222	0.000	0.00	0.0	0.1	OK
2.001	SWMH7	101.703	-0.214	0.000	0.01	0.0	0.6	OK
1.005	SWMH8	101.309	-0.174	0.000	0.05	0.0	2.9	OK
3.000	SWMH9	101.082	0.057	0.000	0.11	0.0	3.2	SURCHARGED
1.006	SWMH10	101.429	0.364	0.000	0.05	0.0	3.2	SURCHARGED
4.000	SWMH11	101.413	0.388	0.000	0.02	0.0	0.5	SURCHARGED
1.007	SWMH12	101.560	0.787	0.000	0.07	0.0	2.0	SURCHARGED

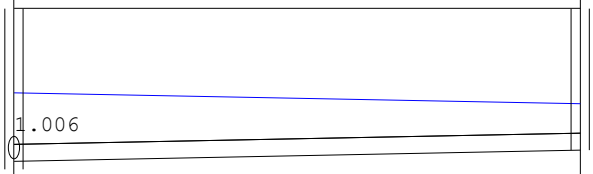
MH Name	SWMH4	SWMH3	SWMH2	SWMH1
Hor Scale 500 Ver Scale 100 Datum (m) 99.000				
PN		1.002	1.001	1.000
Dia (mm)		225	225	225
Slope (1:X)		150.0	150.0	150.0
Cover Level (m)	102.675	102.675	102.675	102.675
Invert Level (m)		101.433	101.536	101.536	101.647	101.647	101.821
Length (m)		15.463	16.654	26.044	

MH Name	SWMH10	SWMH8	SWMH5	SWMH4
Hor Scale 500 Ver Scale 100 Datum (m) 98.000				
PN		1.005	1.004	1.003
Dia (mm)		225	225	225
Slope (1:X)		60.1	250.0	150.0
Cover Level (m)	102.675	102.800	102.675	102.675
Invert Level (m)		100.892	101.258	101.258	101.373	101.373	101.433
Length (m)		21.981	28.759	9.086	

MH Name	EX.S1A	SWMH12	SWMH10	
Hor Scale 500 Ver Scale 100 Datum (m) 98.000				
PN		1.007	1.006	
Dia (mm)		225	300	
Slope (1:X)		250.2	250.0	
Cover Level (m)	102.137	102.675	102.675	
Invert Level (m)		100.441 100.548	100.685 100.765	
Length (m)		26.768	20.003	

MH Name	SWMH8	SWMH7	SWMH6	
Hor Scale 500 Ver Scale 100 Datum (m) 99.000				
PN		2.001	2.000	
Dia (mm)		225	225	
Slope (1:X)		60.1	60.0	
Cover Level (m)	102.800	102.900	103.100	
Invert Level (m)		101.489 101.692	101.692 102.000	
Length (m)		12.193	18.484	

MH Name	SWMH10		
Hor Scale 500 Ver Scale 100 Datum (m) 98.000			
PN			
Dia (mm)			
Slope (1:X)			
Cover Level (m)	102.675	102.675	
Invert Level (m)		100.800	
Length (m)			

MH Name	SWMH12		SWMH11	
Hor Scale 500 Ver Scale 100 Datum (m) 98.000				
PN		4.000		
Dia (mm)		225		
Slope (1:X)		249.7		
Cover Level (m)	102.675		102.675	
Invert Level (m)		100.650	100.800	
Length (m)		37.453		

Appendix D: Foul *WinDes* Design

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FOUL SEWERAGE DESIGN

Design Criteria for Foul - Main

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	0
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.200
Flow Per Person (l/per/day)	222.00	Maximum Backdrop Height (m)	1.500
Persons per House	3.00	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 Soffits

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
F1.000	28.793	0.360	80.0	0.000	0	0.0	1.500	o	225
F1.001	23.015	0.288	80.0	0.000	0	0.0	1.500	o	225
F1.002	48.918	0.612	79.9	0.000	0	0.0	1.500	o	225
F2.000	52.121	0.869	60.0	0.000	0	0.0	1.500	o	225
F1.003	23.989	0.400	60.0	0.000	0	0.0	1.500	o	225

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.000	101.250	0.000	0.0	0	0.0	0	0.00	1.28	51.1	0.0
F1.001	100.890	0.000	0.0	0	0.0	0	0.00	1.28	51.1	0.0
F1.002	100.602	0.000	0.0	0	0.0	0	0.00	1.28	51.1	0.0
F2.000	100.859	0.000	0.0	0	0.0	0	0.00	1.48	59.0	0.0
F1.003	99.990	0.000	0.0	0	0.0	0	0.00	1.48	59.0	0.0

Manhole Schedules for Foul - Main

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)
FFWMH1	102.675	1.425	Open Manhole	1200	F1.000	101.250	225				
FFWMH2	102.675	1.785	Open Manhole	1200	F1.001	100.890	225	F1.000	100.890	225	
FFWMH3	102.675	2.073	Open Manhole	1200	F1.002	100.602	225	F1.001	100.602	225	
FFWMH4	102.850	1.991	Open Manhole	1200	F2.000	100.859	225				
FFWMH5	102.675	2.685	Open Manhole	1200	F1.003	99.990	225	F1.002	99.990	225	
								F2.000	99.990	225	
FEX.F5	102.217	2.627	Open Manhole	0		OUTFALL		F1.003	99.590	225	

PIPELINE SCHEDULES for Foul - Main

Upstream Manhole

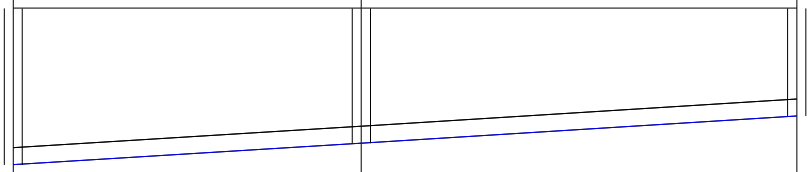
PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F1.000	o	225	FFWMH1	102.675	101.250	1.200	Open Manhole	1200
F1.001	o	225	FFWMH2	102.675	100.890	1.560	Open Manhole	1200
F1.002	o	225	FFWMH3	102.675	100.602	1.848	Open Manhole	1200
F2.000	o	225	FFWMH4	102.850	100.859	1.766	Open Manhole	1200
F1.003	o	225	FFWMH5	102.675	99.990	2.460	Open Manhole	1200

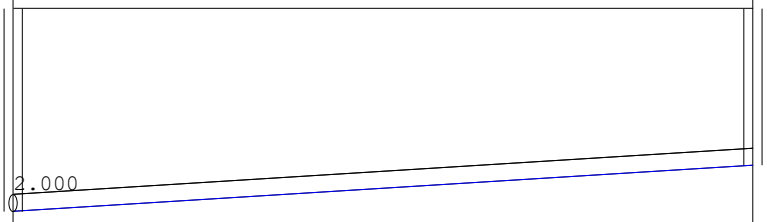
Downstream Manhole

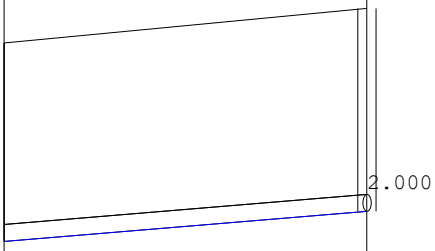
PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F1.000	28.793	80.0	FFWMH2	102.675	100.890	1.560	Open Manhole	1200
F1.001	23.015	80.0	FFWMH3	102.675	100.602	1.848	Open Manhole	1200
F1.002	48.918	79.9	FFWMH5	102.675	99.990	2.460	Open Manhole	1200
F2.000	52.121	60.0	FFWMH5	102.675	99.990	2.460	Open Manhole	1200
F1.003	23.989	60.0	FEX.F5	102.217	99.590	2.402	Open Manhole	0

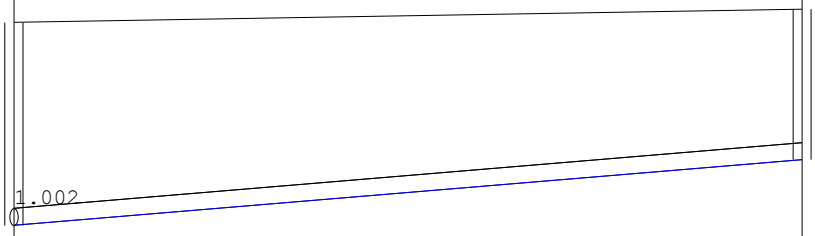
Free Flowing Outfall Details for Foul - Main

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
F1.003	FEX.F5	102.217	99.590	99.298	0	0

MH Name	FFWMH3	FFWMH2	FFWMH1	
Hor Scale 500 Ver Scale 100 Datum (m) 98.000				
PN		F1.001	F1.000	
Dia (mm)		225	225	
Slope (1:X)		80.0	80.0	
Cover Level (m)	102.675	102.675	102.675	
Invert Level (m)	100.602	100.890	100.890	101.250
Length (m)		23.015	28.793	

MH Name	FFWMH5	FFWMH3	
Hor Scale 500 Ver Scale 100 Datum (m) 98.000			
PN		F1.002	
Dia (mm)		225	
Slope (1:X)		79.9	
Cover Level (m)	102.675	102.675	
Invert Level (m)	99.990	100.602	
Length (m)		48.918	

MH Name	FEX.F5	FFWMH5	
Hor Scale 500 Ver Scale 100 Datum (m) 98.000			
PN		F1.003	
Dia (mm)		225	
Slope (1:X)		60.0	
Cover Level (m)	102.217	102.675	
Invert Level (m)	99.590	99.990	
Length (m)		23.989	

MH Name	FFWMH5		FFWMH4
Hor Scale 500 Ver Scale 100 Datum (m) 98.000			
PN		F2.000	
Dia (mm)		225	
Slope (1:X)		60.0	
Cover Level (m)	102.675		102.850
Invert Level (m)	99.990		100.859
Length (m)		52.121	

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Appendix D: Irish Water Confirmation of Feasibility Letter

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Oifig Sheachadta na
Cathrach Theas
Cathair Chorcaí

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

www.water.ie

22 April 2020

Dear Gessica Silva,

Re: Connection Reference No CDS20000980 pre-connection enquiry -
Subject to contract | Contract denied

Connection for Housing Development of 140 unit(s) at Lands at Tallaght, Dublin 24

Irish Water has reviewed your pre-connection enquiry in relation to a water and wastewater connection at Lands at Tallaght, Dublin 24.

Based upon the details that you have provided with your pre-connection enquiry and on the capacity currently available in the network(s), as assessed by Irish Water, we wish to advise you that, subject to a valid connection agreement being put in place, your proposed connection to the Irish Water network(s) can be facilitated.

Water:

There is no Irish Water infrastructure adjacent to the site.

Connection to the Irish Water networks may be through third party infrastructure and/or lands and all relevant wayleave and permissions would need to be obtained by the client. Please be advised that at connection application stage you have to provide written confirmation from the owner of the infrastructure that you have received legal permission to connect to and that the infrastructure is fit for purpose and has capacity to cater additional load from the Development.

Wastewater:

There is no Irish Water infrastructure adjacent to the site.

Connection to the Irish Water networks may be through third party infrastructure and/or lands and all relevant wayleave and permissions would need to be obtained by the client. Please be advised that at connection application stage you have to provide written confirmation from the owner of the infrastructure that you have received legal permission to connect to and that the infrastructure is fit for purpose and has capacity to cater additional load from the Development.

Strategic Housing Development:

Irish Water notes that the scale of this development dictates that it is subject to the Strategic Housing Development planning process. In advance of submitting your full application to An Bord Pleanála for

assessment, you must have reviewed this development with Irish Water and received a Statement of Design Acceptance in relation to the layout of water and wastewater services.

All infrastructure should be designed and installed in accordance with the Irish Water Codes of Practice and Standard Details. A design proposal for the water and/or wastewater infrastructure should be submitted to Irish Water for assessment. Prior to submitting your planning application, you are required to submit these detailed design proposals to Irish Water for review.

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

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

If you have any further questions, please contact Deirdre Ryan from the design team on 022 54620 or email deiryan@water.ie. For further information, visit **www.water.ie/connections.**

Yours sincerely,

Maria O'Dwyer

Connections and Developer Services