

Suir Island, Clonmel

Engineering Planning Report

202276-PUNCH-XX-XX-RP-C-0001

July 2022

Document Control

Document Number: 202276-PUNCH-XX-XX-RP-C-0001

Status	Description	Date	Prepared	Checked	Approved
P0	Part 8 Planning	04-02-2022	J.P. Murray	M. Richardson	M. Richardson
P1	Part 8 Planning	3-3-2022	J.P. Murray	M. Richardson	M. Richardson
P2	Part 8 Planning	16-3-2022	J.P. Murray	M. Richardson	M. Richardson
P3	Part 8 Planning	13-5-2022	J.P. Murray	M. Richardson	M. Richardson
P4	Part 8 Planning	4-7-2022	M. Richardson	M. Richardson	M. Richardson
P5	Part 8 Planning	29-7-2022	M. Richardson	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 Suir Island Gardens, Clonmel, Co Tipperary. The site location is shown in Figure 1 below. The site is approximately 0.93 ha. and is a brownfield site with a mixture of ruins (Suir Island House a protected structure), hardstanding, grasslands and mature trees.

The topography of the site is low in elevation on grounds prone to regular flooding, and which is often submerged by the River Suir. There is no significant fall in height. For reference, the island is generally at an elevation of 18.1m AOD, the water edge is approximately 16.3m AOD, the Raheen Road opposite the island is at 18.6m AOD.

The site is located on an island, bound by the River Suir along its southern and western perimeter, grasslands and trees to the east, and a car park and historical industrial buildings to the north. The proposed public realm works on Suir Island comprises the development of approximately 0.9ha of public gardens and public landscaped areas. The works include:

- Renovation of existing gardens,
- Provision of lawns and landscape planting to include the provision of trees, hedges and shrubs,
- Seating and picnic areas,
- Hard and soft pathways,
- New entrance gate with adjoining wall cladding,
- Childrens play areas with associated equipment,
- Securing of Suir Island House (A Protected Structure) with decorative steel plates at ground floor level,
- Feature lighting to include internal and external lighting of Suir Island House (A Protected Structure),
- Signage,
- Ancillary site development works that shall include site drainage, provision of water supply for the play area and for wash down purposes, provision of electrical supply for the feature lighting, and removal and reconstruction of approximately 19 metres of boundary wall.
- All associated site and landscaping works.



Figure 1: Site Location of the Proposed Development

1.1 Proposed Development

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

The proposed development at Suir Island gardens, located in the centre of Clonmel, is for a public use space. Play areas, seating, and picnicking will be provided, with the house ruins forming a backdrop to the scheme.

2 Stormwater Drainage Design

2.1 Existing Stormwater Drainage

Record drawings provided by Irish Water indicate that no stormwater sewer exists at the site.

A topographical survey carried out by Murphy Surveys (2017) is also available.

Please refer to Appendix A for Irish Water Record Drawings illustrating the existing stormwater drainage arrangement. An extract is shown in Figure 2 below.

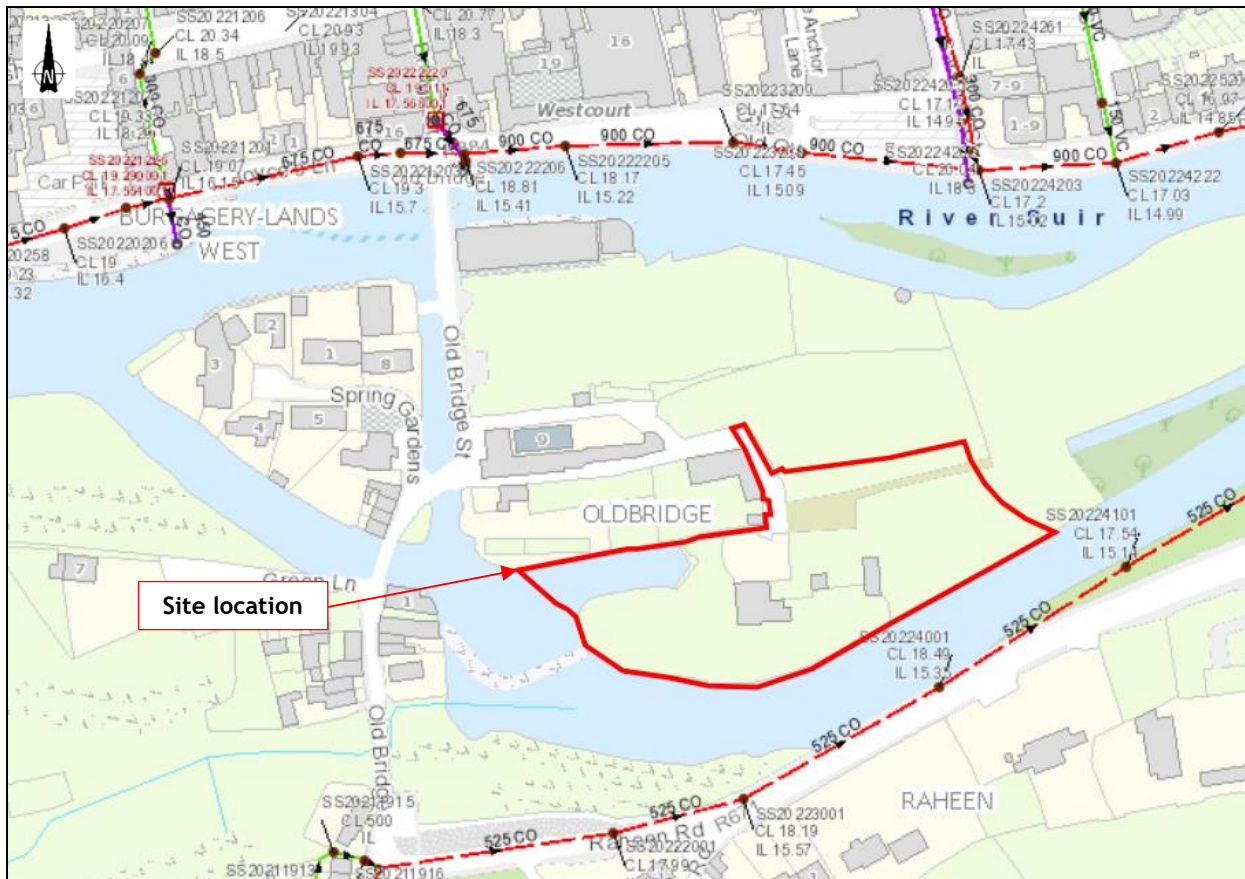


Figure 2: Existing stormwater drainage surrounding the site (Extract from IW records)

2.2 Proposed Stormwater Drainage

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” (GSDS) and the South Tipperary Development Plan 2009.

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

Stormwater from the seating, main play and paved areas will be collected in filter drains, discharged via headwalls into the River Suir to the south of the site. Attenuation is not proposed. Drainage depth is proposed to be limited to 600mm where possible, with a maximum depth of 1.0m proposed. Invert levels are affected by existing ground levels onsite. This has been agreed with Tipperary County Council.

All drainage and watermain installation within tree root zones is to be undertaken in accordance with the arborist's requirements. All drainage and watermain installation within nominated archaeological areas are to be undertaken to in accordance with the archaeologists' requirements.

The site is in a flood risk zone. A site-specific flood risk assessment is by others.

The proposed stormwater sewers have been designed using Causeway Flow software. Table 2-1 describes the stormwater drainage design parameters used and detailed calculations are enclosed in Appendix C.

Note: Ground conditions on the site are shown to be alluvium based on GSI mapping, however a geotechnical report supplied by TCC (Geotech, 2007) shows, that while both alluvial and granular soils are found locally along river edges, cohesive (clay) soils predominated the area.

Table 2-1: Stormwater Drainage Design Parameters

Description	Value
Total Impervious Site area	0.061 ha
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	10%
M5-60	17.7
Ratio R	0.213
SOIL type	4 (clayey)
Soil value	0.45
SAAR	977mm
Peak Discharge Rate	No control

Please refer to proposed stormwater drainage layout as shown on PUNCH drawing: 202276-PUNCH-XX-XX-DR-S-0100.

3 Foul Water Drainage Design

3.1 Existing Foul Water Drainage

Irish Water record drawings indicate the presence of foul water sewers in the vicinity of the site:

- 900mm CO line to the north
- 525mm CO line to the south

A topographical survey carried out by Murphy Surveys (2017) confirms the records.

Please refer to Appendix A for Irish Water Record Drawings illustrating the existing foul water drainage arrangement. An extract is shown in Figure 3 below.

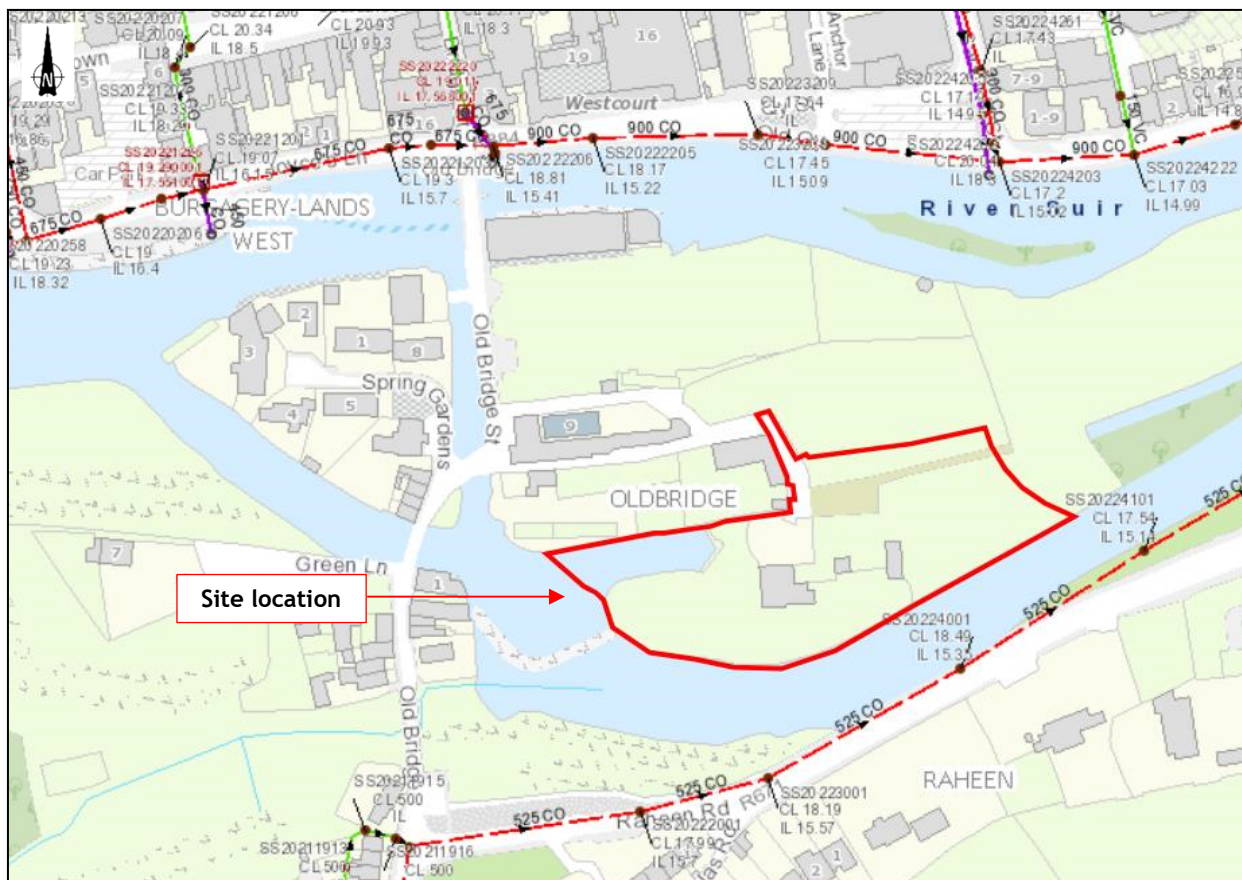


Figure 3: Existing foul drainage surrounding the site (Extract from Irish Water records)

3.2 Proposed Foul Water Drainage

There is no proposed foul sewer as part of the development.

4 Watermain Design

4.1 Existing Watermain

Irish Water record drawings indicate the presence of the following watermains in the vicinity of the site:

- 2" (50.8mm) Cast-Iron pipe located to the north of the site

A topographical survey carried out by Murphy Surveys (2017) confirms the records.

Please refer to Appendix A for Irish Water Record Drawings illustrating the existing watermain arrangement in the area. An extract is shown in Figure 4 below.

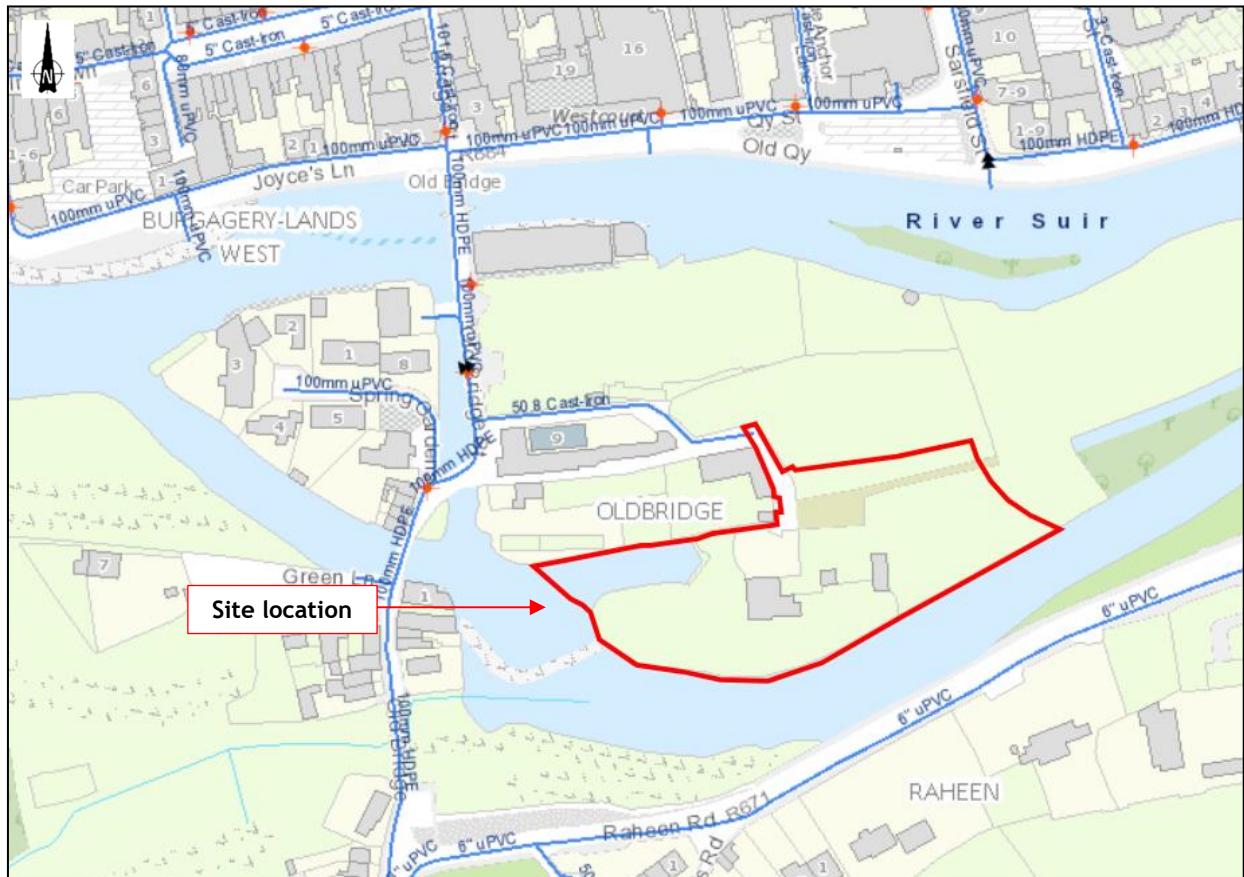


Figure 4: Existing watermain surrounding the site (Extract from Irish Water records)

4.2 Proposed Watermain

It is generally accepted that the design loading for foul drainage can be used to evaluate an approximation of the water demand on the site. With reference to Irish Water's Code of Practice for Water Infrastructure, the average daily flow is calculated as the number of persons multiplied by the flow rate per person. The average day peak week flow is taken to be 1.25 x the average flow, and the peak demand is taken to be the average day peak week flow multiplied by a peaking factor of 5.

Please refer to Architects drawings supplied with this proposal which show the location of the proposed site water use locations, and PUNCH drawings that show the connection to the water servicing. The expected demand is proposed for maintenance and play and the flow demands are expected to be minimal. Further quantification of the demands can be developed as part of the detailed design.

A 50mm diameter watermain is proposed to serve the proposed development based on the above calculated demand. The proposed watermain will connect to the existing (50mm) watermain north of the site.

This feed will provide water to the proposed development. A bulk water meter shall be provided at the site boundary at the location of the proposed connection to the existing watermain. The watermain layout has been designed in accordance with "Irish Water Code of Practice for Water Infrastructure". All watermain are to be constructed in accordance with Irish Water Code of Practice and the Local Authority's requirements.

All drainage and watermain installation within tree root zones is to be undertaken in accordance with the arborist's requirements. All drainage and watermain installation within nominated archaeological areas are to be undertaken to in accordance with the archaeologists' requirements.

Proposed watermain are to be limited in depth to 0.6m maximum.

A Pre-Connection Enquiry Form has been issued to Irish Water by others in relation to the proposed development.

Please refer to proposed watermain layout as shown on PUNCH drawing: 202276-PUNCH-XX-XX-DR-S-0100.

5 Flooding

Flood Risk Assessment by others.


6 Roads and Access

6.1 Proposed Roads & Access

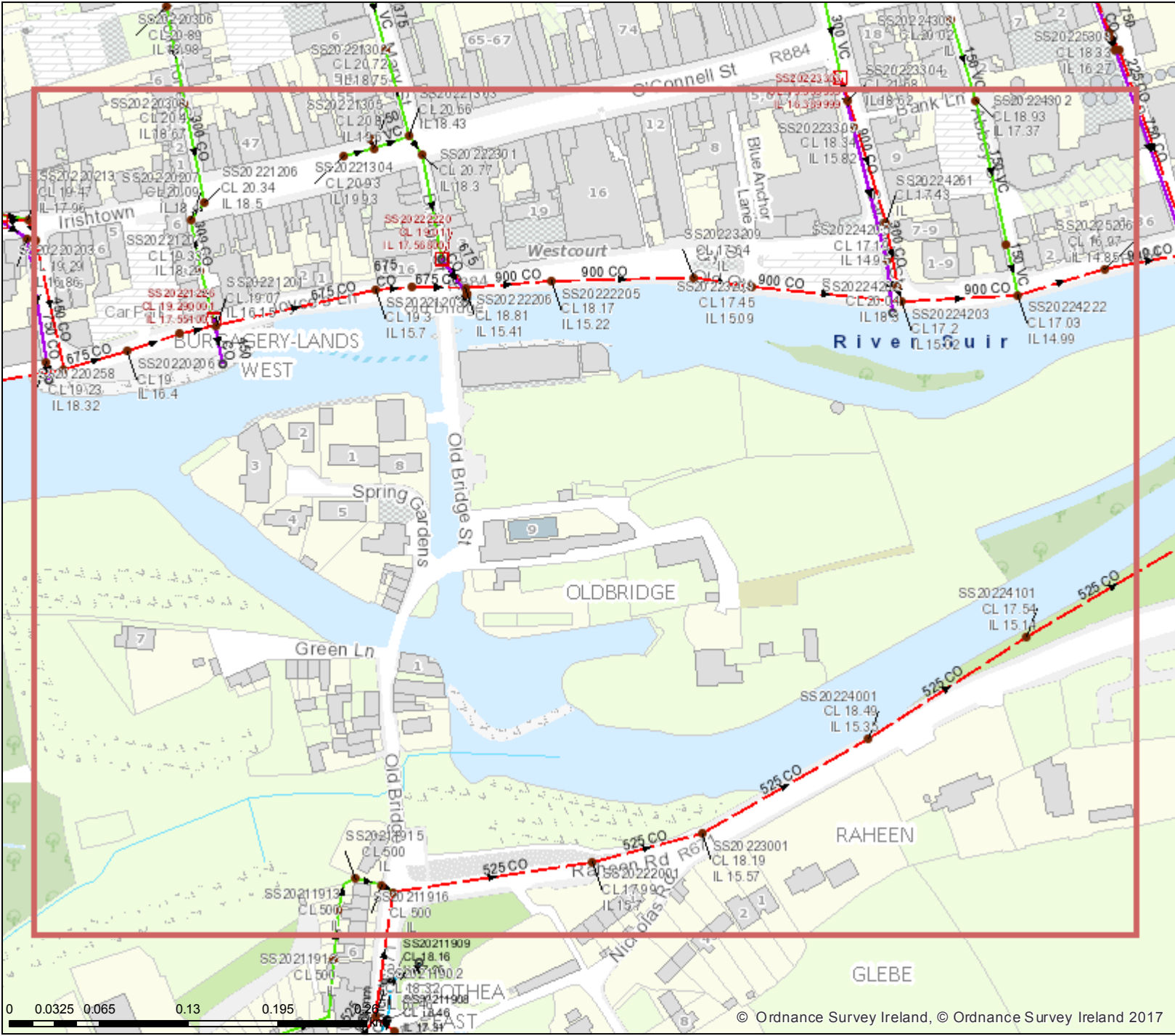
Access for emergency and maintenance vehicles at the site is not part of this submission. Details for this to be developed as part of future detailed design.

Appendix A Existing Record Drawings

Irish Water Web Map - Wastewater Network



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Water Distribution Networks <ul style="list-style-type: none"> Water Treatment Plant Water Pump Station Storage Cell/Tower Dosing Point Meter Station Abstraction Point Telemetry Kiosk 	Sewer Foul Combined Networks <ul style="list-style-type: none"> Waste Water Treatment Plant Waste Water Pump Station Sewer Mains Irish Water Gravily - Combined Gravily - Foul Gravily - Unknown Pumping - Combined Pumping - Foul Pumping - Unknown Syphon - Combined Syphon - Foul Syphon - Unknown Overflow Sewer Mains Private Gravily - Combined Gravily - Foul Gravily - Unknown Pumping - Combined Pumping - Foul Pumping - Unknown Syphon - Combined Syphon - Foul Syphon - Unknown Overflow Sewer Lateral Lines Sewer Casings Sewer Manholes Standard Backdrop Cascade Catchpit Bifurcation Hatchbox Lamphole Hydrobrake Other; Unknown Discharge Type Outfall Overflow Soakaway Other; Unknown Cleanout Type Flushing Structure Other; Unknown Sewer Inlets Catchpit Gully Other; Unknown Sewer Fittings Vent/Cool Other; Unknown 	Storm Water Network <ul style="list-style-type: none"> Surface Gravity Mains Surface Gravity Mains Private Surface Water Pressurised Mains Surface Water Pressurised Mains Private Inlet Type Gully Standard Other; Unknown Storm Manholes Standard Backdrop Cascade Catchpit Bifurcation Hatchbox Lamphole Hydrobrake Other; Unknown Storm Clean Outs Stormwater Chambers Discharge Type Outfall Overflow Soakaway Other; Unknown
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Gas Networks Ireland

- Transmission High Pressure Gasline
- Distribution Medium Pressure Gasline
- Distribution Low Pressure Gasline

ESB Networks

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

Non Service Categories

- Proposed
- Under Construction
- Out of Service
- Decommissioned

Water Non Service Assets

- Water Point Feature
- Water Pipe
- Water Structure

Waste Non Service Assets

- Waste Point Feature
- Sewer
- Waste Structure

Irish Water Web Map - Water Network



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Water Distribution Network	Sewer/Foul/Combined Network	Storm Water Network
Water Treatment Plant	Waste Water Treatment Plant	Surface Water Mains
Water Pump Station	Waste Water Pump Station	Surface Gravity Mains
Storage Cell/Tower	Sewer Mains Irish Water	Surface Gravity Mains Private
Dosing Point	Gravity - Combined	Surface Water Pressurised Mains
Meter Station	Gravity - Foul	Surface Water Pressurised Mains Private
Abstraction Point	Gravity - Unknown	Initial Type
Telemetry Kiosk	Pumping - Combined	Gully
Reservoir	Pumping - Foul	Standard
Possible	Pumping - Unknown	Other, Unknown
Raw Water	Syphon - Combined	Storm Manholes
Private	Syphon - Foul	Standard
Trunk Water Mains	Overflow	Cascade
Irish Water	Sewer Mains Private	Catchpit
Private	Gravity - Combined	Bifurcation
Water Lateral Lines	Gravity - Foul	Hatchbox
Irish Water	Gravity - Unknown	Lamphole
Non IW	Pumping - Combined	Hydrobrake
Water Casings	Pumping - Foul	Other, Unknown
Water Abandoned Lines	Pumping - Unknown	Storm Culverts
Boundary Meter	Syphon - Combined	Stormwater Chambers
Butterfly Valve Open/Closed	Syphon - Foul	Discharge Type
Group Scheme	Overflow	Outfall
Source Meter	Sewer Manholes	Overflow
Waste Meter	Standard	Soakaway
Unknown Meter - Other Meter	Cascade	Other, Unknown
Non-Return	Catchpit	Gas Networks Island
PRV	Bifurcation	Transmission High Pressure Gasline
PSV	Hatchbox	Distribution Medium Pressure Gasline
Sluice Line Valve Open/Closed	Lamphole	Distribution Low Pressure Gasline
Butterfly Line Valve Open/Closed	Hydrobrake	ESB Networks
Sluice Boundary Valve Open/Closed	Other, Unknown	ESB HV Lines
Butterfly Boundary Valve Open/Closed	Discharge Type	HV Underground
Scour Valves	Overflow	MV Overhead Three Phase
Single Air Control Valve	Soakaway	MV Overhead Single Phase
Double Air Control Valve	Standard Outlet	LV Overhead Three Phase
Water Stop Valves	Other, Unknown	LV Overhead Single Phase
Water Service Connections	Cleanout Type	MVLV Underground
Water Distribution Chambers	Rodding Eye	Abandoned
Water Network Junctions	Flushing Structure	Non Service Categories
Pressure Monitoring Point	Other, Unknown	Proposed
Fire Hydrant	Sewer Inlets	Under Construction
Fire Hydrant/Washout	Catchpit	Out of Service
Water Fittings	Gully	Decommissioned
Cap	Standard	Water Non Service Assets
Reducer	Other, Unknown	Water Point Feature
Tap	Sewer Fittings	Water Pipe
Other Fittings	Vent/Cool	Water Structure
	Other, Unknown	Waste Non Service Assets
		Waste Point Feature
		Sewer
		Waste Structure



Appendix B Surface Water Drainage Supporting Data

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 220335, Northing: 122107,

DURATION	Interval		Years													
	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	3.1,	4.0,	4.5,	5.2,	5.6,	6.0,	7.0,	8.1,	8.9,	9.9,	10.7,	11.4,	12.3,	13.1,	13.7,	N/A ,
10 mins	4.3,	5.6,	6.3,	7.2,	7.8,	8.3,	9.8,	11.4,	12.4,	13.7,	14.9,	15.8,	17.2,	18.2,	19.1,	N/A ,
15 mins	5.1,	6.6,	7.4,	8.5,	9.2,	9.8,	11.5,	13.4,	14.5,	16.2,	17.6,	18.6,	20.2,	21.4,	22.4,	N/A ,
30 mins	6.9,	8.9,	9.9,	11.4,	12.4,	13.1,	15.5,	18.0,	19.6,	21.8,	23.7,	25.1,	27.3,	28.9,	30.2,	N/A ,
1 hours	9.3,	12.0,	13.4,	15.4,	16.7,	17.7,	20.9,	24.2,	26.4,	29.3,	31.9,	33.8,	36.7,	38.9,	40.7,	N/A ,
2 hours	12.5,	16.2,	18.0,	20.7,	22.5,	23.9,	28.1,	32.7,	35.6,	39.5,	43.0,	45.6,	49.5,	52.4,	54.9,	N/A ,
3 hours	14.8,	19.2,	21.5,	24.7,	26.8,	28.4,	33.4,	38.9,	42.3,	47.1,	51.1,	54.2,	58.9,	62.4,	65.3,	N/A ,
4 hours	16.8,	21.8,	24.3,	27.9,	30.3,	32.1,	37.8,	44.0,	47.9,	53.3,	57.9,	61.4,	66.6,	70.6,	73.9,	N/A ,
6 hours	20.0,	25.9,	28.9,	33.3,	36.1,	38.3,	45.1,	52.4,	57.0,	63.4,	68.9,	73.1,	79.3,	84.1,	88.0,	N/A ,
9 hours	23.8,	30.9,	34.4,	39.6,	43.0,	45.5,	53.6,	62.4,	67.9,	75.5,	82.0,	87.0,	94.4,	100.1,	104.7,	N/A ,
12 hours	26.9,	34.9,	39.0,	44.8,	48.6,	51.5,	60.7,	70.6,	76.8,	85.4,	92.8,	98.4,	106.9,	113.3,	118.5,	N/A ,
18 hours	32.1,	41.6,	46.4,	53.4,	57.9,	61.4,	72.3,	84.0,	91.5,	101.7,	110.5,	117.2,	127.2,	134.9,	141.1,	N/A ,
24 hours	36.3,	47.0,	52.5,	60.4,	65.5,	69.4,	81.8,	95.1,	103.5,	115.1,	125.0,	132.6,	144.0,	152.6,	159.7,	183.7,
2 days	45.4,	57.8,	64.0,	72.9,	78.6,	83.0,	96.7,	111.2,	120.4,	132.9,	143.6,	151.6,	163.7,	172.9,	180.3,	205.5,
3 days	53.0,	66.8,	73.7,	83.5,	89.8,	94.5,	109.4,	125.1,	134.9,	148.3,	159.7,	168.2,	181.1,	190.7,	198.6,	225.0,
4 days	59.9,	74.9,	82.4,	92.9,	99.7,	104.8,	120.7,	137.5,	148.0,	162.1,	174.1,	183.2,	196.7,	206.8,	215.1,	242.7,
6 days	72.3,	89.5,	97.9,	109.9,	117.5,	123.3,	141.0,	159.6,	171.2,	186.8,	200.0,	209.9,	224.6,	235.6,	244.6,	274.5,
8 days	83.5,	102.6,	112.0,	125.2,	133.5,	139.8,	159.2,	179.5,	192.0,	208.9,	223.1,	233.8,	249.6,	261.4,	271.0,	302.9,
10 days	94.1,	114.9,	125.1,	139.4,	148.4,	155.2,	176.1,	197.9,	211.3,	229.3,	244.5,	255.8,	272.6,	285.2,	295.3,	329.1,
12 days	104.1,	126.6,	137.5,	152.8,	162.5,	169.8,	192.1,	215.2,	229.5,	248.5,	264.6,	276.5,	294.3,	307.5,	318.2,	353.7,
16 days	123.0,	148.6,	160.9,	178.1,	188.9,	197.1,	221.9,	247.5,	263.3,	284.3,	302.0,	315.1,	334.6,	349.0,	360.7,	399.3,
20 days	141.0,	169.3,	182.9,	201.8,	213.7,	222.6,	249.8,	277.7,	294.9,	317.7,	336.8,	351.0,	372.0,	387.5,	400.1,	441.5,
25 days	162.6,	194.0,	209.1,	230.0,	243.2,	253.0,	282.8,	313.4,	332.1,	357.0,	377.8,	393.2,	415.9,	432.8,	446.3,	491.0,

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

$$R = m5-60minutes / m5-2days$$

$$R = 17.7 / 83.0 = 0.213$$

Appendix C 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 Soffits
M5-60 (mm)	17.700	Minimum Backdrop Height (m)	0.200
Ratio-R	0.213	Preferred Cover Depth (m)	0.600
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
SIC 1	0.010	4.00	18.150	450	620282.391	622155.490	0.450
SIC 2			18.100	450	620279.662	622149.360	0.434
SIC 3	0.001	4.00	18.100	450	620272.509	622149.122	0.470
SIC 4	0.008	4.00	18.130	450	620268.155	622144.040	0.533
SIC 5		4.00	18.150	450	620265.298	622128.212	0.650
SIC 6	0.003	4.00	18.100	450	620268.732	622130.421	0.641
SIC 7		4.00	17.800	450	620290.871	622124.327	0.500
SIC 8	0.001	4.00	18.170	450	620280.736	622124.080	0.921
SIC 9	0.001	4.00	17.950	450	620291.041	622117.203	0.600
SIC 10	0.003	4.00	17.980	450	620280.728	622117.142	0.766
HW 1_OUT			17.400	450	620280.671	622111.690	0.241
SIC 11	0.013	4.00	17.800	450	620301.418	622157.953	0.500
SIC 12			17.690	450	620309.527	622158.513	0.471
SIC 13	0.004	4.00	17.850	450	620320.143	622147.740	0.650
SIC 14	0.001	4.00	17.850	450	620320.235	622144.041	0.687
SIC 15	0.003	4.00	17.900	450	620310.604	622142.229	0.786
SIC 16	0.002	4.00	18.050	450	620300.890	622139.220	0.750
SIC 17		4.00	17.700	450	620294.242	622124.787	0.600
SIC 18			17.700	450	620302.719	622126.678	0.750
SIC 19	0.001	4.00	17.850	450	620310.034	622129.405	0.978
HW 2_OUT			17.000	450	620314.305	622125.010	0.189
SIC 20	0.002	4.00	17.600	450	620252.658	622125.462	0.550
SIC 21	0.001	4.00	17.600	450	620240.125	622122.602	0.679
SIC 22	0.008	4.00	17.440	450	620221.352	622132.200	0.744
HW 3_OUT			17.000	450	620212.064	622127.918	0.600
SIC 4A			18.100	450	620266.361	622136.412	0.542
SIC 16A			17.800	450	620300.283	622131.455	0.787

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)
1.007	SIC 10	HW 1_OUT	5.452	0.600	17.214	17.159	0.055	99.1	150	5.40	50.0
1.006	SIC 8	SIC 10	6.938	0.600	17.249	17.214	0.035	200.0	150	5.31	50.0
4.000	SIC 9	SIC 10	10.314	0.600	17.350	17.247	0.103	100.0	150	4.17	50.0
1.005	SIC 6	SIC 8	13.576	0.600	17.459	17.391	0.068	200.0	150	5.14	50.0
3.000	SIC 7	SIC 8	10.138	0.600	17.300	17.249	0.051	200.0	150	4.24	50.0
1.004	SIC 4A	SIC 6	6.443	0.600	17.558	17.526	0.032	200.0	150	4.82	50.0
2.000	SIC 5	SIC 6	4.083	0.600	17.500	17.459	0.041	100.0	150	4.07	50.0
1.003	SIC 4	SIC 4A	7.836	0.600	17.597	17.558	0.039	200.0	150	4.67	50.0
1.002	SIC 3	SIC 4	6.692	0.600	17.630	17.597	0.033	200.0	150	4.48	50.0
1.001	SIC 2	SIC 3	7.156	0.600	17.666	17.630	0.036	200.0	150	4.33	50.0
1.000	SIC 1	SIC 2	6.710	0.600	17.700	17.666	0.034	200.0	150	4.16	50.0
6.003	SIC 19	HW 2_OUT	6.128	0.600	16.872	16.811	0.061	100.5	150	4.92	50.0
6.002	SIC 15	SIC 19	12.837	0.600	17.114	17.050	0.064	200.0	150	4.82	50.0
8.002	SIC 18	SIC 19	7.807	0.600	16.950	16.872	0.078	100.0	150	4.28	50.0
8.001	SIC 16A	SIC 18	5.362	0.600	17.013	16.950	0.063	85.1	150	4.15	50.0
9.000	SIC 17	SIC 18	8.685	0.600	17.100	17.013	0.087	100.0	150	4.14	50.0
8.000	SIC 16	SIC 16A	7.789	0.600	17.300	17.013	0.287	27.1	150	4.07	50.0
6.001	SIC 12	SIC 15	16.329	0.600	17.219	17.137	0.082	200.0	150	4.52	50.0
7.001	SIC 14	SIC 15	9.799	0.600	17.163	17.114	0.049	200.0	150	4.29	50.0
7.000	SIC 13	SIC 14	3.700	0.600	17.200	17.163	0.037	100.0	150	4.06	50.0
6.000	SIC 11	SIC 12	8.129	0.600	17.300	17.219	0.081	100.0	150	4.13	50.0
5.002	SIC 22	HW 3_OUT	10.228	0.600	16.696	16.400	0.296	34.6	150	4.65	50.0
5.001	SIC 21	SIC 22	21.084	0.600	16.921	16.696	0.225	93.7	150	4.55	50.0
5.000	SIC 20	SIC 21	12.855	0.600	17.050	16.921	0.129	100.0	150	4.21	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)
1.007	1.009	17.8	3.7	0.616	0.091	0.027	0.0	47	0.800
1.006	0.707	12.5	3.2	0.771	0.616	0.024	0.0	52	0.593
4.000	1.005	17.8	0.1	0.450	0.583	0.001	0.0	9	0.282
1.005	0.707	12.5	3.1	0.491	0.629	0.023	0.0	51	0.586
3.000	0.707	12.5	0.0	0.350	0.771	0.000	0.0	0	0.000
1.004	0.707	12.5	2.7	0.392	0.424	0.020	0.0	47	0.564
2.000	1.005	17.8	0.0	0.500	0.491	0.000	0.0	0	0.000
1.003	0.707	12.5	2.7	0.383	0.392	0.020	0.0	47	0.564
1.002	0.707	12.5	1.5	0.320	0.383	0.011	0.0	35	0.480
1.001	0.707	12.5	1.4	0.284	0.320	0.010	0.0	34	0.465
1.000	0.707	12.5	1.4	0.300	0.284	0.010	0.0	34	0.465
6.003	1.002	17.7	3.2	0.828	0.039	0.024	0.0	43	0.761
6.002	0.707	12.5	2.8	0.636	0.650	0.021	0.0	48	0.571
8.002	1.005	17.8	0.2	0.600	0.828	0.002	0.0	13	0.353
8.001	1.090	19.3	0.2	0.637	0.600	0.002	0.0	12	0.372
9.000	1.005	17.8	0.0	0.450	0.537	0.000	0.0	0	0.000
8.000	1.940	34.3	0.2	0.600	0.637	0.002	0.0	9	0.551
6.001	0.707	12.5	1.8	0.321	0.613	0.013	0.0	38	0.502
7.001	0.707	12.5	0.6	0.537	0.636	0.004	0.0	23	0.363
7.000	1.005	17.8	0.5	0.500	0.537	0.004	0.0	17	0.437
6.000	1.005	17.8	1.8	0.350	0.321	0.013	0.0	32	0.642
5.002	1.718	30.4	1.5	0.594	0.450	0.011	0.0	23	0.891
5.001	1.038	18.3	0.4	0.529	0.594	0.003	0.0	16	0.421
5.000	1.005	17.8	0.3	0.400	0.529	0.002	0.0	14	0.375

Pipeline Schedule



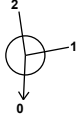


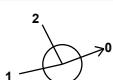
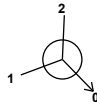






Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.007	5.452	99.1	150	Circular	17.980	17.214	0.616	17.400	17.159	0.091
1.006	6.938	200.0	150	Circular	18.170	17.249	0.771	17.980	17.214	0.616
4.000	10.314	100.0	150	Circular	17.950	17.350	0.450	17.980	17.247	0.583
1.005	13.576	200.0	150	Circular	18.100	17.459	0.491	18.170	17.391	0.629
3.000	10.138	200.0	150	Circular	17.800	17.300	0.350	18.170	17.249	0.771
1.004	6.443	200.0	150	Circular	18.100	17.558	0.392	18.100	17.526	0.424
2.000	4.083	100.0	150	Circular	18.150	17.500	0.500	18.100	17.459	0.491
1.003	7.836	200.0	150	Circular	18.130	17.597	0.383	18.100	17.558	0.392
1.002	6.692	200.0	150	Circular	18.100	17.630	0.320	18.130	17.597	0.383
1.001	7.156	200.0	150	Circular	18.100	17.666	0.284	18.100	17.630	0.320
1.000	6.710	200.0	150	Circular	18.150	17.700	0.300	18.100	17.666	0.284
6.003	6.128	100.5	150	Circular	17.850	16.872	0.828	17.000	16.811	0.039
6.002	12.837	200.0	150	Circular	17.900	17.114	0.636	17.850	17.050	0.650
8.002	7.807	100.0	150	Circular	17.700	16.950	0.600	17.850	16.872	0.828
8.001	5.362	85.1	150	Circular	17.800	17.013	0.637	17.700	16.950	0.600
9.000	8.685	100.0	150	Circular	17.700	17.100	0.450	17.700	17.013	0.537
8.000	7.789	27.1	150	Circular	18.050	17.300	0.600	17.800	17.013	0.637
6.001	16.329	200.0	150	Circular	17.690	17.219	0.321	17.900	17.137	0.613
7.001	9.799	200.0	150	Circular	17.850	17.163	0.537	17.900	17.114	0.636
7.000	3.700	100.0	150	Circular	17.850	17.200	0.500	17.850	17.163	0.537
6.000	8.129	100.0	150	Circular	17.800	17.300	0.350	17.690	17.219	0.321
5.002	10.228	34.6	150	Circular	17.440	16.696	0.594	17.000	16.400	0.450
5.001	21.084	93.7	150	Circular	17.600	16.921	0.529	17.440	16.696	0.594
5.000	12.855	100.0	150	Circular	17.600	17.050	0.400	17.600	16.921	0.529

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.007	SIC 10	450	Manhole	Adoptable	HW 1_OUT	450	Manhole	Adoptable
1.006	SIC 8	450	Manhole	Adoptable	SIC 10	450	Manhole	Adoptable
4.000	SIC 9	450	Manhole	Adoptable	SIC 10	450	Manhole	Adoptable
1.005	SIC 6	450	Manhole	Adoptable	SIC 8	450	Manhole	Adoptable
3.000	SIC 7	450	Manhole	Adoptable	SIC 8	450	Manhole	Adoptable
1.004	SIC 4A	450	Manhole	Adoptable	SIC 6	450	Manhole	Adoptable
2.000	SIC 5	450	Manhole	Adoptable	SIC 6	450	Manhole	Adoptable
1.003	SIC 4	450	Manhole	Adoptable	SIC 4A	450	Manhole	Adoptable
1.002	SIC 3	450	Manhole	Adoptable	SIC 4	450	Manhole	Adoptable
1.001	SIC 2	450	Manhole	Adoptable	SIC 3	450	Manhole	Adoptable
1.000	SIC 1	450	Manhole	Adoptable	SIC 2	450	Manhole	Adoptable
6.003	SIC 19	450	Manhole	Adoptable	HW 2_OUT	450	Manhole	Adoptable
6.002	SIC 15	450	Manhole	Adoptable	SIC 19	450	Manhole	Adoptable
8.002	SIC 18	450	Manhole	Adoptable	SIC 19	450	Manhole	Adoptable
8.001	SIC 16A	450	Manhole	Adoptable	SIC 18	450	Manhole	Adoptable
9.000	SIC 17	450	Manhole	Adoptable	SIC 18	450	Manhole	Adoptable
8.000	SIC 16	450	Manhole	Adoptable	SIC 16A	450	Manhole	Adoptable
6.001	SIC 12	450	Manhole	Adoptable	SIC 15	450	Manhole	Adoptable
7.001	SIC 14	450	Manhole	Adoptable	SIC 15	450	Manhole	Adoptable
7.000	SIC 13	450	Manhole	Adoptable	SIC 14	450	Manhole	Adoptable
6.000	SIC 11	450	Manhole	Adoptable	SIC 12	450	Manhole	Adoptable
5.002	SIC 22	450	Manhole	Adoptable	HW 3_OUT	450	Manhole	Adoptable
5.001	SIC 21	450	Manhole	Adoptable	SIC 22	450	Manhole	Adoptable
5.000	SIC 20	450	Manhole	Adoptable	SIC 21	450	Manhole	Adoptable


Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
SIC 1	620282.391	622155.490	18.150	0.450	450		0	1.000	17.700	150
SIC 2	620279.662	622149.360	18.100	0.434	450		1	1.000	17.666	150
							0	1.001	17.666	150
SIC 3	620272.509	622149.122	18.100	0.470	450		1	1.001	17.630	150
							0	1.002	17.630	150
SIC 4	620268.155	622144.040	18.130	0.533	450		1	1.002	17.597	150
							0	1.003	17.597	150
SIC 5	620265.298	622128.212	18.150	0.650	450		0	2.000	17.500	150
SIC 6	620268.732	622130.421	18.100	0.641	450		1	2.000	17.459	150
							2	1.004	17.526	150
							0	1.005	17.459	150
SIC 7	620290.871	622124.327	17.800	0.500	450		0	3.000	17.300	150
SIC 8	620280.736	622124.080	18.170	0.921	450		1	3.000	17.249	150
							2	1.005	17.391	150
							0	1.006	17.249	150
SIC 9	620291.041	622117.203	17.950	0.600	450		0	4.000	17.350	150
SIC 10	620280.728	622117.142	17.980	0.766	450		1	4.000	17.247	150
							2	1.006	17.214	150
							0	1.007	17.214	150
HW 1_OUT	620280.671	622111.690	17.400	0.241	450		1	1.007	17.159	150
SIC 11	620301.418	622157.953	17.800	0.500	450		0	6.000	17.300	150
SIC 12	620309.527	622158.513	17.690	0.471	450		1	6.000	17.219	150
							0	6.001	17.219	150

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
SIC 13	620320.143	622147.740	17.850	0.650	450		0	7.000	17.200	150
SIC 14	620320.235	622144.041	17.850	0.687	450		1	7.000	17.163	150
							0	7.001	17.163	150
SIC 15	620310.604	622142.229	17.900	0.786	450		1	7.001	17.114	150
							2	6.001	17.137	150
							0	6.002	17.114	150
SIC 16	620300.890	622139.220	18.050	0.750	450		0	8.000	17.300	150
SIC 17	620294.242	622124.787	17.700	0.600	450		0	9.000	17.100	150
SIC 18	620302.719	622126.678	17.700	0.750	450		1	9.000	17.013	150
							2	8.001	16.950	150
							0	8.002	16.950	150
SIC 19	620310.034	622129.405	17.850	0.978	450		1	8.002	16.872	150
							2	6.002	17.050	150
							0	6.003	16.872	150
HW 2_OUT	620314.305	622125.010	17.000	0.189	450		1	6.003	16.811	150
SIC 20	620252.658	622125.462	17.600	0.550	450		0	5.000	17.050	150
SIC 21	620240.125	622122.602	17.600	0.679	450		1	5.000	16.921	150
							0	5.001	16.921	150
SIC 22	620221.352	622132.200	17.440	0.744	450		1	5.001	16.696	150
							0	5.002	16.696	150
HW 3_OUT	620212.064	622127.918	17.000	0.600	450		1	5.002	16.400	150
SIC 4A	620266.361	622136.412	18.100	0.542	450		1	1.003	17.558	150
							0	1.004	17.558	150

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
SIC 16A	620300.283	622131.455	17.800	0.787	450		1	8.000	17.013	150
							0	8.001	17.013	150

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	x
FSR Region	England and Wales	Drain Down Time (mins)	240
M5-60 (mm)	17.700	Additional Storage (m ³ /ha)	20.0
Ratio-R	0.213	Check Discharge Rate(s)	x
Summer CV	0.750	Check Discharge Volume	x
Analysis Speed	Normal		

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	10	0	0

Results for 100 year +10% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
15 minute summer	SIC 1	10	17.760	0.060	3.7	0.0367	0.0000	OK
15 minute summer	SIC 2	10	17.726	0.060	3.7	0.0095	0.0000	OK
15 minute summer	SIC 3	10	17.696	0.066	4.1	0.0134	0.0000	OK
15 minute summer	SIC 4	10	17.684	0.087	7.1	0.0415	0.0000	OK
15 minute summer	SIC 5	11	17.549	0.049	0.5	0.0078	0.0000	OK
15 minute summer	SIC 6	11	17.549	0.090	7.8	0.0228	0.0000	OK
15 minute summer	SIC 7	11	17.343	0.043	0.6	0.0068	0.0000	OK
15 minute summer	SIC 8	11	17.342	0.093	8.2	0.0174	0.0000	OK
15 minute summer	SIC 9	11	17.364	0.014	0.3	0.0026	0.0000	OK
30 minute summer	SIC 10	19	17.297	0.083	8.8	0.0188	0.0000	OK
30 minute summer	HW 1_OUT	19	17.234	0.075	8.9	0.0000	0.0000	OK
15 minute summer	SIC 11	10	17.357	0.057	4.8	0.0386	0.0000	OK
15 minute summer	SIC 12	10	17.285	0.066	4.8	0.0105	0.0000	OK
15 minute summer	SIC 13	10	17.229	0.029	1.3	0.0079	0.0000	OK
30 minute summer	SIC 14	18	17.202	0.039	1.6	0.0071	0.0000	OK
15 minute summer	SIC 15	10	17.199	0.085	7.2	0.0201	0.0000	OK
15 minute summer	SIC 16	10	17.315	0.015	0.7	0.0031	0.0000	OK
15 minute summer	SIC 17	1	17.100	0.000	0.0	0.0000	0.0000	OK
15 minute summer	SIC 18	11	16.970	0.020	0.7	0.0031	0.0000	OK
15 minute summer	SIC 19	11	16.951	0.079	8.2	0.0148	0.0000	OK
15 minute summer	HW 2_OUT	11	16.883	0.072	8.3	0.0000	0.0000	OK
15 minute summer	SIC 20	10	17.072	0.022	0.8	0.0052	0.0000	OK
15 minute summer	SIC 21	10	16.946	0.025	1.1	0.0044	0.0000	OK
15 minute summer	SIC 22	10	16.734	0.038	4.1	0.0145	0.0000	OK
15 minute summer	HW 3_OUT	10	16.437	0.037	4.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
15 minute summer	SIC 1	1.000	SIC 2	3.7	0.571	0.296	0.0438	
15 minute summer	SIC 2	1.001	SIC 3	3.7	0.534	0.295	0.0503	
15 minute summer	SIC 3	1.002	SIC 4	4.0	0.448	0.319	0.0609	
15 minute summer	SIC 4	1.003	SIC 4A	6.9	0.665	0.556	0.0818	
15 minute summer	SIC 5	2.000	SIC 6	-0.5	-0.116	-0.027	0.0328	
15 minute summer	SIC 6	1.005	SIC 8	7.8	0.750	0.624	0.1410	
15 minute summer	SIC 7	3.000	SIC 8	-0.6	-0.116	-0.049	0.0789	
15 minute summer	SIC 8	1.006	SIC 10	7.8	0.740	0.628	0.0739	
15 minute summer	SIC 9	4.000	SIC 10	0.3	0.286	0.017	0.0298	
30 minute summer	SIC 10	1.007	HW 1_OUT	8.9	0.950	0.497	0.0509	5.7
15 minute summer	SIC 11	6.000	SIC 12	4.8	0.726	0.270	0.0552	
15 minute summer	SIC 12	6.001	SIC 15	4.7	0.655	0.378	0.1176	
15 minute summer	SIC 13	7.000	SIC 14	1.3	0.466	0.074	0.0107	
30 minute summer	SIC 14	7.001	SIC 15	1.5	0.238	0.122	0.0679	
15 minute summer	SIC 15	6.002	SIC 19	7.1	0.732	0.571	0.1250	
15 minute summer	SIC 16	8.000	SIC 16A	0.7	0.628	0.020	0.0089	
15 minute summer	SIC 17	9.000	SIC 18	0.0	0.000	0.000	0.0000	
15 minute summer	SIC 18	8.002	SIC 19	0.7	0.131	0.037	0.0419	
15 minute summer	SIC 19	6.003	HW 2_OUT	8.3	0.934	0.467	0.0542	3.3
15 minute summer	SIC 20	5.000	SIC 21	0.8	0.481	0.045	0.0221	
15 minute summer	SIC 21	5.001	SIC 22	1.1	0.403	0.058	0.0571	
15 minute summer	SIC 22	5.002	HW 3_OUT	4.0	1.167	0.133	0.0354	1.6

Results for 100 year +10% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
15 minute summer	SIC 4A	11	17.643	0.085	6.9	0.0135	0.0000	OK
15 minute summer	SIC 16A	10	17.033	0.020	0.7	0.0032	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
15 minute summer	SIC 4A	1.004	SIC 6	6.8	0.713	0.548	0.0618	
15 minute summer	SIC 16A	8.001	SIC 18	0.7	0.505	0.036	0.0074	