

20239721

58 Richmond Street Below Ground Drainage Strategy

February – 2024

Document Control

Revision	Originator	Checked By	Reviewed By	Approved By	Issued to	Issue Date
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A1, Revised model output	Dan Archer, MEng (Hons)	Dan Archer, MEng (Hons)	Dan Archer, MEng (Hons)	Dan Archer, MEng (Hons)	Client	Feb - 2024

The above signatures confirm that:

- the **originator** has to the best of their ability produced a document of high quality work, and made any amendments as required during the checking and reviewing process
- the **checker** has completed a line by line check using source data and agreed changes to be made with the originator
- the **reviewer** has completed a high level review and agreed any changes/corrections with the originator and ensured they have been completed
- the **approver** has confirmed that the check and review has been completed by persons appropriately qualified and that the document is fit for issue

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1 Introduction

1.1 General

This strategy has been developed in relation to the above-mentioned project. This report provides technical feasibility of providing surface water drainage for the development proposals and detailed hydraulic analysis to demonstrate the proposed solution. This report may be modified and updated to suit requirements and obligations of the Local Planning Authority, Environment Agency, Sewerage Undertakers and any other statutory authorities.

This strategy report aims to include the following:

- Identify available data relating to drainage at the existing site.
- Discuss Sustainable Urban Drainage Systems (SUDS) as an option for reducing surface water flood risk
- Determine any potential increase or decrease in surface runoff as a result of the proposed development
- Devise an appropriate high level surface water drainage strategy to deal with any surface water runoff and include for climate change

The proposed drainage network must be capable of operating effectively following climate-change over the anticipated lifespan of the development. Residential developments are considered likely to remain for at least 100 years. According to Table 2 of DEFRA guidance on climate change, the peak rainfall intensity that is used to test the system performance must be increased by 40%. The drainage network, therefore, must be effective at managing surface water on the site for rainfall up to and including the 1 in 100 year + 40% storm event.

2 Policy and Guidance

2.1 National planning policy framework & technical guidance

The National Planning Policy Framework (NPPF) published in February 2019 superseded the previous Planning Policy Guidance (PPG) and Planning Policy Statements (PPS) including PPS25: Development and Flood Risk. One of the key aims of the NPPF is to ensure that flood risk is accounted for at all stages of the planning stages to help mitigate inappropriate development in areas at risk of flooding thus directing development away from such areas. It advises that development in areas of higher risk should be safe and that flood resilience should be incorporated into the design. New developments should not increase flood risk elsewhere and new development should help mitigate flood risk to the wider area.

2.2 Planning Practice Guidance. Climate change & flood risk

The NPPF is accompanied by a Technical Guidance document that is similar to the superseded PPS 25 document in regards to:

- Climate change allowance
- Flood zone categories
- Flood zone / usage compatibility
- Sequential test
- Exception test

3 Existing Site

3.1 Site Address

58 Richmond Street

Manchester

M1 3LY

Approx grid ref – OS: 384293E, 397806N

3.2 Description

The pre-development site is shown in figure 1 below, this occupies a total area of 160m².

The pre-development site is brownfield and currently situates an existing 3 storey RC frame structure with basement. The south-west of site is covered with hardstanding, previously used for parking. To the north, the site is bound by adjacent buildings with a 1.00m clearance between structures. To the south, the site is bound by Richmond Street.



Figure 1: Google Earth Image: Existing Development Site, Boundary Shown in red

3.2.1 Topography

A survey of the existing site has been completed, see Appendix A. It is observed that the site is generally flat however has a gentle fall from north-east (highest level) to south-west (lowest level). Hardstanding to parking area has a defined fall towards Richmond Street (1:45 fall).

3.2.2 Local Geology of Surrounding Area

Defra MagicMap (figure 2 below) indicates that site is likely to be in a region of slowly permeable seasonally wet loam/clay soil types.

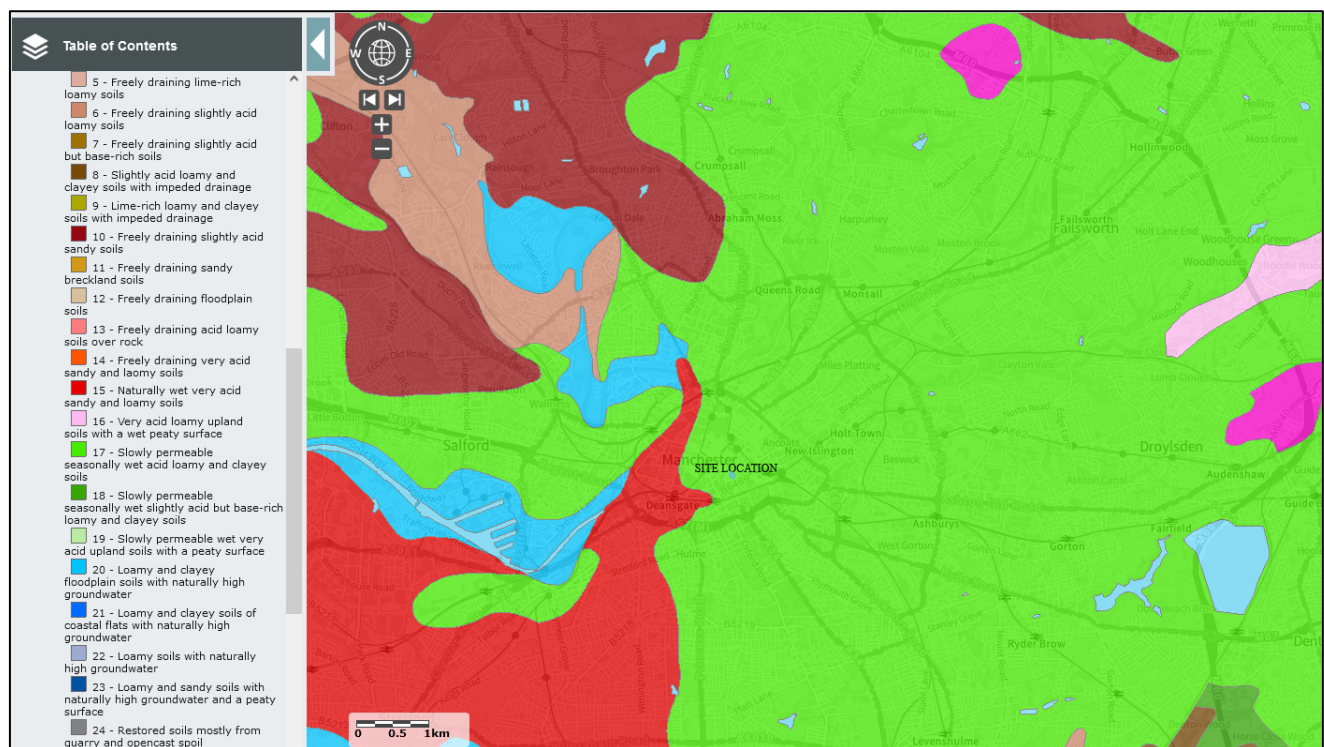


Figure 2: Defra Map Soilscape. Site Location Noted.

3.2.3 Site Investigation of Development Site

No site investigation has been completed on the development site.

At time of writing this report, the development site is currently used to house site cabins for a development on the neighbouring building to the north hence it is not viable to complete any ground investigation works due to lack of access / limited workspace.

Historic borehole records in the vicinity of site can be found in Appendix B. These borehole records are located on Bloom Street/Abingdon Street near the development site hence should provide a reasonably accurate profile of site soil medium. Borehole readings indicate anticipated strata is predominantly clay with a large made ground presence. This concurs generally with the soil profile anticipated in section 3.2.2.

3.2.4 Infiltration Potential of Existing Site

Discharge of water via infiltration is not considered viable on this site for the following reasons:

- As discussed previously, anticipated strata is predominantly clay. A typical infiltration rate of $1 \times 10^{-7} \text{ m/s}$ can be expected – this is not considered a viable medium for infiltration as infiltration coefficients are too slow, refer to figure 3 below
- The site boundary is tight to adjacent buildings and roads. There is no viable location to locate a soakaway without being in close proximity of foundations / site boundary.

Typical infiltration coefficients based on soil texture (after Bettess, 1996)		
Soil type/texture	ISO 14688-1 description (after Blake, 2010)	Typical infiltration coefficients (m/s)
Good infiltration media • gravel • sand • loamy sand • sandy loam	Sandy GRAVEL Slightly silty slightly clayey SAND Silty slightly clayey SAND Silty clayey SAND	$3 \times 10^{-4} - 3 \times 10^{-2}$ $1 \times 10^{-5} - 5 \times 10^{-5}$ $1 \times 10^{-4} - 3 \times 10^{-5}$ $1 \times 10^{-7} - 1 \times 10^{-5}$
Poor infiltration media • loam • silt loam • chalk (structureless) • sandy clay loam	Very silty clayey SAND Very sandy clayey SILT N/A Very clayey silty SAND	$1 \times 10^{-7} - 5 \times 10^{-6}$ $1 \times 10^{-7} - 1 \times 10^{-5}$ $3 \times 10^{-8} - 3 \times 10^{-6}$ $3 \times 10^{-10} - 3 \times 10^{-7}$
Very poor infiltration media • silty clay loam • clay • till	– – Can be any texture of soil described above	$1 \times 10^{-8} - 1 \times 10^{-6}$ $< 3 \times 10^{-8}$ $3 \times 10^{-9} - 3 \times 10^{-6}$
Other • rock* (note mass infiltration capacity will depend on the type of rock and the extent and nature of discontinuities and any infill)	N/A	$3 \times 10^{-9} - 3 \times 10^{-5}$

Figure 3: Typical infiltration rates for different grades of soil

3.2.5 Existing Nearby Sewers

Refer to figure 4 for United Utilities map of existing wastewater services in vicinity of development site.

There is an existing United Utilities combined chamber (REF 2830) located in the carpark of the pre-development site (at the north-west corner of site). It is anticipated that the existing site discharges combined effluent into this chamber in the predevelopment condition.

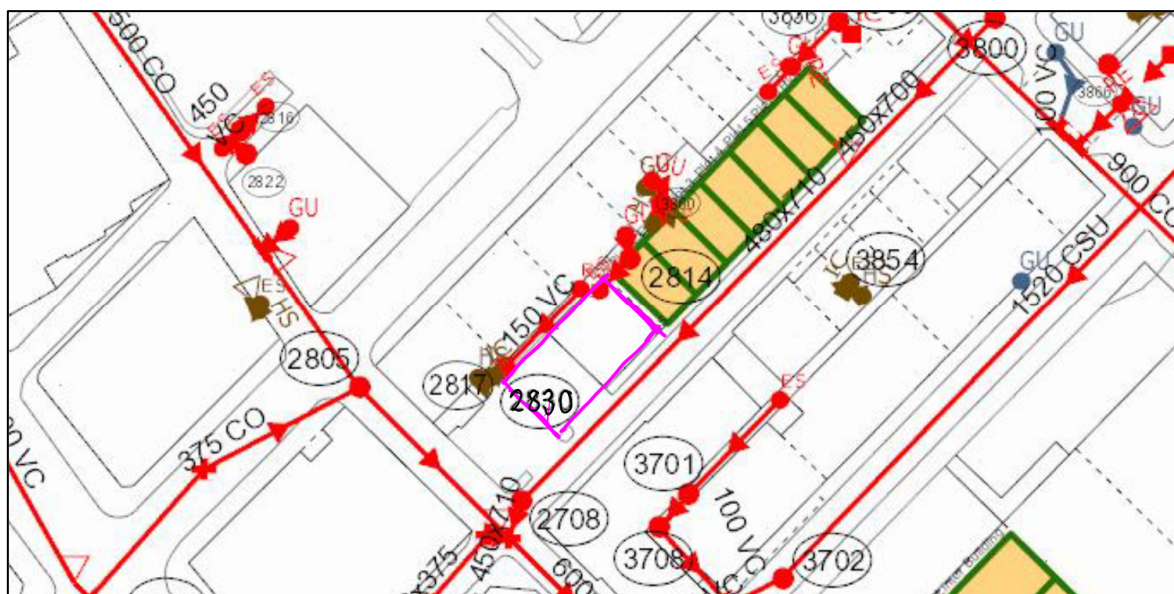


Figure 4: Location of Existing UU Drainage Services in the Vicinity of Site. Site Boundary in Pink

3.2.6 CCTV Survey of Existing Drainage

At time of writing this report, a CCTV survey of the existing drainage network has not been completed. It is assumed that the existing site discharges combined effluent into the chamber (UU REF 2830) at an unrestricted rate. Based on topographical levels, it appears that surface water runoff on existing carpark runs overland (1:45 fall) into the road gulleys on Richmond Street hence contributes to predevelopment catchment area.

3.2.7 Existing Site Brownfield Runoff Rate

The existing peak runoff rate of the predevelopment site for has been determined using a total catchment area of 160m². See Appendix D for calculation output of predevelopment runoff rates for different storm return periods, summarised in table 1 as below:

Storm Return Period	Peak Discharge Rate
1 in 1 Year Storm	2.10 litres/second
1 in 2 Year Storm (Qbar)	2.70 litres/second
1 in 30 Year Storm	5.00 litres/second
1 in 100 Year Storm	6.30 litres/second

Table 1: Summary of Predevelopment Site Peak Discharge Rates

The value Qbar will be used as the basis for providing betterment for any post-development discharge restrictions.

4 Development Proposal

The existing RC frame will be retained and converted into residential apartments. It is proposed to build a steel framed residential building over the area of the existing carpark on site, this will not increase the area of hardstanding on site. The post-development area of hardstanding will be 160m² (same as pre-development area).

4.1 Sequential & Exceptions Test

The development is residential and is thus considered “more vulnerable” as defined in Table 2 of the NPPF Technical Guidance. Although the development falls into Flood zone 1 and thus according to Table 3 of NPPF Technical Guidance sequential and exceptions test are not required.

4.2 Development Flood Risk

The site is wholly within flood zone 1 and is below 1Ha in area, thus a flood risk assessment is not necessary. See Appendix D.

There are no restrictions on finished floor levels in Flood zone 1.

4.3 Development Flood Risk

Though located in Flood Zone 1, there is a medium risk scenario (3.3% risk) of flooding up to 300mm depth along Richmond Street – refer to figure 5 below. It is advised that finish floor of the proposed extension is set 300mm above external ground floor level to omit risk of water ingress. The existing building is already set circa 600mm above external ground level.

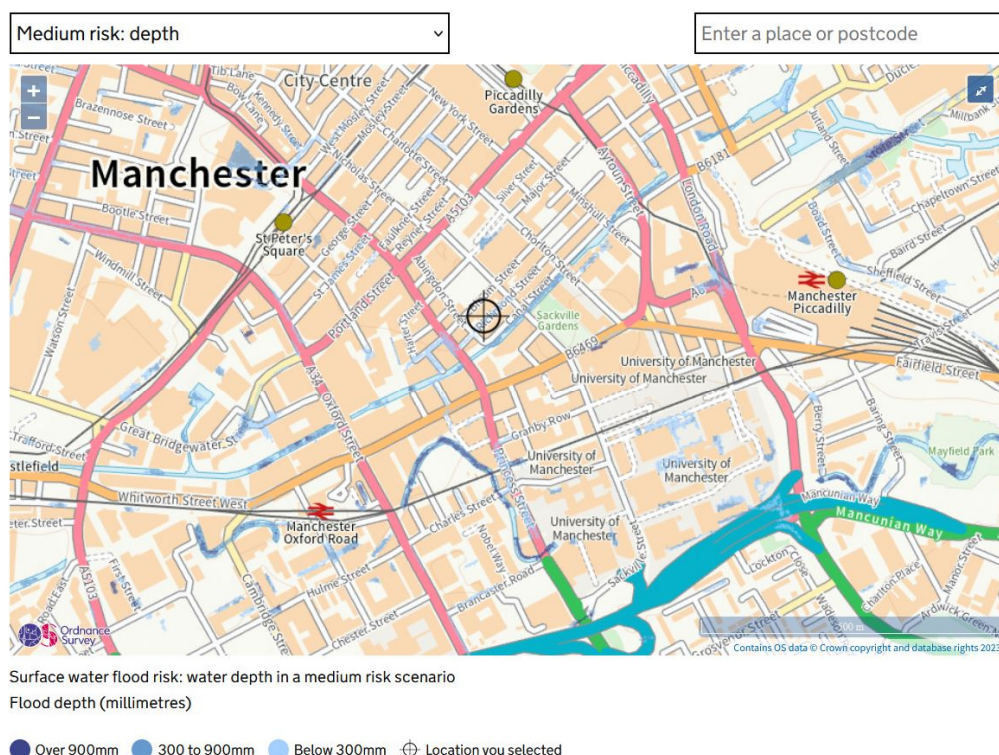


Figure 5: Surface water flood risk depths local to site

5 Climate Change

Climate change allowance is included to account for increased rainfall intensity in the future, to reduce vulnerability and increase resilience to flooding. Upper end and central allowances should be applied to rainfall intensity. The central allowance must be applied to the surface water network for assessment of its performance and ability to contain critical events. The upper end allowance must be applied to assess the potential flood risk implications to the site and ensure that flooding is wholly contained onsite.

The development is assumed to be operational beyond 2085 and thus the Upper end 40% allowance is to be added to the 100 year 6 hour storm event.

6 Surface Water Strategy

National standards for sustainable drainage systems (NSSDS) and National planning practice guidance outline the following hierarchy of surface water destinations:

1. Discharge to ground (infiltration)
2. Discharge to surface water body
3. Discharge to surface water sewer
4. Discharge to combined sewer

The existing site discharges to a combined sewer via direct unrestricted connection.

Consideration to discharge destination of site generated surface water within the above hierarchy as listed below:

1. As discussed in section 3.2.4, the soil on site is not considered a viable medium for discharge of water via infiltration, anticipated infiltration rates would be too low. Further to this, there are no viable locations for soakaways on site.
2. There are no bodies of surface water with flow around the development site that surface water can be discharged to
3. There are no existing surface water sewers within the vicinity of site to discharge to
4. As discussed in section 3.2.5, there is an existing 150mm diameter combined sewer that runs through the development site (UU REF 2830). The predevelopment site currently discharges into this combined sewer, it is proposed that the post-development site also discharges to this location albeit with restricted flow rate.
Flow rate will be restricted to provide 50% betterment of the pre-development Q_{bar} rate highlighted in section 3.2.7.

Use of SuDs features are discussed on the following page.

6.1 Source control

6.1.1 Green Roofs

Green roofs intercept runoff from roofs and the flora contained within the system extract water as required thus contributes to a reduction in runoff entering drainage network.

Green roofs are not considered economically viable on this project.

6.1.2 Rainwater Harvesting

Rainwater harvesting can be used to intercept run off and store for use in grey water flushing, irrigation of planted areas and washing of external areas. Harvesting for grey water flushing is **not considered** economically viable, though could be adopted for irrigation and external washing.

6.2 Site Control

6.2.1 Infiltration – discharge to the ground onsite

Infiltration offers site control and where viable mimics the natural behaviour of the predeveloped site. As previously discussed, infiltration is not considered a viable means of discharging surface water.

6.2.2 Permeable paving

The entire site boundary in the post-development condition will be occupied by buildings, there will be no remaining site area in which to consider permeable paving.

6.3 Hydraulic Design

The site wide drainage and below ground storage is designed conservatively with no reduction in flow by mechanisms discussed above. The site is to contain and control surface water flows up to and including the 100 year storm event + allowance for 40% climate change.

Oversized PCC inspection chambers onsite have been specified to contain the full 100 year rainfall event given we feel that this cannot be adequately contained otherwise.

Surface water runoff is to be collected in below ground pipes and routed towards the north-west of the development site where it is discharged into the existing United Utilities Sewer (as per existing condition). Peak discharge rate will be restricted to 1.35litres/second, providing a 50% betterment of the existing site Qbar discharge rate.

The new surface water network onsite is to be kept private and managed collectively by the land owner. All drainage is to be formed in accordance with current building regulations and also with Ciria C753 The SUDS Manual.

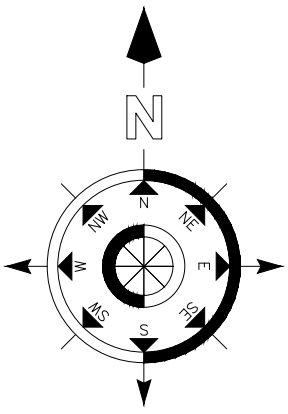
Output from hydraulic calculations can be found in Appendix E.

Proposed below ground drainage layout can be found on BDI drawing 20239721 C1 01.

7 Foul Water Strategy

Foul effluent will be discharged into the United Utilities combined sewer to the north-west of site at an unrestricted rate. Foul network will be kept separate from all new surface water drainage.

Proposed drainage is to be designed in accordance with Building Regulations Document H1 and existing drainage onsite retained is to be surveyed to establish condition, levels and size to verify it can be retained.



ABBREVIATIONS

TOW	Top of Wall
BOL	Bollard
BT	BT Cover
CB	Control Box
CH	Cable Height
CL	Cover Level
DK	Drop Kerb
EH	Eaves Height
FH	Fire Hydrant
FFL	Finished Floor Level
FP	Flag Pole
GV	Gas Valve
GY	Gully
IC	Inspection Cover
LC	Lighting Cover
LP	Lamp Post
MH	Man Hole
PH	Parapet Height
RH	Ridge/Roof Height
RWP	Rain Water Pipe
SP	Sign Post
SVP	Soil Vent Pipe
TF	Top of Fence
TL	Threshold Level
TP	Telegraph Pole
TS	Traffic Signal
TH	Top of Hedge
TW	Top of Wall
U/S	Under Side
WP	Water Pipe
WV	Water Valve

NOTE

Local Grid
Levels defining edge of carriageway are observed at channel (bottom of kerb).

Rev	Date	Amendments
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info@dwasurveyors.com
www.dwasurveyors.com

dwa

DWA Design

Drawing Title
Exiting Topographical Survey

Address
Land at 58 Richmond Street
Manchester

Drawing No:	092/07	Issue
Draw by:	JW	
Drawing Date:	09/08/2016	
Drawing Scale:	1:100@A1	

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Appendix B

Historic Borehole Logs Near Development Site

MANCHESTER CITY COUNCIL
CITY ENGINEER AND SURVEYORS DEPARTMENT

SJ89NW 3S12

SITE INVESTIGATION FOR MAIN DRAINAGE				DATE COMMENCED		4.3.86	
LOCATION BLOOM STREET		BORING METHOD		CABLE PERCUSSION			
BOREHOLE No. 4 (Sheet 1 of 2)				BORING DIAMETER		150mm	
GRID REFERENCE				SCALE:		1:50 (approx.)	

DATE	CASING DEPTH (m)	WATER LEVEL MORNING & EVENING	DEPTH OF STRATA BELOW G.L.	Reduced Level	DESCRIPTION	No. and Type of Sample	SAMPLE DEPTH PENETRATION		No. of Blows	Legend
							From	To		
			0.20		Bituminous surfacing onto setts					
					Ashes, cinders, gravel, brick, concrete etc. onto soft brown-black mottled CLAY with ashes, cinders, brick, gravel, sand, concrete soil etc. MADE GROUND	D1	0.50			
						D2	1.30			
						D3	1.70			
						P4	1.95	2.30	2	
						P5	3.15	3.45	4	
						P6	4.65	4.95	5	
						U7	5.40	5.85		
						D8	5.90			
			6.40		Stiff becoming very stiff brown silty and sandy	P9	6.55	6.85	17	

WATER OBSERVATIONS DURING BORING				WATER LEVEL IN CASED/U NCASED BOREHOLE ON COMPLETION		
DEPTH OF WATER ENTRY (m)	ESTIMATED SEEPAGE	STANDING LEVEL (m)	DEPTH OF CASING WHEN SEALED (m)	DATE	WATER LEVEL	DEPTH OF CASING
				REMARKS:-		
				Borehole dry		

SAMPLE TEST KEY	D - DISTURBED SAMPLE P - SPT SAMPLE	B - BULK SAMPLE W - WATER SAMPLE	U - UNDISTURBED SAMPLE
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NOTE: WHERE FULL 0.3 PENETRATION HAS NOT BEEN ACHIEVED, THE NUMBER OF BLOWS FOR THE QUOTED PENETRATION IS GIVEN (NOT N - VALUE)

ALL DEPTHS AND REDUCED LEVELS IN (m) UNLESS OTHERWISE STATED

REMARKS

MANCHESTER CITY COUNCIL

CITY ENGINEER AND SURVEYORS DEPARTMENT

SJ89NW 3S12

DATE INVESTIGATION FOR	MAIN DRAINAGE	DATE COMMENCED	4.3.86
LOCATION	BLOOM STREET	BORING METHOD	CABLE PERCUSSION
BOREHOLE No.	4 (Sheet 2 of 2)	BORING DIAMETER	150mm
GRID REFERENCE		SCALE:	1:50 (approx)

[illegible][illegible]

SAMPLE TEST KEY	D – DISTURBED SAMPLE	B – BULK SAMPLE	U – UNDISTURBED SAMPLE
	P – SPT SAMPLE	W – WATER SAMPLE	

NOTE: WHERE FULL 0.3 PENETRATION HAS NOT BEEN ACHIEVED, THE NUMBER OF BLOWS FOR THE QUOTED PENETRATION IS GIVEN (NOT N - VALUE)

ALL DEPTHS AND REDUCED LEVELS IN (m) UNLESS OTHERWISE STATED

REMARKS



MANCHESTER CITY COUNCIL
CITY ENGINEER AND SURVEYORS DEPARTMENT

SJ89NW 3513

SITE INVESTIGATION FOR		MAIN DRAINAGE		DATE COMMENCED		5.3.86			
LOCATION		BLOOM STREET		BORING METHOD		Cable Percussion			
BOREHOLE No.		5 (sheet 1 of 2)		BORING DIAMETER		150mm			
GRID REFERENCE				SCALE:		1:50 (approx.)			
DATE	CASING DEPTH (m)	WATER LEVEL MORNING & EVENING	DEPTH OF STRATA BELOW GL	Reduced Level	DESCRIPTION	No. and Type of Sample	SAMPLE DEPTH PENETRATION	No. of Blows	Legend
							From		
			0.15		Bituminous surfacing onto setts.				
			0.60		Ashes, cinders, gravel, brick concrete etc. MADE GROUND	01	0.50		
			1.30		Stiff, brown, yellow & green mottled silty and sandy CLAY with some gravel and coal fragments	D2 U3	1.00 1.20	1.65	
					Stiff becoming very stiff brown silty and sandy CLAY with some grey fissures in the upper zone, some fine-medium gravel, coal fragments, some small sand lenses and slightly laminated in parts.	D4 U5 D6 U8 D9 U10 D11 U12 D13 U14 D15	1.70 2.20 2.70 3.20 3.70 4.20 4.70 5.20 5.70 6.20 6.70	2.65 2.65 2.65 4.65 5.65 6.65	
WATER OBSERVATIONS DURING BORING					WATER LEVEL IN CASSED/UNCASSED BOREHOLE ON COMPLETION				
DEPTH OF WATER ENTRY (m)	ESTIMATED SEE PAGE	STANDING LEVEL (m)	DEPTH OF CASING WHEN SEALED (m)	DATE	WATER LEVEL	DEPTH OF CASING			
				REMARKS: -					
				Borehole dry.					
SAMPLE TEST KEY		D – DISTURBED SAMPLE B – BULK SAMPLE U – UNDISTURBED SAMPLE P – SPT SAMPLE W – WATER SAMPLE							
NOTE: WHERE FULL 0.3 PENETRATION HAS NOT BEEN ACHIEVED, THE NUMBER OF BLOWS FOR THE QUOTED PENETRATION IS GIVEN (NOT N – VALUE)									
ALL DEPTHS AND REDUCED LEVELS IN (m) UNLESS OTHERWISE STATED									
REMARKS									
M/c 5931									

MANCHESTER CITY COUNCIL

CITY ENGINEER AND SURVEYORS DEPARTMENT

SJ89NW 3513

SITE INVESTIGATION FOR	MAIN DRAINAGE	DATE COMMENCED	6.3.86
LOCATION	BLOOM STREET	BORING METHOD	Cable Percussion
BOREHOLE No.	5 (Sheet 2 of 2)	BORING DIAMETER	150 mm

GRID REFERENCE SCALE: 1:50 (approx.)

[illegible]

WATER OBSERVATIONS DURING BORING				WATER LEVEL IN CASSED/UNCASSED BOREHOLE ON COMPLETION		
DEPTH OF WATER ENTRY (m)	ESTIMATED SEE PAGE	STANDING LEVEL (m)	DEPTH OF CASING WHEN SEALED (m)	DATE	WATER LEVEL	DEPTH OF CASING
				REMARKS:—		

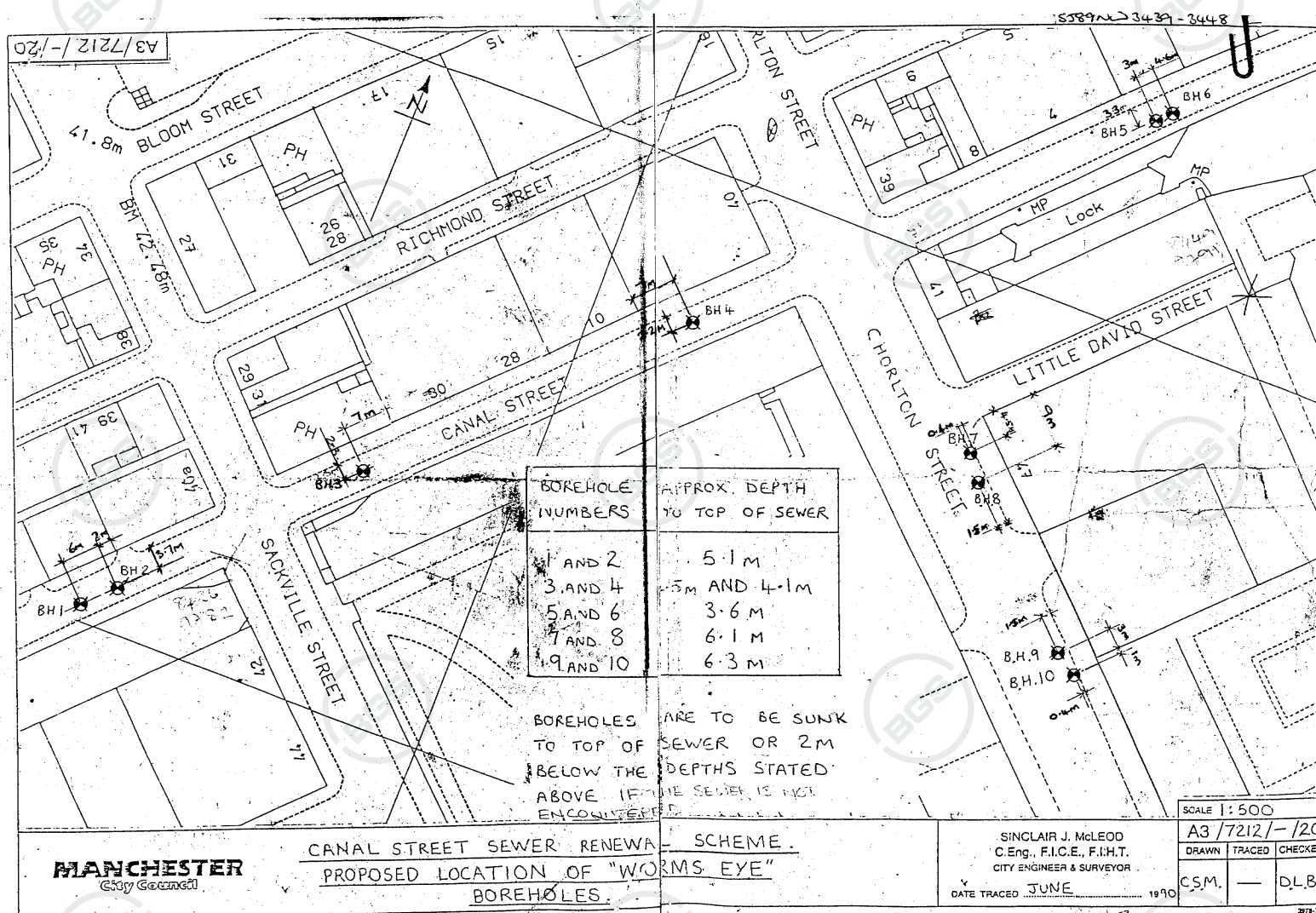
SAMPLE TEST KEY	D – DISTURBED SAMPLE	B – BULK SAMPLE	U – UNDISTURBED SAMPLE
	P – SPT SAMPLE	W – WATER SAMPLE	

NOTE: WHERE FULL 0.3 PENETRATION HAS NOT BEEN ACHIEVED, THE NUMBER OF BLOWS FOR THE QUOTED PENETRATION IS GIVEN (NOT N - VALUE)

ALL DEPTHS AND REDUCED LEVELS IN (m) UNLESS OTHERWISE STATED

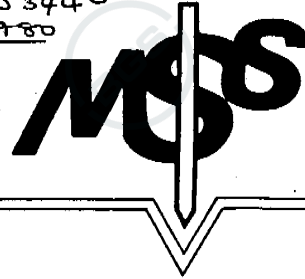
REMARKS

M/c 5931





SJ89NW3440
8434 7780



MINI • SOIL • SURVEYS

JOB NUMBER BOL0818

BOREHOLE No. 2 of 10

CREW A

SITE Canal Street, Manchester

DATE DRILLED 13/08/90

GROUND LVL (if recorded)

Description	Depth	Leg	Sample/Test
45mm TARMAC, 150mm GRANITE SET, 190mm CONCRETE	0.38		
Brown clay FILL occ. brick, ash, and cinder fragments.			
Brown CLAY possibly fill? Occ. gravel and coal fragments.	1.40		
Very stiff brown CLAY with occ gravel and occ black coal fragments.	2.00		2.3 SV 150+Kn/m ²
			4.7 SV 150+Kn/m ²
End of hole.	5.80		

Comments: Sewer not found

Appendix C

Pre-development Site Runoff Rates



BDi Structural & Civil Engineering
BDI Structural Solutions Ltd
Stafford Court, Suite B
M33 7PE

Project 58 Richmond Street				Job no. 20239721	
Calcs for Predevelopment Runoff Rates (1 in 1 Year)				Start page no./Revision 1	
Calcs by DA	Calcs date 07/07/2023	Checked by	Checked date	Approved by	Approved date

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.02

Design rainfall intensity

Location of catchment area	Manchester
Storm duration	D = 5 min
Return period	Period = 1 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.360
5-year return period rainfall of 60 minutes duration	M5_60min = 18.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.36
Rainfall for 5min storm with 5 year return period	M5_5min _i = Z1 × M5_60min = 6.5 mm
Factor Z2 (Wallingford procedure)	Z2 = 0.62
Rainfall for 5min storm with 1 year return period	M1_5min = Z2 × M5_5min _i = 4.0 mm
Design rainfall intensity	I _{max} = M1_5min / D = 48.0 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 160 m ²
Percentage of area that is impermeable	p = 100 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 2.1 l/s

Project 58 Richmond Street				Job no. 20239721	
Calcs for Predevelopment Runoff Rates (1 in 2 Year)				Start page no./Revision 1	
Calcs by DA	Calcs date 07/07/2023	Checked by	Checked date	Approved by	Approved date

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.02

Design rainfall intensity

Location of catchment area	Manchester
Storm duration	D = 5 min
Return period	Period = 2 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.360
5-year return period rainfall of 60 minutes duration	M5_60min = 18.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.36
Rainfall for 5min storm with 5 year return period	M5_5min _i = Z1 × M5_60min = 6.5 mm
Factor Z2 (Wallingford procedure)	Z2 = 0.79
Rainfall for 5min storm with 2 year return period	M2_5min = Z2 × M5_5min _i = 5.1 mm
Design rainfall intensity	I _{max} = M2_5min / D = 61.4 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 160 m ²
Percentage of area that is impermeable	p = 100 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 2.7 l/s

Project 58 Richmond Street				Job no. 20239721	
Calcs for Predevelopment Runoff Rates (1 in 30 Year)				Start page no./Revision 1	
Calcs by DA	Calcs date 07/07/2023	Checked by	Checked date	Approved by	Approved date

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.02

Design rainfall intensity

Location of catchment area	Manchester
Storm duration	D = 5 min
Return period	Period = 30 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.360
5-year return period rainfall of 60 minutes duration	M5_60min = 18.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.36
Rainfall for 5min storm with 5 year return period	M5_5min _i = Z1 × M5_60min = 6.5 mm
Factor Z2 (Wallingford procedure)	Z2 = 1.45
Rainfall for 5min storm with 30 year return period	M30_5min = Z2 × M5_5min _i = 9.4 mm
Design rainfall intensity	I _{max} = M30_5min / D = 112.4 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 160 m ²
Percentage of area that is impermeable	p = 100 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 5.0 l/s

Project 58 Richmond Street				Job no. 20239721	
Calcs for Predevelopment Runoff Rates (1 in 100 Year)				Start page no./Revision 1	
Calcs by DA	Calcs date 07/07/2023	Checked by	Checked date	Approved by	Approved date

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.02

Design rainfall intensity

Location of catchment area	Manchester
Storm duration	D = 5 min
Return period	Period = 100 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.360
5-year return period rainfall of 60 minutes duration	M5_60min = 18.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.36
Rainfall for 5min storm with 5 year return period	M5_5min _i = Z1 × M5_60min = 6.5 mm
Factor Z2 (Wallingford procedure)	Z2 = 1.83
Rainfall for 5min storm with 100 year return period	M100_5min = Z2 × M5_5min _i = 11.8 mm
Design rainfall intensity	I _{max} = M100_5min / D = 142.0 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 160 m ²
Percentage of area that is impermeable	p = 100 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 6.3 l/s

Appendix D

Development Flood Zone Map

Flood map for planning

Your reference
58Richmond St

Location (easting/northing)
384293/397803

Created
5 Jul 2023 15:45

Your selected location is in flood zone 1, an area with a low probability of flooding.

You will need to do a flood risk assessment if your site is **any of the following:**

- bigger than 1 hectare (ha)
- In an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

Flood risk data is covered by the Open Government Licence **which** sets out the terms and conditions for using government data. <https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>

Use of the address and mapping data is subject to Ordnance Survey public viewing terms under Crown copyright and database rights 2022 OS 100024198. <https://flood-map-for-planning.service.gov.uk/os-terms>

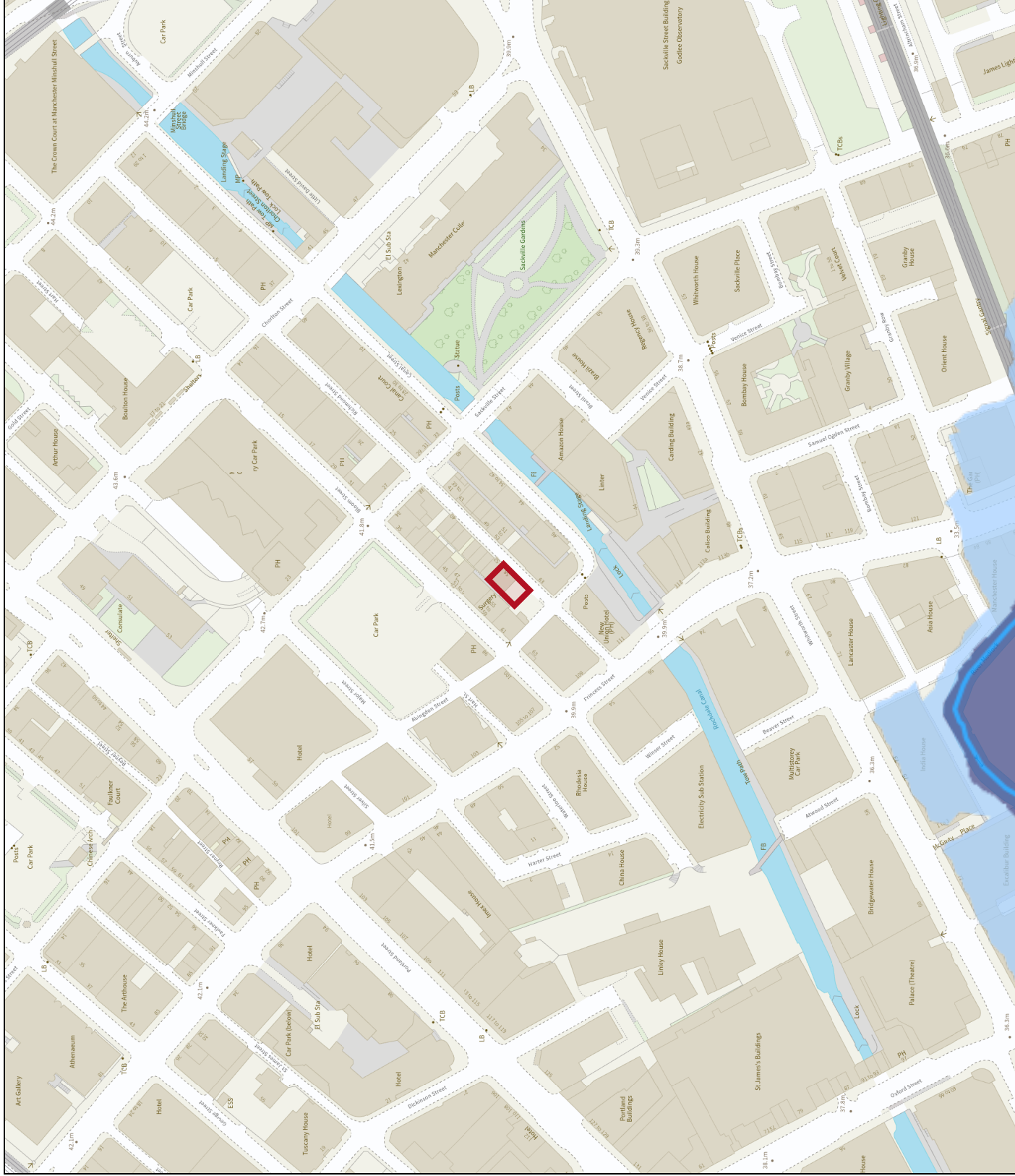


Flood map for planning

Your reference
58Richmond St
Location (easting/northing)
384293/397803

Scale
1:2500
Created
5 Jul 2023 15:45

- Selected area
- Flood zone 3
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Water storage area



Appendix E

Hydraulic Model Output

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	18.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.360	Preferred Cover Depth (m)	0.442
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
RE1	0.010	5.00	50.350		0.542
RE2	0.006	5.00	50.350		0.542
ICS01			50.350	300	0.650
ICS02			50.450		0.850
OUTFALL			50.350		0.850

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)
PIPE 1.01	RE1	ICS01	10.800	0.600	49.808	49.700	0.108	100.0	100	5.23	45.9
PIPE 1.02	RE2	ICS01	3.700	0.600	49.808	49.771	0.037	100.0	100	5.08	46.5
PIPE 1.03	ICS01	ICS02	10.000	0.600	49.700	49.600	0.100	100.0	100	5.45	45.1
PIPE 1.04	ICS02	OUTFALL	10.000	0.600	49.600	49.500	0.100	100.0	100	5.67	44.3

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)
PIPE 1.01	0.769	6.0	1.2	0.442	0.550	0.010	0.0	31	0.605
PIPE 1.02	0.769	6.0	0.8	0.442	0.479	0.006	0.0	24	0.521
PIPE 1.03	0.769	6.0	2.0	0.550	0.750	0.016	0.0	39	0.689
PIPE 1.04	0.769	6.0	1.9	0.750	0.750	0.016	0.0	39	0.682

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	x
FSR Region	England and Wales	Drain Down Time (mins)	60
M5-60 (mm)	18.000	Additional Storage (m³/ha)	0.0
Ratio-R	0.360	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x
Analysis Speed	Detailed		

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440
----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	------

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	40	0	0

Node ICS02 Online Hydro-Brake® Control

Flap Valve	x	Objective	(CL) Minimise blockage risk
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	49.600	Product Number	CTL-SCL-0055-1400-0850-1400
Design Depth (m)	0.850	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.4	Min Node Diameter (mm)	1200

Node ICS02 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	49.600	Depth (m)	
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	33	Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	1.200	Number Required	3
Porosity	1.00	Pit Length (m)	0.750		

Results for 1 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	RE1	10	49.838	0.030	1.2	0.0000	0.0000	OK
15 minute winter	RE2	11	49.832	0.024	0.7	0.0000	0.0000	OK
15 minute winter	ICS01	11	49.738	0.038	1.9	0.0027	0.0000	OK
15 minute winter	ICS02	13	49.700	0.100	1.8	0.2707	0.0000	SURCHARGED
15 minute winter	OUTFALL	1	49.500	0.000	1.3	0.0000	0.0000	OK
Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	RE1	PIPE 1.01	ICS01	1.2	0.504	0.193	0.0250	
15 minute winter	RE2	PIPE 1.02	ICS01	0.7	0.508	0.116	0.0051	
15 minute winter	ICS01	PIPE 1.03	ICS02	1.8	0.650	0.306	0.0509	
15 minute winter	ICS02	Hydro-Brake®	OUTFALL	1.3				0.9

Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	RE1	24	49.903	0.095	2.3	0.0000	0.0000	OK
30 minute winter	RE2	24	49.901	0.093	1.4	0.0000	0.0000	OK
30 minute winter	ICS01	24	49.901	0.201	3.7	0.0142	0.0000	SURCHARGED
30 minute winter	ICS02	24	49.894	0.294	2.9	0.7949	0.0000	SURCHARGED
15 minute winter	OUTFALL	1	49.500	0.000	1.4	0.0000	0.0000	OK
Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	RE1	PIPE 1.01	ICS01	3.0	0.629	0.489	0.0815	
15 minute winter	RE2	PIPE 1.02	ICS01	1.8	0.654	0.294	0.0277	
15 minute winter	ICS01	PIPE 1.03	ICS02	3.8	0.728	0.626	0.0782	
15 minute winter	ICS02	Hydro-Brake®	OUTFALL	1.4				2.2

Results for 100 year +40% 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
30 minute winter	RE1	29	50.271	0.463	4.3	0.0000	0.0000	FLOOD RISK
30 minute winter	RE2	29	50.269	0.461	2.6	0.0000	0.0000	FLOOD RISK
30 minute winter	ICS01	29	50.269	0.569	4.9	0.0404	0.0000	FLOOD RISK
30 minute winter	ICS02	29	50.263	0.663	3.9	1.7912	0.0000	FLOOD RISK
15 minute winter	OUTFALL	1	49.500	0.000	1.4	0.0000	0.0000	OK
Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
15 minute winter	RE1	PIPE 1.01	ICS01	4.0	0.649	0.660	0.0845	
15 minute winter	RE2	PIPE 1.02	ICS01	2.3	0.687	0.388	0.0290	
15 minute winter	ICS01	PIPE 1.03	ICS02	4.6	0.804	0.768	0.0782	
15 minute winter	ICS02	Hydro-Brake®	OUTFALL	1.4				4.0

Results for 1 year 15 minute winter. 75 minute analysis at 1 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	RE1	10	49.838	0.030	1.2	0.0000	0.0000	OK
15 minute winter	RE2	11	49.832	0.024	0.7	0.0000	0.0000	OK
15 minute winter	ICS01	11	49.738	0.038	1.9	0.0027	0.0000	OK
15 minute winter	ICS02	13	49.700	0.100	1.8	0.2707	0.0000	SURCHARGED
15 minute winter	OUTFALL	1	49.500	0.000	1.3	0.0000	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	RE1	PIPE 1.01	ICS01	1.2	0.504	0.193	0.0250	
15 minute winter	RE2	PIPE 1.02	ICS01	0.7	0.508	0.116	0.0051	
15 minute winter	ICS01	PIPE 1.03	ICS02	1.8	0.650	0.306	0.0509	
15 minute winter	ICS02	Hydro-Brake®	OUTFALL	1.3				0.9

Results for 1 year 30 minute winter. 90 minute analysis at 1 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	RE1	18	49.835	0.027	1.0	0.0000	0.0000	OK
30 minute winter	RE2	18	49.830	0.022	0.6	0.0000	0.0000	OK
30 minute winter	ICS01	18	49.735	0.035	1.6	0.0025	0.0000	OK
30 minute winter	ICS02	21	49.691	0.091	1.6	0.2456	0.0000	OK
30 minute winter	OUTFALL	1	49.500	0.000	1.2	0.0000	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	RE1	PIPE 1.01	ICS01	1.0	0.484	0.165	0.0225	
30 minute winter	RE2	PIPE 1.02	ICS01	0.6	0.486	0.099	0.0046	
30 minute winter	ICS01	PIPE 1.03	ICS02	1.6	0.570	0.261	0.0478	
30 minute winter	ICS02	Hydro-Brake®	OUTFALL	1.2				1.2

Results for 1 year 60 minute winter. 120 minute analysis at 1 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	RE1	33	49.831	0.023	0.7	0.0000	0.0000	OK
60 minute winter	RE2	34	49.826	0.018	0.4	0.0000	0.0000	OK
60 minute winter	ICS01	33	49.729	0.029	1.1	0.0020	0.0000	OK
60 minute winter	ICS02	36	49.666	0.066	1.1	0.1792	0.0000	OK
60 minute winter	OUTFALL	1	49.500	0.000	1.0	0.0000	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	RE1	PIPE 1.01	ICS01	0.7	0.436	0.115	0.0173	
60 minute winter	RE2	PIPE 1.02	ICS01	0.4	0.432	0.066	0.0034	
60 minute winter	ICS01	PIPE 1.03	ICS02	1.1	0.507	0.180	0.0362	
60 minute winter	ICS02	Hydro-Brake®	OUTFALL	1.0				1.5

Results for 1 year 120 minute winter. 180 minute analysis at 2 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	RE1	64	49.825	0.017	0.4	0.0000	0.0000	OK
120 minute winter	RE2	64	49.823	0.015	0.3	0.0000	0.0000	OK
120 minute winter	ICS01	64	49.723	0.023	0.7	0.0016	0.0000	OK
120 minute winter	ICS02	66	49.646	0.046	0.7	0.1244	0.0000	OK
120 minute winter	OUTFALL	2	49.500	0.000	0.7	0.0000	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	RE1	PIPE 1.01	ICS01	0.4	0.377	0.066	0.0122	
120 minute winter	RE2	PIPE 1.02	ICS01	0.3	0.398	0.050	0.0028	
120 minute winter	ICS01	PIPE 1.03	ICS02	0.7	0.440	0.115	0.0240	
120 minute winter	ICS02	Hydro-Brake®	OUTFALL	0.7				1.9

Results for 1 year 180 minute winter. 240 minute analysis at 4 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	RE1	88	49.823	0.015	0.3	0.0000	0.0000	OK
180 minute winter	RE2	92	49.821	0.013	0.2	0.0000	0.0000	OK
180 minute winter	ICS01	92	49.719	0.019	0.5	0.0014	0.0000	OK
180 minute winter	ICS02	108	49.638	0.038	0.5	0.1019	0.0000	OK
180 minute winter	OUTFALL	4	49.500	0.000	0.5	0.0000	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
180 minute winter	RE1	PIPE 1.01	ICS01	0.3	0.362	0.050	0.0098	
180 minute winter	RE2	PIPE 1.02	ICS01	0.2	0.353	0.033	0.0021	
180 minute winter	ICS01	PIPE 1.03	ICS02	0.5	0.423	0.083	0.0189	
180 minute winter	ICS02	Hydro-Brake®	OUTFALL	0.5				2.2

Results for 1 year 240 minute winter. 300 minute analysis at 4 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	RE1	124	49.823	0.015	0.3	0.0000	0.0000	OK
240 minute winter	RE2	128	49.821	0.013	0.2	0.0000	0.0000	OK
240 minute winter	ICS01	128	49.719	0.019	0.5	0.0014	0.0000	OK
240 minute winter	ICS02	132	49.638	0.038	0.5	0.1018	0.0000	OK
240 minute winter	OUTFALL	4	49.500	0.000	0.5	0.0000	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
240 minute winter	RE1	PIPE 1.01	ICS01	0.3	0.362	0.050	0.0098	
240 minute winter	RE2	PIPE 1.02	ICS01	0.2	0.353	0.033	0.0021	
240 minute winter	ICS01	PIPE 1.03	ICS02	0.5	0.423	0.083	0.0188	
240 minute winter	ICS02	Hydro-Brake®	OUTFALL	0.5				2.2

Results for 1 year 360 minute winter. 424 minute analysis at 8 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	RE1	168	49.821	0.012	0.2	0.0000	0.0000	OK
360 minute winter	RE2	136	49.817	0.009	0.1	0.0000	0.0000	OK
360 minute winter	ICS01	168	49.715	0.015	0.3	0.0011	0.0000	OK
360 minute winter	ICS02	200	49.628	0.028	0.3	0.0744	0.0000	OK
360 minute winter	OUTFALL	8	49.500	0.000	0.3	0.0000	0.0000	OK
Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
360 minute winter	RE1	PIPE 1.01	ICS01	0.2	0.307	0.033	0.0071	
360 minute winter	RE2	PIPE 1.02	ICS01	0.1	0.287	0.017	0.0013	
360 minute winter	ICS01	PIPE 1.03	ICS02	0.3	0.406	0.050	0.0125	
360 minute winter	ICS02	Hydro-Brake®	OUTFALL	0.3				2.3

Results for 1 year 480 minute winter. 544 minute analysis at 8 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	RE1	240	49.821	0.012	0.2	0.0000	0.0000	OK
480 minute winter	RE2	192	49.817	0.009	0.1	0.0000	0.0000	OK
480 minute winter	ICS01	240	49.715	0.015	0.3	0.0011	0.0000	OK
480 minute winter	ICS02	264	49.628	0.028	0.3	0.0744	0.0000	OK
480 minute winter	OUTFALL	8	49.500	0.000	0.3	0.0000	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
480 minute winter	RE1	PIPE 1.01	ICS01	0.2	0.307	0.033	0.0071	
480 minute winter	RE2	PIPE 1.02	ICS01	0.1	0.287	0.017	0.0013	
480 minute winter	ICS01	PIPE 1.03	ICS02	0.3	0.406	0.050	0.0125	
480 minute winter	ICS02	Hydro-Brake®	OUTFALL	0.3				2.4

Results for 1 year 600 minute winter. 660 minute analysis at 15 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
600 minute winter	RE1	210	49.817	0.009	0.1	0.0000	0.0000	OK
600 minute winter	RE2	255	49.817	0.009	0.1	0.0000	0.0000	OK
600 minute winter	ICS01	255	49.713	0.012	0.2	0.0009	0.0000	OK
600 minute winter	ICS02	285	49.622	0.022	0.2	0.0591	0.0000	OK
600 minute winter	OUTFALL	15	49.500	0.000	0.2	0.0000	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
600 minute winter	RE1	PIPE 1.01	ICS01	0.1	0.288	0.017	0.0049	
600 minute winter	RE2	PIPE 1.02	ICS01	0.1	0.287	0.017	0.0013	
600 minute winter	ICS01	PIPE 1.03	ICS02	0.2	0.334	0.033	0.0091	
600 minute winter	ICS02	Hydro-Brake®	OUTFALL	0.2				2.3

Results for 1 year 720 minute winter. 780 minute analysis at 15 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
720 minute winter	RE1	255	49.817	0.009	0.1	0.0000	0.0000	OK
720 minute winter	RE2	315	49.817	0.009	0.1	0.0000	0.0000	OK
720 minute winter	ICS01	315	49.713	0.012	0.2	0.0009	0.0000	OK
720 minute winter	ICS02	345	49.622	0.022	0.2	0.0591	0.0000	OK
720 minute winter	OUTFALL	15	49.500	0.000	0.2	0.0000	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
720 minute winter	RE1	PIPE 1.01	ICS01	0.1	0.288	0.017	0.0049	
720 minute winter	RE2	PIPE 1.02	ICS01	0.1	0.287	0.017	0.0013	
720 minute winter	ICS01	PIPE 1.03	ICS02	0.2	0.334	0.033	0.0091	
720 minute winter	ICS02	Hydro-Brake®	OUTFALL	0.2				2.5

Results for 1 year 960 minute winter. 1020 minute analysis at 15 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute winter	RE1	360	49.817	0.009	0.1	0.0000	0.0000	OK
960 minute winter	RE2	435	49.817	0.009	0.1	0.0000	0.0000	OK
960 minute winter	ICS01	435	49.713	0.012	0.2	0.0009	0.0000	OK
960 minute winter	ICS02	465	49.622	0.022	0.2	0.0591	0.0000	OK
960 minute winter	OUTFALL	15	49.500	0.000	0.2	0.0000	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
960 minute winter	RE1	PIPE 1.01	ICS01	0.1	0.288	0.017	0.0049	
960 minute winter	RE2	PIPE 1.02	ICS01	0.1	0.287	0.017	0.0013	
960 minute winter	ICS01	PIPE 1.03	ICS02	0.2	0.334	0.033	0.0091	
960 minute winter	ICS02	Hydro-Brake®	OUTFALL	0.2				2.7

Results for 1 year 1440 minute winter. 1500 minute analysis at 30 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	RE1	600	49.817	0.009	0.1	0.0000	0.0000	OK
1440 minute winter	RE2	30	49.808	0.000	0.0	0.0000	0.0000	OK
1440 minute winter	ICS01	600	49.709	0.009	0.1	0.0006	0.0000	OK
1440 minute winter	ICS02	660	49.615	0.015	0.1	0.0392	0.0000	OK
1440 minute winter	OUTFALL	30	49.500	0.000	0.1	0.0000	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
1440 minute winter	RE1	PIPE 1.01	ICS01	0.1	0.289	0.017	0.0037	
1440 minute winter	RE2	PIPE 1.02	ICS01	0.0	0.000	0.000	0.0000	
1440 minute winter	ICS01	PIPE 1.03	ICS02	0.1	0.217	0.017	0.0052	
1440 minute winter	ICS02	Hydro-Brake®	OUTFALL	0.1				2.2

Results for 30 year 15 minute winter. 75 minute analysis at 1 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	RE1	14	49.896	0.088	3.0	0.0000	0.0000	OK
15 minute winter	RE2	15	49.894	0.086	1.8	0.0000	0.0000	OK
15 minute winter	ICS01	15	49.894	0.194	4.7	0.0137	0.0000	SURCHARGED
15 minute winter	ICS02	15	49.888	0.288	3.8	0.7773	0.0000	SURCHARGED
15 minute winter	OUTFALL	1	49.500	0.000	1.4	0.0000	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	RE1	PIPE 1.01	ICS01	3.0	0.629	0.489	0.0815	
15 minute winter	RE2	PIPE 1.02	ICS01	1.8	0.654	0.294	0.0277	
15 minute winter	ICS01	PIPE 1.03	ICS02	3.8	0.728	0.626	0.0782	
15 minute winter	ICS02	Hydro-Brake®	OUTFALL	1.4				2.2

Results for 30 year 30 minute winter. 90 minute analysis at 1 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	RE1	24	49.903	0.095	2.3	0.0000	0.0000	OK
30 minute winter	RE2	24	49.901	0.093	1.4	0.0000	0.0000	OK
30 minute winter	ICS01	24	49.901	0.201	3.7	0.0142	0.0000	SURCHARGED
30 minute winter	ICS02	24	49.894	0.294	2.9	0.7949	0.0000	SURCHARGED
30 minute winter	OUTFALL	1	49.500	0.000	1.4	0.0000	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	RE1	PIPE 1.01	ICS01	2.3	0.583	0.381	0.0837	
30 minute winter	RE2	PIPE 1.02	ICS01	1.4	0.610	0.235	0.0285	
30 minute winter	ICS01	PIPE 1.03	ICS02	2.9	0.673	0.487	0.0782	
30 minute winter	ICS02	Hydro-Brake®	OUTFALL	1.4				2.9

Results for 30 year 60 minute winter. 120 minute analysis at 1 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	RE1	41	49.857	0.049	1.6	0.0000	0.0000	OK
60 minute winter	RE2	41	49.855	0.047	0.9	0.0000	0.0000	OK
60 minute winter	ICS01	41	49.856	0.156	2.5	0.0110	0.0000	SURCHARGED
60 minute winter	ICS02	42	49.849	0.249	2.2	0.6732	0.0000	SURCHARGED
60 minute winter	OUTFALL	1	49.500	0.000	1.4	0.0000	0.0000	OK
Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	RE1	PIPE 1.01	ICS01	1.6	0.523	0.265	0.0627	
60 minute winter	RE2	PIPE 1.02	ICS01	0.9	0.545	0.154	0.0198	
60 minute winter	ICS01	PIPE 1.03	ICS02	2.2	0.599	0.358	0.0782	
60 minute winter	ICS02	Hydro-Brake®	OUTFALL	1.4				3.7

Results for 30 year 120 minute winter. 180 minute analysis at 2 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	RE1	64	49.836	0.028	1.0	0.0000	0.0000	OK
120 minute winter	RE2	64	49.830	0.022	0.6	0.0000	0.0000	OK
120 minute winter	ICS01	72	49.748	0.048	1.6	0.0034	0.0000	OK
120 minute winter	ICS02	72	49.745	0.145	1.6	0.3913	0.0000	SURCHARGED
120 minute winter	OUTFALL	2	49.500	0.000	1.3	0.0000	0.0000	OK
Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	RE1	PIPE 1.01	ICS01	1.0	0.478	0.166	0.0289	
120 minute winter	RE2	PIPE 1.02	ICS01	0.6	0.486	0.099	0.0046	
120 minute winter	ICS01	PIPE 1.03	ICS02	1.6	0.513	0.265	0.0579	
120 minute winter	ICS02	Hydro-Brake®	OUTFALL	1.3				4.6

Results for 30 year 180 minute winter. 240 minute analysis at 4 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	RE1	92	49.831	0.023	0.7	0.0000	0.0000	OK
180 minute winter	RE2	88	49.826	0.018	0.4	0.0000	0.0000	OK
180 minute winter	ICS01	92	49.729	0.029	1.1	0.0021	0.0000	OK
180 minute winter	ICS02	104	49.677	0.077	1.1	0.2088	0.0000	OK
180 minute winter	OUTFALL	4	49.500	0.000	1.1	0.0000	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
180 minute winter	RE1	PIPE 1.01	ICS01	0.7	0.435	0.116	0.0174	
180 minute winter	RE2	PIPE 1.02	ICS01	0.4	0.432	0.066	0.0034	
180 minute winter	ICS01	PIPE 1.03	ICS02	1.1	0.460	0.182	0.0418	
180 minute winter	ICS02	Hydro-Brake®	OUTFALL	1.1				5.1

Results for 30 year 240 minute winter. 300 minute analysis at 4 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	RE1	124	49.829	0.021	0.6	0.0000	0.0000	OK
240 minute winter	RE2	124	49.826	0.018	0.4	0.0000	0.0000	OK
240 minute winter	ICS01	128	49.728	0.028	1.0	0.0020	0.0000	OK
240 minute winter	ICS02	128	49.668	0.068	1.0	0.1829	0.0000	OK
240 minute winter	OUTFALL	4	49.500	0.000	1.0	0.0000	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
240 minute winter	RE1	PIPE 1.01	ICS01	0.6	0.423	0.099	0.0160	
240 minute winter	RE2	PIPE 1.02	ICS01	0.4	0.432	0.066	0.0034	
240 minute winter	ICS01	PIPE 1.03	ICS02	1.0	0.423	0.166	0.0370	
240 minute winter	ICS02	Hydro-Brake®	OUTFALL	1.0				5.7

Results for 30 year 360 minute winter. 424 minute analysis at 8 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	RE1	168	49.825	0.017	0.4	0.0000	0.0000	OK
360 minute winter	RE2	184	49.823	0.015	0.3	0.0000	0.0000	OK
360 minute winter	ICS01	192	49.723	0.023	0.7	0.0016	0.0000	OK
360 minute winter	ICS02	192	49.648	0.048	0.7	0.1301	0.0000	OK
360 minute winter	OUTFALL	8	49.500	0.000	0.7	0.0000	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
360 minute winter	RE1	PIPE 1.01	ICS01	0.4	0.377	0.066	0.0123	
360 minute winter	RE2	PIPE 1.02	ICS01	0.3	0.398	0.050	0.0028	
360 minute winter	ICS01	PIPE 1.03	ICS02	0.7	0.406	0.116	0.0254	
360 minute winter	ICS02	Hydro-Brake®	OUTFALL	0.7				5.9

Results for 30 year 480 minute winter. 544 minute analysis at 8 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	RE1	240	49.825	0.017	0.4	0.0000	0.0000	OK
480 minute winter	RE2	208	49.821	0.013	0.2	0.0000	0.0000	OK
480 minute winter	ICS01	240	49.721	0.021	0.6	0.0015	0.0000	OK
480 minute winter	ICS02	256	49.643	0.043	0.6	0.1158	0.0000	OK
480 minute winter	OUTFALL	8	49.500	0.000	0.6	0.0000	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
480 minute winter	RE1	PIPE 1.01	ICS01	0.4	0.377	0.066	0.0115	
480 minute winter	RE2	PIPE 1.02	ICS01	0.2	0.353	0.033	0.0021	
480 minute winter	ICS01	PIPE 1.03	ICS02	0.6	0.406	0.099	0.0221	
480 minute winter	ICS02	Hydro-Brake®	OUTFALL	0.6				6.5

Results for 30 year 600 minute winter. 660 minute analysis at 15 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
600 minute winter	RE1	285	49.823	0.015	0.3	0.0000	0.0000	OK
600 minute winter	RE2	285	49.821	0.013	0.2	0.0000	0.0000	OK
600 minute winter	ICS01	285	49.719	0.019	0.5	0.0014	0.0000	OK
600 minute winter	ICS02	315	49.638	0.038	0.5	0.1019	0.0000	OK
600 minute winter	OUTFALL	15	49.500	0.000	0.5	0.0000	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
600 minute winter	RE1	PIPE 1.01	ICS01	0.3	0.333	0.050	0.0098	
600 minute winter	RE2	PIPE 1.02	ICS01	0.2	0.353	0.033	0.0021	
600 minute winter	ICS01	PIPE 1.03	ICS02	0.5	0.334	0.083	0.0189	
600 minute winter	ICS02	Hydro-Brake®	OUTFALL	0.5				7.0

Results for 30 year 720 minute winter. 780 minute analysis at 15 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
720 minute winter	RE1	360	49.823	0.015	0.3	0.0000	0.0000	OK
720 minute winter	RE2	360	49.821	0.013	0.2	0.0000	0.0000	OK
720 minute winter	ICS01	360	49.719	0.019	0.5	0.0014	0.0000	OK
720 minute winter	ICS02	390	49.638	0.038	0.5	0.1019	0.0000	OK
720 minute winter	OUTFALL	15	49.500	0.000	0.5	0.0000	0.0000	OK
Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
720 minute winter	RE1	PIPE 1.01	ICS01	0.3	0.333	0.050	0.0098	
720 minute winter	RE2	PIPE 1.02	ICS01	0.2	0.353	0.033	0.0021	
720 minute winter	ICS01	PIPE 1.03	ICS02	0.5	0.334	0.083	0.0189	
720 minute winter	ICS02	Hydro-Brake®	OUTFALL	0.5				6.7

Results for 30 year 960 minute winter. 1020 minute analysis at 15 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute winter	RE1	405	49.821	0.012	0.2	0.0000	0.0000	OK
960 minute winter	RE2	330	49.817	0.009	0.1	0.0000	0.0000	OK
960 minute winter	ICS01	405	49.715	0.015	0.3	0.0011	0.0000	OK
960 minute winter	ICS02	435	49.628	0.028	0.3	0.0744	0.0000	OK
960 minute winter	OUTFALL	15	49.500	0.000	0.3	0.0000	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
960 minute winter	RE1	PIPE 1.01	ICS01	0.2	0.307	0.033	0.0071	
960 minute winter	RE2	PIPE 1.02	ICS01	0.1	0.287	0.017	0.0013	
960 minute winter	ICS01	PIPE 1.03	ICS02	0.3	0.334	0.050	0.0125	
960 minute winter	ICS02	Hydro-Brake®	OUTFALL	0.3				6.5

Results for 30 year 1440 minute winter. 1500 minute analysis at 30 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	RE1	720	49.821	0.012	0.2	0.0000	0.0000	OK
1440 minute winter	RE2	570	49.817	0.009	0.1	0.0000	0.0000	OK
1440 minute winter	ICS01	720	49.715	0.015	0.3	0.0011	0.0000	OK
1440 minute winter	ICS02	750	49.628	0.028	0.3	0.0744	0.0000	OK
1440 minute winter	OUTFALL	30	49.500	0.000	0.3	0.0000	0.0000	OK
Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
1440 minute winter	RE1	PIPE 1.01	ICS01	0.2	0.307	0.033	0.0071	
1440 minute winter	RE2	PIPE 1.02	ICS01	0.1	0.287	0.017	0.0013	
1440 minute winter	ICS01	PIPE 1.03	ICS02	0.3	0.250	0.050	0.0125	
1440 minute winter	ICS02	Hydro-Brake®	OUTFALL	0.3				6.9

Results for 100 year +40% CC 15 minute winter. 75 minute analysis at 1 minute timestep. 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 winter	RE1	16	50.189	0.381	5.4	0.0000	0.0000	FLOOD RISK
15 minute winter	RE2	16	50.187	0.379	3.2	0.0000	0.0000	FLOOD RISK
15 minute winter	ICS01	16	50.187	0.487	6.3	0.0346	0.0000	FLOOD RISK
15 minute winter	ICS02	17	50.183	0.583	4.6	1.5744	0.0000	FLOOD RISK
15 minute winter	OUTFALL	1	49.500	0.000	1.4	0.0000	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
15 minute winter	RE1	PIPE 1.01	ICS01	4.0	0.649	0.660	0.0845	
15 minute winter	RE2	PIPE 1.02	ICS01	2.3	0.687	0.388	0.0290	
15 minute winter	ICS01	PIPE 1.03	ICS02	4.6	0.804	0.768	0.0782	
15 minute winter	ICS02	Hydro-Brake®	OUTFALL	1.4				4.0

Results for 100 year +40% CC 30 minute winter. 90 minute analysis at 1 minute timestep. 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
30 minute winter	RE1	29	50.271	0.463	4.3	0.0000	0.0000	FLOOD RISK
30 minute winter	RE2	29	50.269	0.461	2.6	0.0000	0.0000	FLOOD RISK
30 minute winter	ICS01	29	50.269	0.569	4.9	0.0404	0.0000	FLOOD RISK
30 minute winter	ICS02	29	50.263	0.663	3.9	1.7912	0.0000	FLOOD RISK
30 minute winter	OUTFALL	1	49.500	0.000	1.4	0.0000	0.0000	OK
Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
30 minute winter	RE1	PIPE 1.01	ICS01	3.3	0.581	0.548	0.0845	
30 minute winter	RE2	PIPE 1.02	ICS01	1.8	0.613	0.291	0.0290	
30 minute winter	ICS01	PIPE 1.03	ICS02	3.9	0.714	0.653	0.0782	
30 minute winter	ICS02	Hydro-Brake®	OUTFALL	1.4				5.3

Results for 100 year +40% CC 60 minute winter. 120 minute analysis at 1 minute timestep. 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
60 minute winter	RE1	47	50.262	0.454	2.9	0.0000	0.0000	FLOOD RISK
60 minute winter	RE2	47	50.260	0.452	1.7	0.0000	0.0000	FLOOD RISK
60 minute winter	ICS01	47	50.260	0.560	3.7	0.0397	0.0000	FLOOD RISK
60 minute winter	ICS02	47	50.254	0.654	2.9	1.7671	0.0000	FLOOD RISK
60 minute winter	OUTFALL	1	49.500	0.000	1.4	0.0000	0.0000	OK
Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
60 minute winter	RE1	PIPE 1.01	ICS01	2.3	0.557	0.386	0.0845	
60 minute winter	RE2	PIPE 1.02	ICS01	1.4	0.584	0.235	0.0290	
60 minute winter	ICS01	PIPE 1.03	ICS02	2.9	0.657	0.479	0.0782	
60 minute winter	ICS02	Hydro-Brake®	OUTFALL	1.4				6.8

Results for 100 year +40% CC 120 minute winter. 180 minute analysis at 2 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	RE1	86	50.140	0.332	1.8	0.0000	0.0000	FLOOD RISK
120 minute winter	RE2	86	50.139	0.331	1.1	0.0000	0.0000	FLOOD RISK
120 minute winter	ICS01	86	50.138	0.438	2.6	0.0311	0.0000	FLOOD RISK
120 minute winter	ICS02	86	50.135	0.535	2.2	1.4432	0.0000	SURCHARGED
120 minute winter	OUTFALL	2	49.500	0.000	1.4	0.0000	0.0000	OK
Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	RE1	PIPE 1.01	ICS01	1.6	0.514	0.263	0.0845	
120 minute winter	RE2	PIPE 1.02	ICS01	1.0	0.541	0.165	0.0290	
120 minute winter	ICS01	PIPE 1.03	ICS02	2.2	0.543	0.359	0.0782	
120 minute winter	ICS02	Hydro-Brake®	OUTFALL	1.4				8.4

Results for 100 year +40% CC 180 minute winter. 240 minute analysis at 4 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	RE1	116	49.965	0.157	1.4	0.0000	0.0000	SURCHARGED
180 minute winter	RE2	120	49.963	0.155	0.8	0.0000	0.0000	SURCHARGED
180 minute winter	ICS01	120	49.963	0.263	2.1	0.0187	0.0000	SURCHARGED
180 minute winter	ICS02	120	49.957	0.357	1.8	0.9651	0.0000	SURCHARGED
180 minute winter	OUTFALL	4	49.500	0.000	1.4	0.0000	0.0000	OK
Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
180 minute winter	RE1	PIPE 1.01	ICS01	1.4	0.480	0.224	0.0845	
180 minute winter	RE2	PIPE 1.02	ICS01	0.8	0.508	0.131	0.0290	
180 minute winter	ICS01	PIPE 1.03	ICS02	1.8	0.454	0.302	0.0782	
180 minute winter	ICS02	Hydro-Brake®	OUTFALL	1.4				9.5

Results for 100 year +40% CC 240 minute winter. 300 minute analysis at 4 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	RE1	144	49.851	0.043	1.1	0.0000	0.0000	OK
240 minute winter	RE2	144	49.849	0.041	0.7	0.0000	0.0000	OK
240 minute winter	ICS01	144	49.849	0.149	1.8	0.0106	0.0000	SURCHARGED
240 minute winter	ICS02	144	49.843	0.243	1.7	0.6567	0.0000	SURCHARGED
240 minute winter	OUTFALL	4	49.500	0.000	1.4	0.0000	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
240 minute winter	RE1	PIPE 1.01	ICS01	1.1	0.477	0.182	0.0596	
240 minute winter	RE2	PIPE 1.02	ICS01	0.7	0.508	0.116	0.0178	
240 minute winter	ICS01	PIPE 1.03	ICS02	1.7	0.460	0.275	0.0782	
240 minute winter	ICS02	Hydro-Brake®	OUTFALL	1.4				10.1

Results for 100 year +40% CC 360 minute winter. 424 minute analysis at 8 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	RE1	176	49.833	0.025	0.8	0.0000	0.0000	OK
360 minute winter	RE2	176	49.828	0.020	0.5	0.0000	0.0000	OK
360 minute winter	ICS01	176	49.731	0.031	1.3	0.0022	0.0000	OK
360 minute winter	ICS02	200	49.712	0.112	1.3	0.3021	0.0000	SURCHARGED
360 minute winter	OUTFALL	8	49.500	0.000	1.3	0.0000	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
360 minute winter	RE1	PIPE 1.01	ICS01	0.8	0.447	0.133	0.0194	
360 minute winter	RE2	PIPE 1.02	ICS01	0.5	0.461	0.083	0.0040	
360 minute winter	ICS01	PIPE 1.03	ICS02	1.3	0.480	0.215	0.0497	
360 minute winter	ICS02	Hydro-Brake®	OUTFALL	1.3				11.3

Results for 100 year +40% CC 480 minute winter. 544 minute analysis at 8 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	RE1	248	49.831	0.023	0.7	0.0000	0.0000	OK
480 minute winter	RE2	232	49.826	0.018	0.4	0.0000	0.0000	OK
480 minute winter	ICS01	248	49.729	0.029	1.1	0.0021	0.0000	OK
480 minute winter	ICS02	248	49.677	0.077	1.1	0.2068	0.0000	OK
480 minute winter	OUTFALL	8	49.500	0.000	1.1	0.0000	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
480 minute winter	RE1	PIPE 1.01	ICS01	0.7	0.435	0.116	0.0174	
480 minute winter	RE2	PIPE 1.02	ICS01	0.4	0.432	0.066	0.0034	
480 minute winter	ICS01	PIPE 1.03	ICS02	1.1	0.406	0.182	0.0415	
480 minute winter	ICS02	Hydro-Brake®	OUTFALL	1.1				12.2

Results for 100 year +40% CC 600 minute winter. 660 minute analysis at 15 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
600 minute winter	RE1	285	49.827	0.019	0.5	0.0000	0.0000	OK
600 minute winter	RE2	270	49.823	0.015	0.3	0.0000	0.0000	OK
600 minute winter	ICS01	285	49.725	0.025	0.8	0.0017	0.0000	OK
600 minute winter	ICS02	330	49.654	0.054	0.8	0.1468	0.0000	OK
600 minute winter	OUTFALL	15	49.500	0.000	0.8	0.0000	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
600 minute winter	RE1	PIPE 1.01	ICS01	0.5	0.392	0.083	0.0138	
600 minute winter	RE2	PIPE 1.02	ICS01	0.3	0.398	0.050	0.0028	
600 minute winter	ICS01	PIPE 1.03	ICS02	0.8	0.334	0.133	0.0292	
600 minute winter	ICS02	Hydro-Brake®	OUTFALL	0.8				13.1

Results for 100 year +40% CC 720 minute winter. 780 minute analysis at 15 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
720 minute winter	RE1	360	49.827	0.019	0.5	0.0000	0.0000	OK
720 minute winter	RE2	345	49.823	0.015	0.3	0.0000	0.0000	OK
720 minute winter	ICS01	360	49.725	0.025	0.8	0.0017	0.0000	OK
720 minute winter	ICS02	390	49.654	0.054	0.8	0.1468	0.0000	OK
720 minute winter	OUTFALL	15	49.500	0.000	0.8	0.0000	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
720 minute winter	RE1	PIPE 1.01	ICS01	0.5	0.392	0.083	0.0138	
720 minute winter	RE2	PIPE 1.02	ICS01	0.3	0.398	0.050	0.0028	
720 minute winter	ICS01	PIPE 1.03	ICS02	0.8	0.334	0.133	0.0292	
720 minute winter	ICS02	Hydro-Brake®	OUTFALL	0.8				13.7

Results for 100 year +40% CC 960 minute winter. 1020 minute analysis at 15 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute winter	RE1	465	49.825	0.017	0.4	0.0000	0.0000	OK
960 minute winter	RE2	390	49.821	0.013	0.2	0.0000	0.0000	OK
960 minute winter	ICS01	465	49.721	0.021	0.6	0.0015	0.0000	OK
960 minute winter	ICS02	495	49.643	0.043	0.6	0.1158	0.0000	OK
960 minute winter	OUTFALL	15	49.500	0.000	0.6	0.0000	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
960 minute winter	RE1	PIPE 1.01	ICS01	0.4	0.377	0.066	0.0115	
960 minute winter	RE2	PIPE 1.02	ICS01	0.2	0.353	0.033	0.0021	
960 minute winter	ICS01	PIPE 1.03	ICS02	0.6	0.334	0.099	0.0221	
960 minute winter	ICS02	Hydro-Brake®	OUTFALL	0.6				13.9

Results for 100 year +40% CC 1440 minute winter. 1500 minute analysis at 30 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	RE1	690	49.823	0.015	0.3	0.0000	0.0000	OK
1440 minute winter	RE2	690	49.821	0.013	0.2	0.0000	0.0000	OK
1440 minute winter	ICS01	690	49.719	0.019	0.5	0.0014	0.0000	OK
1440 minute winter	ICS02	720	49.638	0.038	0.5	0.1019	0.0000	OK
1440 minute winter	OUTFALL	30	49.500	0.000	0.5	0.0000	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
1440 minute winter	RE1	PIPE 1.01	ICS01	0.3	0.333	0.050	0.0098	
1440 minute winter	RE2	PIPE 1.02	ICS01	0.2	0.353	0.033	0.0021	
1440 minute winter	ICS01	PIPE 1.03	ICS02	0.5	0.276	0.083	0.0189	
1440 minute winter	ICS02	Hydro-Brake®	OUTFALL	0.5				14.4