NO.1 CATHEDRAL SQUARE, MANCHESTER

DRAINAGE TECHNICAL NOTE

Project No: 2307-10

July 2025

Rev: P02

REN-REN-BB-B2-RP-00010

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Author **HENRY WILKINSON**

Date **18.07.25**

Approved **ANDREW ISHERWOOD**

Date **18.07.25**

Contact Details:

Carvers Warehouse, 77 Dale Street

Manchester, M1 2HG

t: 0161 393 6509

Rev.	Description	Author	Checked	Date
P02	Revised following LLFA comments	H. Wilkinson	A. Isherwood	24.11.2025
P01	First Issue	H. Wilkinson	A. Isherwood	18.07.2025

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1. INTRODUCTION

1.1 Purpose of this Report

This Drainage strategy report has been prepared to support planning application Erection of a part ground and 26 storey, part ground and 13 storey building

To form 300 no. residential apartments (Class C3) and ground floor retail/ leisure floorspace (Class E/ Sui Generis (drinking establishments), together with private amenity space for residents (gym, cinema room and external terraces), new public realm to include riverside walkway and leisure/ food and beverage space (Class E/ Sui Generis (drinking establishments/ drinking establishments with food provision/ hot food takeaways), new landscaping, parking (36 spaces level -1), 300 cycle parking spaces, servicing, supporting infrastructure and associated works

This report includes the information required to Condition 9 of planning application

9) Notwithstanding the details as set out within condition 2 no development shall take place until surface water drainage works have been submitted to and approved in writing by the Local Planning Authority in accordance with Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015) or any subsequent replacements national standards.

**Maximised integration of green SuDS components (utilising infiltration or attenuation) if practicable. This shall include consideration of integrating the drainage strategy with the green landscaping design. Assessment demonstrating maximised integration of green SuDS components is required in-line with Manchester City Council's Climate Change Action Plan 2020-25.*

Refer to section 3.2 for SUDs Assessment. Table 3.1 provides details of various SUDs features noting their suitability to be adopted in the proposed development.

**Details of surface water attenuation that offers a reduction in surface water runoff rate to greenfield runoff rates;*

Refer to Appendix I for site specific Attenuation Tank detail and Type C Permeable Paving detail. The Attenuation Volumes are also indicated on the Below Ground Drainage GA in Appendix F

**An existing and proposed impermeable areas drawing to accompany all discharge rate calculations.*

Refer to Appendix B for Existing Drained Area Plan and Appendix G for Proposed drained Area plan.

**Runoff volume in the 1 in 100 year, 6 hours rainfall shall be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but never to exceed the runoff volume from the development site prior to redevelopment.*

Refer to section 4.2 for proposed discharge rate and section 4.1 for greenfield runoff calcs.

**Evidence that the drainage system has been designed (unless an area is designated to hold and/or convey water as part of the design) so that flooding does not occur during a 1 in 100 year rainfall event with allowance for 40% climate change in any part of a building. This shall include surcharged outfall considerations where applicable.*

The network has been modelled considering the 40% climate change outlined in the planning requirement above. This results in no flooding for both surcharge and free discharge scenarios.

Refer to Hydraulic Calculations in Appendix H and Below Ground Drainage GA in Appendix F.

**Assessment of overland flow routes for extreme events that is diverted away from buildings (including basements). Overland flow routes need to be designed to convey the flood water in a*

safe manner in the event of a blockage or exceedance of the proposed drainage system capacity including inlet structures. A layout with overland flow routes needs to be presented with appreciation of these overland flow routes with regards to the properties on site and adjacent properties off site.

Refer to Overland Flow Route plan in Appendix K

**Hydraulic calculation of the proposed drainage system;*

Refer to Appendix H for hydraulic calculations.

**Construction details* of *flow control and SuDS elements.*

Refer to Appendix I for attenuation tank and permeable paving details and Appendix J for flow control detail.

Where surface water is connected to the River Irwell, agreement in principle from Peel is required. An email of acceptance of proposed flows and/or new connection will suffice. For sites where proposed development would cause unusual pollution risk to surface water (large car park areas (>50 parking spaces) or industrial estates), evidence of pollution control measures (preferably through SuDS) is required.

Refer to Appendix E for correspondence with Peel confirming their acceptance of the proposed connection and flow rates from the site.

Where an application is part of a larger site which already has planning permission it is essential that the new proposal does not compromise the drainage scheme already approved

The proposed Drainage networks function independently to the Phase 1 networks and only drains the area within the proposed drained areas plan.

This report should be read in conjunction with the following documents:

Shepard Gilmour Flood Risk Assessment & Drainage Strategy date November 2019: 70061860-DSR001

Brownfields Phase II site investigation report date May 2025: MB/C5956/14014.

2. THE SITE

2.1 Site Location

The proposed development site is located off Deansgate, Manchester.

The site location is described below:

- Post Code M2 5GU
- OS X (Easting) 383767
- OS Y (Northing) 398655
- Nat. Grid SJ837986

The site location is illustrated in Figure 2.1 below.

Figure 2.1: Site Location

3. SURFACE WATER DISCHARGE & SUDS ASSESSMENT

3.1 Surface Water Discharge Assessment

In accordance with the National Planning Practice Guidance (PPG), the following hierarchy of surface water drainage options has been considered:

- Discharge into the ground (infiltration);
- Discharge to a surface water body;
- Discharge to a surface water sewer, highway drain, or another drainage system;
- Discharge to a combined sewer.

The drainage hierarchy was previously assessed as part of the approved Drainage Strategy produced by Shepard Gilmour. The reasoning is presented below with additional justification provided.

3.1.1 Discharge to Ground (Infiltration)

Intrusive site investigation carried out by Brownfield Solutions indicates infiltration rates are suitable for localised areas of infiltration, however, leachate testing of the made ground suggests an unacceptable risk of pollution to the River Irwell should infiltration be adopted.

Based on the above, discharging into the ground via infiltration has been discounted and additionally, any SuDS systems are to be lined to prevent the mobilisation of contaminants into the groundwater and ultimately the River Irwell.

3.1.2 Connection to a Watercourse

Opportunities to discharge to a watercourse have also been considered. The nearest named watercourse is the River Irwell which flows along the site's northern boundary with existing points of connection.

It is therefore proposed that the surface water drainage network discharges into the River Irwell via an existing connection.

3.2 Sustainable Drainage Systems (SuDS) Assessment

The table below provides a summary of typical SuDS outlined within CIRIA guide C753 'The SuDS Manual'. It provides an assessment of the various above and below ground SuDS that can provide water quality treatment and management of flows to reduce runoff rates and volumes and whether they can be suitably incorporated into this development. The purpose of this assessment is to set out the options that can be considered within the final drainage network and do not mean that all suitable features need to be incorporated into the final design.

SuDS Technique	Description	Suitability for development site	
Rainwater Harvesting	Collection of rainwater run-off for use	Running and maintenance costs would not be acceptable to the client	×
Green Roof	Vegetated roof area that reduces runoff and increases time of concentration.	Not efficient due to stepped roofs. Also, additional structure and costs due to increased loading.	×
Blue Roof	Roof area designed to store and reduce peak runoff rates during intense storms.	Not efficient due to stepped roofs. Also, additional structure and costs due to increased loading.	×
Infiltration systems	Systems that collect and storage runoff allowing it to infiltrate into the ground.	As outlined in the surface water discharge assessment in section 3.1, infiltration is not suitable due to the contaminant	×

		leachate potential into the adjacent River Irwell.	
Filter Strips	Grass strips that promote sedimentation and filtration as runoff is conveyed over the surface	Urban nature of the development means there are no large grass strips	×
Filter Drains	Granular filled Linear drains / soakaway with either granular fill and perforated pipe, or dense vegetation that treat runoff from adjacent impermeable areas	Urban nature of the development means this is not a viable option.	×
Swales	Shallow landscape channels that treat and convey runoff.	Urban nature of the development means this is not a viable option.	×
Bioretention systems	Shallow landscape depressions that allow runoff to pond temporarily on the surface, before filtering through vegetation and underling soils. Can either infiltrate or convey via perforated pipes.	Urban nature of the development means this is not a viable option.	✓
Trees	Tress within soil filled pits or permeable paving that can collect, store and treat run off	Limited external areas in order to be feasible	×
Pervious Paving	Granular build-up beneath permeable paving systems that can be used to either store runoff (lined system) and increase time of concentration or allow percolation into the ground.	Can be adopted to the localised external areas, however, as outlined in the surface water discharge assessment in section 3.1, any permeable paving systems are to be lined in order to prevent the mobilisation of any contaminants into the River Irwell.	✓
Attenuation Storage tanks/ large diameter pipes	Large underground voided spaces used to storage runoff before infiltration or controlled discharge	Suitable to store and convey surface water run off	✓
Ponds and wetlands	Permanent pools of water used to treat run-off and provide attenuation above normal water level	Urban nature of the development means this is not a viable option.	×
Detention Basins	Dry basins that are designed to temporarily store runoff providing water quality treatment. Can either be positively drained or infiltrate or both.	Urban nature of the development means this is not a viable option.	×

× Not suitable ? Potentially suitable subject to further investigation ✓ Suitable

Table 3.1: SuDS Techniques & Suitability for Development Site

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary	Annually
	Remove sediment from pre-treatment structures and/ or internal forebays	Annually, or as required
Remedial Actions	Repair/ rehabilitate inlets, outlets, overflows and vents	As required
Monitoring	Inspect/ check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tanks for sediment build-up and remove if necessary	Every 5 years or as required

Table 4.3 - Operation and Maintenance requirements for Attenuation Storage Tanks (Table 21.3 'The SuDS Manual C753)

4. EXISTING & PROPOSED SURFACE WATER DISCHARGE RATES

A review of the topographical survey and aerial images indicate that the existing development site is circa 0.233 ha and is considered 94% impermeable consisting of an existing building, car park, highway footpath and canal footpath. The impermeable area of the existing site is circa 0.219ha. Refer to Appendix A for Topographical Survey and Appendix B for Existing Drained Area Plan.

4.1 Greenfield Run-Off Rate

The greenfield run-off for the development site area has been calculated using Microdrainage ICP SuDS Method, which utilises the IH124 method and linearly interpolates for sites less 50 hectares.

Refer to Appendix C for Greenfield runoff rate calculations, the results are summarised in the table below.

Return Period	Greenfield Runoff Rates (l/s)
1 in 1 Year	1.1
1 in 2 Year	1.1
1 in 30 Year	2.1
1 in 100 Year	2.5
$Q_{bar\ Rural}$	1.2

Table 4.2 – Greenfield Run-Off Rates

4.2 Greenfield Run-Off Volume

The existing greenfield run off volume expected for a site of this size for a 100-year 6-hour storm has been calculated using the Greenfield Volume calculator within Microdrainage. The Greenfield Runoff Volume is calculated to be **64.7m^3**. Refer to Appendix D for Microdrainage Drainage Greenfield Run-Off Volume calculation.

4.3 Proposed Surface Water Discharge Rates

The Manchester, Salford and Trafford SFRA states that brownfield sites in the Core Conurbation Critical Drainage Area should restrict rates to at least 50% of the pre-development brownfield run-off rates, with an aim of reducing runoff to Greenfield rates up to a 1 in 100-year storm event, considering climate change.

Policy JP-S 5 of the recently adopted Places for Everyone Joint Development Plan expects developments to manage surface water runoff through sustainable drainage systems and as close to source as possible (unless demonstrably inappropriate) so as to not exceed greenfield run-off rates or alternative rates specified in district local plans, such as those identified for areas with critical drainage issues.

It is not considered feasible to restrict the flow rate to QBAR due to the associated blockage risk it would pose. It is therefore proposed that the total runoff from the site is limited to 2.0 l/s to minimise the risk of blockage and overland flooding.

It is also not considered feasible to reduce the discharge volume to greenfield volume or provide long term storage for the additional runoff volume over the Greenfield volume. This is due to the low infiltration rates and the limited space available over the site to provide long term storage.

The connection into the River Irwell at the proposed discharge rate outlined above has been approved in principle by Peel, refer to Appendix E for email correspondence.

5. DRAINAGE STRATEGY

5.1 Surface Water System

The development will have a dedicated surface water network. The network will collect the rainwater from the proposed building roof, and external areas.

The system will then discharge into the River Irwell under gravity

The new connection is subject to the approval Manchester City Council LLFA.

The surface water discharge rate is to be limited to the rate detailed within Section 3.2 of this report using a flow control device within the final manhole on site prior to discharge into River Irwell.

Attenuation will be provided by a geocellular storage tank, and type C permeable paving. Refer to Appendix I for details of the proposed geo-cellular tank and pavement

The surface water drainage network has been designed in accordance with Building Regulations Part H, BS EN 752 and Codes for Adoption.

The surface water system is to be designed to accommodate the 1, 2, 30 and 100 year return events with 40% climate change allowance for the 100 year event as outlined in the planning requirements for this development.

The system is to be designed for a maximum storm duration of 6 hours.

The surface water outfall will potentially be surcharged during exceedance events such as the 1:100 year return period. This may result in blockage of the surface water system and flooding within the B2 basement level until the river flood levels drop.

To assess this risk, two scenarios were modelled: free discharge and surcharged outfall conditions.

The maximum discharge rate occurs in the free discharge scenario. This rate is equivalent to the proposed discharge rate of 2.0 l/s and does not result in flooding for the 1 in 30 year and 1 in 100 year + 40% CC events.

For the surcharged outfall scenario, a surcharge level of 1.585m above the outfall invert was applied. This represents the maximum river level before overtopping occurs.

Under this scenario, no flooding occurs for the 1 in 30, or 1-in-100-year event with a 40% climate change allowance.

Refer to Appendix F for the Below Ground Drainage drawings.

Refer to Appendix G for the Proposed Drained Area Plan

Refer to Appendix H for supporting surface water hydraulic calculations.

Refer to Appendix I for Proposed Attenuation Details

Refer to Appendix J for Flow Control Detail

Refer to Appendix K for Overland Flow Routes

5.2 Foul Water System

The site will have a dedicated foul water network that will collect the foul water associated with the development and discharge into the public combined sewer within Victoria Bridge Street.

The new foul water drainage connection will be subject to the approval of United Utilities via a Section 106 application.

The drainage system is to be designed in accordance with Building Regulations Part H, BS EN 752 and Codes for Adoption.

APPENDIX A

TOPOGRAPHICAL SURVEY

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N

Note:
The survey is plotted on a plane local Grid. Orientation to National Grid.
All levels relate to Ordnance Datum, achieved using the
OS National GPS Network.

Survey Control Markers established for Mapping purposes only and should not be used for Construction without the written approval of Survey Operations Ltd.

Key:

88.88	Floor Level
{88.88}	Ceiling Level
{88.88}	Suspended Ceiling Level
USB88.88	Underside of Beam
USD88.88	Underside of Duct
USP88.88	Underside of Pipe
USS88.88	Underside of Shutter
USCR88.88	Underside of Cable Rack
CL88.88	Cill Level
HL88.88	Head Level
SP88.88	Arch Springing Level
CR88.88	Arch Crown Level

SURVEY STATIONS

Station	Eastings	Northings	Height
DWC1	383766.47	398401.11	19.47
DWC2	383766.47	398401.11	19.47
DWC3	383766.47	398401.11	19.47
DC1	383766.47	398401.11	19.47
DC2	383766.47	398401.11	19.47
SC3	383766.47	398401.11	19.47
SC4	383766.47	398401.11	19.47

SurveY OPERATIONS
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Tel: 01695 725662 Fax: 01695 51816
Email: mail@survops.co.uk – www.survops.co.uk

Client
Renaissance Association

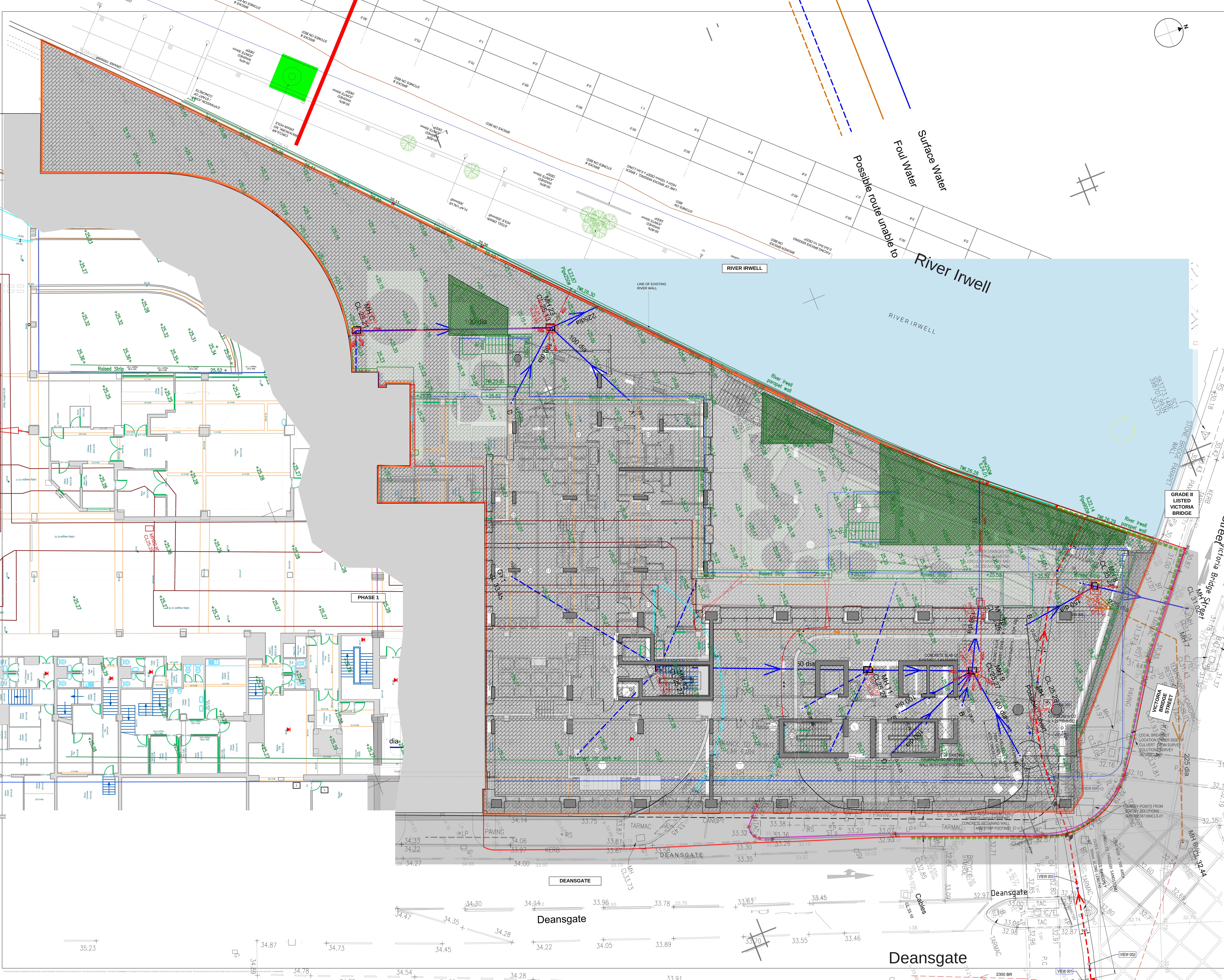
Drawing Title
Topographical/Building Survey of Land at:
Renaissance/Deansgate
Manchester
Ground Floor

Scale(s)	1:200	Surveyor	SI/DC/DJC
Date	Apr 25	Drawn	DS
Job Number	24K224	Checked	MH

Sheet Size & Drg Number & Revision
A0 24K224/001

APPENDIX B

EXISTING DRAINED AREA PLAN



NOTES:

1. THIS DRAWING IS INTENDED TO INDICATE THE EXISTING DRAINED AREAS FROM PHASE 2 OF THE RENAISSANCE SITE. IT IS BASED UPON A REVIEW OF THE TOPOGRAPHICAL SURVEY AND AERIAL IMAGES OF THE SITE.
2. EXISTING DISCHARGE RATES GIVEN HAVE BEEN CALCULATED USING MICRODRAINAGE. GREENFIELD RUN-OFF RATES ARE BASED ON THE AREA OF SOFT LANDSCAPING AND BROWNFIELD RUN-OFF RATES ARE BASED ON THE HARD PAVED AREAS.

GREENFIELD RUN-OFF RATES

EVENT	GREENFIELD RUN-OFF
1:1	1.1 l/s
1:2	1.1 l/s
1:30	2.1 l/s
1:100	2.5 l/s
QBAR	**1.2 l/s**

GREENFIELD RUN-OFF CALCULATED IN MICRODRAINAGE USING ICP SuDS WHICH USES THE IH124 METHOD AND LINEARLY INTERPOLATES THE RESULTS FOR CATCHMENTS LESS THAN 50ha
CATCHMENT AREA = 0.219 ha

KEY

OWNERSHIP BOUNDARY
TOTAL AREA: 2,325m^2 (0.233 ha)

SOFT LANDSCAPED AREAS
AREA: 136m^2 (0.014 ha)

HARD PAVED AREAS
AREA: 2,189m^2 (0.219 ha)

Rev:	Description:	Date:	By:	Chkd:
P02	STAGE 4 ISSUE	18.07.25	HW	AI
P01	RIBA STAGE 3	08.07.25	HW	KG

Renaissance Associates Ltd
Carvers Warehouse
77 Dale Street
Manchester
M1 2HG

Project:
RENAISSANCE MANCHESTER

Drawing Title:
EXISTING DRAINED AREA PLAN

Status:
RIBA STAGE 4

Size:	Date:	Drawn by:	Designed by:	Checked by:
A0	NOV 24	HW	-	KG

Scale: 1:100 — Project No: 2307-10

Project: Originator: Volume: Level: Type: Role: Category/Number: Rev:

REN-REN-BB-ZZ-DR-C-00050-P02

APPENDIX C

GREENFIELD RUNOFF CALCS

ICP SUDS Mean Annual Flood

Input

Return Period (years)	2	Soil	0.450
Area (ha)	0.219	Urban	0.000
SAAR (mm)	858	Region Number	Region 10

Results	**l/s**
QBAR Rural	1.2
QBAR Urban	1.2
Q2 years	1.1
Q1 year	1.1
Q30 years	2.1
Q100 years	2.5

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APPENDIX D

GREENFIELD RUNOFF VOLUME

Greenfield Runoff Volume

FSR Data

Return Period (years)	100
Storm Duration (mins)	360
Region	England and Wales
M5-60 (mm)	18.000
Ratio R	0.358
Areal Reduction Factor	1.00
Area (ha)	0.219
SAAR (mm)	868
CWI	120.636
Urban	0.000
SPR	47.000

Results

Percentage Runoff (%)	49.52
Greenfield Runoff Volume (m^3)	64.669

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APPENDIX E

EMAIL CORRESPONDENCE WITH PEEL

Peel
WATER SERVICES

Henry Wilkinson
Renaissance Associates Ltd
2nd Floor Tribeca House,
Dale Street,
Manchester
M1 1EY

11th July 2025

Dear Henry,

RE: Surface Water Drainage to the River Irwell from No1 Cathedral Square, Salford

Peel NRE Water Services Limited, acting as agents of The Manchester Ship Canal Company Ltd (MSCCL), confirm that in principle we can accept a surface water drainage discharge at a rate of 2.0 l/sec as outlined in plan REN-REN-BB-B2-DR-C-01100.pdf from the above development.

Such agreement is conditional on the completion of a licence for discharge being entered into on such terms as MSCCL require.

Yours sincerely

Neil Adair
Associate Director
Email: nadair@peel.co.uk
Tel: 0161 629 8353

Henry Wilkinson

From: Neil Adair <nadair@peel.co.uk>
Sent: 11 July 2025 14:57
To: Henry Wilkinson
Cc: Andrew Isherwood
Subject: RE: No.1 Cathedral Square -
Attachments: 2025.07.11_Ltr_re_drainage.pdf

Hi Henry,

Please see attached letter – let me know if you need a signed copy and I will print and scan.

If you need anything amending / adding please let me know and we can consider this.

Kind Regards

Neil

Neil Adair
Associate Director - Water
Peel Water Services
0161 629 8353
07825 513 990
nadair@peel.co.uk

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From: Henry Wilkinson <HenryWilkinson@renaissance-ltd.com>
Sent: 10 July 2025 10:05
To: Neil Adair <nadair@peel.co.uk>
Cc: Andrew Isherwood <AndrewIsherwood@renaissance-ltd.com>
Subject: RE: No.1 Cathedral Square -

WARNING - This email originated from outside of the organisation.
Please check you recognise both the sender's name and email address to ensure the content is safe, if in doubt, contact IT.

Hi Neil,

Further to our conversation earlier, the discharge will be via a new connection as indicated on the drainage GA in the folder link below.

Kind regards,

Henry Wilkinson | Engineer
MEng

2nd Floor Tribeca House,
Dale Street,
Manchester M1 1EY

e: henrywilkinson@renaissance-ltd.com
t: 0161 393 6509
ddi: 0161 552 1961
w: www.renaissance-ltd.com
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From: Neil Adair <nadair@peel.co.uk>
Sent: 10 July 2025 09:09
To: Henry Wilkinson <HenryWilkinson@renaissance-ltd.com>
Cc: Andrew Isherwood <AndrewIsherwood@renaissance-ltd.com>
Subject: RE: No.1 Cathedral Square -

Hi Ben,

You can get me on my mobile – 07825 513990.

Thanks

Neil

Neil Adair
Associate Director - Water
Peel Water Services
0161 629 8353
07825 513 990
nadair@peel.co.uk

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From: Henry Wilkinson <HenryWilkinson@renaissance-ltd.com>
Sent: 09 July 2025 10:04
To: Neil Adair <nadair@peel.co.uk>
Cc: Andrew Isherwood <AndrewIsherwood@renaissance-ltd.com>; Mark Baldwin <Mark.Baldwin@peelports.com>
Subject: RE: No.1 Cathedral Square -

WARNING - This email originated from outside of the organisation.
Please check you recognise both the sender's name and email address to ensure the content is safe, if in doubt, contact IT.

Hi Neil,

Do you have a preferred contact number I can call on?

Kind regards,

Henry Wilkinson | Engineer
MEng

2nd Floor Tribeca House,
Dale Street,
Manchester M1 1EY

e: henrywilkinson@renaissance-ltd.com
t: 0161 393 6509
ddi: 0161 552 1961

w: www.renaissance-ltd.com
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From: Mark Baldwin <Mark.Baldwin@peelports.com>
Sent: 09 July 2025 09:48
To: Henry Wilkinson <HenryWilkinson@renaissance-ltd.com>
Cc: Andrew Isherwood <AndrewIsherwood@renaissance-ltd.com>; Adair, Neil <nadair@peel.co.uk>
Subject: RE: No.1 Cathedral Square -

Hi Henry

Please can you liaise with @Neil Adair (in cc) on this?

Kind regards

Mark

Mark Baldwin
Senior Estates Manager

0151 949 6252
07795602308
Mark.Baldwin@peelports.com

Port of Liverpool
Liverpool
L21 1LA

Work Safe. Home Safe.

Please consider the environment before printing this e-mail

From: Henry Wilkinson <HenryWilkinson@renaissance-ltd.com>
Sent: 09 July 2025 09:11
To: Mark Baldwin <Mark.Baldwin@peelports.com>
Cc: Andrew Isherwood <AndrewIsherwood@renaissance-ltd.com>
Subject: RE: No.1 Cathedral Square -

Hi Mark,

Have you managed to have a look at this?

If you need to clarify anything then feel free to contact me on my direct dial below.

Kind regards,

Henry Wilkinson | Engineer

MEng

2nd Floor Tribeca House,
Dale Street,
Manchester M1 1EY

e: henrywilkinson@renaissance-ltd.com
t: 0161 393 6509
ddi: 0161 552 1961
w: www.renaissance-ltd.com
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Renaissance Associates Ltd trading as Renaissance, a company incorporated in England and Wales under Company Number: 08149019, Registered Office: 2ND Floor Tribeca House, 21-27 Dale Street, Manchester, M1 1EY, UK

From: Henry Wilkinson
Sent: 07 July 2025 15:50
To: mark.baldwin@peelports.com
Cc: Andrew Isherwood <AndrewIsherwood@renaissance-ltd.com>
Subject: No.1 Cathedral Square - [Filed 07 Jul 2025 15:50]

Hi Mark,

I've been passed on your contact details from the main switchboard to discuss a proposed drainage connection into the Manchester Ship Canal.

In short, planning application is for

> *Erection of a part ground and 26 storey, part ground and 13 storey building to form 300 no. residential apartments (Class C3) and ground floor retail/ leisure floorspace (Class E/ Sui Generis (drinking establishments), together with private amenity space for residents (gym, cinema room and external terraces), new public realm to include riverside walkway and leisure/ food and beverage space (Class E/ Sui Generis (drinking establishments/ drinking establishments with food provision/ hot food takeaways), new landscaping, parking (36 spaces level -1), 300 cycle parking spaces, servicing, supporting infrastructure and associated works.*

Site Location:

> Eastings: 383767
> Northings: 398655
>
> Postcode: M3 1AZ

Proposed development plans

> No.1 Cathedral Square

The proposed connection into the Ship Canal will be via an existing point of connection and we are proposing to limit the discharge from site to a rate of 2.0l/s in line with good practice and MCC planning policy..

Appreciate the Heads and Terms need to be agreed but in the first instance please can you confirm the above discharge rate is acceptable the surface water connection.

Kind regards,

Henry Wilkinson | Engineer
MEng

2nd Floor Tribeca House,
21-27 Dale Street,

Manchester M1 1EY

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Registered in England and Wales

Company number: 05965116

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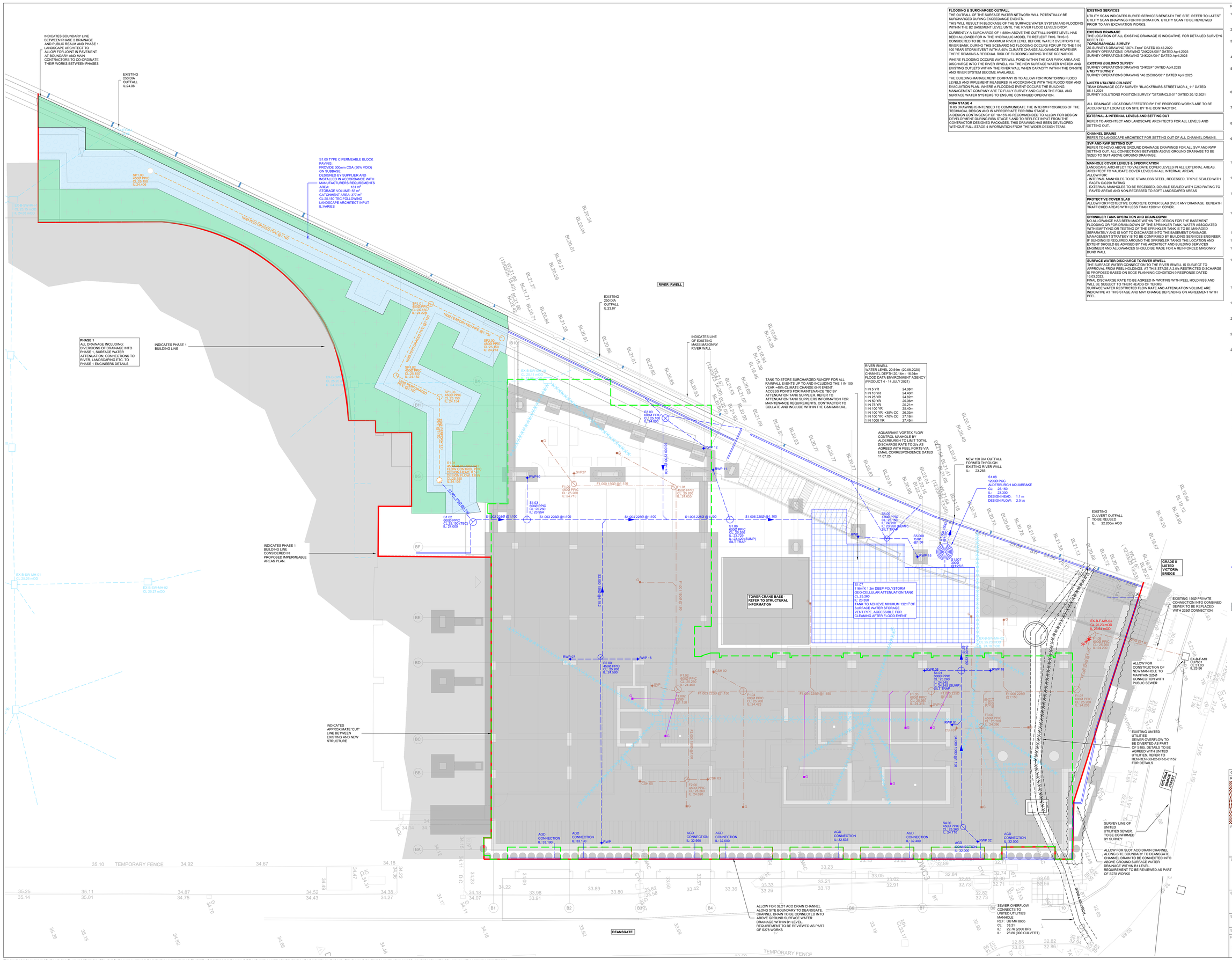
APPENDIX F

BELOW GROUND DRAINAGE GENERAL ARRANGEMENT



FLOODING & SURCHARGED OUTFALL
THE OUTFALL OF THE SURFACE WATER NETWORK WILL POTENTIALLY BE SURCHARGED DURING EXCEEDANCE EVENTS.
THIS WILL RESULT IN BLOCKAGE OF THE SURFACE WATER SYSTEM AND FLOODING WITHIN THE B2 BASEMENT LEVEL UNTIL THE RIVER FLOOD LEVELS DROP.

CURRENTLY A SURCHARGE OF 1.585m ABOVE THE OUTFALL INVERT LEVEL HAS BEEN ALLOWED FOR IN THE HYDRAULIC MODEL TO REFLECT THIS. THIS IS CONSIDERED TO BE THE MAXIMUM RIVER LEVEL BEFORE WATER OVERTOPS THE RIVER BANK. DURING THIS SCENARIO NO FLOODING OCCURS FOR UP TO THE 1 IN 100 YEAR STORM EVENT WITH A 40% CLIMATE CHANGE ALLOWANCE HOWEVER THERE REMAINS A RESIDUAL RISK OF FLOODING DURING THESE SCENARIOS.

WHERE FLOODING OCCURS WATER WILL POND WITHIN THE CAR PARK AREA AND DISCHARGE INTO THE RIVER IRWELL VIA THE NEW SURFACE WATER SYSTEM AND EXISTING OUTLETS WITHIN THE RIVER WALL WHEN CAPACITY WITHIN THE ON-SITE AND RIVER SYSTEM BECOME AVAILABLE.

THE BUILDING MANAGEMENT COMPANY IS TO ALLOW FOR MONITORING FLOOD LEVELS AND IMPLEMENT MEASURES IN ACCORDANCE WITH THE FLOOD RISK AND EVACUATION PLAN. WHERE A FLOODING EVENT OCCURS THE BUILDING MANAGEMENT COMPANY ARE TO FULLY SURVEY AND CLEAN THE FOUL AND SURFACE WATER SYSTEMS TO ENSURE CONTINUED OPERATION.

RIBA STAGE 4
THIS DRAWING IS INTENDED TO COMMUNICATE THE INTERIM PROGRESS OF THE TECHNICAL DESIGN AND IS APPROPRIATE FOR RIBA STAGE 4
A DESIGN CONTINGENCY OF 10-15% IS RECOMMENDED TO ALLOW FOR DESIGN DEVELOPMENT DURING RIBA STAGE 5 AND TO REFLECT INPUT FROM THE CONTRACTOR DESIGNED PACKAGES. THIS DRAWING HAS BEEN DEVELOPED WITHOUT FULL STAGE 4 INFORMATION FROM THE WIDER DESIGN TEAM.

EXISTING SERVICES
UTILITY SCAN INDICATES BURIED SERVICES BENEATH THE SITE. REFER TO LATEST UTILITY SCAN DRAWINGS FOR INFORMATION. UTILITY SCAN TO BE REVIEWED PRIOR TO ANY EXCAVATION WORKS.

EXISTING DRAINAGE
THE LOCATION OF ALL EXISTING DRAINAGE IS INDICATIVE. FOR DETAILED SURVEYS REFER TO:
TOPOGRAPHICAL SURVEY
ZS SURVEYS DRAWING "2074-Topo" DATED 03.12.2020
SURVEY OPERATIONS DRAWING "24K224001" DATED April.2025
SURVEY OPERATIONS DRAWING "24K224/004" DATED April.2025

EXISTING BUILDING SURVEY
SURVEY OPERATIONS DRAWING "24K224" DATED April.2025
UTILITY SURVEY
SURVEY OPERATIONS DRAWING "A0 25C065/001" DATED April 2025

UNITED UTILITIES CULVERT
TEAM DRAINAGE CCTV SURVEY "BLACKFRIARS STREET MCR 4_11" DATED 05.11.2021
SURVEY SOLUTIONS POSITION SURVEY "38738MCLS-01" DATED 20.12.2021

ALL DRAINAGE LOCATIONS EFFECTED BY THE PROPOSED WORKS ARE TO BE ACCURATELY LOCATED ON SITE BY THE CONTRACTOR.

EXTERNAL & INTERNAL LEVELS AND SETTING OUT
REFER TO ARCHITECT AND LANDSCAPE ARCHITECTS FOR ALL LEVELS AND SETTING OUT.

CHANNEL DRAINS
REFER TO LANDSCAPE ARCHITECT FOR SETTING OUT OF ALL CHANNEL DRAINS.

SVP AND RWP SETTING OUT
REFER TO NOVO ABOVE GROUND DRAINAGE DRAWINGS FOR ALL SVP AND RWP SETTING OUT. ALL CONNECTIONS BETWEEN ABOVE GROUND DRAINAGE TO BE SIZED TO SUIT ABOVE GROUND DRAINAGE.

MANHOLE COVER LEVELS & SPECIFICATION
LANDSCAPE ARCHITECT TO VALIDATE COVER LEVELS IN ALL EXTERNAL AREAS. ARCHITECT TO VALIDATE COVER LEVELS IN ALL INTERNAL AREAS.
ALLOW FOR:
- INTERNAL MANHOLES TO BE STAINLESS STEEL, RECESSED, TRIPLE SEALED WITH FACTA CIC250 RATING
- EXTERNAL MANHOLES TO BE RECESSED, DOUBLE SEALED WITH C250 RATING TO PAVED AREAS AND NON-RECESSED TO SOFT LANDSCAPED AREAS

PROTECTIVE COVER SLAB
ALLOW FOR PROTECTIVE CONCRETE COVER SLAB OVER ANY DRAINAGE BENEATH TRAFFICKED AREAS WITH LESS THAN 1200mm COVER.

SPRINKLER TANK OPERATION AND DRAIN-DOWN
NO ALLOWANCE HAS BEEN MADE WITHIN THE DESIGN FOR THE BASEMENT FLOODING OR FOR DRAIN-DOWN OF THE SPRINKLER TANK. WATER ASSOCIATED WITH EMPTYING OR TESTING OF THE SPRINKLER TANK IS TO BE MANAGED SEPARATELY AND IS NOT TO DISCHARGE INTO THE BASEMENT DRAINAGE.
MANAGEMENT STRATEGY IS TO BE CONFIRMED BY BUILDING SERVICES ENGINEER
IF BUNDING IS REQUIRED AROUND THE SPRINKLER TANKS THE LOCATION AND EXTENT SHOULD BE ADVISED BY THE ARCHITECT AND BUILDING SERVICES ENGINEER AND ALLOWANCES SHOULD BE MADE FOR A REINFORCED MASONRY BUND WALL.

SURFACE WATER DISCHARGE TO RIVER IRWELL
THE SURFACE WATER CONNECTION TO THE RIVER IRWELL IS SUBJECT TO APPROVAL FROM PEEL HOLDINGS. AT THIS STAGE A 2 l/s RESTRICTED DISCHARGE IS PROPOSED BASED ON BCGE PLANNING CONDITION 9 RESPONSE DATED 16.03.2022.
FINAL DISCHARGE RATE TO BE AGREED IN WRITING WITH PEEL HOLDINGS AND WILL BE SUBJECT TO THEIR HEADS OF TERMS.
SURFACE WATER RESTRICTED FLOW RATE AND ATTENUATION VOLUME ARE INDICATIVE AT THIS STAGE AND MAY CHANGE DEPENDING ON AGREEMENT WITH PEEL.

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RENAISSANCE, ARCHITECTS, LANDSCAPE ARCHITECTS AND BUILDING SERVICES ENGINEERS DRAWINGS.
2. FOR SITE CONSTRAINTS AND ASSOCIATED RISKS REFER TO DRAWING REN-REN-BB-ZZ-DR-C-00020.
3. THE FINAL CONNECTION TO THE PUBLIC SEWER IS SUBJECT TO UNITED UTILITIES APPROVAL AND IS TO BE IN ACCORDANCE WITH THEIR AGREED DETAILS.
4. FOR ALL ABOVE GROUND DRAINAGE AND ASSOCIATED PUMPS REFER TO BUILDING SERVICES AND ARCHITECT'S DRAWINGS
5. ALL BELOW GROUND DRAINAGE WORKS TO BE IN ACCORDANCE WITH RELEVANT BUILDING REGULATIONS AND SEWER SECTOR GUIDANCE APPENDIX C- DESIGN AND CONSTRUCTION GUIDANCE. IF DISCREPANCIES ARE NOTED BETWEEN BSG AND DRAWINGS THESE SHOULD BE BROUGHT TO THE ATTENTION OF RENAISSANCE FOR REVIEW.
6. RWPs, SVPs, SSs AND FLOOR GULLEYS ARE TO HAVE RODDABLE ACCESS POINTS ABOVE GROUND FLOOR TO BUILDING SERVICES DETAILS. ALL FLOOR GULLEYS AND RWPS ARE TO BE TRAPPED.
7. ALL GULLY AND CHANNEL DRAIN LOCATIONS INDICATIVE. REFER TO ARCHITECT AND LANDSCAPE ARCHITECT DRAWINGS FOR SETTING OUT AND SPECIFICATION.
8. THE ATTENUATION TANK AND FLOW CONTROL ARE TO BE TO SUPPLIERS DESIGN AND DETAILS. INSTALLATION IS TO BE IN ACCORDANCE WITH THE SUPPLIERS REQUIREMENTS.
9. SEWERS TO BE LAID IN CLASS S BEDDING (150mm GRANULAR BED AND SURROUND). WHERE DEPTH OF COVER TO TOP OF THE SEWER IS LESS THAN: 1.2m IN HIGHWAYS OR VERGES, OR LESS THAN 0.9m IN PEDESTRIAN AREAS, THEN A 150mm CONCRETE SLAB SHOULD BE PROVIDED ABOVE THE GRANULAR BED AND SURROUND. REFER TO DETAILS SHEETS.
10. DURING THE WORKS ALTERATIONS TO THE DRAINAGE LAYOUT ARE TO BE MARKED UP BY THE CONTRACTOR AND AGREED WITH RENAISSANCE IN WRITING.
11. THE CHAMBER SIZE OF PCC MANHOLES WITH MORE THAN ONE CONNECTION IN THEM MAY NEED TO BE INCREASED AN INCREMENT TO ACCOMMODATE THE CONNECTIONS AND BENDS.
12. MANHOLE COVERS ARE TO BE ACCORDANCE WITH BS EN 124 FOR THE RATING INDICATED IN THE MANHOLE SCHEDULE. THE CONTRACTOR IS TO SUBMIT DETAILS FOR THE PROPOSED MANHOLE COVERS TO THE ENGINEER AND LANDSCAPE ARCHITECT FOR REVIEW PRIOR TO INSTALLATION.
13. COVER SLABS MUST CARRY THE BSI KITEMARK. WHERE THE CLEAR OPENING OF THE KITEMARKED PRODUCT IS DIFFERENT TO THAT OF THE COVER AND FRAME, A LOAD BEARING REDUCING SLAB SHOULD BE FITTED ABOVE THE COVER SLAB TO BRING THE SIZE DOWN TO REQUIRED SIZE.
14. ALL SEWERS TO BE BSI KITEMARK (CERTIFIED TO WIS 4-35-01)
15. ALL CONCRETE PIPES TO BE TO ES EN 1916 CLASS 120 (54kN/m).
16. BEDDING AND BACKFILL MATERIAL TO CONFORM TO THE REQUIREMENTS OF THE WATER INDUSTRY SPECIFICATION 4-08092 (TABLE A2).
17. IF PLASTIC PIPES ARE TO BE USED THEN THE FOLLOWING MUST APPLY:
    A. BSI KITEMARK (CERTIFIED TO BS EN 13476-1 AND WIS 4-35-01)
    B. PIPES LESS THAN OR EQUAL TO 500mm DIA
    C. BEDDING AND BACKFILL MATERIAL TO CONFORM TO THE
    D. REQUIREMENTS OF THE WATER INDUSTRY SPECIFICATION 4-08092 (TABLE A2)
18. THE MINIMUM CRUSHING STRENGTH FOR CLAY PIPES SHOULD BE AS FOLLOWS: 100mm DIA. 40kN/m, 150mm DIA. 40kN/m, 225mm DIA. 45kN/m AND 300mm DIA. 72kN/m.
19. THE MINIMUM CRUSHING STRENGTH FOR CONCRETE PIPES SHOULD BE -CLASS 120 TO EN 1916/BS5911-1 2002). PLASTIC PIPES SHOULD CONFORM TO WIS 4-35-01 AND BS EN13476.
20. SULPHATE RESISTANT CEMENT (C20-DC2) AND PRECAST CONCRETE PRODUCTS MUST BE USED OR A LABORATORY REPORT PROVIDED PROVIDING THAT SUCH PRECAUTIONS ARE NOT NECESSARY.
21. SEWER PIPES TO BE LAID IN MAXIMUM 3 METER LENGTHS UNLESS THERE IS A SPECIFIC OPERATIONAL NEED TO LAY LONGER PIPES, AND THIS IS AGREED BY THE CONTRACTOR WITH THE PIPE MANUFACTURER.
22. ALLOW FOR ALL EXISTING DRAINAGE ON SITE TO BE GRUBBED UP AND BACKFILLED. ANY CONNECTIONS FROM THE SITE TO THE PUBLIC SEWER TO THE SITE ARE TO BE CAPPED AND GROUTED.

KEY

- INDICATES APPROXIMATE PHASE 2 SITE BOUNDARY. REFER TO ARCHITECTS DRAWINGS
- INDICATES APPROXIMATE EXTENT OF NEW TOWER DEVELOPMENT
- INDICATES EXISTING UNITED UTILITIES CULVERT TO BE ABANDONED/DIVERTED
- INDICATES DIVERTED CULVERT. DETAIL TBC FOLLOWING CONFIRMATION OF ABANDONMENT OR DIVERSION BY UNITED UTILITIES
- INDICATES EXISTING DRAINAGE TO REMOVED. ALLOW FOR GRUBBING UP ALL DRAINAGE AND MANHOLES, AND GROUTING OUTFALLS THROUGH RIVER WALL
- INDICATES APPROXIMATE LOCATION OF UNITED UTILITIES COMBINED SEWER. TO BE SURVEYED PRIOR TO COMMENCEMENT OF RIBA STAGE 4
- INDICATES EXISTING FOUL WATER DRAINAGE TO REMOVED. ALLOW FOR GRUBBING UP ALL DRAINAGE AND MANHOLES
- INDICATES NEW FOUL WATER DRAINAGE. ALLOW FOR 150 DIA PIPE WITH 1:40 FALLS U.N.O.
- INDICATES TRAPPED FOUL WATER GULLY. REFER TO ARCHITECTS AND BUILDING SERVICES ENGINEERS DRAWINGS FOR SETTING OUT.
- INDICATES TEMPORARY FOUL WATER GULLY. TO BE GROUTED UP ON COMPLETION OF CONSTRUCTION WORKS. REFER TO ARCHITECTS AND BUILDING SERVICES ENGINEERS DRAWINGS FOR SETTING OUT.
- INDICATES NEW SURFACE WATER DRAINAGE. ALLOW FOR 150 DIA PIPE WITH 1:100 FALLS U.N.O. BUT NOT SMALLER THAN ABOVE GROUND DRAINAGE PIPE SIZE
- ATTENUATION TANK TO SPECIALISTS DESIGN AND DETAIL
- INDICATES ACO SLOT DRAIN LOCATIONS.
- EXISTING RIVER WALL DRAINAGE OUTLET
- EXTENT OF PERMEABLE PAVING - REFER TO LANDSCAPE ARCHITECT GA FOR SETTING OUT
- PERFORATED PIPE NETWORK WITHIN PERMEABLE PAVING - REFER TO PAVEMENT BUILDUP DETAILS

Rev:	Description:	Date:	By:	Chkd:
C01	GATEWAY SUBMISSION	31.07.25	HW	AI

renaissance

Renaissance Associates Ltd
2nd Floor Tribeca House
21-27 Dale Street
Manchester
M1 1EY

Project:
NO.1 CATHEDRAL SQUARE, MANCHESTER

Drawing Title:
BELOW GROUND DRAINAGE BASEMENT B2 PLAN

Status:
RIBA STAGE 4

Size:	Date:	Drawn by:	Designed by:	Checked by:
A0	JUN 25	HW	HW	AI

Scale:	Project No:	Revision:
1:100	2307-10	

Project – Originator – Volume – Level – Type – Role – Number:
REN-REN-BB-B2-DR-C-01100 | C01

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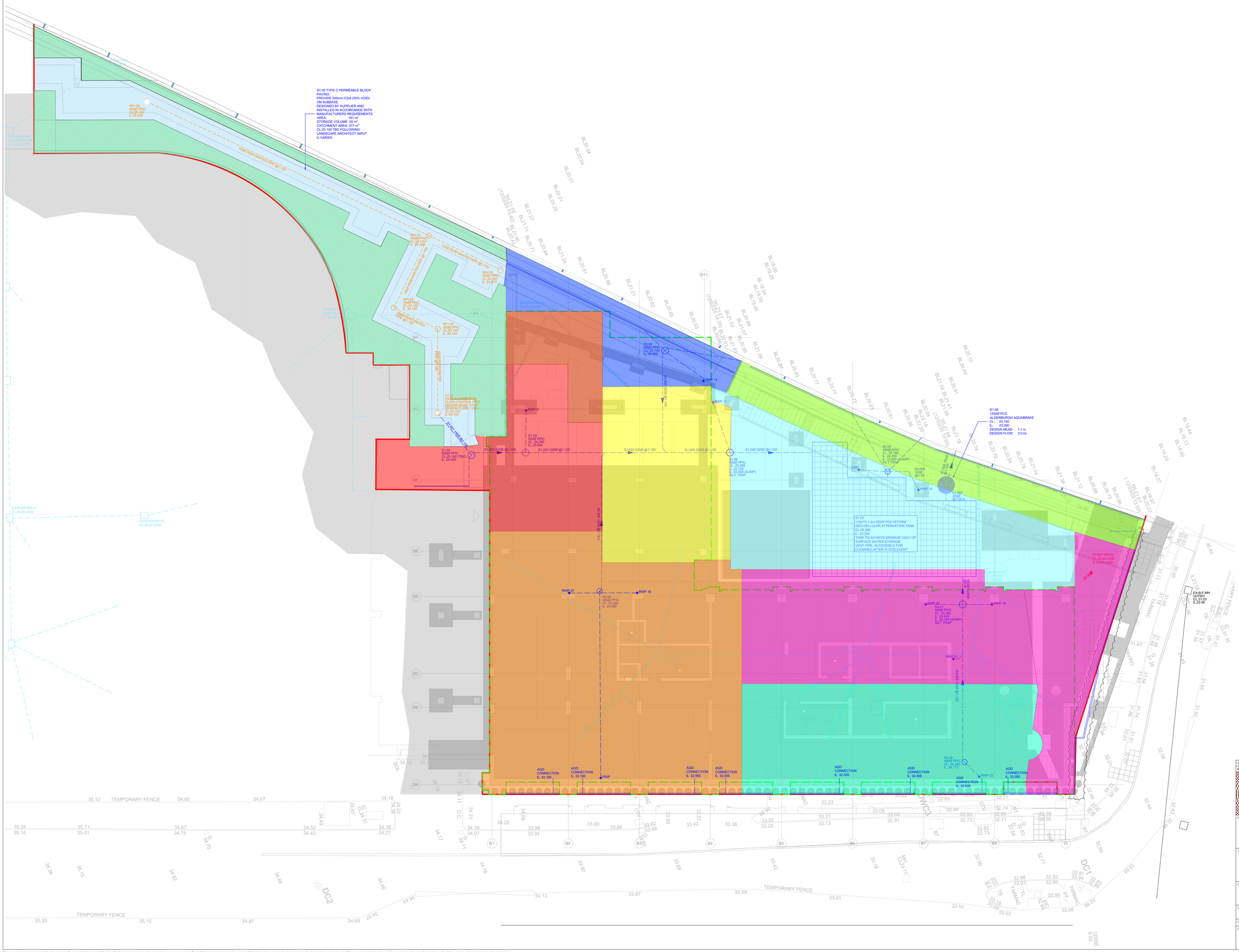
APPENDIX G

PROPOSED DRAINED AREAS

NOTES

1. THIS DRAWING IS INTENDED TO INDICATE THE PROPOSED DRAINED CATCHMENT AREAS FROM PHASE 2 OF THE ONE NORTH CATHEDRAL SITE.
2. IT IS BASED UPON THE ABOVE GROUND DRAINAGE DISCHARGING ROOF AND LANDSCAPED AREAS INTO THE MANHOLES INDICATED.



PROPOSED IMPERMEABLE AREAS		
MH REFERENCE	HATCH	AREA (Ha)
S1.00		0.018
S1.02		0.015
S1.03		0.005
S2.00		0.045
S3.00		0.009
S1.06		0.016
S4.00		0.023
S4.01		0.034
S5.00		0.011
TANK		0.027
	TOTAL	0.191

Rev:	Description:	Date:	By:	Chkd:
C01	GATEWAY SUBMISSION	31.07.25	HW	AI

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2nd Floor Tribeca House
21-27 Dale Street
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Project:

NO.1 CATHEDRAL SQUARE, MANCHESTER

Drawing Title:

PROPOSED DRAINED AREA PLAN

Status:

RIBA STAGE 4

Size:	Date:	Drawn by:	Designed by:	Checked by:
A0	JUN 25	HW	HW	AI

Scale:	Project No:
1:100	2307-10

Project – Originator – Volume – Level – Type – Role – Number: REN-REN-BB-ZZ-DR-C-00060

Revision: C01

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APPENDIX H

HYDRAULIC CALCULATIONS

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.358	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	100	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

- Indicates pipe length does not match coordinates
« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	6.026	0.075	80.3	0.018	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.001	4.613	0.030	153.8	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.002	4.640	0.046	100.9	0.015	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	6.442	0.064	100.0	0.005	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	11.849	0.616	19.2	0.043	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.004	5.210	0.052	100.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.000	8.686	0.087	100.0	0.009	5.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	100.00	5.09	24.180	0.018	0.0	0.0	0.0	1.12	19.8	4.9
S1.001	100.00	5.18	24.105	0.018	0.0	0.0	0.0	0.81	14.3	4.9
S1.002	100.00	5.24	24.000	0.033	0.0	0.0	0.0	1.30	51.8	8.9
S1.003	100.00	5.33	23.954	0.038	0.0	0.0	0.0	1.31	52.0	10.3
S2.000	100.00	5.09	24.580	0.043	0.0	0.0	0.0	2.31	40.8	11.6
S1.004	100.00	5.39	23.889	0.081	0.0	0.0	0.0	1.31	52.0	21.9
S3.000	100.00	5.14	24.000	0.009	0.0	0.0	0.0	1.00	17.8	2.4

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.005	5.827	0.058	100.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.006	13.323	0.133	100.0	0.016	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.000	13.475	0.090	150.0	0.023	5.00	0.0	0.600	o	150	Pipe/Conduit	
S4.001	2.376#	0.297	8.0	0.034	0.00	0.0	0.600	o	225	Pipe/Conduit	
S5.000	0.500#	0.010	50.0	0.011	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.007	1.331#	0.050	26.6	0.027	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.008	3.017	0.030	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.005	100.00	5.47	23.837	0.090	0.0	0.0	0.0	1.31	52.0	24.4
S1.006	100.00	5.64	23.779	0.106	0.0	0.0	0.0	1.31	52.0	28.7
S4.000	100.00	5.27	24.710	0.023	0.0	0.0	0.0	0.82	14.5	6.2
S4.001	100.00	5.28	24.545	0.057	0.0	0.0	0.0	4.66	185.1	15.4
S5.000	100.00	5.01	24.250	0.011	0.0	0.0	0.0	1.43	25.2	3.0
S1.007	100.00	5.65	23.645	0.201	0.0	0.0	0.0	2.55	101.3	54.4
S1.008	100.00	5.70	23.300	0.201	0.0	0.0	0.0	1.00	17.8«	54.4

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.018	0.018	0.018
1.001	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.015	0.015	0.015
1.003	-	-	100	0.005	0.005	0.005
2.000	-	-	100	0.043	0.043	0.043
1.004	-	-	100	0.000	0.000	0.000
3.000	-	-	100	0.009	0.009	0.009
1.005	-	-	100	0.000	0.000	0.000
1.006	-	-	100	0.016	0.016	0.016
4.000	-	-	100	0.023	0.023	0.023
4.001	-	-	100	0.034	0.034	0.034
5.000	-	-	100	0.011	0.011	0.011
1.007	-	-	100	0.027	0.027	0.027
1.008	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.201	0.201	0.201

Surcharged Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.008	S	25.260	23.270	0.000	0	0

Datum (m) 23.291 Offset (mins) 0

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
5	0.000	100	0.000	195	0.000	290	0.000	385	0.000	480	0.000
10	0.000	105	0.000	200	0.000	295	0.000	390	0.000	485	0.000
15	0.000	110	0.000	205	0.000	300	0.000	395	0.000	490	0.000
20	0.000	115	0.000	210	0.000	305	0.000	400	0.000	495	0.000
25	0.000	120	0.000	215	0.000	310	0.000	405	0.000	500	0.000
30	0.000	125	0.000	220	0.000	315	0.000	410	0.000	505	0.000
35	0.000	130	0.000	225	0.000	320	0.000	415	0.000	510	0.000
40	0.000	135	0.000	230	0.000	325	0.000	420	0.000	515	0.000
45	0.000	140	0.000	235	0.000	330	0.000	425	0.000	520	0.000
50	0.000	145	0.000	240	0.000	335	0.000	430	0.000	525	0.000
55	0.000	150	0.000	245	0.000	340	0.000	435	0.000	530	0.000
60	0.000	155	0.000	250	0.000	345	0.000	440	0.000	535	0.000
65	0.000	160	0.000	255	0.000	350	0.000	445	0.000	540	0.000
70	0.000	165	0.000	260	0.000	355	0.000	450	0.000	545	0.000
75	0.000	170	0.000	265	0.000	360	0.000	455	0.000	550	0.000
80	0.000	175	0.000	270	0.000	365	0.000	460	0.000	555	0.000
85	0.000	180	0.000	275	0.000	370	0.000	465	0.000	560	0.000
90	0.000	185	0.000	280	0.000	375	0.000	470	0.000	565	0.000
95	0.000	190	0.000	285	0.000	380	0.000	475	0.000	570	0.000

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Surcharged Outfall Details for Storm

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
575	0.000	825	0.000	1075	0.000	1325	0.000	1575	0.000	1825	0.000
580	0.000	830	0.000	1080	0.000	1330	0.000	1580	0.000	1830	0.000
585	0.000	835	0.000	1085	0.000	1335	0.000	1585	0.000	1835	0.000
590	0.000	840	0.000	1090	0.000	1340	0.000	1590	0.000	1840	0.000
595	0.000	845	0.000	1095	0.000	1345	0.000	1595	0.000	1845	0.000
600	0.000	850	0.000	1100	0.000	1350	0.000	1600	0.000	1850	0.000
605	0.000	855	0.000	1105	0.000	1355	0.000	1605	0.000	1855	0.000
610	0.000	860	0.000	1110	0.000	1360	0.000	1610	0.000	1860	0.000
615	0.000	865	0.000	1115	0.000	1365	0.000	1615	0.000	1865	0.000
620	0.000	870	0.000	1120	0.000	1370	0.000	1620	0.000	1870	0.000
625	0.000	875	0.000	1125	0.000	1375	0.000	1625	0.000	1875	0.000
630	0.000	880	0.000	1130	0.000	1380	0.000	1630	0.000	1880	0.000
635	0.000	885	0.000	1135	0.000	1385	0.000	1635	0.000	1885	0.000
640	0.000	890	0.000	1140	0.000	1390	0.000	1640	0.000	1890	0.000
645	0.000	895	0.000	1145	0.000	1395	0.000	1645	0.000	1895	0.000
650	0.000	900	0.000	1150	0.000	1400	0.000	1650	0.000	1900	0.000
655	0.000	905	0.000	1155	0.000	1405	0.000	1655	0.000	1905	0.000
660	0.000	910	0.000	1160	0.000	1410	0.000	1660	0.000	1910	0.000
665	0.000	915	0.000	1165	0.000	1415	0.000	1665	0.000	1915	0.000
670	0.000	920	0.000	1170	0.000	1420	0.000	1670	0.000	1920	0.000
675	0.000	925	0.000	1175	0.000	1425	0.000	1675	0.000	1925	0.000
680	0.000	930	0.000	1180	0.000	1430	0.000	1680	0.000	1930	0.000
685	0.000	935	0.000	1185	0.000	1435	0.000	1685	0.000	1935	0.000
690	0.000	940	0.000	1190	0.000	1440	0.000	1690	0.000	1940	0.000
695	0.000	945	0.000	1195	0.000	1445	0.000	1695	0.000	1945	0.000
700	0.000	950	0.000	1200	0.000	1450	0.000	1700	0.000	1950	0.000
705	0.000	955	0.000	1205	0.000	1455	0.000	1705	0.000	1955	0.000
710	0.000	960	0.000	1210	0.000	1460	0.000	1710	0.000	1960	0.000
715	0.000	965	0.000	1215	0.000	1465	0.000	1715	0.000	1965	0.000
720	0.000	970	0.000	1220	0.000	1470	0.000	1720	0.000	1970	0.000
725	0.000	975	0.000	1225	0.000	1475	0.000	1725	0.000	1975	0.000
730	0.000	980	0.000	1230	0.000	1480	0.000	1730	0.000	1980	0.000
735	0.000	985	0.000	1235	0.000	1485	0.000	1735	0.000	1985	0.000
740	0.000	990	0.000	1240	0.000	1490	0.000	1740	0.000	1990	0.000
745	0.000	995	0.000	1245	0.000	1495	0.000	1745	0.000	1995	0.000
750	0.000	1000	0.000	1250	0.000	1500	0.000	1750	0.000	2000	0.000
755	0.000	1005	0.000	1255	0.000	1505	0.000	1755	0.000	2005	0.000
760	0.000	1010	0.000	1260	0.000	1510	0.000	1760	0.000	2010	0.000
765	0.000	1015	0.000	1265	0.000	1515	0.000	1765	0.000	2015	0.000
770	0.000	1020	0.000	1270	0.000	1520	0.000	1770	0.000	2020	0.000
775	0.000	1025	0.000	1275	0.000	1525	0.000	1775	0.000	2025	0.000
780	0.000	1030	0.000	1280	0.000	1530	0.000	1780	0.000	2030	0.000
785	0.000	1035	0.000	1285	0.000	1535	0.000	1785	0.000	2035	0.000
790	0.000	1040	0.000	1290	0.000	1540	0.000	1790	0.000	2040	0.000
795	0.000	1045	0.000	1295	0.000	1545	0.000	1795	0.000	2045	0.000
800	0.000	1050	0.000	1300	0.000	1550	0.000	1800	0.000	2050	0.000
805	0.000	1055	0.000	1305	0.000	1555	0.000	1805	0.000	2055	0.000
810	0.000	1060	0.000	1310	0.000	1560	0.000	1810	0.000	2060	0.000
815	0.000	1065	0.000	1315	0.000	1565	0.000	1815	0.000	2065	0.000
820	0.000	1070	0.000	1320	0.000	1570	0.000	1820	0.000	2070	0.000

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Surcharged Outfall Details for Storm

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
2075	0.000	2325	0.000	2575	0.000	2825	0.000	3075	0.000	3325	0.000
2080	0.000	2330	0.000	2580	0.000	2830	0.000	3080	0.000	3330	0.000
2085	0.000	2335	0.000	2585	0.000	2835	0.000	3085	0.000	3335	0.000
2090	0.000	2340	0.000	2590	0.000	2840	0.000	3090	0.000	3340	0.000
2095	0.000	2345	0.000	2595	0.000	2845	0.000	3095	0.000	3345	0.000
2100	0.000	2350	0.000	2600	0.000	2850	0.000	3100	0.000	3350	0.000
2105	0.000	2355	0.000	2605	0.000	2855	0.000	3105	0.000	3355	0.000
2110	0.000	2360	0.000	2610	0.000	2860	0.000	3110	0.000	3360	0.000
2115	0.000	2365	0.000	2615	0.000	2865	0.000	3115	0.000	3365	0.000
2120	0.000	2370	0.000	2620	0.000	2870	0.000	3120	0.000	3370	0.000
2125	0.000	2375	0.000	2625	0.000	2875	0.000	3125	0.000	3375	0.000
2130	0.000	2380	0.000	2630	0.000	2880	0.000	3130	0.000	3380	0.000
2135	0.000	2385	0.000	2635	0.000	2885	0.000	3135	0.000	3385	0.000
2140	0.000	2390	0.000	2640	0.000	2890	0.000	3140	0.000	3390	0.000
2145	0.000	2395	0.000	2645	0.000	2895	0.000	3145	0.000	3395	0.000
2150	0.000	2400	0.000	2650	0.000	2900	0.000	3150	0.000	3400	0.000
2155	0.000	2405	0.000	2655	0.000	2905	0.000	3155	0.000	3405	0.000
2160	0.000	2410	0.000	2660	0.000	2910	0.000	3160	0.000	3410	0.000
2165	0.000	2415	0.000	2665	0.000	2915	0.000	3165	0.000	3415	0.000
2170	0.000	2420	0.000	2670	0.000	2920	0.000	3170	0.000	3420	0.000
2175	0.000	2425	0.000	2675	0.000	2925	0.000	3175	0.000	3425	0.000
2180	0.000	2430	0.000	2680	0.000	2930	0.000	3180	0.000	3430	0.000
2185	0.000	2435	0.000	2685	0.000	2935	0.000	3185	0.000	3435	0.000
2190	0.000	2440	0.000	2690	0.000	2940	0.000	3190	0.000	3440	0.000
2195	0.000	2445	0.000	2695	0.000	2945	0.000	3195	0.000	3445	0.000
2200	0.000	2450	0.000	2700	0.000	2950	0.000	3200	0.000	3450	0.000
2205	0.000	2455	0.000	2705	0.000	2955	0.000	3205	0.000	3455	0.000
2210	0.000	2460	0.000	2710	0.000	2960	0.000	3210	0.000	3460	0.000
2215	0.000	2465	0.000	2715	0.000	2965	0.000	3215	0.000	3465	0.000
2220	0.000	2470	0.000	2720	0.000	2970	0.000	3220	0.000	3470	0.000
2225	0.000	2475	0.000	2725	0.000	2975	0.000	3225	0.000	3475	0.000
2230	0.000	2480	0.000	2730	0.000	2980	0.000	3230	0.000	3480	0.000
2235	0.000	2485	0.000	2735	0.000	2985	0.000	3235	0.000	3485	0.000
2240	0.000	2490	0.000	2740	0.000	2990	0.000	3240	0.000	3490	0.000
2245	0.000	2495	0.000	2745	0.000	2995	0.000	3245	0.000	3495	0.000
2250	0.000	2500	0.000	2750	0.000	3000	0.000	3250	0.000	3500	0.000
2255	0.000	2505	0.000	2755	0.000	3005	0.000	3255	0.000	3505	0.000
2260	0.000	2510	0.000	2760	0.000	3010	0.000	3260	0.000	3510	0.000
2265	0.000	2515	0.000	2765	0.000	3015	0.000	3265	0.000	3515	0.000
2270	0.000	2520	0.000	2770	0.000	3020	0.000	3270	0.000	3520	0.000
2275	0.000	2525	0.000	2775	0.000	3025	0.000	3275	0.000	3525	0.000
2280	0.000	2530	0.000	2780	0.000	3030	0.000	3280	0.000	3530	0.000
2285	0.000	2535	0.000	2785	0.000	3035	0.000	3285	0.000	3535	0.000
2290	0.000	2540	0.000	2790	0.000	3040	0.000	3290	0.000	3540	0.000
2295	0.000	2545	0.000	2795	0.000	3045	0.000	3295	0.000	3545	0.000
2300	0.000	2550	0.000	2800	0.000	3050	0.000	3300	0.000	3550	0.000
2305	0.000	2555	0.000	2805	0.000	3055	0.000	3305	0.000	3555	0.000
2310	0.000	2560	0.000	2810	0.000	3060	0.000	3310	0.000	3560	0.000
2315	0.000	2565	0.000	2815	0.000	3065	0.000	3315	0.000	3565	0.000
2320	0.000	2570	0.000	2820	0.000	3070	0.000	3320	0.000	3570	0.000

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Surcharged Outfall Details for Storm

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
3575	0.000	3795	0.000	4015	0.000	4235	0.000	4455	0.000	4675	0.000
3580	0.000	3800	0.000	4020	0.000	4240	0.000	4460	0.000	4680	0.000
3585	0.000	3805	0.000	4025	0.000	4245	0.000	4465	0.000	4685	0.000
3590	0.000	3810	0.000	4030	0.000	4250	0.000	4470	0.000	4690	0.000
3595	0.000	3815	0.000	4035	0.000	4255	0.000	4475	0.000	4695	0.000
3600	0.000	3820	0.000	4040	0.000	4260	0.000	4480	0.000	4700	0.000
3605	0.000	3825	0.000	4045	0.000	4265	0.000	4485	0.000	4705	0.000
3610	0.000	3830	0.000	4050	0.000	4270	0.000	4490	0.000	4710	0.000
3615	0.000	3835	0.000	4055	0.000	4275	0.000	4495	0.000	4715	0.000
3620	0.000	3840	0.000	4060	0.000	4280	0.000	4500	0.000	4720	0.000
3625	0.000	3845	0.000	4065	0.000	4285	0.000	4505	0.000	4725	0.000
3630	0.000	3850	0.000	4070	0.000	4290	0.000	4510	0.000	4730	0.000
3635	0.000	3855	0.000	4075	0.000	4295	0.000	4515	0.000	4735	0.000
3640	0.000	3860	0.000	4080	0.000	4300	0.000	4520	0.000	4740	0.000
3645	0.000	3865	0.000	4085	0.000	4305	0.000	4525	0.000	4745	0.000
3650	0.000	3870	0.000	4090	0.000	4310	0.000	4530	0.000	4750	0.000
3655	0.000	3875	0.000	4095	0.000	4315	0.000	4535	0.000	4755	0.000
3660	0.000	3880	0.000	4100	0.000	4320	0.000	4540	0.000	4760	0.000
3665	0.000	3885	0.000	4105	0.000	4325	0.000	4545	0.000	4765	0.000
3670	0.000	3890	0.000	4110	0.000	4330	0.000	4550	0.000	4770	0.000
3675	0.000	3895	0.000	4115	0.000	4335	0.000	4555	0.000	4775	0.000
3680	0.000	3900	0.000	4120	0.000	4340	0.000	4560	0.000	4780	0.000
3685	0.000	3905	0.000	4125	0.000	4345	0.000	4565	0.000	4785	0.000
3690	0.000	3910	0.000	4130	0.000	4350	0.000	4570	0.000	4790	0.000
3695	0.000	3915	0.000	4135	0.000	4355	0.000	4575	0.000	4795	0.000
3700	0.000	3920	0.000	4140	0.000	4360	0.000	4580	0.000	4800	0.000
3705	0.000	3925	0.000	4145	0.000	4365	0.000	4585	0.000	4805	0.000
3710	0.000	3930	0.000	4150	0.000	4370	0.000	4590	0.000	4810	0.000
3715	0.000	3935	0.000	4155	0.000	4375	0.000	4595	0.000	4815	0.000
3720	0.000	3940	0.000	4160	0.000	4380	0.000	4600	0.000	4820	0.000
3725	0.000	3945	0.000	4165	0.000	4385	0.000	4605	0.000	4825	0.000
3730	0.000	3950	0.000	4170	0.000	4390	0.000	4610	0.000	4830	0.000
3735	0.000	3955	0.000	4175	0.000	4395	0.000	4615	0.000	4835	0.000
3740	0.000	3960	0.000	4180	0.000	4400	0.000	4620	0.000	4840	0.000
3745	0.000	3965	0.000	4185	0.000	4405	0.000	4625	0.000	4845	0.000
3750	0.000	3970	0.000	4190	0.000	4410	0.000	4630	0.000	4850	0.000
3755	0.000	3975	0.000	4195	0.000	4415	0.000	4635	0.000	4855	0.000
3760	0.000	3980	0.000	4200	0.000	4420	0.000	4640	0.000	4860	0.000
3765	0.000	3985	0.000	4205	0.000	4425	0.000	4645	0.000	4865	0.000
3770	0.000	3990	0.000	4210	0.000	4430	0.000	4650	0.000	4870	0.000
3775	0.000	3995	0.000	4215	0.000	4435	0.000	4655	0.000	4875	0.000
3780	0.000	4000	0.000	4220	0.000	4440	0.000	4660	0.000	4880	0.000
3785	0.000	4005	0.000	4225	0.000	4445	0.000	4665	0.000		
3790	0.000	4010	0.000	4230	0.000	4450	0.000	4670	0.000		

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Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.358		

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Online Controls for Storm

Depth/Flow Relationship Manhole: S1.01 Perm Paving Flow Control, DS/PN: S1.001, Volume (m³): 0.3

Invert Level (m) 24.105

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.0000	1.200	1.5000	3.000	2.2000	7.000	3.4000
0.200	1.0000	1.400	1.6000	3.500	2.4000	7.500	3.5000
0.300	0.9000	1.600	1.7000	4.000	2.6000	8.000	3.6000
0.400	0.9000	1.800	1.8000	4.500	2.7000	8.500	3.7000
0.500	1.0000	2.000	1.9000	5.000	2.8000	9.000	3.8000
0.600	1.1000	2.200	1.9000	5.500	3.0000	9.500	3.9000
0.800	1.2000	2.400	2.0000	6.000	3.1000		
1.000	1.4000	2.600	2.1000	6.500	3.2000		

Depth/Flow Relationship Manhole: S1.08, DS/PN: S1.008, Volume (m³): 2.1

Invert Level (m) 23.300

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.6000	1.200	2.1000	3.000	3.2000	7.000	4.7000
0.200	1.8000	1.400	2.2000	3.500	3.4000	7.500	4.9000
0.300	1.8000	1.600	2.4000	4.000	3.6000	8.000	5.0000
0.400	1.8000	1.800	2.5000	4.500	3.8000	8.500	5.1000
0.500	1.7000	2.000	2.6000	5.000	4.0000	9.000	5.3000
0.600	1.5000	2.200	2.7000	5.500	4.2000	9.500	5.4000
0.800	1.7000	2.400	2.9000	6.000	4.4000		
1.000	1.9000	2.600	3.0000	6.500	4.5000		

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Storage Structures for Storm

Porous Car Park Manhole: S1.00, DS/PN: S1.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	18.6
Max Percolation (l/s)	51.7	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	24.700	Cap Volume Depth (m)	0.300

Cellular Storage Manhole: S1.07 Tank, DS/PN: S1.007

Invert Level (m)	23.350	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	115.0	0.0	1.201	0.0	0.0
1.200	115.0	0.0			

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 2
Number of Online Controls 2 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.360
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 400.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 2, 30, 100
Climate Change (%) 0, 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)
S1.000	S1.00	60 minute 1 year Winter I+0%	25.160	24.215
S1.001	S1.01 Perm Paving Flow Control	60 minute 1 year Winter I+0%	25.210	24.211
S1.002	S1.02	30 minute 1 year Winter I+0%	25.260	24.037
S1.003	S1.03	30 minute 1 year Winter I+0%	25.260	23.990
S2.000	S2.00	15 minute 1 year Winter I+0%	25.260	24.617
S1.004	S1.04	15 minute 1 year Winter I+0%	25.260	23.962
S3.000	S3.00	15 minute 1 year Winter I+0%	25.100	24.026
S1.005	S1.05	15 minute 1 year Winter I+0%	25.260	23.912
S1.006	S1.06	15 minute 1 year Winter I+0%	25.260	23.850
S4.000	S4.00	15 minute 1 year Winter I+0%	25.260	24.757
S4.001	S4.01	15 minute 1 year Winter I+0%	25.260	24.588
S5.000	S5.00	15 minute 1 year Winter I+0%	25.150	24.285
S1.007	S1.07 Tank	1440 minute 1 year Winter I+0%	25.260	23.672
S1.008	S1.08	1440 minute 1 year Winter I+0%	25.150	23.363

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)
S1.000	S1.00	-0.115	0.000	0.07		0.005
S1.001	S1.01 Perm Paving Flow Control	-0.044	0.000	0.09		0.056
S1.002	S1.02	-0.188	0.000	0.06		0.010
S1.003	S1.03	-0.189	0.000	0.06		0.024
S2.000	S2.00	-0.113	0.000	0.14		0.005
S1.004	S1.04	-0.152	0.000	0.22		0.110
S3.000	S3.00	-0.124	0.000	0.07		0.006
S1.005	S1.05	-0.149	0.000	0.24		0.114
S1.006	S1.06	-0.154	0.000	0.22		0.059
S4.000	S4.00	-0.103	0.000	0.21		0.007
S4.001	S4.01	-0.182	0.000	0.08		0.012
S5.000	S5.00	-0.115	0.000	0.12		0.005
S1.007	S1.07 Tank	-0.199	0.000	0.03		35.457
S1.008	S1.08	-0.087	0.000	0.09		0.066

PN	US/MH Name	Discharge Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S1.000	S1.00	0.790	0.5	1.1	OK
S1.001	S1.01 Perm Paving Flow Control	0.790	0.5	0.9	OK
S1.002	S1.02	1.524	0.5	1.8	OK
S1.003	S1.03	1.895	0.5	2.1	OK
S2.000	S2.00	2.423	1.5	5.2	OK
S1.004	S1.04	3.634	0.7	7.2	OK*
S3.000	S3.00	0.507	0.5	1.1	OK
S1.005	S1.05	4.142	0.7	8.3	OK*
S1.006	S1.06	5.043	0.9	9.9	OK
S4.000	S4.00	1.296	0.6	2.7	OK
S4.001	S4.01	3.211	1.2	6.2	OK
S5.000	S5.00	0.620	0.4	1.3	OK
S1.007	S1.07 Tank	18.967	0.4	1.0	OK*
S1.008	S1.08	18.970	0.5	1.0	OK

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 2
Number of Online Controls 2 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.360
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 400.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 2, 30, 100
Climate Change (%) 0, 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)
S1.000	S1.00	30 minute 2 year Winter I+0%	25.160	24.363
S1.001	S1.01 Perm Paving Flow Control	30 minute 2 year Winter I+0%	25.210	24.361
S1.002	S1.02	30 minute 2 year Winter I+0%	25.260	24.045
S1.003	S1.03	30 minute 2 year Winter I+0%	25.260	23.999
S2.000	S2.00	15 minute 2 year Winter I+0%	25.260	24.623
S1.004	S1.04	15 minute 2 year Winter I+0%	25.260	23.972
S3.000	S3.00	15 minute 2 year Winter I+0%	25.100	24.030
S1.005	S1.05	15 minute 2 year Winter I+0%	25.260	23.924
S1.006	S1.06	15 minute 2 year Winter I+0%	25.260	23.860
S4.000	S4.00	15 minute 2 year Winter I+0%	25.260	24.763
S4.001	S4.01	15 minute 2 year Winter I+0%	25.260	24.594
S5.000	S5.00	15 minute 2 year Winter I+0%	25.150	24.290
S1.007	S1.07 Tank	720 minute 2 year Winter I+0%	25.260	23.679
S1.008	S1.08	720 minute 2 year Winter I+0%	25.150	23.449

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)
S1.000	S1.00	0.033	0.000	0.11		0.028
S1.001	S1.01 Perm Paving Flow Control	0.106	0.000	0.09		0.138
S1.002	S1.02	-0.180	0.000	0.09		0.012
S1.003	S1.03	-0.180	0.000	0.09		0.031
S2.000	S2.00	-0.107	0.000	0.18		0.006
S1.004	S1.04	-0.142	0.000	0.29		0.127
S3.000	S3.00	-0.120	0.000	0.09		0.007
S1.005	S1.05	-0.138	0.000	0.32		0.133
S1.006	S1.06	-0.143	0.000	0.29		0.068
S4.000	S4.00	-0.097	0.000	0.27		0.008
S4.001	S4.01	-0.176	0.000	0.10		0.014
S5.000	S5.00	-0.110	0.000	0.16		0.006
S1.007	S1.07 Tank	-0.192	0.000	0.05		36.271
S1.008	S1.08	-0.001	0.000	0.15		0.162

PN	US/MH Name	Discharge Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S1.000	S1.00	0.798	0.4	1.8	SURCHARGED
S1.001	S1.01 Perm Paving Flow Control	0.798	0.5	1.0	SURCHARGED
S1.002	S1.02	2.238	0.5	2.6	OK
S1.003	S1.03	2.718	0.6	3.1	OK
S2.000	S2.00	3.135	1.6	6.7	OK
S1.004	S1.04	4.977	0.7	9.3	OK*
S3.000	S3.00	0.656	0.6	1.4	OK
S1.005	S1.05	5.634	0.8	10.8	OK*
S1.006	S1.06	6.801	1.0	12.9	OK
S4.000	S4.00	1.677	0.6	3.5	OK
S4.001	S4.01	4.156	1.3	8.0	OK
S5.000	S5.00	0.802	0.5	1.7	OK
S1.007	S1.07 Tank	17.918	0.5	1.7	OK*
S1.008	S1.08	17.918	0.6	1.7	OK

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 2
Number of Online Controls 2 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.360
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 400.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 2, 30, 100
Climate Change (%) 0, 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)
S1.000	S1.00	60 minute 30 year Winter I+0%	25.160	24.717
S1.001	S1.01 Perm Paving Flow Control	60 minute 30 year Winter I+0%	25.210	24.919
S1.002	S1.02	15 minute 30 year Summer I+0%	25.260	24.066
S1.003	S1.03	15 minute 30 year Winter I+0%	25.260	24.031
S2.000	S2.00	15 minute 30 year Winter I+0%	25.260	24.641
S1.004	S1.04	15 minute 30 year Winter I+0%	25.260	24.018
S3.000	S3.00	15 minute 30 year Winter I+0%	25.100	24.042
S1.005	S1.05	15 minute 30 year Winter I+0%	25.260	23.970
S1.006	S1.06	15 minute 30 year Winter I+0%	25.260	23.904
S4.000	S4.00	15 minute 30 year Winter I+0%	25.260	24.787
S4.001	S4.01	15 minute 30 year Winter I+0%	25.260	24.618
S5.000	S5.00	15 minute 30 year Winter I+0%	25.150	24.306
S1.007	S1.07 Tank	600 minute 30 year Winter I+0%	25.260	23.891
S1.008	S1.08	600 minute 30 year Winter I+0%	25.150	23.906

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)
S1.000	S1.00	0.387	0.000	0.10		1.050
S1.001	S1.01 Perm Paving Flow Control	0.664	0.000	0.10		0.227
S1.002	S1.02	-0.159	0.000	0.17		0.019
S1.003	S1.03	-0.148	0.000	0.19		0.056
S2.000	S2.00	-0.089	0.000	0.34		0.009
S1.004	S1.04	-0.096	0.000	0.61		0.222
S3.000	S3.00	-0.108	0.000	0.17		0.010
S1.005	S1.05	-0.092	0.000	0.66		0.244
S1.006	S1.06	-0.099	0.000	0.59		0.118
S4.000	S4.00	-0.073	0.000	0.51		0.011
S4.001	S4.01	-0.152	0.000	0.23		0.021
S5.000	S5.00	-0.094	0.000	0.30		0.008
S1.007	S1.07 Tank	0.021	0.000	0.10		60.064
S1.008	S1.08	0.456	0.000	0.17		0.709

PN	US/MH Name	Discharge Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S1.000	S1.00	3.252	0.6	1.6	SURCHARGED
S1.001	S1.01 Perm Paving Flow Control	3.252	0.5	1.1	FLOOD RISK
S1.002	S1.02	3.132	0.6	5.1	OK
S1.003	S1.03	4.308	0.6	6.8	OK
S2.000	S2.00	5.926	1.9	12.7	OK
S1.004	S1.04	10.236	0.8	19.5	OK*
S3.000	S3.00	1.240	0.7	2.7	OK
S1.005	S1.05	11.477	0.9	22.3	OK*
S1.006	S1.06	13.683	1.2	26.7	OK
S4.000	S4.00	3.170	0.8	6.7	OK
S4.001	S4.01	7.855	1.6	17.4	OK
S5.000	S5.00	1.516	0.5	3.2	OK
S1.007	S1.07 Tank	54.108	0.5	3.1	SURCHARGED*
S1.008	S1.08	54.107	0.6	1.8	SURCHARGED

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 2
Number of Online Controls 2 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.360
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 400.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 2, 30, 100
Climate Change (%) 0, 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)
S1.000	S1.00	60 minute 100 year Winter I+40%	25.160	24.766
S1.001	S1.01 Perm Paving Flow Control	60 minute 100 year Winter I+40%	25.210	24.983
S1.002	S1.02	720 minute 100 year Winter I+40%	25.260	24.377
S1.003	S1.03	720 minute 100 year Winter I+40%	25.260	24.377
S2.000	S2.00	15 minute 100 year Winter I+40%	25.260	24.666
S1.004	S1.04	15 minute 100 year Summer I+40%	25.260	24.115
S3.000	S3.00	720 minute 100 year Winter I+40%	25.100	24.377
S1.005	S1.05	15 minute 100 year Summer I+40%	25.260	24.063
S1.006	S1.06	720 minute 100 year Winter I+40%	25.260	24.376
S4.000	S4.00	15 minute 100 year Winter I+40%	25.260	24.824
S4.001	S4.01	15 minute 100 year Winter I+40%	25.260	24.646
S5.000	S5.00	720 minute 100 year Winter I+40%	25.150	24.374
S1.007	S1.07 Tank	720 minute 100 year Winter I+40%	25.260	24.374
S1.008	S1.08	720 minute 100 year Winter I+40%	25.150	24.386

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)
S1.000	S1.00	0.436	0.000	0.10		3.754
S1.001	S1.01 Perm Paving Flow Control	0.728	0.000	0.10		0.237
S1.002	S1.02	0.152	0.000	0.05		0.178
S1.003	S1.03	0.198	0.000	0.05		0.279
S2.000	S2.00	-0.064	0.000	0.62		0.013
S1.004	S1.04	0.001	0.000	0.96		0.522
S3.000	S3.00	0.227	0.000	0.03		0.105
S1.005	S1.05	0.001	0.000	1.01		0.521
S1.006	S1.06	0.372	0.000	0.10		0.387
S4.000	S4.00	-0.036	0.000	0.91		0.017
S4.001	S4.01	-0.124	0.000	0.41		0.030
S5.000	S5.00	-0.026	0.000	0.05		0.019
S1.007	S1.07 Tank	0.504	0.000	0.10		113.420
S1.008	S1.08	0.936	0.000	0.18		1.252

PN	US/MH Name	Discharge Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S1.000	S1.00	6.652	0.5	1.7	FLOOD RISK
S1.001	S1.01 Perm Paving Flow Control	6.511	0.5	1.1	FLOOD RISK
S1.002	S1.02	26.207	0.4	1.6	SURCHARGED
S1.003	S1.03	30.318	0.5	1.8	SURCHARGED
S2.000	S2.00	10.712	2.2	22.9	OK
S1.004	S1.04	17.088	0.9	30.9	SURCHARGED*
S3.000	S3.00	7.401	0.4	0.4	SURCHARGED
S1.005	S1.05	19.086	1.0	34.4	SURCHARGED*
S1.006	S1.06	86.237	0.7	4.7	SURCHARGED
S4.000	S4.00	5.729	0.9	12.1	OK
S4.001	S4.01	14.198	1.8	31.4	OK
S5.000	S5.00	9.046	0.3	0.5	OK
S1.007	S1.07 Tank	123.824	0.5	3.2	SURCHARGED*
S1.008	S1.08	123.341	0.7	2.0	SURCHARGED

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.358	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	100	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.167	4-8	0.034

Total Area Contributing (ha) = 0.201

Total Pipe Volume (m³) = 2.408

Network Design Table for Storm

- Indicates pipe length does not match coordinates
« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	6.026	0.075	80.3	0.018	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.001	4.613	0.030	153.8	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.002	4.640	0.046	100.9	0.015	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	6.442	0.064	100.0	0.005	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	100.00	5.09	24.180	0.018	0.0	0.0	0.0	1.12	19.8	4.9
S1.001	100.00	5.18	24.105	0.018	0.0	0.0	0.0	0.81	14.3	4.9
S1.002	100.00	5.24	24.000	0.033	0.0	0.0	0.0	1.30	51.8	8.9
S1.003	100.00	5.33	23.954	0.038	0.0	0.0	0.0	1.31	52.0	10.3

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S2.000	11.849	0.616	19.2	0.043	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.004	5.210	0.052	100.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.000	8.686	0.087	100.0	0.009	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.005	5.827	0.058	100.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.006	13.323	0.133	100.0	0.016	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.000	13.475	0.090	150.0	0.023	5.00	0.0	0.600	o	150	Pipe/Conduit	
S4.001	2.376#	0.297	8.0	0.034	0.00	0.0	0.600	o	225	Pipe/Conduit	
S5.000	0.500#	0.010	50.0	0.011	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.007	1.331#	0.050	26.6	0.027	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.008	3.017	0.030	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S2.000	100.00	5.09	24.580	0.043	0.0	0.0	0.0	2.31	40.8	11.6
S1.004	100.00	5.39	23.889	0.081	0.0	0.0	0.0	1.31	52.0	21.9
S3.000	100.00	5.14	24.000	0.009	0.0	0.0	0.0	1.00	17.8	2.4
S1.005	100.00	5.47	23.837	0.090	0.0	0.0	0.0	1.31	52.0	24.4
S1.006	100.00	5.64	23.779	0.106	0.0	0.0	0.0	1.31	52.0	28.7
S4.000	100.00	5.27	24.710	0.023	0.0	0.0	0.0	0.82	14.5	6.2
S4.001	100.00	5.28	24.545	0.057	0.0	0.0	0.0	4.66	185.1	15.4
S5.000	100.00	5.01	24.250	0.011	0.0	0.0	0.0	1.43	25.2	3.0
S1.007	100.00	5.65	23.645	0.201	0.0	0.0	0.0	2.55	101.3	54.4
S1.008	100.00	5.70	23.300	0.201	0.0	0.0	0.0	1.00	17.8«	54.4

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.018	0.018	0.018
1.001	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.015	0.015	0.015
1.003	-	-	100	0.005	0.005	0.005
2.000	-	-	100	0.043	0.043	0.043
1.004	-	-	100	0.000	0.000	0.000
3.000	-	-	100	0.009	0.009	0.009
1.005	-	-	100	0.000	0.000	0.000
1.006	-	-	100	0.016	0.016	0.016
4.000	-	-	100	0.023	0.023	0.023
4.001	-	-	100	0.034	0.034	0.034
5.000	-	-	100	0.011	0.011	0.011
1.007	-	-	100	0.027	0.027	0.027
1.008	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.201	0.201	0.201

Surcharged Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.008	S	25.260	23.270	0.000	0	0

Datum (m) 23.291 Offset (mins) 0

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
5	1.577	100	1.577	195	1.577	290	1.577	385	1.577	480	1.577
10	1.577	105	1.577	200	1.577	295	1.577	390	1.577	485	1.577
15	1.577	110	1.577	205	1.577	300	1.577	395	1.577	490	1.577
20	1.577	115	1.577	210	1.577	305	1.577	400	1.577	495	1.577
25	1.577	120	1.577	215	1.577	310	1.577	405	1.577	500	1.577
30	1.577	125	1.577	220	1.577	315	1.577	410	1.577	505	1.577
35	1.577	130	1.577	225	1.577	320	1.577	415	1.577	510	1.577
40	1.577	135	1.577	230	1.577	325	1.577	420	1.577	515	1.577
45	1.577	140	1.577	235	1.577	330	1.577	425	1.577	520	1.577
50	1.577	145	1.577	240	1.577	335	1.577	430	1.577	525	1.577
55	1.577	150	1.577	245	1.577	340	1.577	435	1.577	530	1.577
60	1.577	155	1.577	250	1.577	345	1.577	440	1.577	535	1.577
65	1.577	160	1.577	255	1.577	350	1.577	445	1.577	540	1.577
70	1.577	165	1.577	260	1.577	355	1.577	450	1.577	545	1.577
75	1.577	170	1.577	265	1.577	360	1.577	455	1.577	550	1.577
80	1.577	175	1.577	270	1.577	365	1.577	460	1.577	555	1.577
85	1.577	180	1.577	275	1.577	370	1.577	465	1.577	560	1.577
90	1.577	185	1.577	280	1.577	375	1.577	470	1.577	565	1.577
95	1.577	190	1.577	285	1.577	380	1.577	475	1.577	570	1.577

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Surcharged Outfall Details for Storm

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
575	1.577	825	1.577	1075	1.577	1325	1.577	1575	1.577	1825	1.577
580	1.577	830	1.577	1080	1.577	1330	1.577	1580	1.577	1830	1.577
585	1.577	835	1.577	1085	1.577	1335	1.577	1585	1.577	1835	1.577
590	1.577	840	1.577	1090	1.577	1340	1.577	1590	1.577	1840	1.577
595	1.577	845	1.577	1095	1.577	1345	1.577	1595	1.577	1845	1.577
600	1.577	850	1.577	1100	1.577	1350	1.577	1600	1.577	1850	1.577
605	1.577	855	1.577	1105	1.577	1355	1.577	1605	1.577	1855	1.577
610	1.577	860	1.577	1110	1.577	1360	1.577	1610	1.577	1860	1.577
615	1.577	865	1.577	1115	1.577	1365	1.577	1615	1.577	1865	1.577
620	1.577	870	1.577	1120	1.577	1370	1.577	1620	1.577	1870	1.577
625	1.577	875	1.577	1125	1.577	1375	1.577	1625	1.577	1875	1.577
630	1.577	880	1.577	1130	1.577	1380	1.577	1630	1.577	1880	1.577
635	1.577	885	1.577	1135	1.577	1385	1.577	1635	1.577	1885	1.577
640	1.577	890	1.577	1140	1.577	1390	1.577	1640	1.577	1890	1.577
645	1.577	895	1.577	1145	1.577	1395	1.577	1645	1.577	1895	1.577
650	1.577	900	1.577	1150	1.577	1400	1.577	1650	1.577	1900	1.577
655	1.577	905	1.577	1155	1.577	1405	1.577	1655	1.577	1905	1.577
660	1.577	910	1.577	1160	1.577	1410	1.577	1660	1.577	1910	1.577
665	1.577	915	1.577	1165	1.577	1415	1.577	1665	1.577	1915	1.577
670	1.577	920	1.577	1170	1.577	1420	1.577	1670	1.577	1920	1.577
675	1.577	925	1.577	1175	1.577	1425	1.577	1675	1.577	1925	1.577
680	1.577	930	1.577	1180	1.577	1430	1.577	1680	1.577	1930	1.577
685	1.577	935	1.577	1185	1.577	1435	1.577	1685	1.577	1935	1.577
690	1.577	940	1.577	1190	1.577	1440	1.577	1690	1.577	1940	1.577
695	1.577	945	1.577	1195	1.577	1445	1.577	1695	1.577	1945	1.577
700	1.577	950	1.577	1200	1.577	1450	1.577	1700	1.577	1950	1.577
705	1.577	955	1.577	1205	1.577	1455	1.577	1705	1.577	1955	1.577
710	1.577	960	1.577	1210	1.577	1460	1.577	1710	1.577	1960	1.577
715	1.577	965	1.577	1215	1.577	1465	1.577	1715	1.577	1965	1.577
720	1.577	970	1.577	1220	1.577	1470	1.577	1720	1.577	1970	1.577
725	1.577	975	1.577	1225	1.577	1475	1.577	1725	1.577	1975	1.577
730	1.577	980	1.577	1230	1.577	1480	1.577	1730	1.577	1980	1.577
735	1.577	985	1.577	1235	1.577	1485	1.577	1735	1.577	1985	1.577
740	1.577	990	1.577	1240	1.577	1490	1.577	1740	1.577	1990	1.577
745	1.577	995	1.577	1245	1.577	1495	1.577	1745	1.577	1995	1.577
750	1.577	1000	1.577	1250	1.577	1500	1.577	1750	1.577	2000	1.577
755	1.577	1005	1.577	1255	1.577	1505	1.577	1755	1.577	2005	1.577
760	1.577	1010	1.577	1260	1.577	1510	1.577	1760	1.577	2010	1.577
765	1.577	1015	1.577	1265	1.577	1515	1.577	1765	1.577	2015	1.577
770	1.577	1020	1.577	1270	1.577	1520	1.577	1770	1.577	2020	1.577
775	1.577	1025	1.577	1275	1.577	1525	1.577	1775	1.577	2025	1.577
780	1.577	1030	1.577	1280	1.577	1530	1.577	1780	1.577	2030	1.577
785	1.577	1035	1.577	1285	1.577	1535	1.577	1785	1.577	2035	1.577
790	1.577	1040	1.577	1290	1.577	1540	1.577	1790	1.577	2040	1.577
795	1.577	1045	1.577	1295	1.577	1545	1.577	1795	1.577	2045	1.577
800	1.577	1050	1.577	1300	1.577	1550	1.577	1800	1.577	2050	1.577
805	1.577	1055	1.577	1305	1.577	1555	1.577	1805	1.577	2055	1.577
810	1.577	1060	1.577	1310	1.577	1560	1.577	1810	1.577	2060	1.577
815	1.577	1065	1.577	1315	1.577	1565	1.577	1815	1.577	2065	1.577
820	1.577	1070	1.577	1320	1.577	1570	1.577	1820	1.577	2070	1.577

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Surcharged Outfall Details for Storm

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
2075	1.577	2325	1.577	2575	1.577	2825	1.577	3075	1.577	3325	1.577
2080	1.577	2330	1.577	2580	1.577	2830	1.577	3080	1.577	3330	1.577
2085	1.577	2335	1.577	2585	1.577	2835	1.577	3085	1.577	3335	1.577
2090	1.577	2340	1.577	2590	1.577	2840	1.577	3090	1.577	3340	1.577
2095	1.577	2345	1.577	2595	1.577	2845	1.577	3095	1.577	3345	1.577
2100	1.577	2350	1.577	2600	1.577	2850	1.577	3100	1.577	3350	1.577
2105	1.577	2355	1.577	2605	1.577	2855	1.577	3105	1.577	3355	1.577
2110	1.577	2360	1.577	2610	1.577	2860	1.577	3110	1.577	3360	1.577
2115	1.577	2365	1.577	2615	1.577	2865	1.577	3115	1.577	3365	1.577
2120	1.577	2370	1.577	2620	1.577	2870	1.577	3120	1.577	3370	1.577
2125	1.577	2375	1.577	2625	1.577	2875	1.577	3125	1.577	3375	1.577
2130	1.577	2380	1.577	2630	1.577	2880	1.577	3130	1.577	3380	1.577
2135	1.577	2385	1.577	2635	1.577	2885	1.577	3135	1.577	3385	1.577
2140	1.577	2390	1.577	2640	1.577	2890	1.577	3140	1.577	3390	1.577
2145	1.577	2395	1.577	2645	1.577	2895	1.577	3145	1.577	3395	1.577
2150	1.577	2400	1.577	2650	1.577	2900	1.577	3150	1.577	3400	1.577
2155	1.577	2405	1.577	2655	1.577	2905	1.577	3155	1.577	3405	1.577
2160	1.577	2410	1.577	2660	1.577	2910	1.577	3160	1.577	3410	1.577
2165	1.577	2415	1.577	2665	1.577	2915	1.577	3165	1.577	3415	1.577
2170	1.577	2420	1.577	2670	1.577	2920	1.577	3170	1.577	3420	1.577
2175	1.577	2425	1.577	2675	1.577	2925	1.577	3175	1.577	3425	1.577
2180	1.577	2430	1.577	2680	1.577	2930	1.577	3180	1.577	3430	1.577
2185	1.577	2435	1.577	2685	1.577	2935	1.577	3185	1.577	3435	1.577
2190	1.577	2440	1.577	2690	1.577	2940	1.577	3190	1.577	3440	1.577
2195	1.577	2445	1.577	2695	1.577	2945	1.577	3195	1.577	3445	1.577
2200	1.577	2450	1.577	2700	1.577	2950	1.577	3200	1.577	3450	1.577
2205	1.577	2455	1.577	2705	1.577	2955	1.577	3205	1.577	3455	1.577
2210	1.577	2460	1.577	2710	1.577	2960	1.577	3210	1.577	3460	1.577
2215	1.577	2465	1.577	2715	1.577	2965	1.577	3215	1.577	3465	1.577
2220	1.577	2470	1.577	2720	1.577	2970	1.577	3220	1.577	3470	1.577
2225	1.577	2475	1.577	2725	1.577	2975	1.577	3225	1.577	3475	1.577
2230	1.577	2480	1.577	2730	1.577	2980	1.577	3230	1.577	3480	1.577
2235	1.577	2485	1.577	2735	1.577	2985	1.577	3235	1.577	3485	1.577
2240	1.577	2490	1.577	2740	1.577	2990	1.577	3240	1.577	3490	1.577
2245	1.577	2495	1.577	2745	1.577	2995	1.577	3245	1.577	3495	1.577
2250	1.577	2500	1.577	2750	1.577	3000	1.577	3250	1.577	3500	1.577
2255	1.577	2505	1.577	2755	1.577	3005	1.577	3255	1.577	3505	1.577
2260	1.577	2510	1.577	2760	1.577	3010	1.577	3260	1.577	3510	1.577
2265	1.577	2515	1.577	2765	1.577	3015	1.577	3265	1.577	3515	1.577
2270	1.577	2520	1.577	2770	1.577	3020	1.577	3270	1.577	3520	1.577
2275	1.577	2525	1.577	2775	1.577	3025	1.577	3275	1.577	3525	1.577
2280	1.577	2530	1.577	2780	1.577	3030	1.577	3280	1.577	3530	1.577
2285	1.577	2535	1.577	2785	1.577	3035	1.577	3285	1.577	3535	1.577
2290	1.577	2540	1.577	2790	1.577	3040	1.577	3290	1.577	3540	1.577
2295	1.577	2545	1.577	2795	1.577	3045	1.577	3295	1.577	3545	1.577
2300	1.577	2550	1.577	2800	1.577	3050	1.577	3300	1.577	3550	1.577
2305	1.577	2555	1.577	2805	1.577	3055	1.577	3305	1.577	3555	1.577
2310	1.577	2560	1.577	2810	1.577	3060	1.577	3310	1.577	3560	1.577
2315	1.577	2565	1.577	2815	1.577	3065	1.577	3315	1.577	3565	1.577
2320	1.577	2570	1.577	2820	1.577	3070	1.577	3320	1.577	3570	1.577

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Surcharged Outfall Details for Storm

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
3575	1.577	3795	1.577	4015	1.577	4235	1.577	4455	1.577	4675	1.577
3580	1.577	3800	1.577	4020	1.577	4240	1.577	4460	1.577	4680	1.577
3585	1.577	3805	1.577	4025	1.577	4245	1.577	4465	1.577	4685	1.577
3590	1.577	3810	1.577	4030	1.577	4250	1.577	4470	1.577	4690	1.577
3595	1.577	3815	1.577	4035	1.577	4255	1.577	4475	1.577	4695	1.577
3600	1.577	3820	1.577	4040	1.577	4260	1.577	4480	1.577	4700	1.577
3605	1.577	3825	1.577	4045	1.577	4265	1.577	4485	1.577	4705	1.577
3610	1.577	3830	1.577	4050	1.577	4270	1.577	4490	1.577	4710	1.577
3615	1.577	3835	1.577	4055	1.577	4275	1.577	4495	1.577	4715	1.577
3620	1.577	3840	1.577	4060	1.577	4280	1.577	4500	1.577	4720	1.577
3625	1.577	3845	1.577	4065	1.577	4285	1.577	4505	1.577	4725	1.577
3630	1.577	3850	1.577	4070	1.577	4290	1.577	4510	1.577	4730	1.577
3635	1.577	3855	1.577	4075	1.577	4295	1.577	4515	1.577	4735	1.577
3640	1.577	3860	1.577	4080	1.577	4300	1.577	4520	1.577	4740	1.577
3645	1.577	3865	1.577	4085	1.577	4305	1.577	4525	1.577	4745	1.577
3650	1.577	3870	1.577	4090	1.577	4310	1.577	4530	1.577	4750	1.577
3655	1.577	3875	1.577	4095	1.577	4315	1.577	4535	1.577	4755	1.577
3660	1.577	3880	1.577	4100	1.577	4320	1.577	4540	1.577	4760	1.577
3665	1.577	3885	1.577	4105	1.577	4325	1.577	4545	1.577	4765	1.577
3670	1.577	3890	1.577	4110	1.577	4330	1.577	4550	1.577	4770	1.577
3675	1.577	3895	1.577	4115	1.577	4335	1.577	4555	1.577	4775	1.577
3680	1.577	3900	1.577	4120	1.577	4340	1.577	4560	1.577	4780	1.577
3685	1.577	3905	1.577	4125	1.577	4345	1.577	4565	1.577	4785	1.577
3690	1.577	3910	1.577	4130	1.577	4350	1.577	4570	1.577	4790	1.577
3695	1.577	3915	1.577	4135	1.577	4355	1.577	4575	1.577	4795	1.577
3700	1.577	3920	1.577	4140	1.577	4360	1.577	4580	1.577	4800	1.577
3705	1.577	3925	1.577	4145	1.577	4365	1.577	4585	1.577	4805	1.577
3710	1.577	3930	1.577	4150	1.577	4370	1.577	4590	1.577	4810	1.577
3715	1.577	3935	1.577	4155	1.577	4375	1.577	4595	1.577	4815	1.577
3720	1.577	3940	1.577	4160	1.577	4380	1.577	4600	1.577	4820	1.577
3725	1.577	3945	1.577	4165	1.577	4385	1.577	4605	1.577	4825	1.577
3730	1.577	3950	1.577	4170	1.577	4390	1.577	4610	1.577	4830	1.577
3735	1.577	3955	1.577	4175	1.577	4395	1.577	4615	1.577	4835	1.577
3740	1.577	3960	1.577	4180	1.577	4400	1.577	4620	1.577	4840	1.577
3745	1.577	3965	1.577	4185	1.577	4405	1.577	4625	1.577	4845	1.577
3750	1.577	3970	1.577	4190	1.577	4410	1.577	4630	1.577	4850	1.577
3755	1.577	3975	1.577	4195	1.577	4415	1.577	4635	1.577	4855	1.577
3760	1.577	3980	1.577	4200	1.577	4420	1.577	4640	1.577	4860	1.577
3765	1.577	3985	1.577	4205	1.577	4425	1.577	4645	1.577	4865	1.577
3770	1.577	3990	1.577	4210	1.577	4430	1.577	4650	1.577	4870	1.577
3775	1.577	3995	1.577	4215	1.577	4435	1.577	4655	1.577	4875	1.577
3780	1.577	4000	1.577	4220	1.577	4440	1.577	4660	1.577	4880	1.577
3785	1.577	4005	1.577	4225	1.577	4445	1.577	4665	1.577		
3790	1.577	4010	1.577	4230	1.577	4450	1.577	4670	1.577		

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Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.358		

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Online Controls for Storm

Depth/Flow Relationship Manhole: S1.01 Perm Paving Flow Control, DS/PN: S1.001, Volume (m³): 0.3

Invert Level (m) 24.105

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.0000	1.200	1.5000	3.000	2.2000	7.000	3.4000
0.200	1.0000	1.400	1.6000	3.500	2.4000	7.500	3.5000
0.300	0.9000	1.600	1.7000	4.000	2.6000	8.000	3.6000
0.400	0.9000	1.800	1.8000	4.500	2.7000	8.500	3.7000
0.500	1.0000	2.000	1.9000	5.000	2.8000	9.000	3.8000
0.600	1.1000	2.200	1.9000	5.500	3.0000	9.500	3.9000
0.800	1.2000	2.400	2.0000	6.000	3.1000		
1.000	1.4000	2.600	2.1000	6.500	3.2000		

Depth/Flow Relationship Manhole: S1.08, DS/PN: S1.008, Volume (m³): 2.1

Invert Level (m) 23.300

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.6000	1.200	2.1000	3.000	3.2000	7.000	4.7000
0.200	1.8000	1.400	2.2000	3.500	3.4000	7.500	4.9000
0.300	1.8000	1.600	2.4000	4.000	3.6000	8.000	5.0000
0.400	1.8000	1.800	2.5000	4.500	3.8000	8.500	5.1000
0.500	1.7000	2.000	2.6000	5.000	4.0000	9.000	5.3000
0.600	1.5000	2.200	2.7000	5.500	4.2000	9.500	5.4000
0.800	1.7000	2.400	2.9000	6.000	4.4000		
1.000	1.9000	2.600	3.0000	6.500	4.5000		

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Storage Structures for Storm

Porous Car Park Manhole: S1.00, DS/PN: S1.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	18.6
Max Percolation (l/s)	51.7	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	24.700	Cap Volume Depth (m)	0.300

Cellular Storage Manhole: S1.07 Tank, DS/PN: S1.007

Invert Level (m)	23.350	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	115.0	0.0	1.201	0.0	0.0
1.200	115.0	0.0			

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 2
Number of Online Controls 2 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.360
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 400.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 2, 30, 100
Climate Change (%) 0, 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)
S1.000	S1.00	60 minute 1 year Winter I+0%	25.160	24.215
S1.001	S1.01 Perm Paving Flow Control	60 minute 1 year Winter I+0%	25.210	24.211
S1.002	S1.02	30 minute 1 year Winter I+0%	25.260	24.037
S1.003	S1.03	30 minute 1 year Winter I+0%	25.260	23.990
S2.000	S2.00	15 minute 1 year Winter I+0%	25.260	24.617
S1.004	S1.04	15 minute 1 year Winter I+0%	25.260	23.962
S3.000	S3.00	15 minute 1 year Winter I+0%	25.100	24.026
S1.005	S1.05	15 minute 1 year Winter I+0%	25.260	23.912
S1.006	S1.06	15 minute 1 year Winter I+0%	25.260	23.850
S4.000	S4.00	15 minute 1 year Winter I+0%	25.260	24.757
S4.001	S4.01	15 minute 1 year Winter I+0%	25.260	24.588
S5.000	S5.00	15 minute 1 year Winter I+0%	25.150	24.285
S1.007	S1.07 Tank	1440 minute 1 year Winter I+0%	25.260	23.809
S1.008	S1.08	1440 minute 1 year Winter I+0%	25.150	23.814

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)
S1.000	S1.00	-0.115	0.000	0.07		0.005
S1.001	S1.01 Perm Paving Flow Control	-0.044	0.000	0.09		0.056
S1.002	S1.02	-0.188	0.000	0.06		0.010
S1.003	S1.03	-0.189	0.000	0.06		0.024
S2.000	S2.00	-0.113	0.000	0.14		0.005
S1.004	S1.04	-0.152	0.000	0.22		0.110
S3.000	S3.00	-0.124	0.000	0.07		0.006
S1.005	S1.05	-0.149	0.000	0.24		0.114
S1.006	S1.06	-0.154	0.000	0.22		0.059
S4.000	S4.00	-0.103	0.000	0.21		0.007
S4.001	S4.01	-0.182	0.000	0.08		0.012
S5.000	S5.00	-0.115	0.000	0.12		0.005
S1.007	S1.07 Tank	-0.061	0.000	0.01		50.848
S1.008	S1.08	0.364	0.000	0.00		0.601

PN	US/MH Name	Discharge Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S1.000	S1.00	0.790	0.5	1.1	OK
S1.001	S1.01 Perm Paving Flow Control	0.790	0.5	0.9	OK
S1.002	S1.02	1.524	0.5	1.8	OK
S1.003	S1.03	1.895	0.5	2.1	OK
S2.000	S2.00	2.423	1.5	5.2	OK
S1.004	S1.04	3.634	0.7	7.2	OK*
S3.000	S3.00	0.507	0.5	1.1	OK
S1.005	S1.05	4.142	0.7	8.3	OK*
S1.006	S1.06	5.043	0.9	9.9	OK
S4.000	S4.00	1.296	0.6	2.7	OK
S4.001	S4.01	3.211	1.2	6.2	OK
S5.000	S5.00	0.620	0.4	1.3	OK
S1.007	S1.07 Tank	0.592	0.4	0.4	OK*
S1.008	S1.08	0.000	0.0	0.0	SURCHARGED

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 2
Number of Online Controls 2 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.360
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 400.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 2, 30, 100
Climate Change (%) 0, 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)
S1.000	S1.00	30 minute 2 year Winter I+0%	25.160	24.363
S1.001	S1.01 Perm Paving Flow Control	30 minute 2 year Winter I+0%	25.210	24.361
S1.002	S1.02	30 minute 2 year Winter I+0%	25.260	24.045
S1.003	S1.03	30 minute 2 year Winter I+0%	25.260	23.999
S2.000	S2.00	15 minute 2 year Winter I+0%	25.260	24.623
S1.004	S1.04	15 minute 2 year Winter I+0%	25.260	23.972
S3.000	S3.00	15 minute 2 year Winter I+0%	25.100	24.030
S1.005	S1.05	15 minute 2 year Winter I+0%	25.260	23.924
S1.006	S1.06	1440 minute 2 year Winter I+0%	25.260	23.896
S4.000	S4.00	15 minute 2 year Winter I+0%	25.260	24.763
S4.001	S4.01	15 minute 2 year Winter I+0%	25.260	24.594
S5.000	S5.00	15 minute 2 year Winter I+0%	25.150	24.290
S1.007	S1.07 Tank	1440 minute 2 year Winter I+0%	25.260	23.896
S1.008	S1.08	1440 minute 2 year Winter I+0%	25.150	23.907

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)
S1.000	S1.00	0.033	0.000	0.11		0.028
S1.001	S1.01 Perm Paving Flow Control	0.106	0.000	0.09		0.138
S1.002	S1.02	-0.180	0.000	0.09		0.012
S1.003	S1.03	-0.180	0.000	0.09		0.031
S2.000	S2.00	-0.107	0.000	0.18		0.006
S1.004	S1.04	-0.142	0.000	0.29		0.127
S3.000	S3.00	-0.120	0.000	0.09		0.007
S1.005	S1.05	-0.138	0.000	0.32		0.133
S1.006	S1.06	-0.107	0.000	0.02		0.107
S4.000	S4.00	-0.097	0.000	0.27		0.008
S4.001	S4.01	-0.176	0.000	0.10		0.014
S5.000	S5.00	-0.110	0.000	0.16		0.006
S1.007	S1.07 Tank	0.026	0.000	0.02		60.627
S1.008	S1.08	0.457	0.000	0.00		0.710

PN	US/MH Name	Discharge Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S1.000	S1.00	0.798	0.4	1.8	SURCHARGED
S1.001	S1.01 Perm Paving Flow Control	0.798	0.5	1.0	SURCHARGED
S1.002	S1.02	2.238	0.5	2.6	OK
S1.003	S1.03	2.718	0.6	3.1	OK
S2.000	S2.00	3.135	1.6	6.7	OK
S1.004	S1.04	4.977	0.7	9.3	OK*
S3.000	S3.00	0.656	0.6	1.4	OK
S1.005	S1.05	5.634	0.8	10.8	OK*
S1.006	S1.06	31.900	0.6	1.0	OK
S4.000	S4.00	1.677	0.6	3.5	OK
S4.001	S4.01	4.156	1.3	8.0	OK
S5.000	S5.00	0.802	0.5	1.7	OK
S1.007	S1.07 Tank	0.705	0.4	0.5	SURCHARGED*
S1.008	S1.08	0.000	0.0	0.0	SURCHARGED

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 2
Number of Online Controls 2 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.360
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 400.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 2, 30, 100
Climate Change (%) 0, 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)
S1.000	S1.00	60 minute 30 year Winter I+0%	25.160	24.717
S1.001	S1.01 Perm Paving Flow Control	60 minute 30 year Winter I+0%	25.210	24.919
S1.002	S1.02	1440 minute 30 year Winter I+0%	25.260	24.281
S1.003	S1.03	1440 minute 30 year Winter I+0%	25.260	24.281
S2.000	S2.00	15 minute 30 year Winter I+0%	25.260	24.641
S1.004	S1.04	1440 minute 30 year Summer I+0%	25.260	24.115
S3.000	S3.00	1440 minute 30 year Winter I+0%	25.100	24.282
S1.005	S1.05	1440 minute 30 year Summer I+0%	25.260	24.063
S1.006	S1.06	1440 minute 30 year Winter I+0%	25.260	24.282
S4.000	S4.00	15 minute 30 year Winter I+0%	25.260	24.787
S4.001	S4.01	15 minute 30 year Winter I+0%	25.260	24.618
S5.000	S5.00	15 minute 30 year Winter I+0%	25.150	24.306
S1.007	S1.07 Tank	1440 minute 30 year Winter I+0%	25.260	24.282
S1.008	S1.08	1440 minute 30 year Winter I+0%	25.150	24.296

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)
S1.000	S1.00	0.387	0.000	0.10		1.050
S1.001	S1.01 Perm Paving Flow Control	0.664	0.000	0.10		0.227
S1.002	S1.02	0.056	0.000	0.02		0.147
S1.003	S1.03	0.103	0.000	0.02		0.252
S2.000	S2.00	-0.089	0.000	0.34		0.009
S1.004	S1.04	0.001	0.000	0.06		0.574
S3.000	S3.00	0.132	0.000	0.01		0.078
S1.005	S1.05	0.001	0.000	0.06		0.696
S1.006	S1.06	0.278	0.000	0.04		0.361
S4.000	S4.00	-0.073	0.000	0.51		0.011
S4.001	S4.01	-0.152	0.000	0.23		0.021
S5.000	S5.00	-0.094	0.000	0.30		0.008
S1.007	S1.07 Tank	0.411	0.000	0.02		103.227
S1.008	S1.08	0.846	0.000	0.00		1.150

PN	US/MH Name	Discharge Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S1.000	S1.00	3.252	0.6	1.6	SURCHARGED
S1.001	S1.01 Perm Paving Flow Control	3.252	0.5	1.1	FLOOD RISK
S1.002	S1.02	16.484	0.4	0.5	SURCHARGED
S1.003	S1.03	18.898	0.5	0.6	SURCHARGED
S2.000	S2.00	5.926	1.9	12.7	OK
S1.004	S1.04	37.079	0.5	1.8	SURCHARGED*
S3.000	S3.00	4.721	0.3	0.1	SURCHARGED
S1.005	S1.05	40.634	0.5	2.0	SURCHARGED*
S1.006	S1.06	53.463	0.6	1.7	SURCHARGED
S4.000	S4.00	3.170	0.8	6.7	OK
S4.001	S4.01	7.855	1.6	17.4	OK
S5.000	S5.00	1.516	0.5	3.2	OK
S1.007	S1.07 Tank	1.150	0.4	0.6	SURCHARGED*
S1.008	S1.08	0.000	0.0	0.0	SURCHARGED

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 2
Number of Online Controls 2 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.360
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 400.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 2, 30, 100
Climate Change (%) 0, 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)
S1.000	S1.00	1440 minute 100 year Winter I+40%	25.160	24.937
S1.001	S1.01 Perm Paving Flow Control	1440 minute 100 year Winter I+40%	25.210	25.017
S1.002	S1.02	1440 minute 100 year Winter I+40%	25.260	25.052
S1.003	S1.03	1440 minute 100 year Winter I+40%	25.260	25.053
S2.000	S2.00	1440 minute 100 year Winter I+40%	25.260	25.057
S1.004	S1.04	15 minute 100 year Summer I+40%	25.260	24.115
S3.000	S3.00	1440 minute 100 year Winter I+40%	25.100	25.055
S1.005	S1.05	15 minute 100 year Summer I+40%	25.260	24.063
S1.006	S1.06	1440 minute 100 year Winter I+40%	25.260	25.055
S4.000	S4.00	1440 minute 100 year Winter I+40%	25.260	25.056
S4.001	S4.01	1440 minute 100 year Winter I+40%	25.260	25.054
S5.000	S5.00	1440 minute 100 year Winter I+40%	25.150	25.054
S1.007	S1.07 Tank	1440 minute 100 year Summer I+40%	25.260	24.551
S1.008	S1.08	1440 minute 100 year Winter I+40%	25.150	25.054

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)
S1.000	S1.00	0.607	0.000	0.03		13.335
S1.001	S1.01 Perm Paving Flow Control	0.762	0.000	0.05		0.243
S1.002	S1.02	0.827	0.000	0.03		0.368
S1.003	S1.03	0.874	0.000	0.03		0.470
S2.000	S2.00	0.327	0.000	0.03		0.075
S1.004	S1.04	0.001	0.000	0.96		0.522
S3.000	S3.00	0.905	0.000	0.01		0.297
S1.005	S1.05	0.001	0.000	1.01		0.521
S1.006	S1.06	1.051	0.000	0.06		0.579
S4.000	S4.00	0.196	0.000	0.05		0.054
S4.001	S4.01	0.284	0.000	0.02		0.371
S5.000	S5.00	0.654	0.000	0.03		0.127
S1.007	S1.07 Tank	0.681	0.000	0.02		133.296
S1.008	S1.08	1.604	0.000	0.16		2.007

PN	US/MH Name	Discharge Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S1.000	S1.00	6.573	0.5	0.5	FLOOD RISK
S1.001	S1.01 Perm Paving Flow Control	6.354	0.4	0.5	FLOOD RISK
S1.002	S1.02	20.186	0.4	0.9	FLOOD RISK
S1.003	S1.03	24.483	0.5	1.0	FLOOD RISK
S2.000	S2.00	40.803	1.1	1.2	FLOOD RISK
S1.004	S1.04	17.088	0.9	30.9	SURCHARGED*
S3.000	S3.00	8.222	0.4	0.2	FLOOD RISK
S1.005	S1.05	19.086	1.0	34.4	SURCHARGED*
S1.006	S1.06	85.250	0.6	2.7	FLOOD RISK
S4.000	S4.00	21.905	0.4	0.6	FLOOD RISK
S4.001	S4.01	53.860	1.0	1.6	FLOOD RISK
S5.000	S5.00	10.279	0.3	0.3	FLOOD RISK
S1.007	S1.07 Tank	20.747	0.4	0.7	SURCHARGED*
S1.008	S1.08	39.634	0.1	1.8	FLOOD RISK

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APPENDIX I

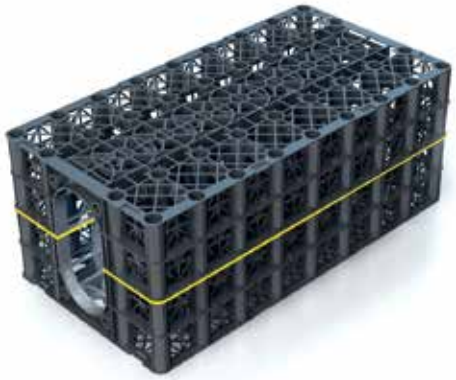
ATTENUATION DETAILS

Polystorm Inspect

Data Sheet

Product code: PSM4

The Polystorm Inspect cell is complementary to the Polystorm range of modular cell solutions. Its primary purpose is to provide a tunnel along the length of a fully installed Polystorm structure to enable access for inspection and maintenance. Polystorm Inspect is a high strength thermoplastic cell which evenly distributes its load through the Polystorm structure.
The tunnel end is left open by default but the unit can be closed off if required by clipping into place the moulded end plate. For purposes of identification the cell features a yellow centre section and end plate.



Key Benefits

- Creates a horizontal tunnel running through the middle of the tank to provide access for inspection and maintenance, i.e. jetting and rodding
- Can be used with Polystorm Lite, Polystorm-R and Polystorm (cannot be used in the same layer as Polystorm Xtra as the Polystorm Inspect cell is deeper)
- Tunnel can be used as a flow inlet track achieving greater stormwater flow distribution within the unit
- Large access tunnel (height 320mm and width 172mm nominal) – allows maximum field of vision while maintaining the system's structural performance
- High strength to weight ratio
- Light weight cell allows easier handling and reduced Health and Safety risk
- Utilises the same Shear Connectors and Clips as the Polystorm range
- The tunnel restricts the dissipation of silt in to the overall structure making inspection and maintenance easier
- Polystorm Inspect cells with 225mm (PSM4CRD225) or 300mm (PSM4CRD300) inlets are available

Applications

Polystorm Inspect is designed to work with the rest of the Polystorm range within a layered hybrid system enabling an intelligently engineered attenuation or infiltration structure to be created. It is intended to be used from the inlet point of the Polystorm structure. If used other than along an inlet tract, the Polystorm Inspect end plate should be used to cap off the tunnel entrance. The most cost effective way to create a tank is to use a combination of Polystorm Inspect cells and other Polystorm modular cells.

UNIT TYPE	VALUE
PHYSICAL PROPERTIES	
Length	1m
Width	0.5m
Depth	0.4m
Total volume	0.2m³
Unit weight	11.6kg*
Cube storage volume	0.188m³ (188 litres)
Volumetric void ratio	94%
SHORT TERM COMPRESSIVE STRENGTH	
Vertical	Minimum 440kN/m²
Lateral	Minimum 63kN/m²
SHORT TERM DEFLECTION	
Short-term vertical deflection	Minimum 70.1kN/m²
LONG TERM DEFLECTION	
Estimated long term vertical deflection (creep)	0.6113Ln (design life in hrs)

Note: The table above is applicable to PSM4 without the end plate.
*Approximate weight
End plates to be purchased separately as required.

Please note: The use of Polystorm Inspect does not negate the requirement for a Silt Trap to be installed prior to the Polystorm structure. The use of a Silt Trap or other silt prevention device would always be recommended.

Technical Support

Detailed guidance and assistance is available.
For further information, please contact our Technical Team on **+44 (0) 1509 615100** or email **civils@polypipe.com**

Polypipe Civils
Charnwood Business Park, Loughborough, Leicestershire LE11 1LE
Tel: +44 (0) 1509 615100 Fax: +44 (0) 1509 610215 Email: civils@polypipe.com
www.polypipe.com/wms

Polypipe

RECOMMENDED MAXIMUM DEPTH OF INSTALLATION (to cell invert) [m]

TYPICAL SOIL TYPE	TYPICAL ANGLE OF SHEAR RESISTANCE	WITHOUT GROUNDWATER (below base of cells) NORMAL CASE		WITH GROUNDWATER AT 1M BELOW GROUND LEVEL AND UNITS WRAPPED IN GEOMEMBRANE	
		Pedestrian	Trafficked (cars)	Pedestrian	Trafficked (cars)
Stiff over consolidated clay e.g. London clay	24°	2.3	2.0	1.8	1.7
Normally consolidated silty sandy clay e.g. alluvium, made ground	26°	2.4	2.2	1.9	1.7
Loose sand and gravel	30°	2.8	2.6	2.0	1.8
Medium dense sand and gravel	33°	3.2	2.9	2.1	1.9
Dense sand and gravel	38°	3.9	3.6	2.2	2.1

Note:

1) Stated depths based on the calculation methodology detailed within CIRIA C680 (2008)
2) Assuming a soil density = 19 kN/m³ water density = 9.81 kN/m³
3) Assumed ultimate limit state (ULS) partial factor of safety applied to: Material = 2.75 Live load = 1.5 Dead load = 1.35

Notes:

1. Unless stated, all values are nominal and may vary within normal production tolerances.
2. Polypipe reserve the right to change product specifications without prior notice.
3. This document is uncontrolled and updates will not be issued automatically.

RECOMMENDED MINIMUM COVER LEVELS [m]

LIVE LOAD CONDITIONS	PEDESTRIAN	LIGHT TRAFFICKED
		Car park with vehicle mass <6000kg
Minimum cover depth required (m)	0.50	0.60

Note:

1) Stated depths based on the calculation methodology detailed within CIRIA C680 (2008)
2) Assumed serviceability limit state (SLS) partial factor of safety applied to: Material = 1.5 Live load = 1.0 Dead load = 1.0
3) Shallower minimum burial depths may be applicable subject to specific site conditions.

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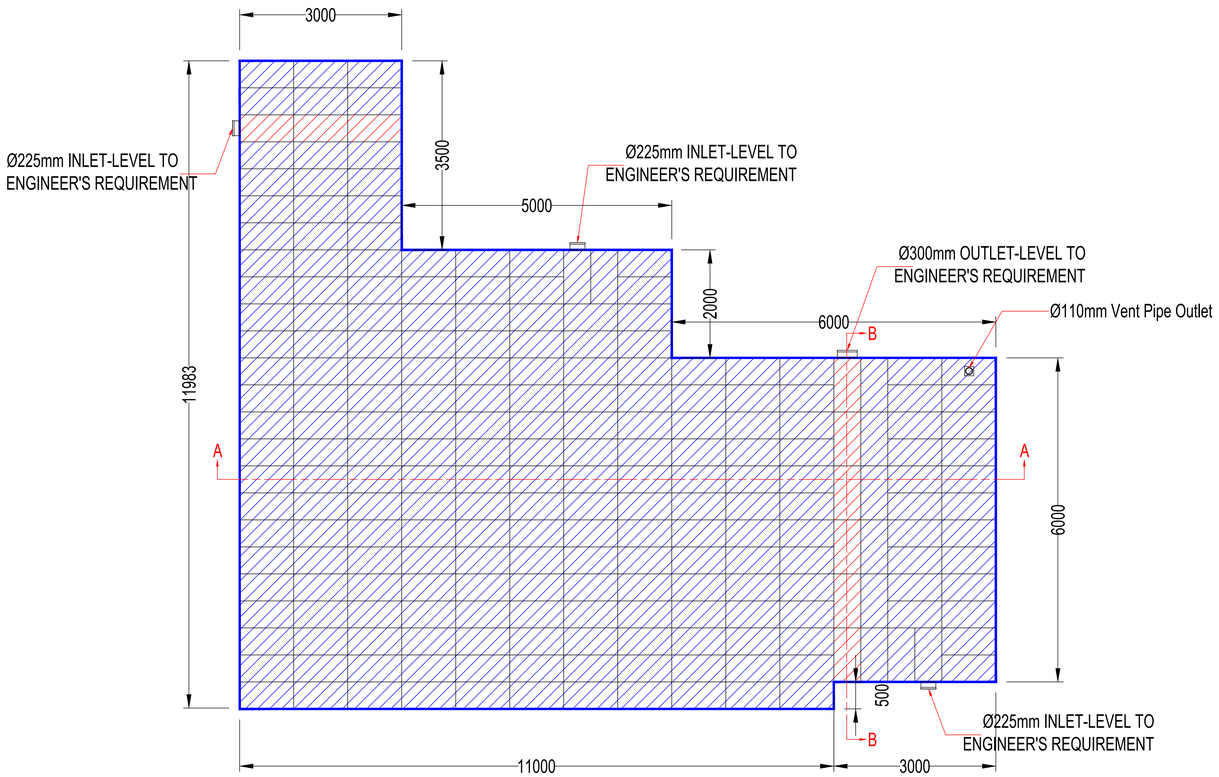
Polypipe Civils

Charnwood Business Park, Loughborough, Leicestershire LE11 1LE

Tel: +44 (0) 1509 615100 Fax: +44 (0) 1509 610215 Email: civils@polypipe.com

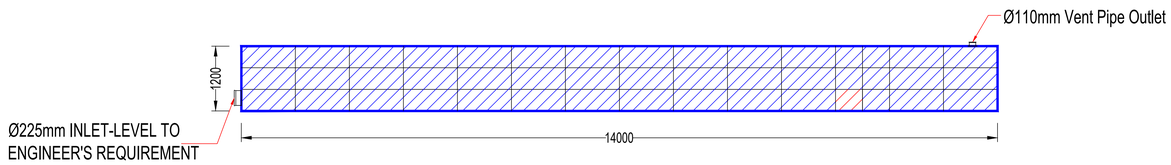
www.polypipe.com/wms

Polypipe



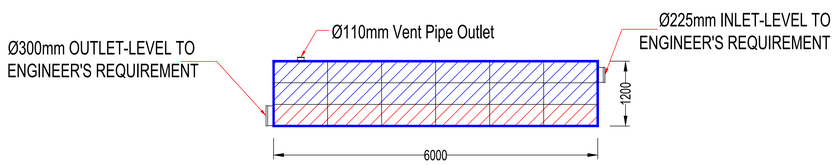
PLAN

Scale 1:40



SECTION A-A

Scale 1:40



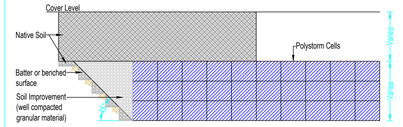
SECTION B-B

Scale 1:40

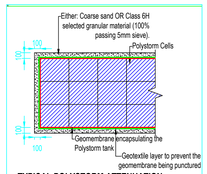
PROPOSED POLYSTORM STRUCTURE	
Plan Area	116m²
Tank Volume	139.20m³
Storage	132.24m³
Polystorm-R Units	687 (PSM1A)
Polystorm-Inspect Units	9 (PSM4)

LEGEND:

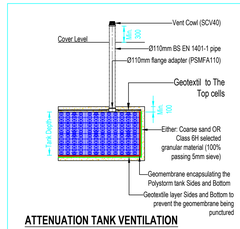
- Polystorm-R Units (PSM1A)
- Polystorm-Inspect Units (PSM4)



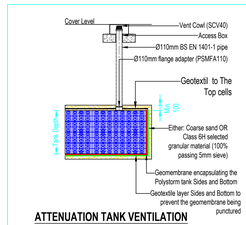
SOIL IMPROVEMENT DETAIL
Scale (1:40)



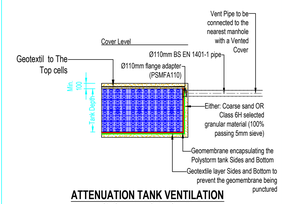
TYPICAL POLYSTORM ATTENUATION INSTALLATION DETAIL
Scale (1:40)



ATTENUATION TANK VENTILATION SYSTEM - OPTION 1)
Scale (N.T.S)



ATTENUATION TANK VENTILATION SYSTEM - OPTION 2)
Scale (N.T.S)



ATTENUATION TANK VENTILATION SYSTEM - OPTION 3)
Scale (N.T.S)

NOTES - PE STUB PIPE ADAPTERS

	PIPE ADAPTOR
Ø160mm SDR26 PE - Ø150mm Polysewer	PS888
Ø250mm SDR26 PE - Ø225mm Polysewer	PS1089
Ø315mm SDR41 PE - Ø300mm Polysewer	PS1289
Ø450mm SDR17 PE - Ø400mm Rdgsewer	see note below*
Ø500mm SDR17 PE - Ø450mm Rdgsewer	see note below*
Ø560mm SDR17 PE - Ø500mm Rdgsewer	see note below*
Ø630mm SDR33 PE - Ø600mm Rdgsewer	see note below*

* - For this transition, Flexseals are required, please refer to their website.

POLYSTORM NOTES

1. This drawing needs to be read in conjunction with all relevant Architects, Engineers and specialist drawings.
2. Stormwater Attenuation / Infiltration system shall be Polypipe Civil's Polystorm pre-formed geocellular system, with minimum 94% volumetric void. Units shall be installed using recommended jointing clips to maintain rigidity and minimise deflection.
3. Multi-layered Polystorm tank configurations shall be fixed with proprietary shear connectors between each vertical layer to maintain rigidity and minimise lateral displacement.
4. Drawings should be read in conjunction with the supportings structural calculations, which are illustrative and should be validated by a suitably qualified Engineer, or similar.
5. For Field conditions, backfill should be placed and compacted in layers no greater than 300mm and for trafficked areas, backfill should be placed and compacted in layers no greater than 150mm.
6. The installer shall ensure that all expected temporary construction transient loads have been considered as part of the structural design and a minimum of 300mm backfill should be placed prior to initial compaction.
7. Polystorm Tanks should be installed in accordance with Polypipe Civils recommendations (refer to technical guidance for further information).

COVER SLAB THICKNESS

1. Where cover slabs are applicable, the slab thickness (shown in red) has been assumed and therefore needs to be confirmed by others.

STANDARD TOLERANCES

ALL DIMENSIONS IN MILLIMETRES, UNLESS OTHERWISE STATED.

Benching Slope	1:10 to 1:30 (1.9° - 5.7°)
Angles	+/-1.5°
All Dimensions	+50mm / -30mm

STANDARD SPIGOTS IN ACCORDANCE WITH SPEC. ES23.

JOINTING KEY

Socket	RS	Ring seal joint
	IEW	Internal extrusion welding joint
Spigot	EF	Electro-fusion joint

GENERAL NOTES

1. This drawing details Polypipe Civils proposed offering, reflecting our interpretation of the information provided.
2. Polypipe bespoke Ridgistorm-XL chambers are complete pre-formed units.
3. Polypipe products to be installed in accordance with Polypipe Civils recommendations (refer to Keytec Installation guidance for further information), giving due consideration to the requirements of the organisation who will take ultimate ownership of the installation.
4. Site conditions may require specific installation requirements. The installer should verify that the proposed installation method is acceptable, giving due consideration to the requirements of the relevant approving and adopting authorities, before construction activities commence.
5. Advice on any system requirements specific to the proposed Ridgistorm XL system should be sought from Polypipe Civils.
6. All PE stub connections will require adaptors (to be supplied by Contractor / Developer).

DRAWING NOTES

1. Drawings should not be scaled, refer to figured dimensions only.
2. All dimensions in millimetres, unless otherwise stated.
3. All dimensions are nominal and may vary within manufacturing or construction tolerances.
4. All site temporary and enabling works by others.
5. This drawing is intended for guidance only. Confirmation of the information contained within this document should be sought from the consulting engineers before final design or construction activities commence.

NOTE:

- Fall Arrest Grill to be provided by the developer / contractor (please refer to Consultant's drawings.
- The final position of the access cover should be confirmed by the Consultant and detailed on their drawing.
-Lifting Eyes are to be pointed type - to be provided by the Developer / Contractor (please refer to Consultant's drawings).
- All Polystorm tanks to be installed with a 1:500 fall, please note tank would still drain even if left flat due to our cells 3D flow.

KEYTEC INSTALLATION SERVICES

KEYTEC INSTALLATION SERVICES
ROYLE HOUSE
COWM TOP BUSINESS PARK
COWM TOP LANE
OL11 2PU
TEL: 0808 141 5800
EMAIL: TECHNICAL@KEYTEC.CO.UK

PROJECT

CATHEDRAL SQUARE - MANCHESTER

ATTENUATION TANK

TITLE

DETAILS OF ATTENUATION/STORAGE TANK DETAILS USING POLYSTORM PSM1A & PSM4 UNITS

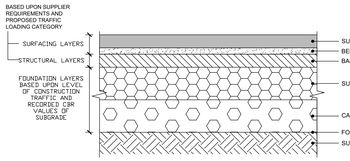
Scale	Drawn	Checked
AS SHOWN	FA	KD
Date	**Drawing No.**	**Revision**
19/06/2025	PSM - 3.0	R0

	SUBGRADE CBR DESIGN VALUE							
CONSTRUCTION TRAFFIC [A]	2%	2.5%	3%	4%	5%	10%	15%	30%
NO CONSTRUCTION TRAFFIC	150/150	150/150	150/0	150/0	150/0	150/0	150/0	150/0
100 STANDARD AXLES (E.G. UP TO 100m OF ROAD,10 DWELLINGS OR 1000m^2 COMMERCIAL DEVELOPMENT)	150/210	150/180	150/150	160/0	150/0	150/0	150/0	150/0
200 STANDARD AXLES (E.G. UP TO 200m OF ROAD,10 DWELLINGS OR 2000m^2 COMMERCIAL DEVELOPMENT)	150/370	150/250	150/170	150/160	150/150	150/150	150/0	150/0
500 STANDARD AXLES (E.G. UP TO 500m OF ROAD,50 DWELLINGS OR 5000m^2 COMMERCIAL DEVELOPMENT)	150/470	150/340	150/250	150/220	150/200	150/150	150/0	150/0
1000 STANDARD AXLES (E.G. UP TO 1km OF ROAD, 100 DWELLINGS OR 10,000m^2 COMMERCIAL DEVELOPMENT)	150/600	150/450	150/350	150/300	150/250	150/180	150/0	150/0
5000 STANDARD AXLES (E.G. UP TO 5km OF ROAD, 500 DWELLINGS OR A LARGE COMMERCIAL DEVELOPMENT)	200/600	200/450	150/450	150/350	150/300	150/250	150/150	150/0

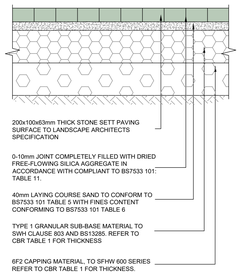
1. SUB-BASE ON CAPPING DESIGNS ARE DESCRIBED THUS: SUB-BASE/CAPPING (mm)
2. FOR SUBGRADES WITH A CBR LESS THAN 2% LOCALISED GROUND IMPROVEMENT IS REQUIRED TO INCREASE TO CBR TO SUITABLE LEVELS.
3. FOR OTHER CBR VALUES FOUNDATION THICKNESSES MAY BE INTERPOLATED
4. UNDER ADVERSE WEATHER CONDITIONS OR FOR SUBGRADES WITH A CBR LESS THAN 3%, A GEOTEXTILE SEPARATING LATER IS RECOMMENDED TO PREVENT THE MIGRATION OF THE FOUNDATION MATERIAL DURING COMPACTION.
5. WHERE THE SUBGRADE CBR IS GREATER THAN OR EQUAL TO 30%, THE FOUNDATION MAY BE OMITTED WHERE THE SUBGRADE CAN BE ADEQUATELY TRIMMED AND PROFILED TO PROVIDE THE REQUIRED SURFACE GRADIENTS AND ENABLE THE CONSTRUCTION OF THE BASE LAYERS
6. STANDARD AXLE: AXLE CARRYING A LOAD OF 8200 kg

A) THE LEVEL ON CONSTRUCTION TRAFFIC SHOULD CONSIDER THAT WHICH IS REQUIRED TO CONSTRUCT THE OVERLYING BASE LAYERS. UN-TRAFFICKED DESIGNS ARE APPLICABLE WHERE HAND LAY METHODS ARE USED TO CONSTRUCT THE UPPER LAYERS. WHERE UNCERTAINTY EXISTS A DEGREE OF TRAFFICKING SHOULD BE ASSUMED.

TABLE 1 (TABLE 17 BS 7533-101:2021)
FOUNDATION DESIGN THICKNESS - SUB-BASE ON CAPPING DESIGN



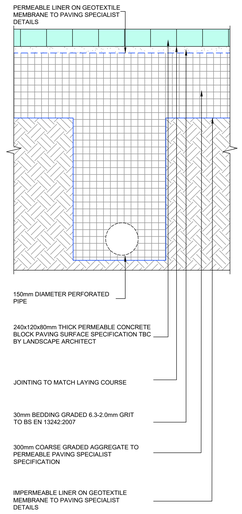
PAVEMENT LAYERS KEY



63mm STONE SETT PAVING
(UNBOUND CONSTRUCTION)
PEDESTRIAN AND CYCLES ONLY, DOMESTIC DRIVEWAY
(TRAFFIC CATEGORY 2 - BS 7533-101:2021)
SCALE 1:10

63mm STONE SLAB PAVING
(UNBOUND CONSTRUCTION)
PEDESTRIAN AND CYCLES ONLY, DOMESTIC DRIVEWAY
(TRAFFIC CATEGORY 2 - BS 7533-101:2021)
SCALE 1:10

63mm STONE SLAB HAZARD PAVING
(UNBOUND CONSTRUCTION), PEDESTRIAN (TRAFFIC CATEGORY 1 - BS 7533-101:2021) TO TOP AND BOTTOM OF STEPS
SCALE 1:10



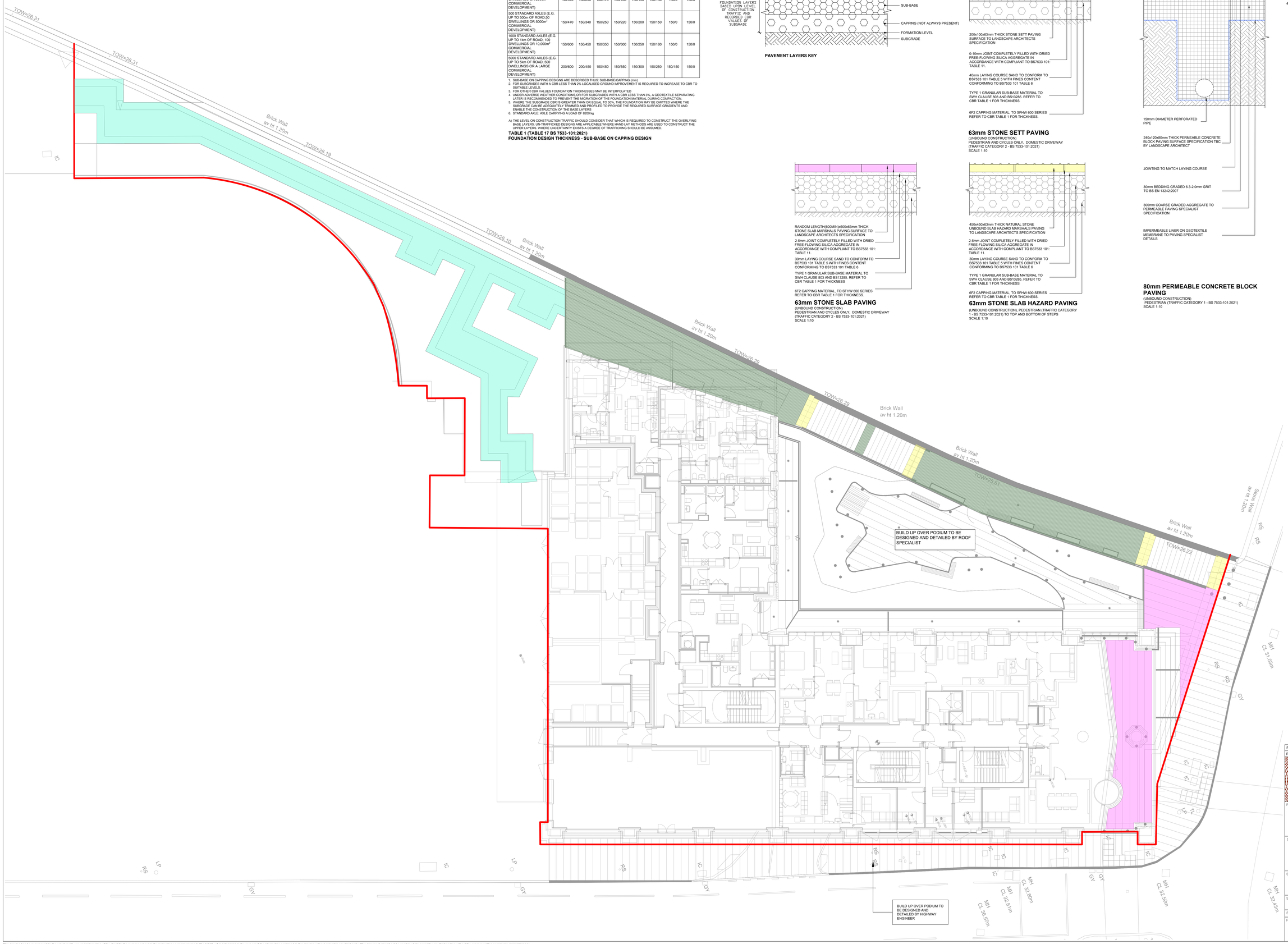
80mm PERMEABLE CONCRETE BLOCK PAVING
(UNBOUND CONSTRUCTION)
PEDESTRIAN (TRAFFIC CATEGORY 1 - BS 7533-101:2021)
SCALE 1:10

NOTES:

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT RENAISSANCE, ARCHITECTS, AND LANDSCAPE ARCHITECTS DRAWINGS AND SPECIFICATIONS.
2. DO NOT SCALE FROM THIS DRAWING, ANY AMBIGUITIES, OMISSIONS AND ERRORS ON DRAWINGS SHALL BE BROUGHT TO THE ENGINEERS ATTENUATION IMMEDIATELY. ALL DIMENSIONS MUST BE CHECKED / VERIFIED ON SITE.
3. REFER TO LANDSCAPE ARCHITECTS SPECIFICATION AND DRAWINGS FOR DETAILS OF SURFACE FINISHES.
4. REFER TO LANDSCAPE ARCHITECTS DRAWING FOR SETTING OUT AND FINAL EXTENTS.

DRAWING LEGEND

- **63mm NATURAL STONE SETTS PAVING** — PEDESTRIAN AND CYCLES ONLY, DOMESTIC DRIVEWAY (TRAFFIC CATEGORY 2 - BS 7533-101:2021)
- **63mm NATURAL STONE SLABS PAVING** — PEDESTRIAN AND CYCLES ONLY, DOMESTIC DRIVEWAY (TRAFFIC CATEGORY 2 - BS 7533-101:2021)
- **63mmm NATURAL STONE HAZARD PAVING** — PEDESTRIAN (TRAFFIC CATEGORY 1 - BS 7533-101:2021)
- **80mmm PERMEABLE CONCRETE BLOCK PAVING** — PEDESTRIAN (TRAFFIC CATEGORY 1 - BS 7533-101:2021)



Rev:	Description:	Date:	By:	Chkd:
P01	STAGE 4 ISSUE	18.07.25	SA	AI

renaissance
Renaissance Associates Ltd
2nd Floor Tribeca House
21-27 Dale Street
Manchester
M1 1EY

Project:
RENAISSANCE MANCHESTER

Drawing Title:
NON-ADOPTED PAVMENT BUILD-UP PLAN

Status:
STAGE 4

Size:	Date:	Drawn by:	Designed by:	Checked by:
A0	JUL 25	SA	SA	AI

Scale: AS NOTED | Project No: 2307-10

Project – Originator – Volume – Level – Type – Role – Number: REN-REN-BB-00-DR-C-01400 | Revision: P01

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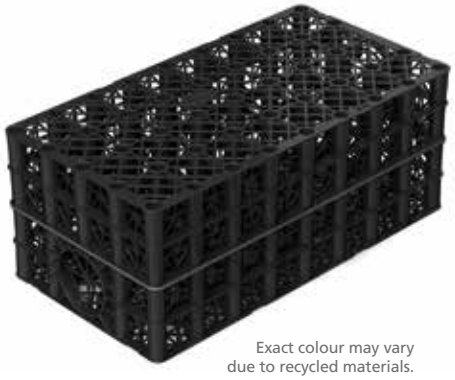
Polystorm-R Modular Cell

Data Sheet

Product code: PSM1A

The Polystorm-R modular cell is ideally suited for loaded applications at greater depths, such as housing, commercial and infrastructure projects and has a compressive strength of up to 61 tonnes/m². It offers all the proven performance of the Polystorm cell, with the added benefits of being manufactured from over 90% recycled material content.

Wherever performance criteria and standards allow, we will always maximise the sustainability of our products by using post consumer plastics in their manufacture. By sourcing and carefully controlling the quality of the recycled material we use our precision injection moulding. Therefore we are able to guarantee consistent quality in our recycled plastic, giving you the confidence and the performance levels you expect from the market leader.



Exact colour may vary due to recycled materials.

Key Benefits

- Made from specially selected and controlled recycled materials
- Environmentally friendly, sustainable solution
- Has undergone stringent testing to ensure product performance
- Compressive strength of 61 tonnes/m²
- Ideal for retention, attenuation and infiltration applications with a suitable geomembrane or geotextile
- BBA approved
- Allow flexibility of shape - ideal for shallow excavation systems, narrow strips or use in restricted areas
- Can be used as part of a value engineered hybrid system with Polystorm, Polystorm Lite and Polystorm Xtra
- Integrated inlet and outlet
- 3D flow throughout the structure
- 95% void ratio
- Light weight yet robust - excellent Health and Safety and installation benefits
- 60 years creep limited life expectancy

Technical Support

Detailed guidance and assistance is available.
For further information, please contact our Technical Team on **+44 (0) 1509 615100** or email **civils@polypipe.com**

BBA BRITISH BOARD OF AGREMENT
CERTIFICATE No. 06/4297

ELEMENT	VALUE
PHYSICAL PROPERTIES	
Length	1m
Width	0.5m
Depth	0.4m
Total volume	0.2m³
Unit weight	9kg (approx)
Unit storage volume	0.19m³ (190 litres)
Void ratio	95%
SHORT TERM COMPRESSIVE STRENGTH	
Vertical	610 kN/m² **
Lateral	63 kN/m² **
SHORT TERM DEFLECTION	
Short-term vertical deflection	60 kN/m² per mm
LONG TERM DEFLECTION	
Estimated long term vertical deflection (creep)	0.2798 Ln (design life in hrs) +0.485 [Based on an applied test load = 162 kN/m²] Creep data limit 60 years
Estimated long term lateral deflection (creep)	1.0192 Ln (design life in hrs) -3.864 [Based on an applied test load = 30.8 kN/m²] Creep data limit 60 years

Note: Polystorm-R is ideal for use in trafficked and pedestrian applications subject to a structural design check and suitable installation conditions

* Each unit includes 4 Clips and 2 Shear Connectors.

** Compressive strength at yield, maximum recommended value for design purposes.

Polypipe Civils
Charnwood Business Park, Loughborough, Leicestershire LE11 1LE
Tel: +44 (0) 1509 615100 Fax: +44 (0) 1509 610215 Email: civils@polypipe.com
www.polypipe.com/wms

Polypipe

RECOMMENDED MAXIMUM DEPTH OF INSTALLATION (to cell invert) [m]

TYPICAL SOIL TYPE	TYPICAL ANGLE OF SHEAR RESISTANCE	SOIL WEIGHT kN/m³	WITHOUT GROUNDWATER (below base of cells) NORMAL CASE		WITH GROUNDWATER AT 1M BELOW GROUND LEVEL AND UNITS WRAPPED IN GEOMEMBRANE	
			Pedestrian	Trafficked (cars) <3000kg GVW	Pedestrian	Trafficked (cars) <3000kg GVW
Stiff over consolidated clay e.g. London clay	24	20.0	2.2	1.9	1.8	1.6
Normally consolidated silty sandy clay e.g. alluvium, made ground	26	19.0	2.4	2.2	1.9	1.7
Loose sand and gravel	30	18.0	3.0	2.7	2.0	1.9
Medium dense sand and gravel	33	19.0	3.2	2.9	2.0	1.9
Dense sand and gravel	38	20.0	3.7	3.5	2.1	2.0

Note:
1) Stated depths based on the calculation methodology detailed within CIRIA C680 (2008)
2) Assuming water density = 10.0kN/m³
3) Assumed ultimate limit state (ULS) partial factor of safety applied to: Material = 2.75 Lateral pressure = 1.35

Durability

The polymer material used in the manufacture of the Polystorm-R unit has an adequate resistance to attack from the type and quantities of chemicals that may be expected to naturally occur in uncontaminated soils and rainwater runoff. When installed in accordance with our recommendations, it is expected that the Polystorm-R unit will have a design life in excess of 60 years*. The installer of a proposed geocellular structure should ensure that an appropriate design check has been undertaken, in accordance with the recommended methodology and factors of safety given in CIRIA C680 (2008), Structural Design of Modular Geocellular Drainage Tanks, prior to the commencement of construction activities.

* Derived from long term extrapolated creep testing

Notes

1. Unless stated, all values are nominal and may vary within normal production tolerances.
2. The characteristic unit parameters stated have been based on Polypipe BBA certificate N° 06/4297, sheet 3.
3. Polypipe reserve the right to change product specifications without prior notice.
4. This document is uncontrolled and updates will not be issued automatically.

RECOMMENDED MINIMUM COVER LEVELS [m]

LIVE LOAD CONDITIONS	PEDESTRIAN	LIGHT TRAFFICKED	
		Car park with vehicle mass <GVW	
Minimum cover depth required (m)	0.50	<3000kg 0.50	<9000kg 0.65

Note
1) Stated depths based on the calculation methodology detailed within CIRIA C680 (2008)
2) Assumed serviceability limit state (SLS) partial factor of safety applied to: Material = 1.5 Live load = 1.0 Dead load = 1.0
3) Shallower minimum burial depths may be applicable subject to an assessment of the specific site conditions. For further details please consult our Technical Team on 01509 615100.

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Polypipe Civils
Charnwood Business Park, Loughborough, Leicestershire LE11 1LE
Tel: +44 (0) 1509 615100 Fax: +44 (0) 1509 610215 Email: civils@polypipe.com
www.polypipe.com/wms

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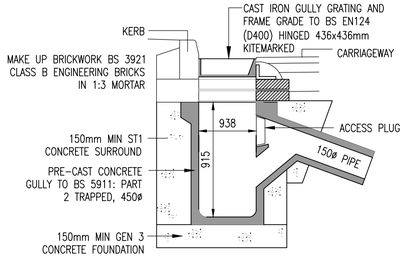
APPENDIX J

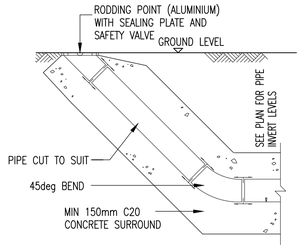
FLOW CONTROL DETAILS

NOTES:

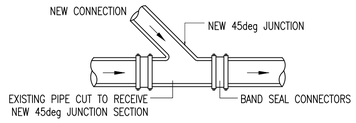
1. FOR GENERAL NOTES REFER TO RENAISSANCE DRAWING REN-REN-BB-B2-DR-C-01100 FOR DRAINAGE NOTES REFER TO REN-REN-BB-ZZ-DR-C-03100.
2. DO NOT SCALE FROM THIS DRAWING. ANY AMBIGUITIES OMISSIONS AND ERRORS ON DRAWINGS SHALL BE BROUGHT TO THE ENGINEERS ATTENTION IMMEDIATELY. ALL DIMENSIONS TO BE CHECKED/ VERIFIED ON SITE.



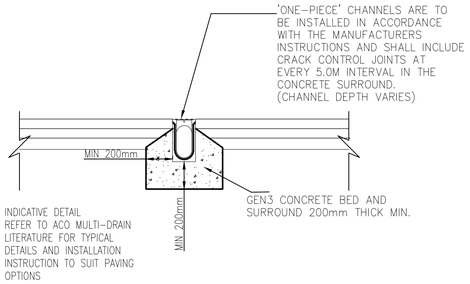
TYPICAL PRECAST CONCRETE ROAD GULLY DETAIL



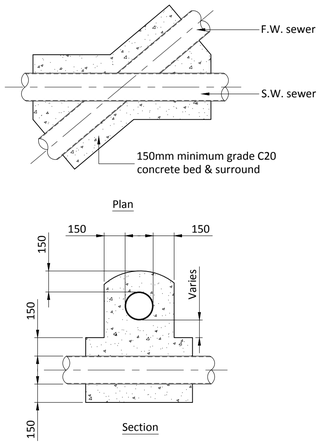
RODDING EYE DETAIL



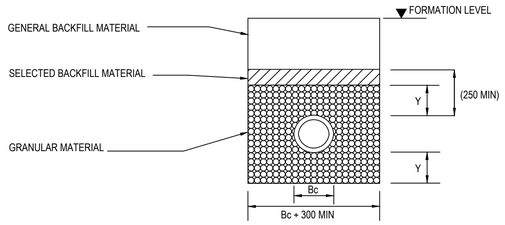
BRANCH INSERTION DETAIL



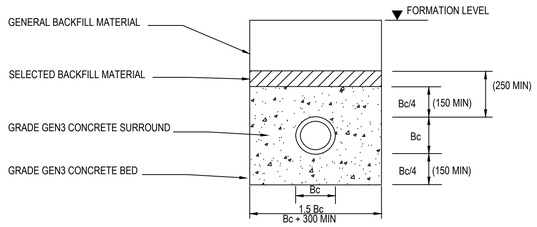
ACO CHANNEL DETAIL



TYPICAL CROSS-OVER DETAIL TO FOUL AND SURFACE WATER SEWERS



CLASS S DETAIL



CLASS Z DETAIL

NOMINAL PIPE DIA. (mm)	SINGLE SIZED. (mm)	GRADED. (mm)
150 200 TO 300 375 TO 525 GREATER THAN 525	10 OR 14 10,14 OR 20 14 OR 20 14,20 OR 40	14 TO 5 14 TO 5 OR 20 TO 5 14 TO 5 OR 20 TO 5 14 TO 5,20 TO 5 OR 40 TO 5

GRANULAR BEDDING MATERIAL

(ALL AGGREGATES TO TABLE 4 OF BS 882 :1983)

NOTES:
A) Bc = OUTSIDE DIAMETER OF PIPE BARREL

B) Y = FOR UNIFORM SOILS: SLEEVE JOINTED PIPES, MIN. 50mm OR 1/6Bc, WHICHEVER IS THE GREATER. SOCKETED PIPE, MIN. 100mm OR 1/6Bc, WHICHEVER IS THE GREATER UNDER BARRELS AND NOT LESS THAN 50mm UNDER SOCKETS.
FOR ROCK OR MIXED SOILS CONTAINING ROCK BANDS, BOULDERS, STONES OR OTHER IRREGULAR HARD SPOTS: SLEEVE JOINTED PIPES, MIN. 150mm OR 1/4Bc, WHICHEVER IS THE GREATER. SOCKETED PIPE, MIN. 200mm OR 1/4Bc, WHICHEVER IS THE GREATER UNDER.

SUITABLE FILL:- THE SUITABLE FILL SHALL BE SUITABLE FOR THE LOCATION AND SHALL BE CAREFULLY COMPACTED TO PROVIDE STABILITY WITHOUT DAMAGING THE PIPE.
FILL UNDER CAR PARKING AREAS AND PRIVATE ROADS TO BE WELL COMPACTED GRADED MATERIAL. FILL UNDER ADOPTED ROADS TO BE TYPE 1 GRANULAR SUB-BASE.

WHERE THE PIPES ARE TO BE ADOPTED CLASS S BEDDING TO BE USED FOR EITHER RIGID OR FLEXIBLE PIPES

SIZE OF BEDDING MATERIAL - ALL GRANULAR MATERIAL TO BE SINGLE SIZED OR GRADED IN ACCORDANCE WITH BS 882.BS1047,BS3797		
PIPE DIAMETER	NOMINAL SINGLE SIZED	GRADED
UP TO 100mm	10mm	
OVER 100mm TO 150mm	10mm or 14mm	5mm to 14mm
OVER 150mm TO 300mm	10mm,14mm or 20mm	5mm to 14mm or 5mm to 20mm
OVER 300mm TO 550mm	14mm or 20mm	5mm to 14mm or 5mm to 20mm
OVER 550mm	14mm, 20mm or 40mm	5mm to 14mm or 5mm to 20mm or 5mm to 40mm

Trench widths	
Dia. of drain	Width
100 150 225	450 600 700
300 375 450	750 1050 1150
525 600 675	1200 1350 1450
750 825 900	1500 1600 1900
975 1050 1200	2000 2300 2300
Over 1200	Dia. + 1000

LIMITS OF COVER IN ANY WIDTH OF TRENCH			
NOMINAL SIZE	LAID IN FIELDS	LAID IN LIGHT ROADS	LAID IN MAIN ROADS
CLASS 120 CLAYWARE PIPES (CLASS B BEDDING)			
100-150mm	0.6m - 8.0m	1.2m - 8.0m	1.2m - 8.0m
225mm	0.6m - 5.0m	1.2m - 5.0m	1.2m - 4.5m
400mm	0.6m - 4.5m	1.2m - 4.5m	1.2m - 4.0m
600mm	0.6m - 4.5m	1.2m - 4.5m	1.2m - 4.0m
CLASS M CONCRETE PIPES (CLASS B BEDDING)			
300mm	0.6m - 3.0m	1.2m - 3.0m	1.2m - 2.5m
450mm	0.6m - 3.5m	1.2m - 3.5m	1.2m - 2.5m
600mm	0.6m - 3.5m	1.2m - 3.5m	1.2m - 3.0m
THERMOPLASTIC PIPES (CLASS S BEDDING)			
100 - 300mm	0.6m - 7.0m	0.9m - 7.0m	0.9m - 7.0m

WHERE COVER IS LESS THAN THE ALLOWABLE DEPTH PIPES TO HAVE A CLASS Z CONCRETE SURROUND OR CONCRETE COVER SLAB PROTECTION

CONCRETE PROTECTION	
CLASS 1 SULPHATE CONDITIONS	
ADOPTABLE STANDARDS AND AREAS SUBJECT TO HEAVY LOADING	GEN3 OR GEN 3
AREAS SUBJECT TO LIGHT LOADING eg. PRIVATE DRIVES, SMALL CAR PARKS	GEN1 OR ST2
FOR BURIED CONCRETE EXPOSED TO SULPHATE CONDITIONS	
CLASS 2 CLASS 3 CLASS 4A CLASS 4B	FND 2 FND 3 FND 4A FND 4B

PRODUCT NAME	DIAMETER (mm)	MANUFACTURER	MATERIAL
Supersleve	100&150 (I.D)	Hepworth	Vitrified Clay
Superseal	100&225 (I.D)	Hepworth	Vitrified Clay
Densleeve	100,150&225 (I.D)	Naylor	Vitrified Clay
Denseal	100,150&225 (I.D)	Naylor	Vitrified Clay
Ultra-Drain	110&160 (O.D)	Uponor	uPVC
Plastidrain	110&160 (O.D)	Hepworth	uPVC
Osmadrain	110&160 (O.D)	Wavin	uPVC
Osma Ultrarib	150&225 (I.D)	Wavin	uPVC
Solid Wall	110&160 (O.D)	Marley	uPVC
Quantum	150&225 (I.D)	Marley	uPVC
Underground Drain	110&160 (O.D)	Polypipe	uPVC
Ridgisewer	150&225 (I.D)	Polypipe	uPVC

MANUFACTURER	PRODUCT NAME	MATERIAL	MAX DEPTH
Naylor	Plastic Inspection Chamber	Polypropylene	Up to 1200mm
Hepworth	PPIC	Polypropylene	Up to 1200mm
Uponor	Inspection Chamber (450mmØ)	Polypropylene	Up to 1200mm
Marshalls	Inspection Chamber To BS5911 pt2	Precast concrete	Up to 1000mm
Wavin	Osma Ultrarib Inspection Chamber	Polypropylene	Up to 1200mm
Wavin	OsmaDrain Universal Inspection Chamber	Polypropylene	Up to 1200mm
Wavin	Non Entry Inspection Chamber	Polypropylene	Up to 2000mm
Marley	Inspection Chamber (450mmØ)	Polypropylene	Up to 1200mm
Polypipe	110mm Inspection Chamber (460mmØ)	Polypropylene	Up to 1200mm

Rev:	Description:	Date:	By:	Chkd:
P01	STAGE 4 ISSUE	18.07.25	HW	AI

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Carvers Warehouse
77 Dale Street
Manchester
M1 2HG

Project:

NO.1 CATHEDRAL SQUARE, MANCHESTER

Drawing Title:

BELOW GROUND DRAINAGE DETAILS SHEET 4

Status:

STAGE 4

Size:	Date:	Drawn by:	Designed by:	Checked by:
A1	JUL 25	HW	--	AI

Scale: NTS | Project No: 2307-10

Project - Originator - Volume - Level - Type - Role - Number: REN-REN-BB-ZZ-DR-C-03103 | Revision: P01

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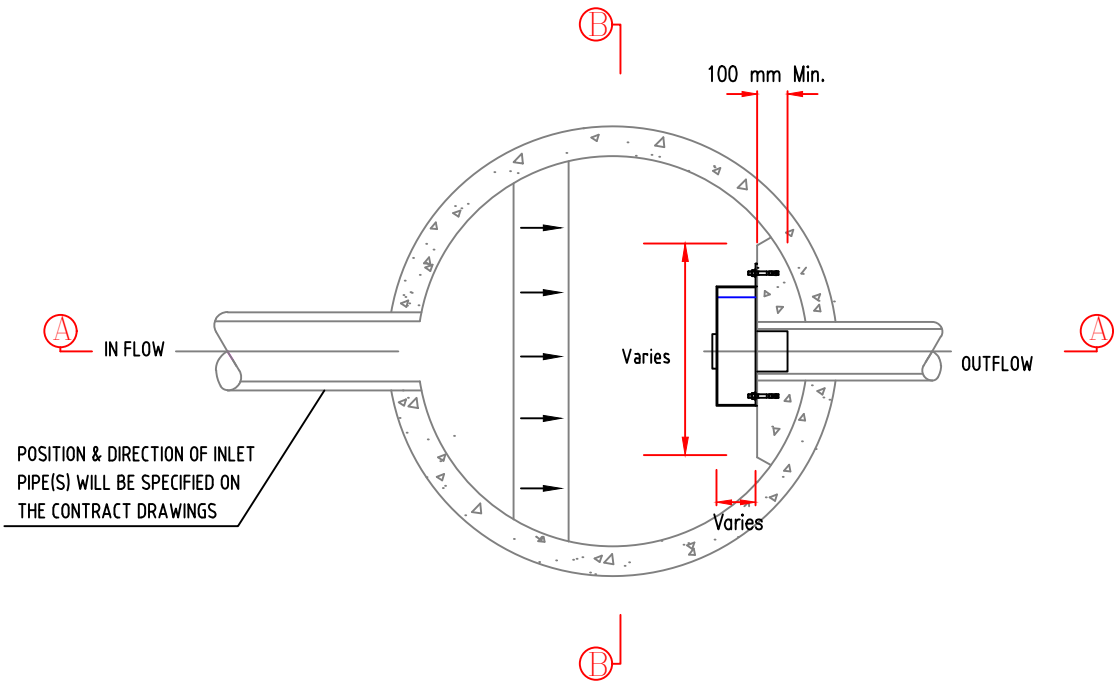
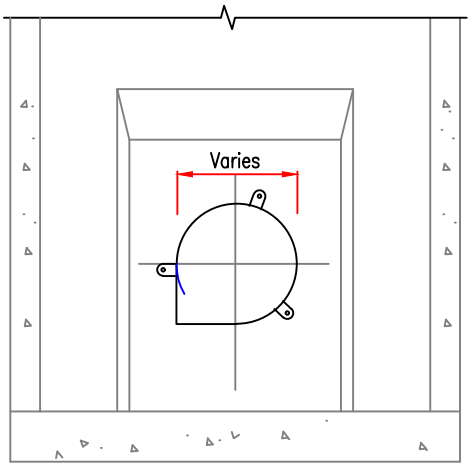
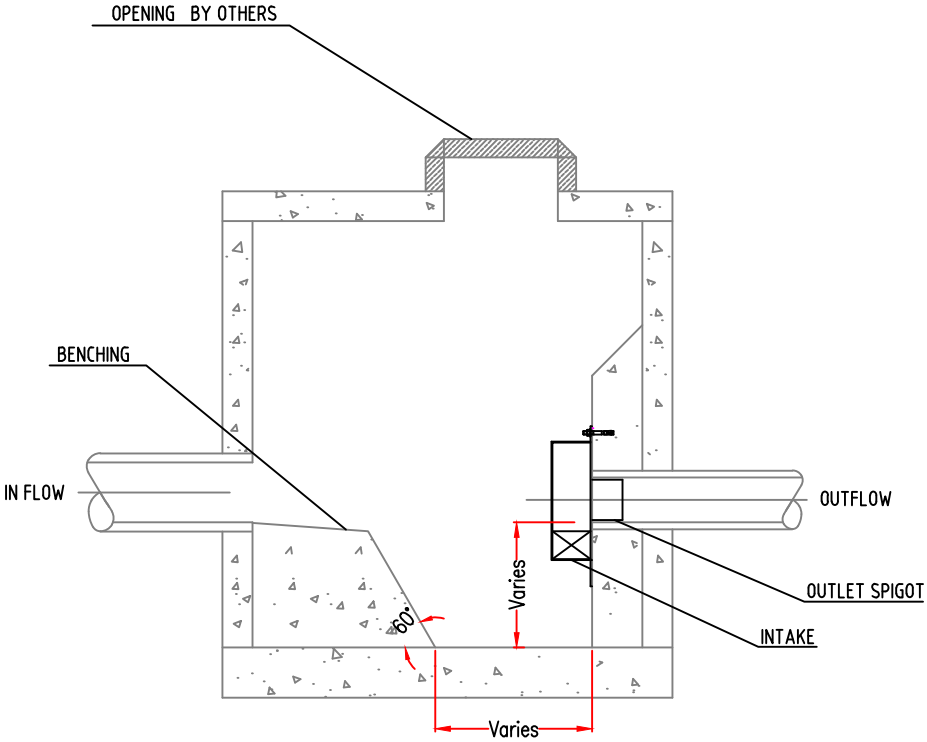




SECTION B–B



SECTION A–A

ENVIRONMENTAL SUSTAINABLE SOLUTIONS LTD

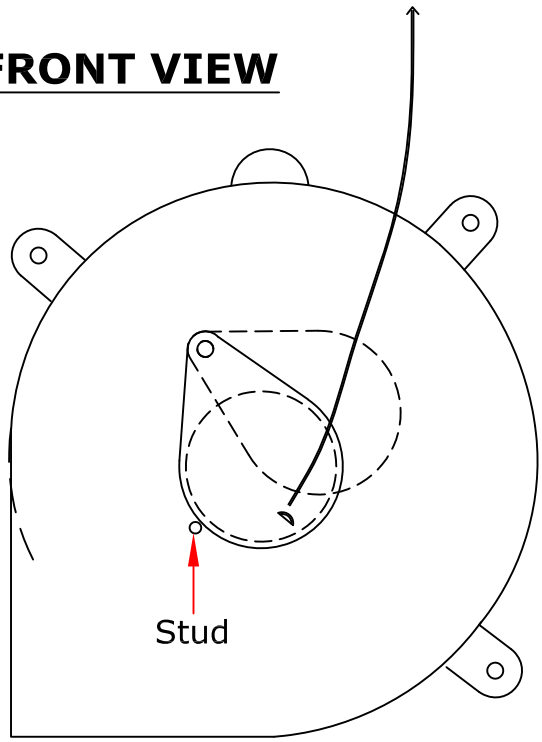
SOLUTIONS HOUSE,
DANE STREET
ROCHDALE
OL11 4EZ
TEL: 01706 374416
FAX 01706 376785

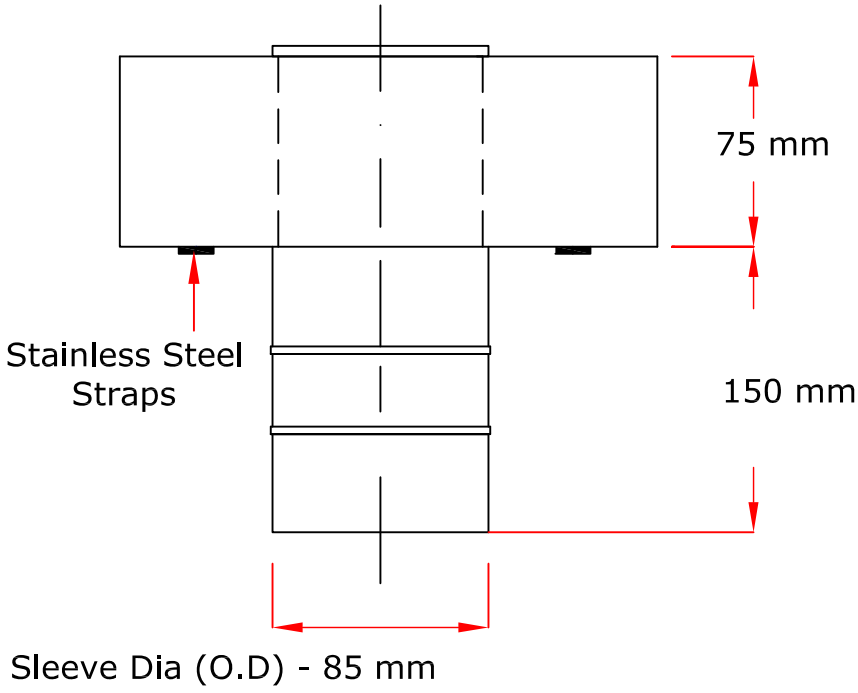
TYPICAL DETAILS FOR AQUABRAKE CHAMBER - CONCRETE

HEAD	m
DISCHARAGE	lts/sec

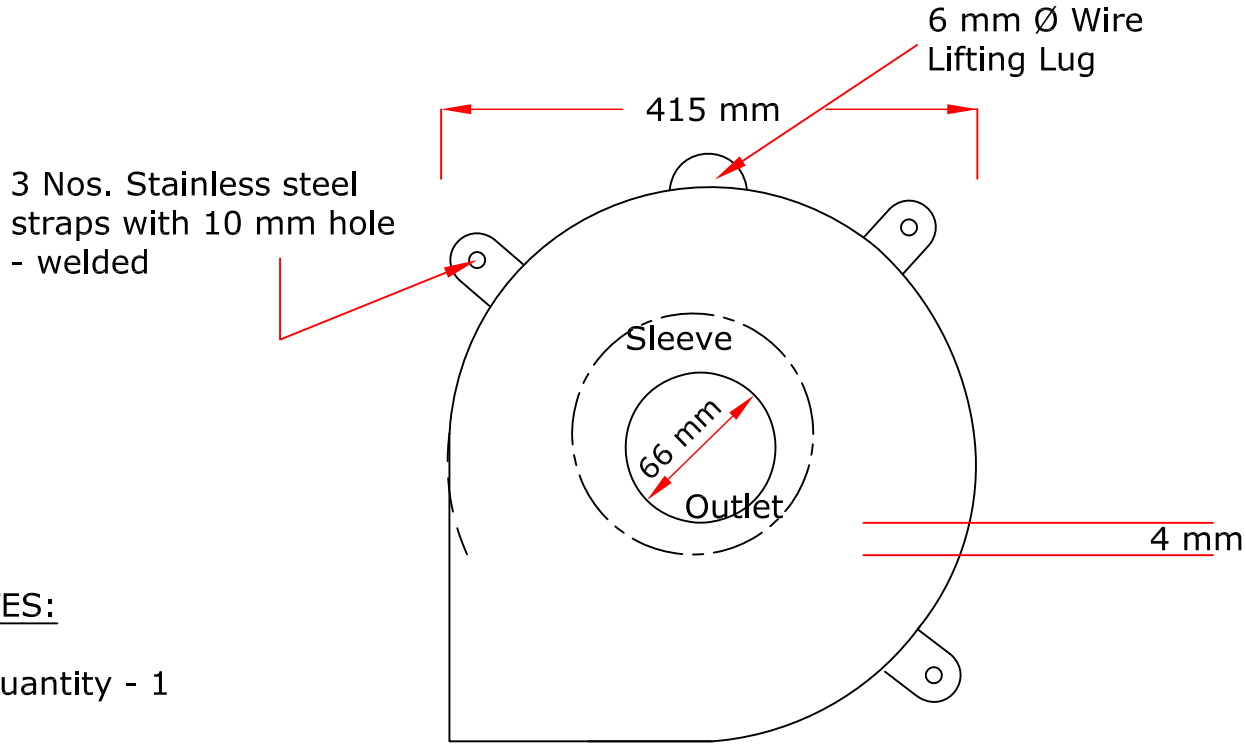
DATE 24/06/2019	DRAWN VH	PROJECT:	
SCALE N.T.S.	CHECKED PD	JOB No.	REVISION No.

FRONT VIEW





TOP VIEW



NOTES:

1. Quantity - 1
2. Outlet - 66 mm
3. All welds continuous, unless otherwise noted

SECTION VIEW

KEYTEC INSTALLATION SERVICES
ROYLE HOUSE,
COWM TOP LN,
ROCHDALE
OL11 2PU
TEL: 01706 374416
FAX 01706 376785

FLUIDIC-AMP AQUABRAKE STAINLESS STEEL STRAP ATTACHMENT FABRICATION DRAWING		HEAD 1.1m DISCHARAGE 2.0 l/sec (TYPE 3)	
DATE 18/07/2025	DRAWN KZ	NAME:	
SCALE N.T.S.	CHECKED FA	JOB No.	REVISION No.

AquaBrake Flow Control

Project :- Chester Gate

Technical Information :-

AquaBrake Type : 66mm Orifice - TYPE3

Head = 1.1 mH / **Flow** = 2.0 l/s

Primary Design Point (A)

Control Points	Head (m)	Flow (l/s)
Wash-Flo (B)	0.200	1.80
Hit-Flo ©	0.800	1.70

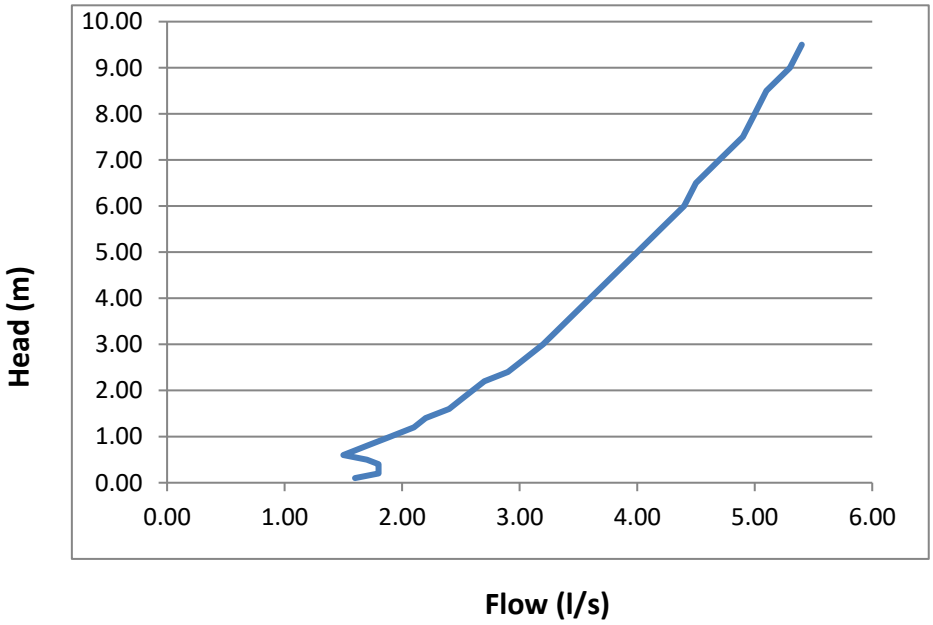
Wash-Flo (B)

The point at which the vortex begins to initiate and have a throttling effect. This point on the AquaBrake curve is usually much nearer to the maximum design flow (Design Point) than other vortex flow controls leading to more water passing through the unit during the earlier stages of a storm, thus reducing the amount of water that needs to be stored upstream.

Hit-Flo (C)

The point at which the vortex has initiated and at which the curve begins to return back to follow the orifice curve and reach the same design point or desired head / flow condition.

Head / Flow characteristic



Flow (l/s)	Head (m)
1.60	0.10
1.80	0.20
1.80	0.30
1.80	0.40
1.70	0.50
1.50	0.60
1.70	0.80
1.90	1.00
2.10	1.20
2.20	1.40
2.40	1.60
2.50	1.80
2.60	2.00
2.70	2.20
2.90	2.40
3.00	2.60
3.20	3.00
3.40	3.50
3.60	4.00
3.80	4.50
4.00	5.00
4.20	5.50
4.40	6.00
4.50	6.50
4.70	7.00
4.90	7.50
5.00	8.00
5.10	8.50
5.30	9.00
5.40	9.50

ROYLE HOUSE,
COWM TOP LN,
ROCHDALE
OL11 2PU
TEL: 01706 374416

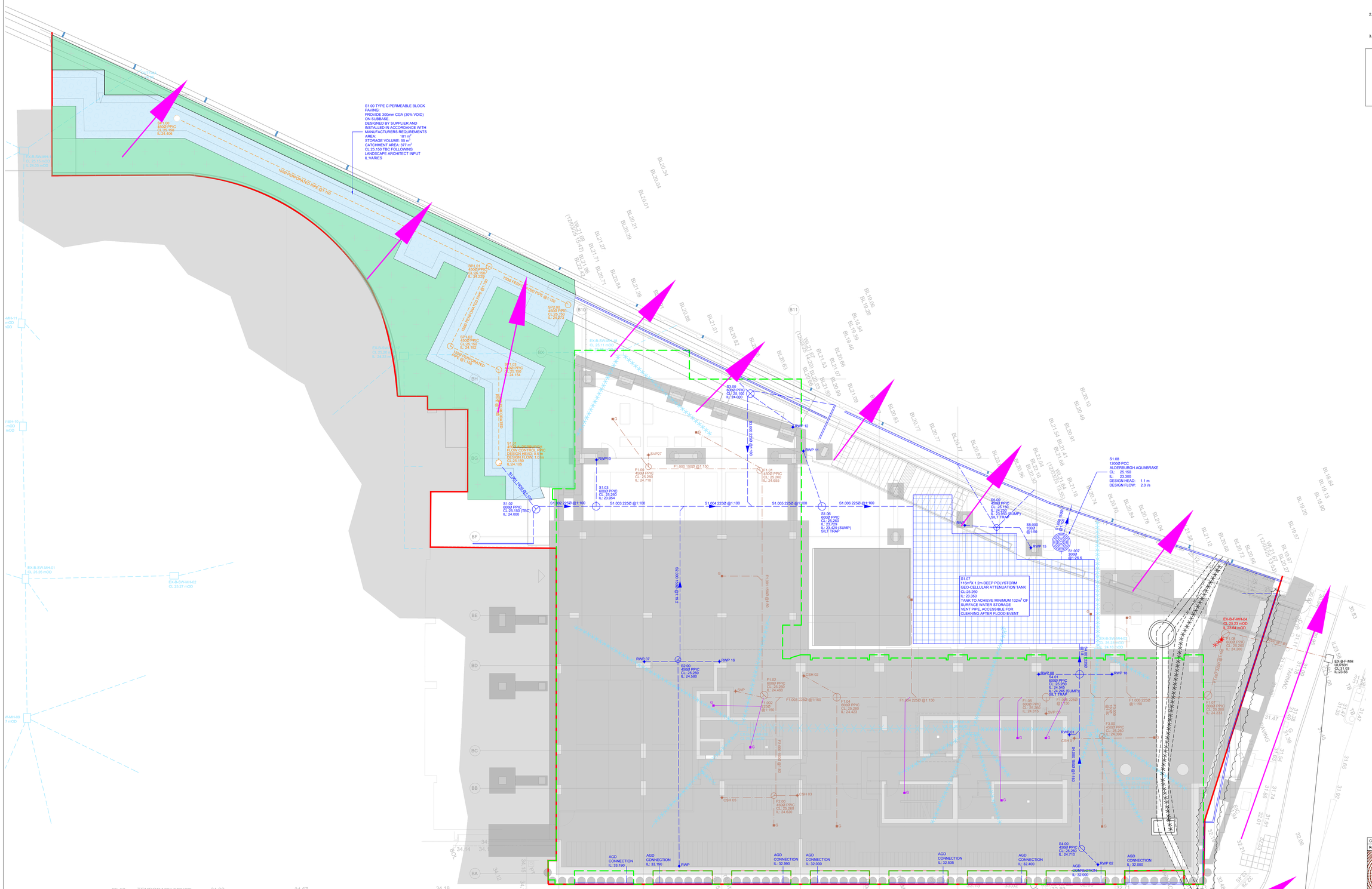
APPENDIX K

OVERLAND FLOW ROUTES

NOTES

1. 1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RENAISSANCE, ARCHITECTS, LANDSCAPE ARCHITECTS AND BUILDING SERVICES ENGINEERS DRAWINGS.
2. THE DRAINAGE SYSTEM HAS BEEN DESIGNED TO ACCOMMODATE RAINFALL EVENTS UP TO 1 IN 100 YEAR + 45% CLIMATE CHANGE. THIS DRAWING INDICATES THE OVERLAND FLOW ROUTES FOR AN EXCEEDANCE EVENT OF THE DRAINAGE SYSTEM.
3. THE DRAWING ALSO INDICATES THE SAFE EGRESS ROUTE OFF SITE IN AN EXCEEDANCE EVENT.

LEGEND	
REF	DESCRIPTION
	SITE BOUNDARY
	EXCEEDANCE FLOOD FLOW ROUTES



Rev:	Description:	Date:	By:	Chkd:
C01	GATEWAY SUBMISSION	31.07.25	HW	AI

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Renaissance Associates Ltd
2nd Floor Tribeca House
21-27 Dale Street
Manchester
M1 1EY

Project:

NO.1 CATHEDRAL SQUARE, LOCATION

Drawing Title:

OVERLAND FLOW ROUTES PLAN

Status:

RIBA STAGE 4

Size:	Date:	Drawn by:	Designed by:	Checked by:
A0	JUL 25	HW	HW	PC

Scale:	Project No:
1:100	2106-01

Project – Originator – Volume – Level – Type – Role – Number: REN-REN-BB-B2-DR-C-00070

Revision: C01

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