THOMAS CONSULTING
STRUCTURAL & CIVIL DESIGN ENGINEERS

LV0118-TC-LS-XX-CA-C-001

DRAINAGE CALCULATIONS

AT

Store Street
Manchester
M1 2NJ

FOR

Cosmic Build Ltd

ISO 9001
ISO 14001
ISO 45001
Certificate No: 14272

Constructionline
Gold Member

CYBER ESSENTIALS CERTIFIED

Supply Chain Charter for Nuclear Decommissioning Sites Signatory

STA STRUCTURAL TIMBER ASSOCIATION

CHAS Accredited Contractor

REPORT VERIFICATION

Site Address	Store Street, Manchester, M1 2NJ

Document Reference	LV0118-TC-LS-XX-CA-C-001
QA Grade	QA4
Originator	Shea Beesley
Checked	James Gendall MEng (Hons) CEng MIStructE
Verified	Michael Dean BEng (Hons) CEng MIStructE

Revision	Date	Status
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1 INTRODUCTION

1.1 Site Location, Description & Topography

The site is located along Store Street, Manchester and is located approximately off Lissadel Street, Salford approximately 300m Northeast of Manchester Piccadilly Station in the centre of Manchester.

The proposed development is a fifteen storey residential apartment block with associated soft landscaping. Store StreetThe location of the site is shown on Figure 1.

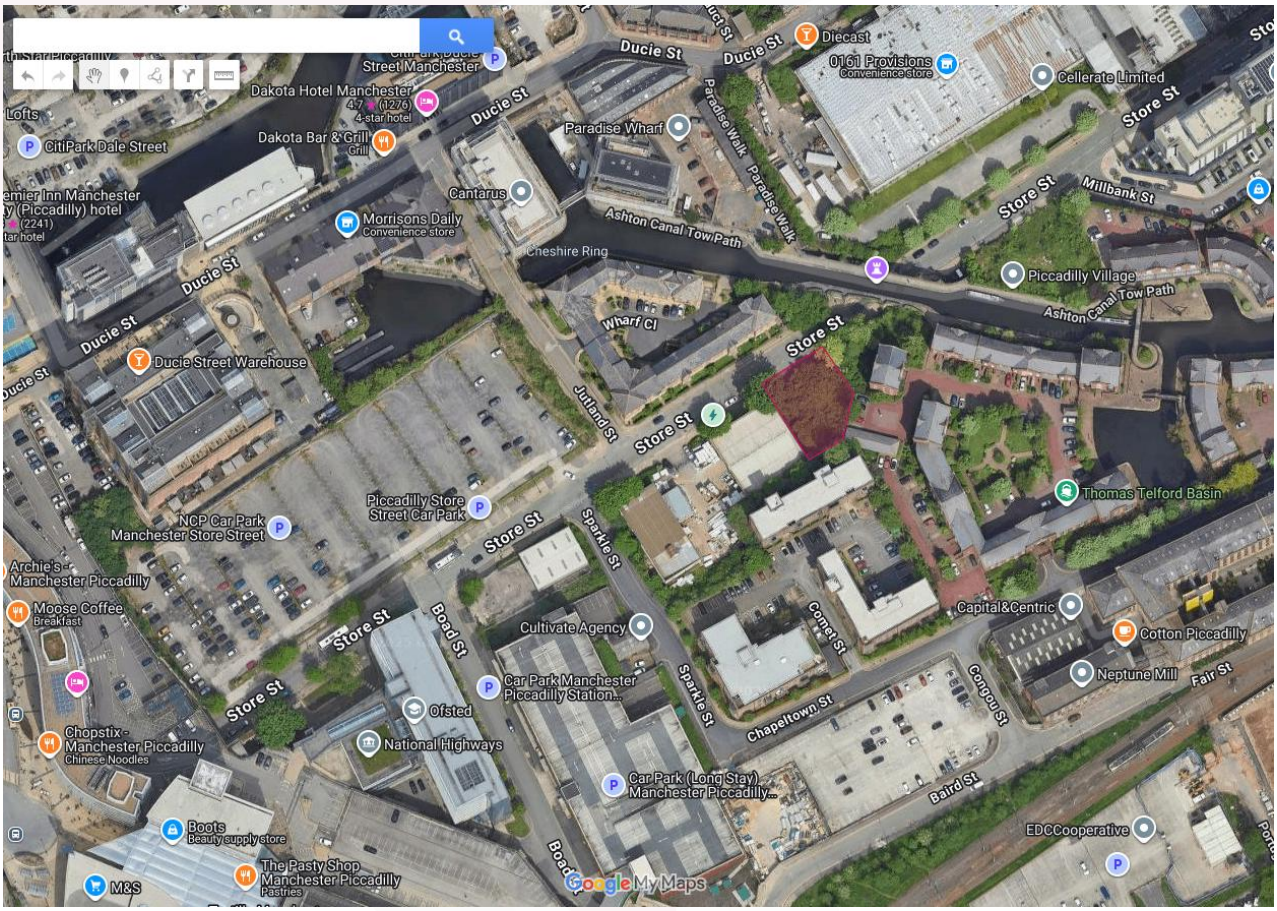


Figure 1: Site Location Plan (MyMaps, 2025)

The site is bound to the South and West by commercial developments, the East an area of overgrown vegetation and to the North, Store Street.

2 SURFACE WATER DRAINAGE STRATEGY

2.1 Design Parameters

The following design parameters have been utilised within the drainage model:

- Simulations have been set to analyse return periods of 1 in 2-years, , 1 in 30-years, 1 in 100-year and 1 in-100 year with a 40% uplift for climate change.
- Storm durations from 15 minutes to 1440 minutes (1 day) have been analysed.
- CV values have been set to a the default 0.75 (summer) and 1.0 (winter) storm events.
- The calculations utilise FEH-22 rainfall data for the analysis.
- Agreed discharge rate of 5.0l/s as per Alan Johnston Partnership Drawing PWM-AJP-XX-00-DR-C-3010-P02 dated March 2021.

2.2 Surface Water Drainage Proposals

The proposals are to positively drain the site usings rainwater pipes to collect runoff from the roof and using gullies and drainage channels to collect runoff from hardstanding areas around the development; these will then convey the surface water runoff to the drainage network which will ultimately discharge off-site into the receiving dedicated surface water sewer.

In accordance with the approved Alan Johnston Partnership Drawing PWM-AJP-XX-00-DR-C-3010-P02 dated March 2021, the surface water drainage has been designed to a restricted runoff rate of 5.0l/s which will be achieved through the use of a Hydrobrake flow control; In order to ensure that the permitted discharge rate is not exceeded, or no flooding occurs within the site, it has been necessary to utilise additional storage in the form of geocelluar attenuation crates.

The drainage has been designed to contain flood events up to the 1% AEP with a 40% uplift allowance for climate change without and flooding occurring from the proposed drainage system. This has resulted in the requirement for 20m^3 of geo-cellular storage to be provided as part of the proposals. This includes a 10% increase of the attenuation requirement in accordance with recommendations of The SuDS Manual (CIRIA C753). This recommends the increase in the volume of an attenuation tank for hard-to-clean systems to account for long-term sediment build-up that can reduce storage volume. This increase ensures the system maintains its designed capacity over its lifespan, especially when effective upstream sediment capture methods are lacking.

There are no areas trafficked by vehicles, so no interceptor has been provided.

Drawings included in Appendix A are as follows;

- LV0037-TC-LS-DN-DR-C-050 – Proposed General Arrangement
- LV0037-TC-LS-DN-DR-C-051 – Drainage Details Part 1
- LV0037-TC-LS-DN-DR-C-052 – Drainage Details Part 2
- LV0037-TC-LS-DN-DR-C-053 – Drainage Details Part 3
- LV0037-TC-LS-DN-DR-C-054 – Drainage Manhole Schedule

Drainage calculations have been developed using Flow Version 12 by Causeway and are included in Appendix B.

APPENDIX A

THOMAS CONSULTING DRAINAGE DRAWINGS

Surface Water Hierarchy

Infiltration - not possible to due to the site constraints - the building occupies a large potion of the footprint foundations will be within 5m of any proposed soakaway and therefore unviable. Initial investigations indicate stiff clay superficial deposits over sandstone bedrock - this will prevent the use of infiltration.

Water course - there are no nearby water course that are within a suitable distance from site that would not entail crossing 3rd party

Surface Water Sewer - located on Store Street, connection as proposed.

SuDS Assessment

The assessment for infiltration cannot be carried out on site due to the existing site level and amount of existing fill on site.

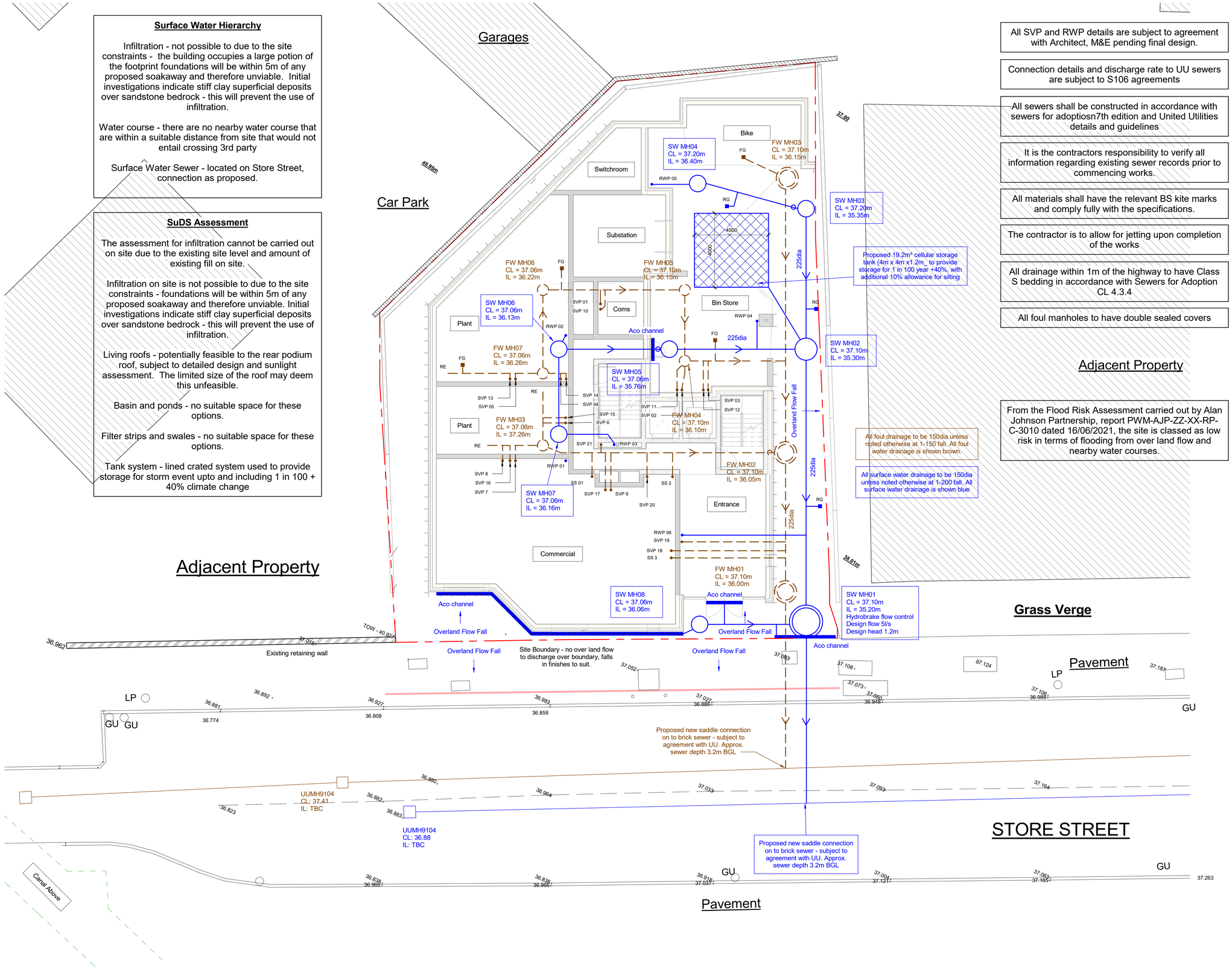
Infiltration on site is not possible to due to the site constraints - foundations will be within 5m of any proposed soakaway and therefore unviable. Initial investigations indicate stiff clay superficial deposits over sandstone bedrock - this will prevent the use of infiltration.

Living roofs - potentially feasible to the rear podium roof, subject to detailed design and sunlight assessment. The limited size of the roof may deem this unfeasible.

Basin and ponds - no suitable space for these options.

Filter strips and swales - no suitable space for these options.

Tank system - lined crated system used to provide storage for storm event upto and including 1 in 100 + 40% climate change



1 PLAN ON SURFACE AND FOUL WATER BELOW GROUND DRAINAGE

1 : 100

All SVP and RWP details are subject to agreement with Architect, M&E pending final design.

Connection details and discharge rate to UU sewers are subject to S106 agreements

All sewers shall be constructed in accordance with sewers for adoptiosn7th edition and United Utilities details and guidelines

It is the contractors responsibility to verify all information regarding existing sewer records prior to commencing works.

All materials shall have the relevant BS kite marks and comply fully with the specifications.

The contractor is to allow for jetting upon completion of the works

All drainage within 1m of the highway to have Class S bedding in accordance with Sewers for Adoption CL 4.3.4

All foul manholes to have double sealed covers

Adjacent Property

From the Flood Risk Assessment carried out by Alan Johnson Partnership, report PWM-AJP-ZZ-XX-RP-C-3010 dated 16/06/2021, the site is classed as low risk in terms of flooding from over land flow and nearby water courses.

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Revisions

Rev	Date	Description	Drawn	Checked
P1	29/09/25	Preliminary Issue	SB	JG

DRAWING STATUS: Preliminary

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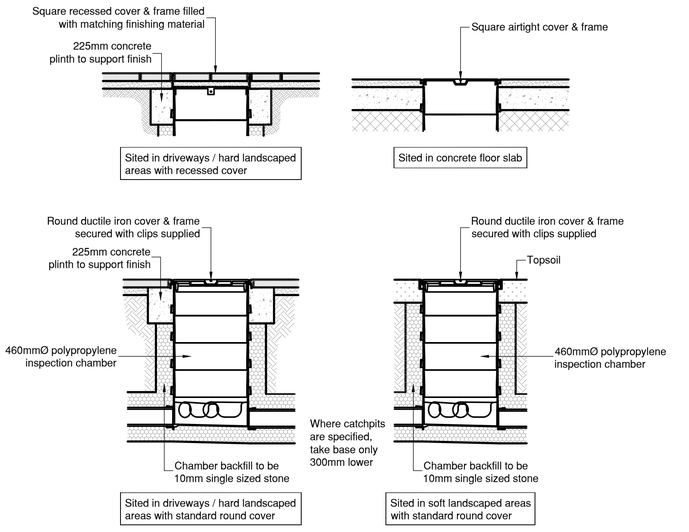
CLIENT: COSMIC BUILD

PROJECT: STORE STREET, MANCHESTER

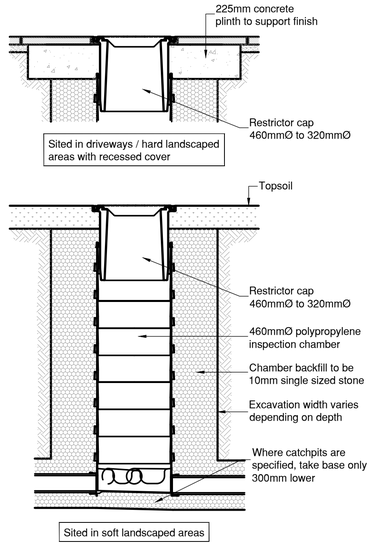
DRAWING TITLE: BELOW GROUND DRAINAGE ARRANGEMENT

DATE CREATED	DRAWING SCALE:	DRAWN BY:	CHECKED:	QA CATEGORY:
09/25/25	1 : 100	Author	Checker	

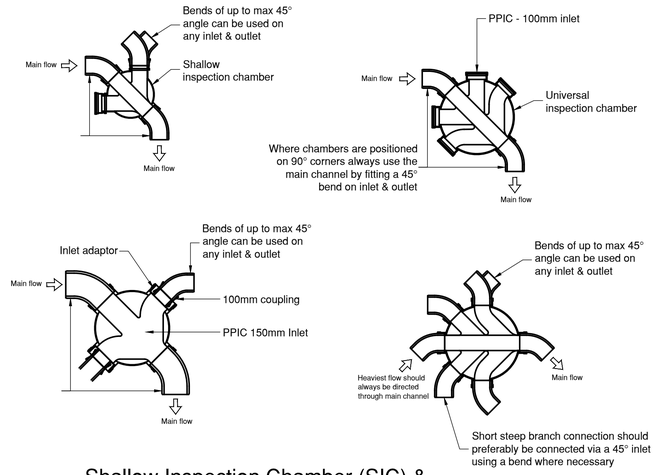
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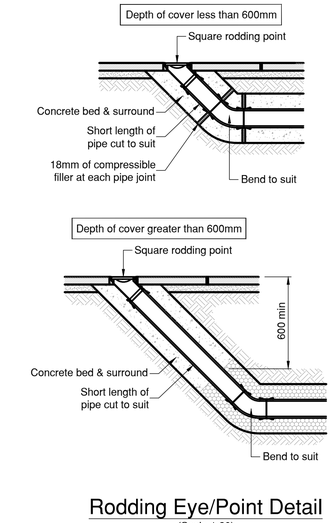
460mmØ Universal Inspection Chamber Detail
Max. depth 1.2m
(Scale 1:20)



460mmØ Non-entry Inspection Chamber Detail
Depths Between 1.2m - 3m
(Scale 1:20)



Shallow Inspection Chamber (SIC) & Universal Inspection Chamber (UIC) Installation Detail
(Scale 1:20)

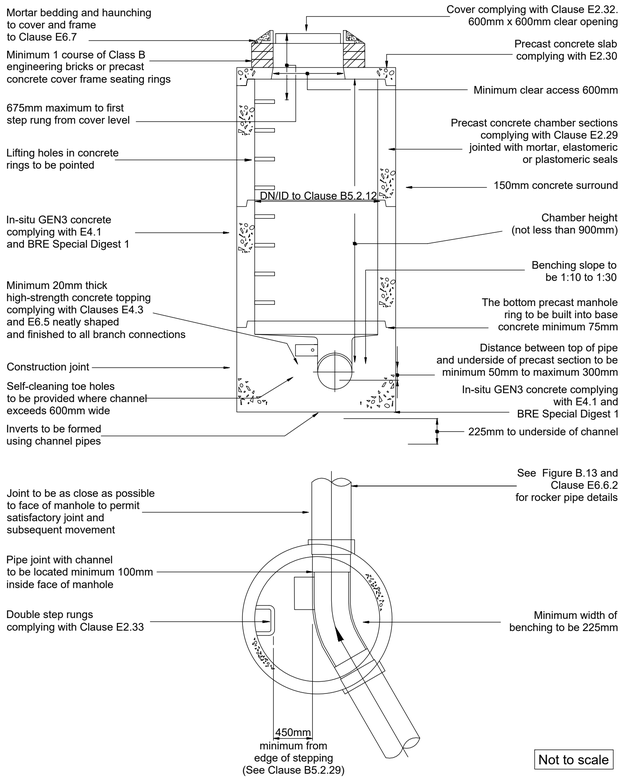


Rodding Eye/Point Detail
(Scale 1:20)

Coupling within
150mm of structure

Typical manhole detail - Type B

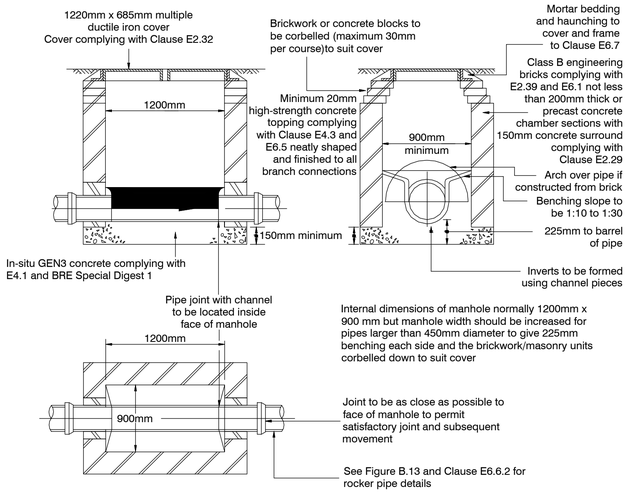
Depth from cover level to soffit of pipe 1.5m to 3.0m
Alternative Rigid material construction with concrete surround



Not to scale

Figure B 14
Typical manhole detail - Type C

Depth from cover level to soffit of pipe less than 1.5m
Rigid material construction



Note: The use of precast concrete chamber units to E2.29 with 150mm GEN3 in-situ concrete complying with E4.1 and BRE Special Digest 1 in place of brickwork construction is permitted.

Not to scale

Typical manhole detail - Type B with Catchpit

Polypropylene Yard Gully Detail
(Scale 1:20)

Road Gully Detail - Type 1
(Scale 1:20)

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REVISIONS

REV	DATE	DESCRIPTION	DRAWN BY	CHECKED BY
P1	24.09.25	Preliminary	MD	BRH

DRAWING STATUS:
PRELIMINARY ISSUE

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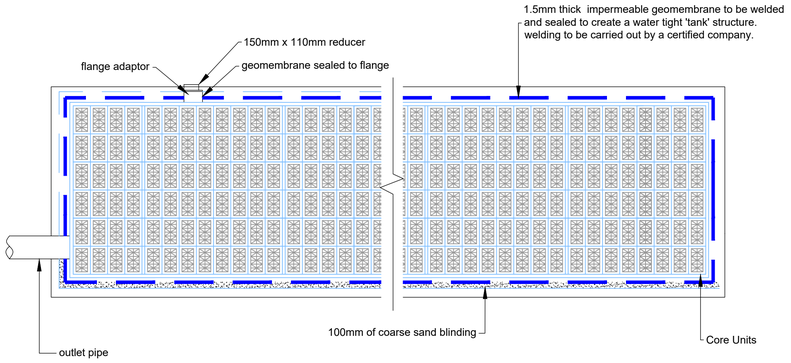
PROJECT:
STORE STREET, MANCHESTER

DRAWING TITLE:
DRAINAGE DETAILS PART 1

DATE CREATED:	DRAWING SCALE:	DRAWN BY:	CHECKED BY:	QA CATEGORY:
29.08.2025	1:150 @A0	MWJ	MD	4

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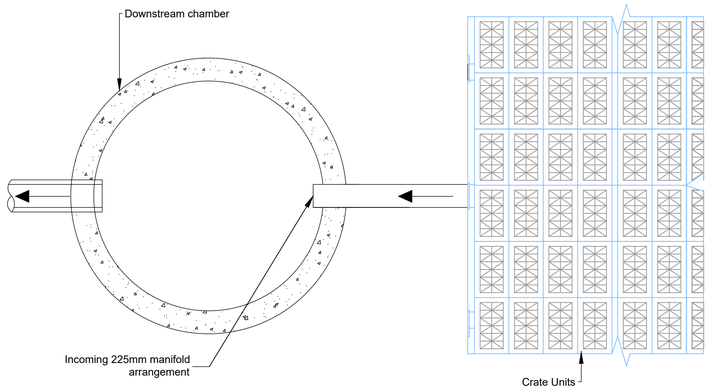
Sump at each end of trench to drain water while installing the tank

Based on polypipe polystorm unit (1.0m x 0.5m x 0.4m high) and laid to manufacturers recommendations

Manhole dimensions and design to suit health and safety requirements

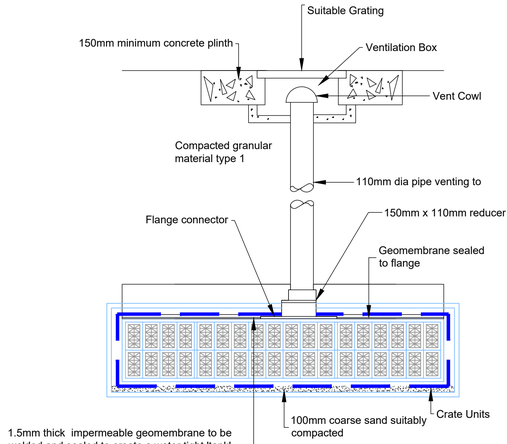
Typical Section Through Cellular Crate Storage

Scale: NTS



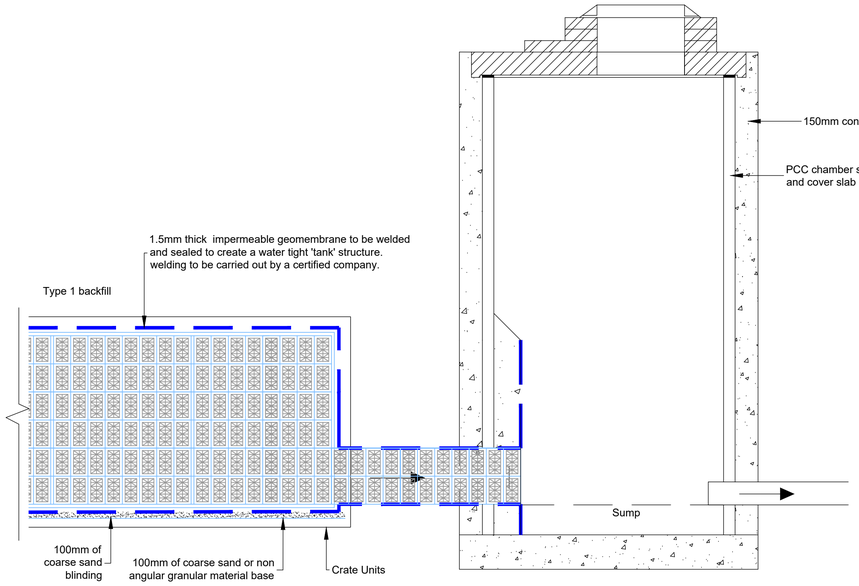
Typical Outgoing Manifold Connection Configuration

Scale: NTS



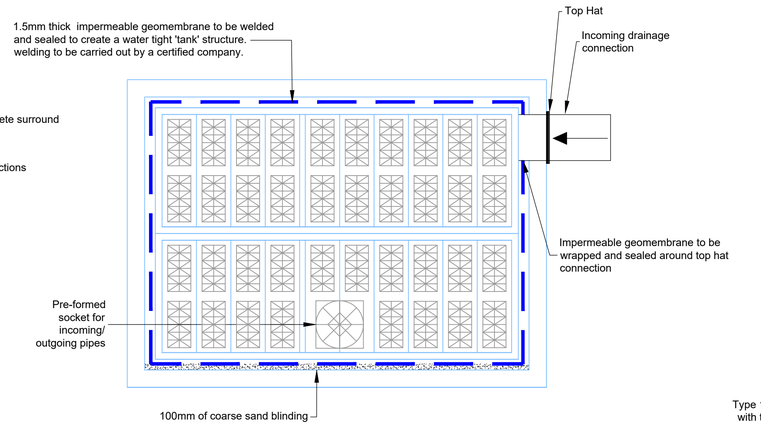
Note: It is recommended that one vent pipe, 110mm in diameter, is provided per 7,500 square meters of impermeable catchment area on a site

Note: Vent to be positioned out of the way of children/ those with visual impairments. To be concealed within nearby planting.



Typical Box Feed Connection

Scale: NTS



Typical Incoming Connections

Scale: NTS

Backfill Notes
Type 1 or Type 2 sub-base backfill to the sides and over the cells only. Material to be compacted in accordance with table 6/1 or 8/1 of the specification for highway works and taking into account maximum roller weights as advised by manufacturer.

Construction plant **not** to traffic near or over tank locations unless specifically authorised by the engineer.

Typical Air Vent Installation Details

Scale: NTS

For Trafficked Areas - With Storage Wrapping

Pipework shown indicatively only. See general arrangement for locations and levels of pipework.

POLYPIPE POLYSTORM UNIT (FOR TRAFFICKED AREAS)
(EACH UNIT 1.0 x 0.5 x 0.4)
LAID TO MANUFACTURERS RECOMMENDATIONS
0.6m COVER BETWEEN TOP OF TANK AND GROUND LEVEL

Notes
Type 1 or Type 2 sub-base backfill to the sides and over the cells only. Material to be compacted in accordance with table 6/1 or 8/1 of the specification for highway works and taking into account maximum roller weights as advised by Manufacturer.

Construction plant **not** to traffic near or over tank locations unless specifically authorised by the engineer.

Units to be wrapped in a geomembrane as recommended and specified by the manufacturer units to be placed on 100mm deep of sharp sand.
Pipe entry points and geotextile to be sealed in accordance with manufacturers recommendations, including welded double seams.
Polystorm by Polypipe units to be used unless specific agreement given by client for alternative approved product.

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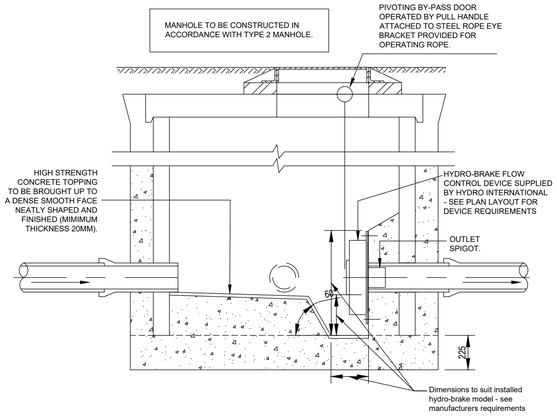
PROJECT: STORE STREET, MANCHESTER

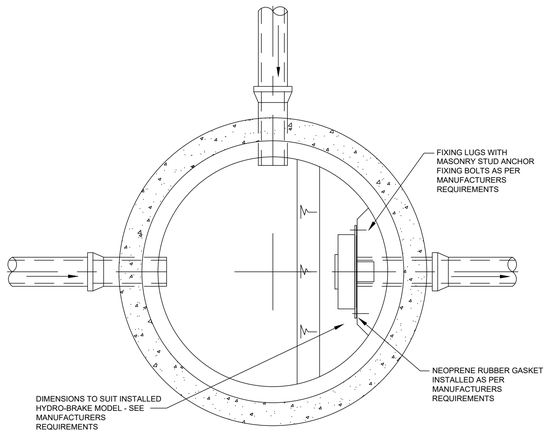
DRAWING TITLE: DRAINAGE DETAILS PART 3

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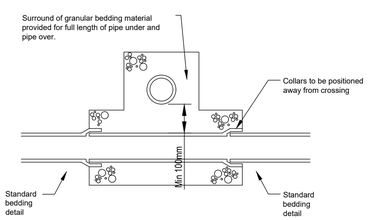
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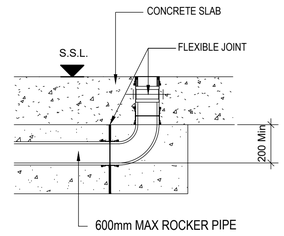




Typical Flow Control Hyrdrobrake) Detail

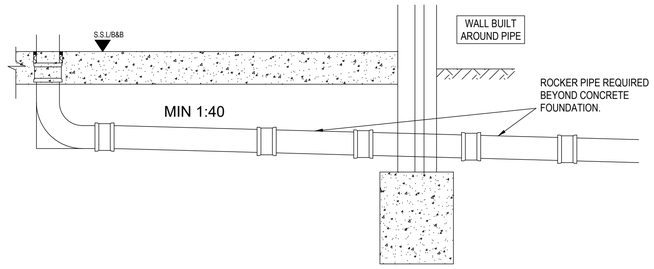


PIPE CROSSINGS DETAIL

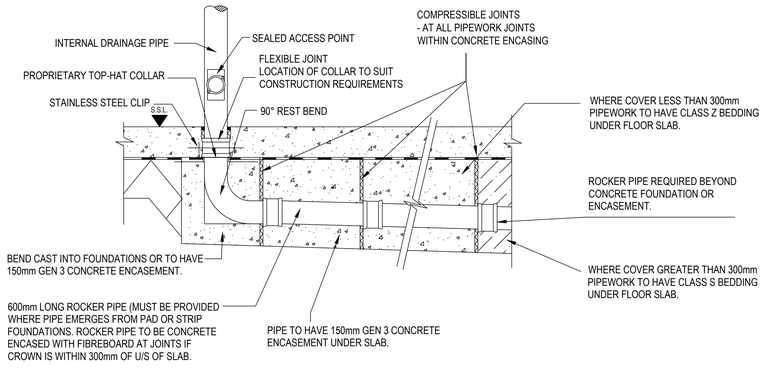


TYPICAL SECTION THROUGH SLAB (100mmØ downpipe)

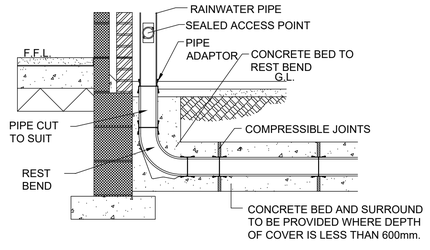
TYPICAL DETAIL WHERE DRAINAGE PASSES ABOVE GROUND BEAM



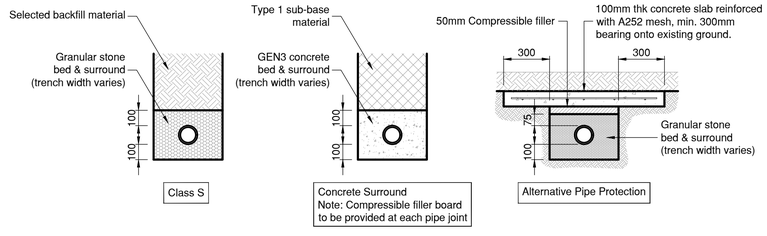
Bedding & Sidefill Materials For Flexible Pipes



Drainage Under Buildings

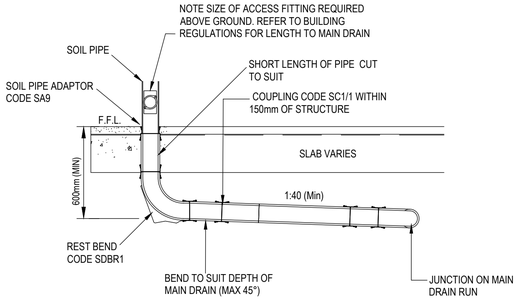


RWP Connection Detail

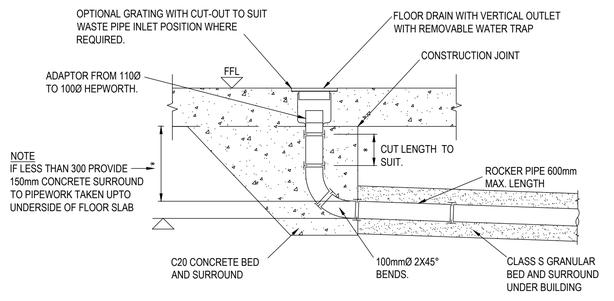


Pipe Bedding Details

(Scale 1:20)



TYPICAL SVP/SS CONNECTION TO MAIN RUN



TYPICAL INTERNAL FLOOR DRAIN

The table (A2 from WIS 4-08-02) shows specification for processed granular material.

Pipe nominal bore (mm) See note (d)	Nominal Max. Particle Size (mm)	Either: Maximum CF value for acceptability See note (b)		Or: Materials specified in British Standards See note (a)
		Non-pressure pipe	Pressure pipe	
100	10	0.15	0.30	10mm nominal single-size
Over 100 to 150	16	0.15	0.30	10 or 14mm. nominal single-size or 14mm to 5mm graded.
Over 150 to 300	20	0.15	0.30	10, 14 or 20mm nominal single-size or 14mm to 5mm graded or 20mm to 5mm graded.
Over 300 to 550	20	0.15	0.30	14 or 20mm nominal single-size or 14mm to 5mm graded or 20mm to 5mm graded.
Over 550	40	0.15	0.30	14, 20 or 40mm nominal single-size or 14mm to 5mm graded or 20mm to 5mm graded. or 40mm to 5mm graded.

Notes:
(a) Processed granular materials to include aggregates to BS EN 13242.
(b) Compaction Fraction value (CF), see WIS No. 4-08-02.
(c) For the purpose of this table, PE pipes of 630mm OD can be regarded as having nominal bores of over 550mm, irrespective of wall thickness.
(d) Nominal bore is used in preference to DN because of the different nominal size classifications for flexible pipes.
(e) For PE80 & PE100 polyethylene pipe complying with current relevant Water Industry Specifications, the maximum sidefill particle size may be increased to 10% of the pipe nominal size.
(f) For E values for processed granular materials refernece should be made to table A.3 where specific site tests have not been performed.
(g) For ferrous and cementitious pipeline materials, the sulphate content of bedding and sidefill materials should not be greater than 0.3% as sulphur trioxide.

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REVISIONS

REV	DATE	DESCRIPTION	DRAWN BY	CHECKED BY
P1	24.09.25	Preliminary	MD	BRH

DRAWING STATUS: PRELIMINARY ISSUE

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CLIENT: COSMIC BUILD

PROJECT: STORE STREET, MANCHESTER

DRAWING TITLE: DRAINAGE DETAILS PART 2

DATE CREATED:	DRAWING SCALE:	DRAWN BY:	CHECKED BY:	QA CATEGORY:
29.08.2025	1:150 @A0	MWJ	MD	4

DRAWING REF: LV0118-TC-SS-DT-DR-C-052 | REV: P1

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FOUL WATER MANHOLES

	MANHOLE REFERENCE	MANHOLE DIAM. (mm)	APPROX. COVER LEVEL (m).	APPROX. INVERT LEVEL (m).	APPROX. DEPTH (m).	MANHOLE TYPE	COVER TYPE
	FW MH01	600	37.100	36.000	1.100	1C	LOAD CLASS B125 TO BS.EN.124
	FW MH02	600	37.100	36.050	1.050	1C	LOAD CLASS B125 TO BS.EN.124
	FW MH03	600	37.060	36.260	0.800	1C	LOAD CLASS B125 TO BS.EN.124
	FW MH04	600	37.100	36.100	1.000	1C	LOAD CLASS B125 TO BS.EN.124
	FW MH05	600	37.100	36.150	0.950	1C	LOAD CLASS B125 TO BS.EN.124
	FW MH06	600	37.060	36.220	0.840	1C	LOAD CLASS B125 TO BS.EN.124
	FW MH07	600	37.060	36.260	0.800	1C	LOAD CLASS B125 TO BS.EN.124
	FW MH08	600	37.100	36.150	0.950	1C	LOAD CLASS B125 TO BS.EN.124

SURFACE WATER MANHOLES

	MANHOLE REFERENCE	MANHOLE DIAM. (mm)	APPROX. COVER LEVEL (m).	APPROX. INVERT LEVEL (m).	APPROX. DEPTH (m).	MANHOLE TYPE	COVER TYPE
	SW MH01	1200	37.100	35.200	1.900	B	LOAD CLASS B125 TO BS.EN.124
	SW MH02	1200	37.100	35.300	1.800	B	LOAD CLASS B125 TO BS.EN.124
	SW MH03	1200	37.200	35.350	1.850	B	LOAD CLASS B125 TO BS.EN.124
	SW MH04	1200	37.200	36.400	0.800	C	LOAD CLASS B125 TO BS.EN.124
	SW MH05	1200	37.060	35.760	1.300	C	LOAD CLASS B125 TO BS.EN.124
	SW MH06	1200	37.060	36.130	0.930	C	LOAD CLASS B125 TO BS.EN.124
	SW MH07	1200	37.060	36.160	0.900	C	LOAD CLASS B125 TO BS.EN.124
	SW MH08	1200	37.060	36.060	1.000	C	LOAD CLASS B125 TO BS.EN.124

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Revisions

Rev	Date	Description	Drawn	Checked
P1	29/10/25	Preliminary Issue	SB	MD

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CLIENT:
SHAW STREET HOMES

PROJECT:
STORE STREET, MANCHESTER

DRAWING TITLE:
MANHOLE SCHEDULE

DATE CREATED	DRAWING SCALE:	DRAWN BY:	CHECKED:	QA CATEGORY:
10/29/25	1 : 1	Author	Checker	

Drawing Number: LV0118-TC- SS-GND-SH-C-054 | REV: P1

APPENDIX B

THOMAS CONSULTING DRAINAGE CALCULATIONS

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	30	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	0.750	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	15.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	x
Maximum Rainfall (mm/hr)	50.0		

Adoptable Manhole Type

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

>900 Link+900 mm

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

Circular Link Type

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

Available Diameters (mm)

100 | 150

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
4	0.010	15.00	37.200	1200	20.720	81.237	0.800
5	0.001	15.00	37.200	1200	36.011	77.812	1.850
6	0.006	15.00	37.100	1200	36.377	57.996	1.875
8	0.008	15.00	37.100	1200	36.377	20.320	1.949
1	0.014	15.00	37.060	1200	2.127	46.253	0.900
2	0.016	15.00	37.060	1200	1.760	58.240	0.923
3	0.001	15.00	37.060	1200	16.561	58.118	1.300
7	0.004	15.00	37.060	1200	20.842	20.075	1.000
~Depth/Area 1		15.00	37.200		25.491	71.574	1.900
8_OUT			37.093		35.644	7.354	1.986

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Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
3.000	4	5	6.000	0.600	36.400	36.370	0.030	200.0	150	15.14	50.0
3.001	5	6	7.600	0.600	35.350	35.312	0.038	200.0	225	15.28	50.0
1.000	1	2	4.600	0.600	36.160	36.137	0.023	200.0	150	15.11	50.0
1.001	2	3	6.000	0.600	36.137	36.107	0.030	200.0	150	15.25	50.0
1.002	3	6	7.400	0.600	35.760	35.723	0.037	200.0	225	15.38	50.0
1.003	6	8	14.740	0.600	35.225	35.151	0.074	200.0	225	15.65	50.0
4.000	7	8	5.800	0.600	36.060	36.031	0.029	200.0	150	15.14	50.0
1.004	8	8_OUT	9.800	0.600	35.151	35.107	0.044	225.0	225	15.84	50.0
2.000	~Depth/Area 1	6	17.403	0.600	35.300	35.300	0.000	0.0	150	15.29	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
3.000	0.707	12.5	1.4	0.650	0.680	0.010	0.0	33	0.460
3.001	0.921	36.6	1.5	1.625	1.563	0.011	0.0	31	0.456
1.000	0.707	12.5	1.9	0.750	0.773	0.014	0.0	40	0.511
1.001	0.707	12.5	4.1	0.773	0.803	0.030	0.0	59	0.632
1.002	0.921	36.6	4.2	1.075	1.152	0.031	0.0	51	0.617
1.003	0.921	36.6	6.5	1.650	1.724	0.048	0.0	64	0.696
4.000	0.707	12.5	0.5	0.850	0.919	0.004	0.0	21	0.351
1.004	0.867	34.5	8.1	1.724	1.761	0.060	0.0	74	0.712
2.000	1.000	17.7	0.0	1.750	1.650	0.000	0.0	0	0.000

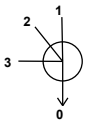
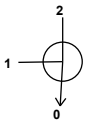
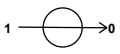
Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
3.000	6.000	200.0	150	Circular	37.200	36.400	0.650	37.200	36.370	0.680
3.001	7.600	200.0	225	Circular	37.200	35.350	1.625	37.100	35.312	1.563
1.000	4.600	200.0	150	Circular	37.060	36.160	0.750	37.060	36.137	0.773
1.001	6.000	200.0	150	Circular	37.060	36.137	0.773	37.060	36.107	0.803
1.002	7.400	200.0	225	Circular	37.060	35.760	1.075	37.100	35.723	1.152
1.003	14.740	200.0	225	Circular	37.100	35.225	1.650	37.100	35.151	1.724
4.000	5.800	200.0	150	Circular	37.060	36.060	0.850	37.100	36.031	0.919
1.004	9.800	225.0	225	Circular	37.100	35.151	1.724	37.093	35.107	1.761
2.000	17.403	0.0	150	Circular	37.200	35.300	1.750	37.100	35.300	1.650

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
3.000	4	1200	Manhole	Adoptable	5	1200	Manhole	Adoptable
3.001	5	1200	Manhole	Adoptable	6	1200	Manhole	Adoptable
1.000	1	1200	Manhole	Adoptable	2	1200	Manhole	Adoptable
1.001	2	1200	Manhole	Adoptable	3	1200	Manhole	Adoptable
1.002	3	1200	Manhole	Adoptable	6	1200	Manhole	Adoptable
1.003	6	1200	Manhole	Adoptable	8	1200	Manhole	Adoptable
4.000	7	1200	Manhole	Adoptable	8	1200	Manhole	Adoptable
1.004	8	1200	Manhole	Adoptable	8_OUT		Junction	
2.000	~Depth/Area 1		Junction		6	1200	Manhole	Adoptable

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Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
4	20.720	81.237	37.200	0.800	1200				
						0	3.000	36.400	150
5	36.011	77.812	37.200	1.850	1200	1	3.000	36.370	150
									
						0	3.001	35.350	225
6	36.377	57.996	37.100	1.875	1200		1	3.001	35.312	225
							2	2.000	35.300	150
							3	1.002	35.723	225
							0	1.003	35.225	225
8	36.377	20.320	37.100	1.949	1200		1	4.000	36.031	150
							2	1.003	35.151	225
							0	1.004	35.151	225
1	2.127	46.253	37.060	0.900	1200				
						0	1.000	36.160	150
2	1.760	58.240	37.060	0.923	1200	1	1.000	36.137	150
									
						0	1.001	36.137	150
3	16.561	58.118	37.060	1.300	1200	1	1.001	36.107	150
									
						0	1.002	35.760	225
7	20.842	20.075	37.060	1.000	1200				
						0	4.000	36.060	150
~Depth/Area 1	25.491	71.574	37.200	1.900					
						0	2.000	35.300	150
8_OUT	35.644	7.354	37.093	1.986			1	1.004	35.107	225

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Starting Level (m)	
Rainfall Events	Singular	Skip Steady State	x	Check Discharge Rate(s)	x
Summer CV	0.750	Drain Down Time (mins)	240	Check Discharge Volume	✓
Winter CV	1.000	Additional Storage (m³/ha)	20.0	100 year 360 minute (m³)	

Storm Durations

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

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Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	0	0	0
100	40	0	0

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)		Storm Duration (mins)	360
Soil Index	1	Betterment (%)	0
SPR	0.10	PR	
CWI		Runoff Volume (m^3)	

Node 8 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	35.151	Product Number	CTL-SHE-0105-5000-1030-5000
Design Depth (m)	1.030	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	5.0	Min Node Diameter (mm)	1200

Node ~Depth/Area 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	35.300
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.96	Time to half empty (mins)	30

Depth (m)	Area (m^2)	Inf Area (m^2)	Depth (m)	Area (m^2)	Inf Area (m^2)	Depth (m)	Area (m^2)	Inf Area (m^2)
0.000	16.0	16.0	1.199	16.0	16.0	1.200	0.0	16.0

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Results for 2 year Critical Storm Duration. Lowest mass balance: 99.77%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	4	25	36.427	0.027	0.8	0.0366	0.0000	OK
15 minute winter	5	18	35.375	0.025	0.9	0.0285	0.0000	OK
30 minute winter	6	26	35.338	0.113	4.0	0.1352	0.0000	OK
30 minute winter	8	26	35.338	0.187	4.6	0.2263	0.0000	OK
30 minute winter	1	24	36.192	0.032	1.2	0.0468	0.0000	OK
30 minute winter	2	24	36.185	0.048	2.5	0.0708	0.0000	OK
30 minute winter	3	24	35.802	0.042	2.6	0.0483	0.0000	OK
30 minute winter	7	27	36.076	0.016	0.3	0.0200	0.0000	OK
30 minute winter	~Depth/Area 1	32	35.307	0.007	0.3	0.1100	0.0000	OK
30 minute winter	8_OUT	27	35.161	0.054	4.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	4	3.000	5	0.8	0.398	0.064	0.0121	
15 minute winter	5	3.001	6	0.9	0.394	0.025	0.0174	
30 minute winter	6	1.003	8	3.6	0.210	0.099	0.4067	
30 minute winter	8	1.004	8_OUT	4.4	0.602	0.129	0.0724	5.5
30 minute winter	1	1.000	2	1.2	0.317	0.096	0.0176	
30 minute winter	2	1.001	3	2.5	0.540	0.200	0.0278	
30 minute winter	3	1.002	6	2.6	0.523	0.071	0.0368	
30 minute winter	7	4.000	8	0.3	0.306	0.024	0.0057	
30 minute winter	~Depth/Area 1	2.000	6	-0.3	-0.192	-0.016	0.0314	

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Results for 30 year Critical Storm Duration. Lowest mass balance: 99.77%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	4	24	36.444	0.044	2.1	0.0602	0.0000	OK
30 minute winter	5	33	35.591	0.241	2.3	0.2751	0.0000	SURCHARGED
30 minute winter	6	33	35.591	0.366	10.0	0.4373	0.0000	SURCHARGED
30 minute winter	8	33	35.590	0.439	5.8	0.5322	0.0000	SURCHARGED
30 minute winter	1	24	36.224	0.064	3.0	0.0919	0.0000	OK
30 minute winter	2	24	36.219	0.082	6.4	0.1208	0.0000	OK
30 minute winter	3	24	35.828	0.068	6.6	0.0785	0.0000	OK
30 minute winter	7	23	36.088	0.028	0.9	0.0340	0.0000	OK
30 minute winter	~Depth/Area 1	33	35.593	0.293	7.2	4.4932	0.0000	SURCHARGED
30 minute winter	8_OUT	42	35.164	0.057	5.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	4	3.000	5	2.1	0.515	0.168	0.0245	
30 minute winter	5	3.001	6	2.4	0.424	0.066	0.3023	
30 minute winter	6	1.003	8	4.7	0.227	0.128	0.5862	
30 minute winter	8	1.004	8_OUT	5.0	0.620	0.144	0.0787	14.4
30 minute winter	1	1.000	2	3.0	0.355	0.240	0.0389	
30 minute winter	2	1.001	3	6.4	0.698	0.512	0.0550	
30 minute winter	3	1.002	6	6.6	0.677	0.180	0.0722	
30 minute winter	7	4.000	8	0.9	0.409	0.072	0.0127	
30 minute winter	~Depth/Area 1	2.000	6	-7.2	-0.597	-0.406	0.3064	

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Results for 100 year Critical Storm Duration. Lowest mass balance: 99.77%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	4	23	36.451	0.051	2.8	0.0703	0.0000	OK
30 minute winter	5	35	35.786	0.436	3.1	0.4977	0.0000	SURCHARGED
30 minute winter	6	35	35.786	0.561	12.5	0.6702	0.0000	SURCHARGED
30 minute winter	8	35	35.785	0.634	6.1	0.7688	0.0000	SURCHARGED
30 minute winter	1	23	36.239	0.079	3.9	0.1132	0.0000	OK
30 minute winter	2	23	36.233	0.096	8.3	0.1419	0.0000	OK
30 minute winter	3	23	35.839	0.079	8.6	0.0906	0.0000	OK
30 minute winter	7	24	36.091	0.031	1.1	0.0377	0.0000	OK
30 minute winter	~Depth/Area 1	35	35.787	0.487	9.5	7.4788	0.0000	SURCHARGED
60 minute summer	8_OUT	42	35.164	0.057	5.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	4	3.000	5	2.8	0.556	0.224	0.0302	
30 minute winter	5	3.001	6	2.7	0.430	0.073	0.3023	
30 minute winter	6	1.003	8	4.7	0.242	0.128	0.5862	
30 minute winter	8	1.004	8_OUT	5.0	0.620	0.144	0.0787	18.5
30 minute winter	1	1.000	2	3.9	0.367	0.312	0.0488	
30 minute winter	2	1.001	3	8.3	0.752	0.664	0.0661	
30 minute winter	3	1.002	6	8.6	0.725	0.235	0.0876	
30 minute winter	7	4.000	8	1.1	0.434	0.088	0.0147	
30 minute winter	~Depth/Area 1	2.000	6	-9.5	-0.658	-0.537	0.3064	

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Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.77%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	4	23	36.461	0.061	3.9	0.0845	0.0000	OK
60 minute winter	5	58	36.166	0.816	3.6	0.9320	0.0000	SURCHARGED
60 minute winter	6	58	36.166	0.941	14.9	1.1246	0.0000	SURCHARGED
60 minute winter	8	58	36.165	1.014	6.0	1.2301	0.0000	SURCHARGED
30 minute winter	1	23	36.265	0.105	5.4	0.1509	0.0000	OK
30 minute winter	2	23	36.258	0.121	11.6	0.1791	0.0000	OK
60 minute winter	3	58	36.166	0.406	10.2	0.4656	0.0000	SURCHARGED
60 minute winter	7	58	36.165	0.105	1.3	0.1273	0.0000	OK
60 minute winter	~Depth/Area 1	57	36.166	0.866	12.2	13.3091	0.0000	SURCHARGED
120 minute winter	8_OUT	150	35.164	0.057	5.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	4	3.000	5	3.9	0.609	0.312	0.0385	
60 minute winter	5	3.001	6	2.9	0.407	0.079	0.3023	
60 minute winter	6	1.003	8	4.7	0.243	0.128	0.5862	
60 minute winter	8	1.004	8_OUT	5.0	0.620	0.144	0.0787	33.1
30 minute winter	1	1.000	2	5.4	0.380	0.432	0.0652	
30 minute winter	2	1.001	3	11.6	0.833	0.927	0.0831	
60 minute winter	3	1.002	6	10.1	0.757	0.276	0.2943	
60 minute winter	7	4.000	8	1.3	0.453	0.104	0.0864	
60 minute winter	~Depth/Area 1	2.000	6	-12.2	-0.693	-0.690	0.3064	

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