



**DEARDEN STREET
BURY
BL8 2PB**

DRAINAGE STRATEGY

2ND JULY 2026

**DOCUMENT No:
20013-DOC-001-A**

**Issue Sheet.**

Prepared	Date		Checked	Date
M M	02-07-26		M M	02-07-26

Revisions	Comment	Date
A	Initial Issue	02-07-26

The report is based on the information that has been acquired and / or made available to Advant Engineers via the various searches and consultations undertaken as part of the Drainage Strategy. In some cases, anecdotal information has been relied upon, where documented evidence has been lacking.

The conclusions drawn in the above report are considered correct although any subsequent additional information may allow refinement of the conclusions.

All work carried out in preparing this report has utilised and is based upon Advant Engineers current professional knowledge and understanding of current UK standards and codes, technology and legislation. Changes in this legislation and guidance may occur at any time in the future and cause any conclusions to become inappropriate or incorrect.

This report has been prepared using information contained in maps and documents prepared by others. Advant Engineers can accept no responsibility for the accuracy of such information.



Table of Contents

Table of Contents.....	3
1. Introduction.....	4
2. Existing Site.....	4
3. Proposed Development	5
4. Drainage Strategy.....	6
5. SUDS Elements	8
6. SUDS Operations and Maintenance	9
7. Flood Exceedance Events	11
8. Conclusion	12
9. References.....	12
APPENDIX A TOPOGRAPHICAL SURVEY.....	13
APPENDIX B SEWER RECORDS	14
APPENDIX C PROPOSED LAYOUT	15
APPENDIX D EXTRACT FROM SI.....	16
APPENDIX E GREENFIELD CALCULATION	17
APPENDIX F DRAINAGE LAYOUT	18
APPENDIX G DRAINAGE CALCULATION.....	19
APPENDIX H FLOOD EXCEEDANCE PLAN	20

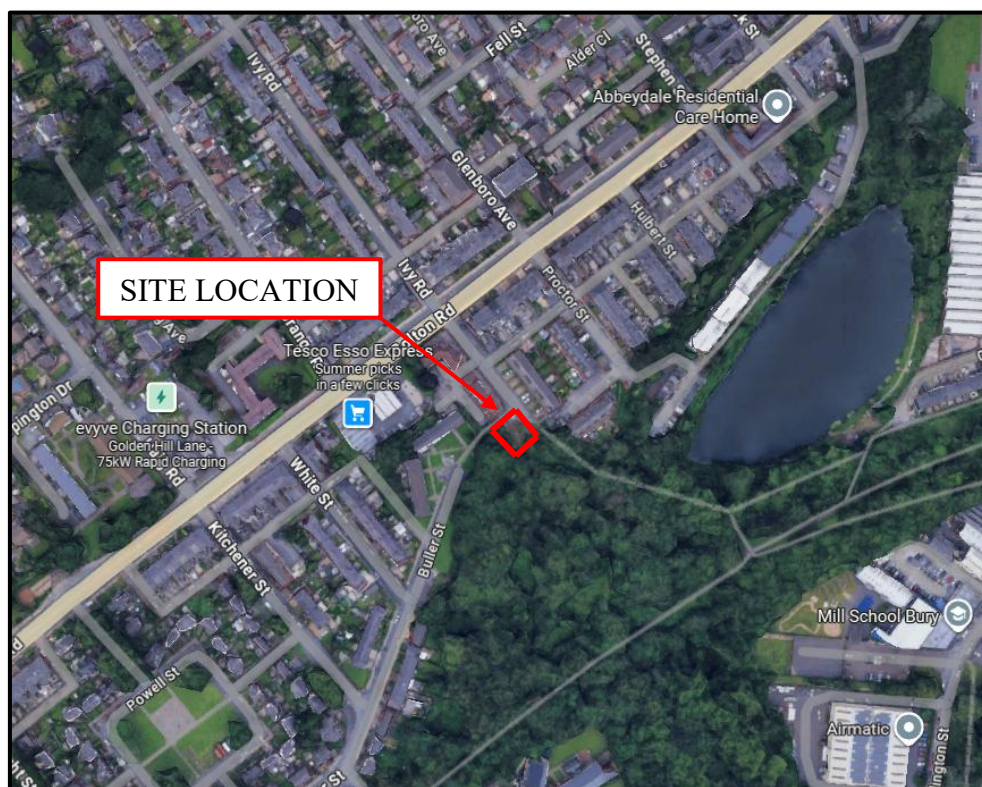


1. Introduction

- 1.1. Advant Engineers has been commissioned to undertake a Drainage Strategy for the proposed development at Dearden Street in Bury.
- 1.2. The proposal consists of 5 town houses in a single block with new private access road and associated hard standing areas.
- 1.3. This report should be read in conjunction with drawing 20013-101 and associated architectural and engineering drawings.

2. Existing Site

- 2.1. The existing site is wasteland with broken hard standing area that is believed to have been used for parking in the past and therefore would be classed as a brownfield site, vehicular access to the site will be from the access road to the east of the site. The overall site area is 733m² (0.07ha).
- 2.2. This site can be located at the following co-ordinates 379108E, 410313N and the nearest postcode is BL8 2PB and can be seen on the below extract.





- 2.3. The site is fairly flat with a gentle fall from the north to the south with a high point of 94.47 and a low point of 93.86 which gives an approximate gradient of 1:50. (See Appendix A for Survey).
- 2.4. There are existing public combined and surface water sewers that are crossing the site. (See Appendix B for sewer records).

3. Proposed Development

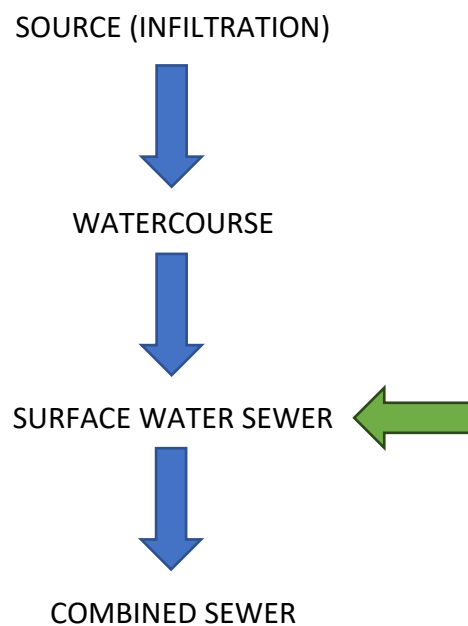
- 3.1. The proposed development is for 5 new town 3-bedroomed town houses with a new access road. (See Appendix C for layout)



4. Drainage Strategy

4.1. Surface Water

- 4.2. The surface water drainage should be designed in accordance with the SUD hierarchy providing evidence to each step before moving on to the next one, the SUDS hierarchy is as follows:



- 4.3. A combined Phase 1/2 Site Investigation was undertaken by EPS (Doc: UK21.5294) and falling head tests were undertaken in the boreholes on site, from which an infiltration rate was calculated, however due to the presence of made ground then it was recommended that infiltration should not be used, also the constrained nature of the site would make it difficult to utilise soakaways and maintain 5.0m from the buildings and the highway, therefore the use of soakaways have been discounted. (See Appendix D for SI extract).
- 4.4. Next in the hierarchy is to discharge to a water course, as there are no watercourses in the vicinity then this has also been discounted.
- 4.5. It is therefore proposed to discharge the surface water to the existing public surface water sewer that crosses the site.



4.6. The site is a brownfield site which would generate a runoff of :

$$2.78 \times 0.07 \times 50 = 9.73 \text{ l/s}$$

4.7. However, wherever possible surface water discharge rates should be returned to the equivalent Greenfield rate, which for this site are as follows: (See Appendix E for Greenfield Calc):

$$Q_{bar} = 0.6 \text{ l/s}$$

$$1 \text{ in } 1 \text{ Year} = 0.5 \text{ l/s}$$

$$1 \text{ in } 30 \text{ Year} = 0.9 \text{ l/s}$$

$$1 \text{ in } 100 \text{ Year} = 1.2 \text{ l/s}$$

4.8. We are unable to achieve the QBar rate as the orifice required would be too small and at a risk of blockages, we believe the smallest orifice should be 40mm to alleviate the risk of blockages which equates to 4.0 l/s which is a 59% reduction on the brownfield rates.

4.9. Therefore, we are proposing a rate of **4.0l/s** via a vortex flow control and provide attenuation on site to accommodate the 1 in 100 year + 40% climate change rainfall event. (See Appendix F for Drainage Layout and Appendix G for Calcs).

4.10. Foul Drainage

4.11. The foul drainage is proposed to connect into the public foul sewer that crosses the site.



5. SUDS Elements

5.1. All new surface water drainage systems should implement SUDS features where reasonably possible, these features are incorporated to offer benefits in Water Quality, Water Quantity, Amenity and Biodiversity. Below we have considered each SUDS element and determined its use within this particular development.

COMPONENT	SUITABILITY	REASON
Green Roof	X	Pitched roofs are not suitable for Green Roofs
Blue Roof	X	Pitched roofs are not suitable for Blue Roofs
Infiltration Systems	X	Not suitable due to site constraints and made ground
Proprietary Treatment Systems	✓	Flow control device to be utilised.
Filter Strips	X	Not suitable due to site constraints and made ground
Filter Drains	X	Not suitable due to site constraints and made ground
Swales	X	Not suitable due to site constraints and made ground
Bioretention Systems	X	Insufficient land available.
Trees	X	Insufficient land available.
Rain Garden	X	Insufficient land available.
Rainwater Harvesting	X	Not proposed.
Pervious Pavements	X	Not practical on driveway due to the congested utilities that run beneath it
Attenuation Storage Tanks	✓	Cellular tank proposed.
Detention Basins	X	Insufficient land available.
Ponds and Wetlands	X	Insufficient land available.



6. SUDS Operations and Maintenance

- 6.1. Responsibility of the drainage system, and SUDS elements will be with a management company that services the communal areas of the apartments.
- 6.2. The convention drainage system, consisting of standard manholes and pipework, are maintained by sub-contractors using specialist machinery to clear gullies, pipework and storage zones of rubbish and sediment. The frequency of this task is determined by the need, this can be identified by a reduced flow through the pipework, water surcharging or the visible sight of sediment or buildup in the manholes.
- 6.3. Beyond the convention drainage manholes and pipework, the drainage system also has the following SUDS elements that requires routine inspection and maintenance as outlined below.

ELEMENT	RESPONSIBILITY		
	PUBLIC	PRIVATE	MANAGEMENT COMPANY
FLOW CONTROL			✓
ATTENUATION TANK			✓

**FLOW CONTROL MANHOLE – HYDROBRAKE UNIT**

MAINTENANCE SCHEDULE	REQUIRED ACTION	FREQUENCY
Regular Maintenance	Vacuum clean the sump in the manhole.	Annually
	Inspect pipework for silt accumulation and jet-vac clean.	Annually
	All other moving parts should be lightly oiled / greased.	As required.
Remedial Actions	Repair / rehabilitate inlets, outlets and vents.	As required.
	Replace hydrobrake unit should it become damage and fail to operate.	As required.
	Anytime the hydrobrake unit is removed then new neoprene seals should be installed.	As required.
Monitoring	Check that flow control manhole is emptying, there should be little or no water after consecutive days of dry weather.	Twice in the first year, once after heavy rainfall, and then once after consecutive days of dry weather. After that annual inspections.
	The hydrobrake has one moving part which is the bypass gate, and the penstock has a gate operated by a rising spindle, both elements should be opened and closed to check their operation.	Every 3 months
	Check for any leakages between the hydrobrake / penstock units and the concrete mounting block.	Annually
	Check tightness of all fixing bolts.	Annually

6.4. The above is scheduled maintenance, additional inspections and cleaning of the hydrobrake chamber should be undertaken in the event of a failure or after every extreme flood event.

**CELLULAR ATTENUATION TANK**

MAINTENANCE SCHEDULE	REQUIRED ACTION	FREQUENCY
Regular Maintenance	Inspect and identify areas that are not operating correctly. If required take remedial action.	Monthly for the first 3 months and then annually.
	Jet clean the inside of the tank for sediment removal	Annually
Remedial Actions	Repair / rehabilitate inlets, outlets and vents.	As required.
Monitoring	Inspect / check all inlets, outlets and vents to ensure that they are in good condition and operating as designed.	Annually

- 6.5. The above is scheduled maintenance, additional inspections and cleaning of the tank should be undertaken in the event of a failure or after every extreme flood event.

7. Flood Exceedance Events

- 7.1. Although the surface water drainage has been designed to accommodate the 1 in 100 year + 40% climate change rainfall event with no flooding, we have to consider events that exceed this and what happens to any flooding that may occur.
- 7.2. To illustrate this event, we have produced a Flood Exceedance Layout plan (See Appendix H for layout) and from this we can see that flood would occur at manhole (S6) and then would flow downhill towards the reservoir, this mimics how the site would operate pre-development as per the original contours of the site.



8. Conclusion

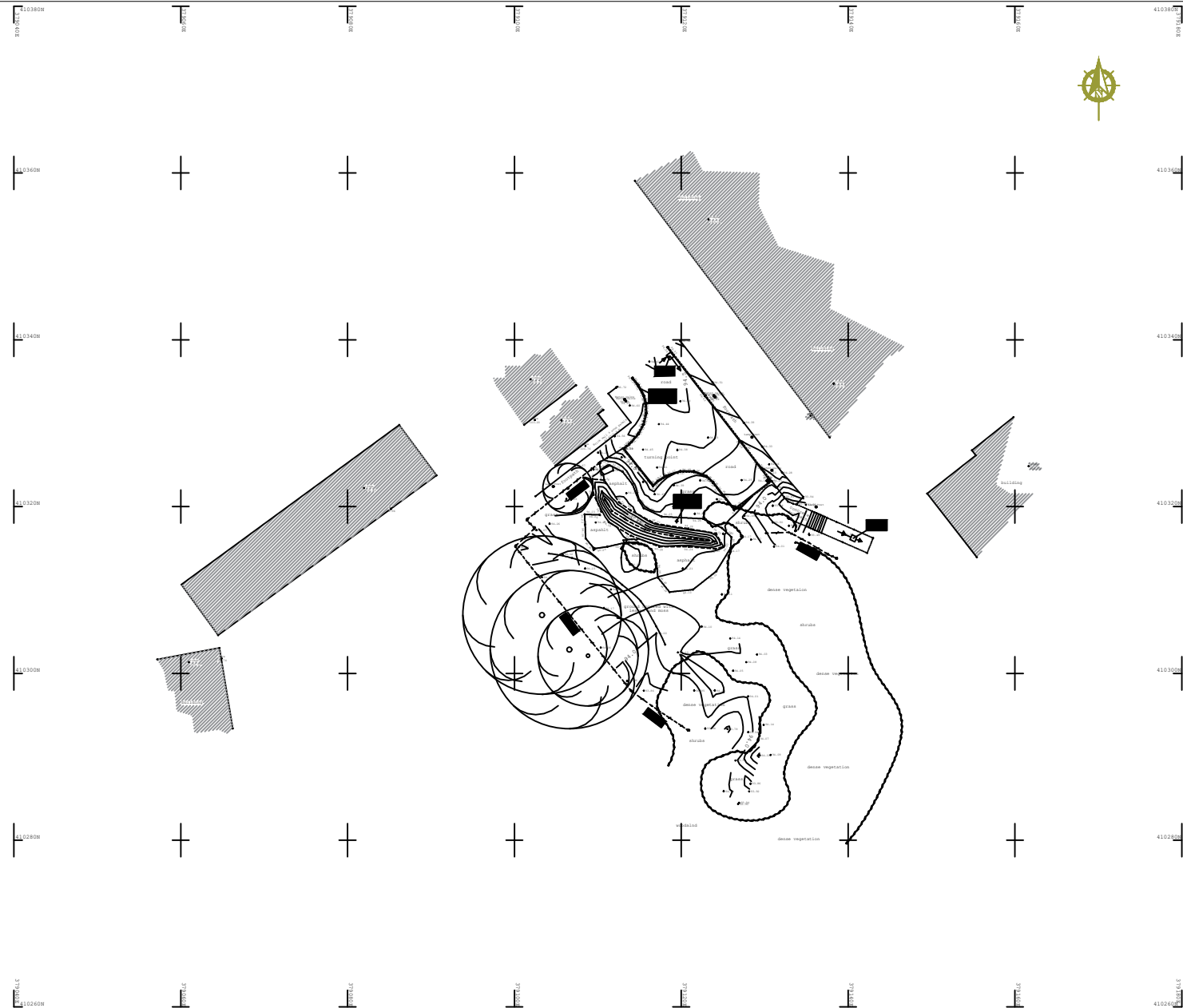
- 8.1. Advant Engineers were commissioned to undertake a Drainage Strategy for the proposed development at Dearden Street in Bury. This report will be provided as supporting documentation to discharge a planning condition.
- 8.2. The site currently consists old tarmac that was historically used for parking.
- 8.3. It is proposed to discharge the surface water to the public surface water sewer that crosses the site at 4.0 l/s and to accommodate the 1 in 100 year + 40% climate change rainfall event on site in cellular storage.
- 8.4. Foul drainage is to be discharged to the public foul sewer that crosses the site.

9. References

- 9.1. CIRIA C753 The SuDS Manual



**APPENDIX A
TOPOGRAPHICAL SURVEY**



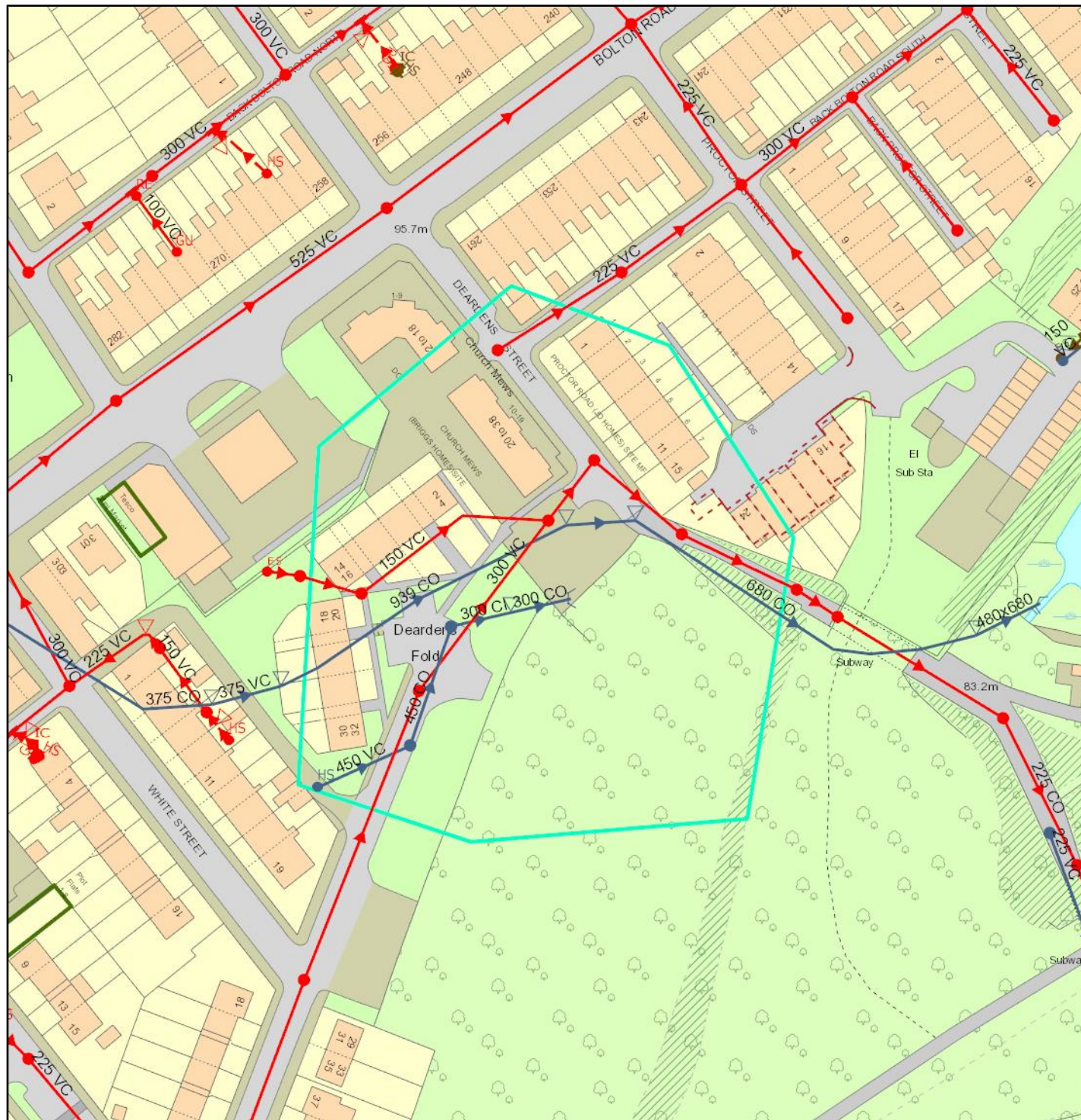
Client: Michael Micklethwaite
Title : Topographical survey @ Deardens Street Bury BL8 2PB
Subject : Topographic Survey
Units: Metres
Coordinate system: WGS84
Produced by: Gregory Smolko - SGS Surveys Ltd
Survey date: 06/12/2020
Drawing date: 07/12/2020
Survey equipment: Leica Viva GNSS GS14 & CS15
Survey equipment: Leica Total station TS15 1" R1000
Terrain contours interval: 0.1m
Grid interval: 20m



**APPENDIX B
SEWER RECORDS**

SEWER RECORD

24 PROCTOR STREET, BURY, BL8 2NY



Wastewater Symbolology

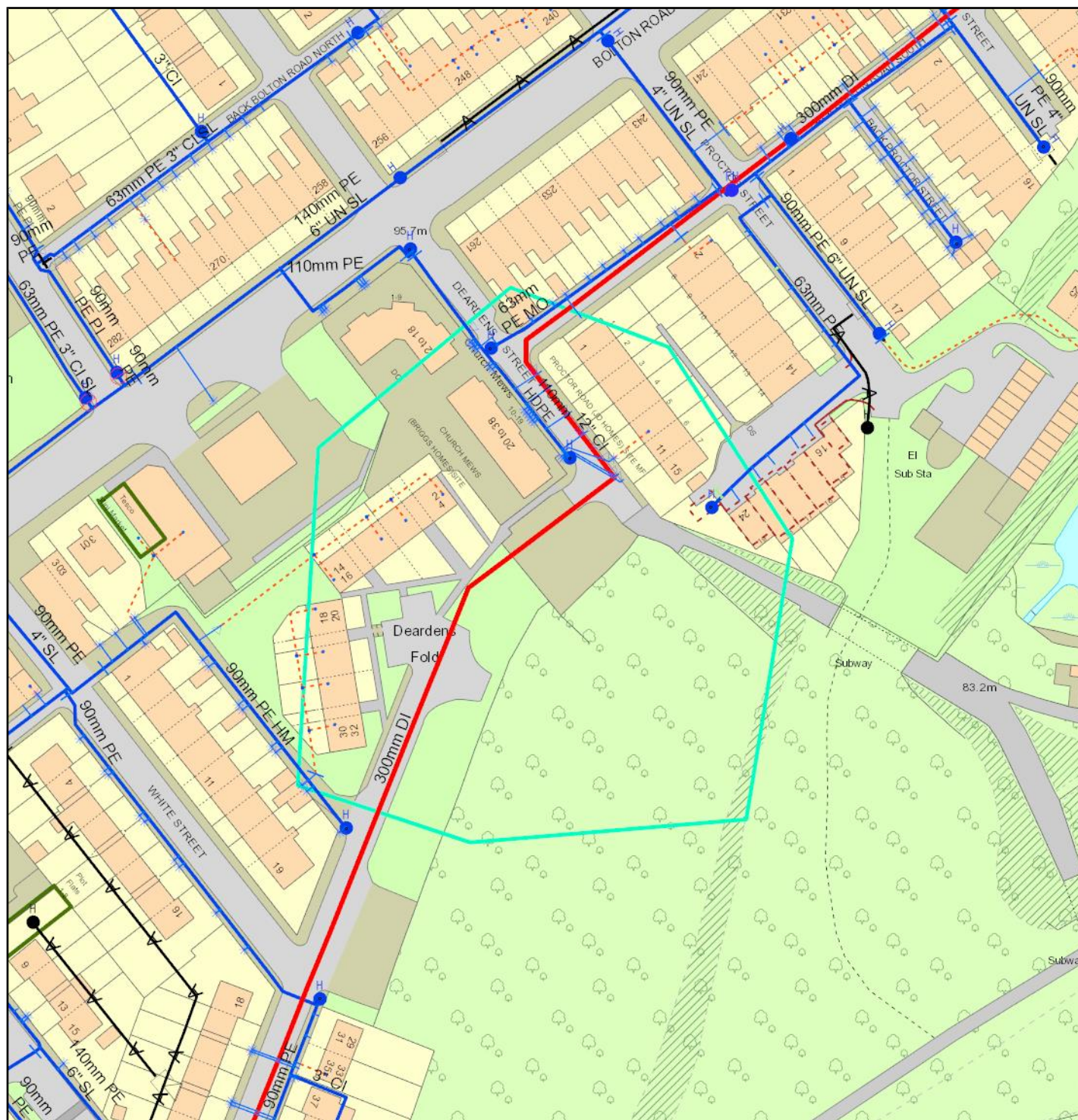
Abandoned	Foul	Surface Water	Combined	
				Public Sewer
				Private Sewer
				Section 104
				Rising Main
				Sludge Main
				Overflow
				Water Course
				Highway Drain

All point assets follow the standard colour convention: **red** – combined **brown** - foul
blue – surface water **purple** - overflow

Manhole	Side Entry Manhole
Head of System	Outfall
Extent of Survey	Screen Chamber
Rodding Eye	Inspection Chamber
Inlet	Bifurcation Chamber
Discharge Point	Lamp Hole
Vortex	T Junction / Saddle
Penstock	Catchpit
Washout Chamber	Valve Chamber
Valve	Vent Column
Air Valve	Vortex Chamber
Non Return Valve	Penstock Chamber
Soakaway	Network Storage Tank
Gully	Sewer Overflow
Cascade	Ww Treatment Works
Flow Meter	Ww Pumping Station
Hatch Box	Septic Tank
Oil Interceptor	Control Kiosk
Summit	
Drop Shaft	Change of Characteristic
Orifice Plate	

WATER RECORD

24 PROCTOR STREET, BURY, BL8 2NY



The position of underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. The actual positions may be different from those shown on the plan and private pipes, sewers or drains may not be recorded. United Utilities Water PLC will not accept any liability for any damage caused by the actual positions being different from those shown.

© United Utilities Water PLC 2017. The plan is based upon the Ordnance Survey Map with the sanction of the Controller of H.M. Stationery Office, Crown copyright 100022432 and United Utilities Water PLC copyrights are reserved. Unauthorised reproduction will infringe these copyrights.

Clean Water Symbolology

Proposed	Abandoned	Live	
			Distribution Main
			Trunk Main
			Comms Pipe
			Private Pipe
			Concessionary Service
			Raw Water
			LDTM Raw Water
			LDTM Treated Water
			Air Valve
			AC Valve, open
			AC Valve, closed
			CC Valve, open
			CC Valve, closed
			Non Return Valve
			Pressure Management Valve
			OMS Valve
			Stop Tap
			Flow Meter
			Domestic Meter
			Commercial Meter
			Pump
			Hydrant
			Fire Hydrant
			Anode
			Chlorination Point
			De-chlorination Point
			Strainer Point
			Access Point
			Hatch Box
			IP Point
			Sampling Station
			Logger Box
			Bore Hole
			Inlet Point
			Bulk Supply Point
			End Cap
			Site Termination
			Change of Characteristic
			Condition Report
			<u>Property Types</u>
			Water Tower
			Valve House
			Booster Pumping Station
			Intake Pumping Station
			Water Treatment Works
			Supply Reservoir
			Service Reservoir
			Impounding Reservoir
			Pipe Bridge

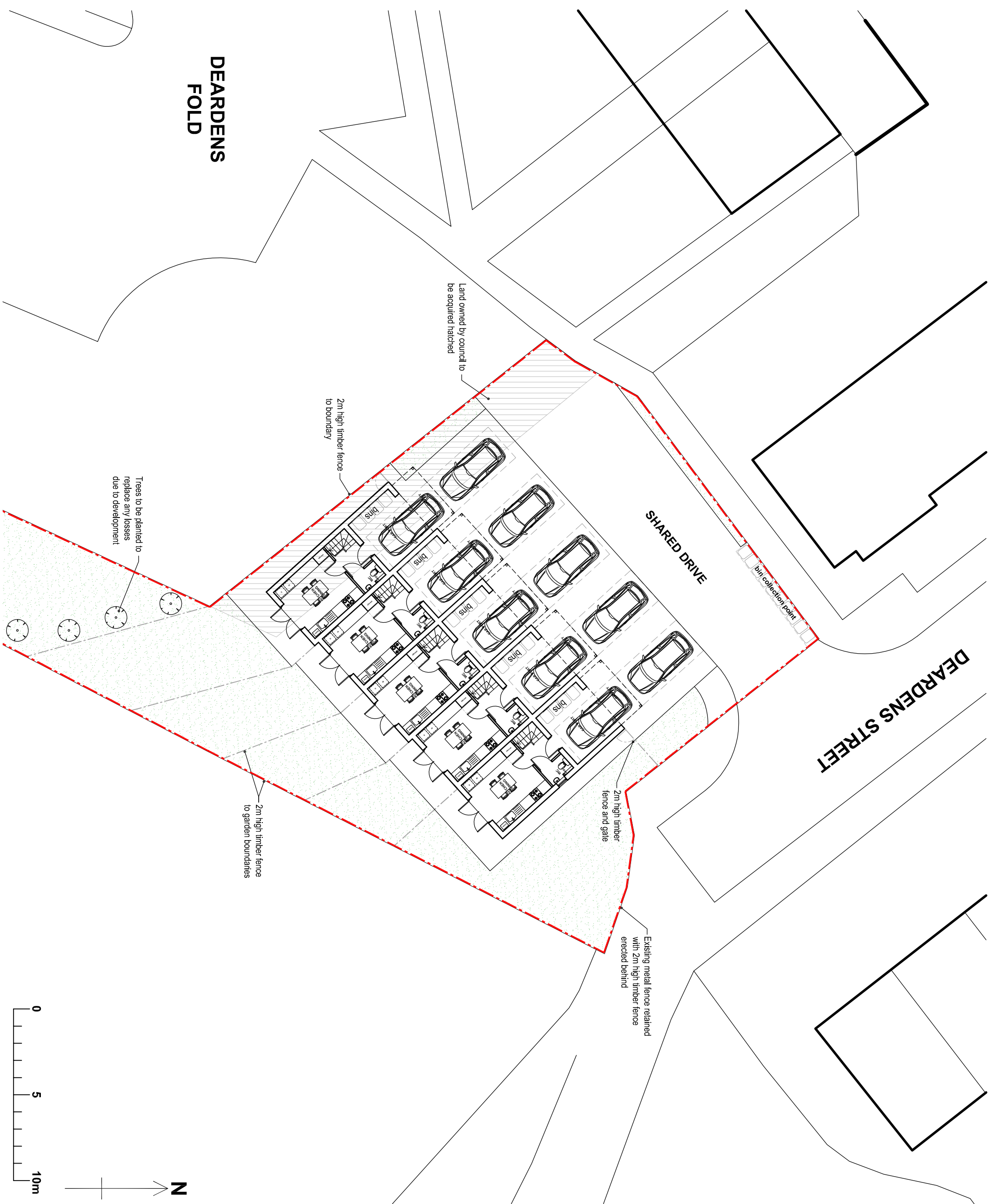
Symbolology for proposed assets is the same as above, but shown in green
Symbolology for abandoned assets is the same as above, but shown in black



APPENDIX C PROPOSED LAYOUT

Do not scale drawings. All dimensions to be verified on site before proceeding with the work. All dimensions given in millimetres unless stated otherwise. All drawings to be read in conjunction with other consultants' drawings and specifications.

rev/sb/n	drawn	date
A	AEP	11.02.21
Boundary landscaping treatment added		
B	AEP	07.06.21
Bin store moved to Ground Floor car ports		
C	AEP	02.09.21
Bin collection point shown		
D	AEP	27.10.22
Car port canopy added		



PLANNING

PROJECT TITLE: LAND TO SOUTH OF DEARDENS STREET, BURY. PROPOSED TOWNHOUSES TO VACANT LAND

PROJECT NO: 2007_01

REVISION: D

DRAWING TITLE: PROPOSED SITE PLAN

DRAWING NO: 003

SCALE: 1:200@A3

DATE: 10.08.20

DRAWN BY:

pettifer architecture

tel: 07373629158
email: as@pettiferarchitecture.com
www.pettiferarchitecture.com



**APPENDIX D
EXTRACT FROM SI**

6.6 Drainage

Falling head infiltration testing was undertaken in one borehole to give an indication of the infiltration potential of the underlying soils, as applicable to the adoption of soakaways or other shallow drainage features as part of the proposed scheme. The results of the testing are detailed in the table below:

Borehole Location	Test Depth (m bgl)	Indicative Infiltration Rate (m/s)	
		Test 1	Test 2
WS01	4.415	4.26x10 ⁻⁶	2.45x10 ⁻⁶
		Test 2	4.24x10 ⁻⁶
		Test 3	4.24x10 ⁻⁶

The infiltration testing in WS01 was targeted to assess the permeability on natural geology rather than the overlying made ground and is generally indicative of low to medium permeability conditions. It should also be noted that EPS do not recommend the installation of soakaways in made ground due to the inherent variability in its nature and as any concentrated infiltration will most likely result in consolidation of the made ground and settlement that could affect structures.

If a soakaway system is being considered further for the proposed scheme, full testing in accordance with *BRE Digest 365* would be recommended to inform the design. The results of this method are often more favourable when compared against falling head tests, which should only be treated as a guide.



**APPENDIX E
GREENFIELD CALCULATION**

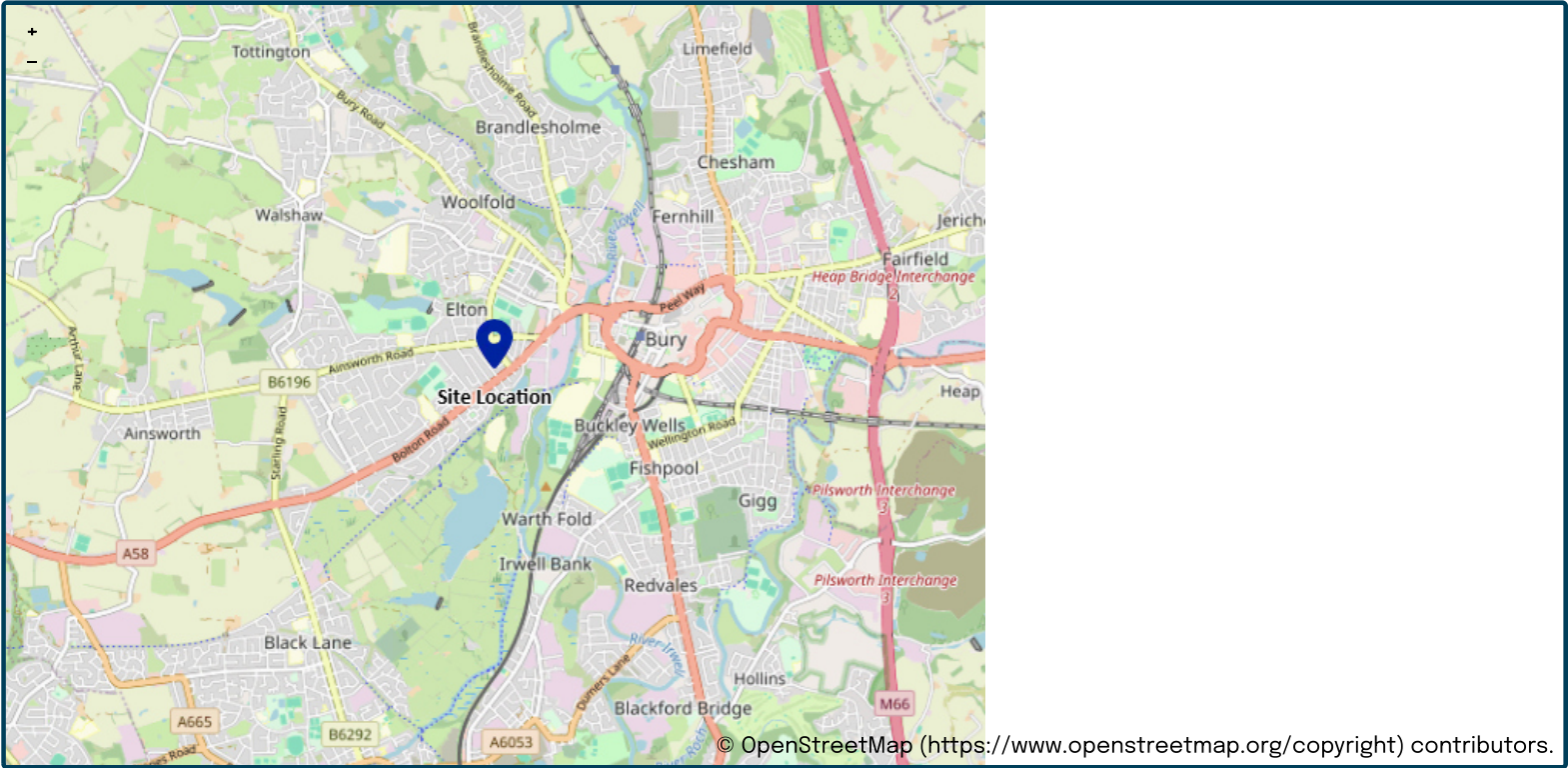
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Project details

Date	02/07/2026
Calculated by	Michael Micklethwaite
Reference	20013
Model version	2.2.3

Location

Site name	Dearden Street
Site location	Bury



Site easting (British National Grid)	379101
Site northing (British National Grid)	410337

Site details

Total site area (ha)	.07	ha
----------------------	----------------------------------	----

Greenfield runoff

Method

Method	IH124
--------	-------

IH124

	<u>My value</u>		<u>Map value</u>
SAAR (mm)	1075 mm	☐	1075
How should SPR be derived?	WRAP soil type		
WRAP soil type	4	☐	4
SPR	0.47		
QBar (IH124) (l/s)	0.6 l/s		

Growth curve factors

	<u>My value</u>		<u>Map value</u>
Hydrological region	10	☐	10
1 year growth factor	0.87		
2 year growth factor	0.93		
10 year growth factor	1.38		
30 year growth factor	1.7		
100 year growth factor	2.08		
200 year growth factor	2.37		

Results

Method	IH124	
Flow rate 1 year (l/s)	0.5	l/s
Flow rate 2 year (l/s)	0.5	l/s
Flow rate 10 years (l/s)	0.8	l/s
Flow rate 30 years (l/s)	0.9	l/s
Flow rate 100 years (l/s)	1.2	l/s
Flow rate 200 years (l/s)	1.3	l/s

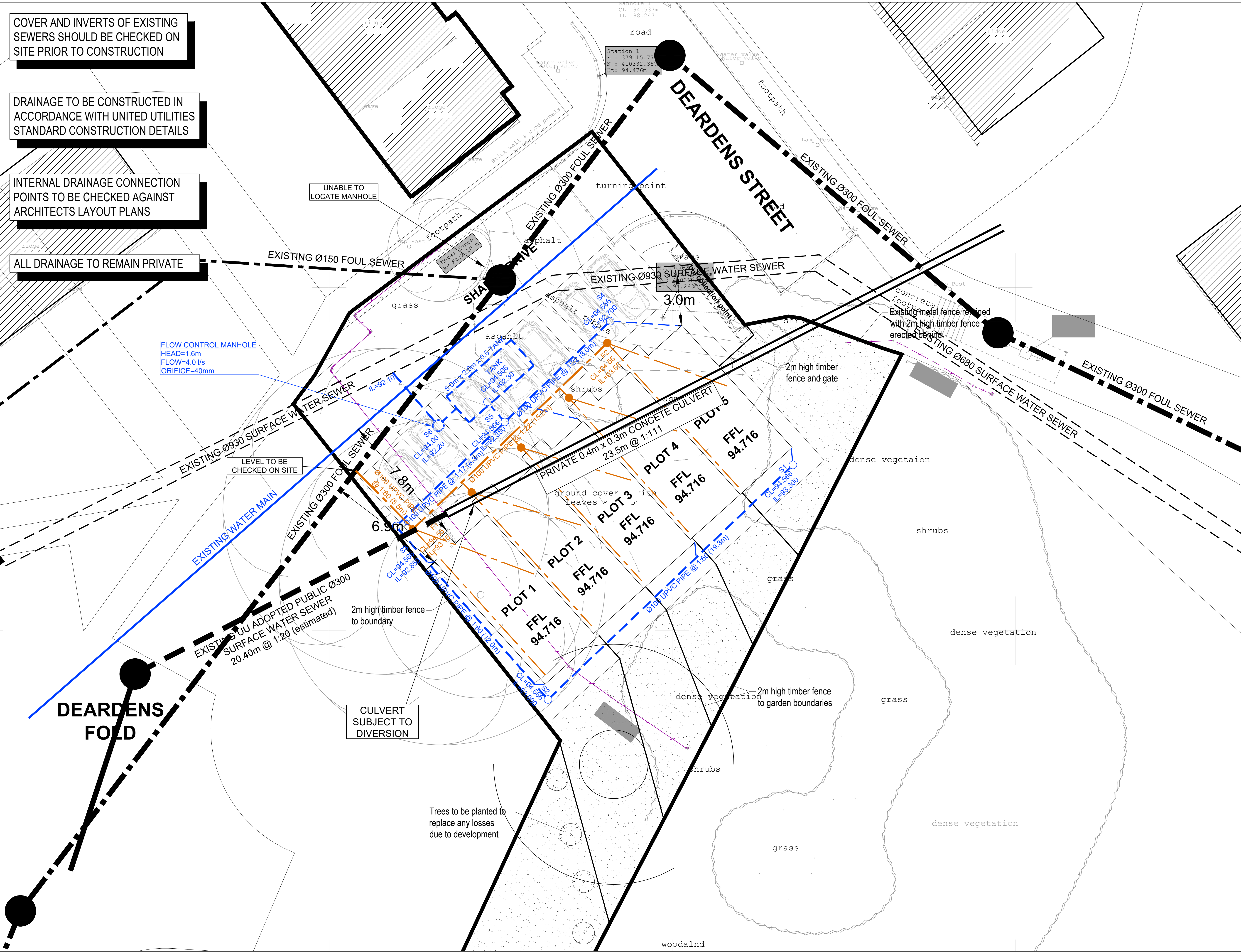
Please note runoff estimation is subject to significant uncertainty. Results are therefore normally reported to only 1 decimal place. Where 2 decimal places are provided, this does not indicate accuracy to this level, it has been adopted to prevent 'zero' figures from being reported. Outputs less than 0.01 l/s are reported as 0.01 l/s.

Disclaimer

This report was produced using the Greenfield runoff rate estimation tool (2.2.3) developed by HR Wallingford and available at [uksuds.com](https://www.uksuds.com) (<https://www.uksuds.com/>). The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at [uksuds.com/terms-conditions](https://www.uksuds.com/terms-conditions) (<https://www.uksuds.com/terms-conditions>). The outputs from this tool have been used to estimate Greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, Centre for Ecology and Hydrology, Wallingford Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.



APPENDIX F DRAINAGE LAYOUT



COVER AND INVERTS OF EXISTING SEWERS SHOULD BE CHECKED ON SITE PRIOR TO CONSTRUCTION

DRAINAGE TO BE CONSTRUCTED IN ACCORDANCE WITH UNITED UTILITIES STANDARD CONSTRUCTION DETAILS

INTERNAL DRAINAGE CONNECTION POINTS TO BE CHECKED AGAINST ARCHITECTS LAYOUT PLANS

ALL DRAINAGE TO REMAIN PRIVATE

FLOW CONTROL MANHOLE
HEAD=1.6m
FLOW=4.0 l/s
ORIFICE=40mm

LEVEL TO BE CHECKED ON SITE

CULVERT SUBJECT TO DIVERSION

Trees to be planted to replace any losses due to development

Notes

- This drawing is produced for use in this project only and may not be used for any other purpose. The consulting Engineers accept no liability for the use of this drawing other than the purpose for which it was intended in connection with this project as recorded on the title block fields 'Purpose for Issue' and 'File Status Code'.
- This drawing may not be reproduced in any form without prior written agreement.
- Do not scale from the drawing, use written dimensions only.
- All dimensions are in millimetres unless otherwise specified.
- Discrepancies must be reported back to the engineer prior to construction.

Key

EXISTING FW SEWER

EXISTING SW SEWER

PROPOSED SW SEWER

PROPOSED FW SEWER

DRAINAGE STRATEGY

SURFACE WATER

In accordance with the SuDS Hierarchy then infiltration should be considered in the first instance, a site investigation was undertaken that has shown the ground has some permeability but also has a significant amount of 'made ground' and therefore it states that soakaways are not suitable.

As soakaways are not expected to work and then discharge to a watercourse should be the next considered point of discharge, there is no watercourse in the vicinity of the site and therefore it is proposed to discharge to the public sewer.

Discharge of the surface water is proposed to go to the United Utility Surface Water sewer that crosses the site at a controlled rate with attenuation on site.

The site is currently a greenfield site which requires the discharge rates to be restricted to the equivalent greenfield rates which equate to:

QBar = 0.6 l/s

1 in 1 Year = 0.5 l/s

1 in 30 Year = 0.9 l/s

1 in 100 Year = 1.2 l/s

The above rates are quite low to be achieved as it would require a 20mm orifice to attain a 1.2 l/s discharge rate and therefore it is proposed to restrict to a 4.0 l/s which equates to a 40mm orifice.

It has been envisaged to store up the 1 in 100 year + 40% climate rainfall event on site in a attenuation tank.

FOUL DRAINAGE

It is proposed to discharge to the existing united utility foul sewer that crosses the site.

G	MM	WATER MAIN ADDED	02.07.26
F	MM	DRAINAGE UPDATED	30.11.25
E	MM	DRAINAGE UPDATED	19.11.25
D	MM	LAYOUT UPDATED	01.10.25
C	MM	STATUS UPDATE	01.08.25
B	MM	DRAINAGE UPDATED	18.12.21
A	MM	INITIAL ISSUE	22.04.21
REV	BY	AMENDMENTS	DATE

FOR APPROVAL

STATUS	CHK'D
PRELIMINARY	MJM
FOR COMMENT	MJM
FOR APPROVAL	MJM
FOR CONSTRUCTION	
AS BUILT	

advant
ENGINEERS

Unit 6 Benton Office Park, Bennett Avenue
Horbury, Wakefield, West Yorkshire, WF4 5RA
01924 654108
wakefield@advantengineers.co.uk

CONTRACT	
DEARDENS STREET BURY NEW BUILD 5 UNITS	
TITLE	
DRAINAGE LAYOUT	
DRAWN	MM
SCALE	1:125 @ A1
CHK'D	MM
DATE	22.04.21
JOB No	20013
DRG No	101
REV	G



**APPENDIX G
DRAINAGE CALCULATION**

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

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

1 STANDARD Link Type

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

Available Diameters (mm)

100 | 150

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S1	0.011	5.00	94.566	450	379127.045	410309.671	1.266
S2	0.011	5.00	94.566	450	379112.764	410295.996	1.566
S3	0.011	5.00	94.566	450	379104.551	410305.354	1.716
S4	0.011	5.00	94.566	450	379117.027	410317.301	1.866
S5			94.566	450	379110.885	410311.419	2.216
TANK			94.566	450	379109.370	410313.174	2.266
S6			94.566	600	379112.773	410316.659	2.366
EX			94.566	450	379112.009	410318.364	2.466

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	S1	S2	19.773	0.600	93.300	93.000	0.300	65.9	100	5.35	50.0
1.001	S2	S3	12.451	0.600	93.000	92.850	0.150	83.0	100	5.59	50.0
1.002	S3	S5	8.769	0.600	92.850	92.350	0.500	17.5	100	5.67	50.0
2.000	S4	S5	8.504	0.600	92.700	92.350	0.350	24.3	100	5.09	50.0
1.003	S5	TANK	2.318	0.600	92.350	92.300	0.050	46.4	100	5.71	50.0
1.004	TANK	S6	4.871	0.600	92.300	92.200	0.100	48.7	100	5.78	50.0
1.005	S6	EX	1.868	0.600	92.200	92.100	0.100	18.7	100	5.80	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	0.950	7.5	1.5	1.166	1.466	0.011	0.0	30	0.737
1.001	0.845	6.6	3.0	1.466	1.616	0.022	0.0	47	0.825
1.002	1.853	14.6	4.5	1.616	2.116	0.033	0.0	38	1.628
2.000	1.572	12.3	1.5	1.766	2.116	0.011	0.0	24	1.070
1.003	1.135	8.9	6.0	2.116	2.166	0.044	0.0	60	1.215
1.004	1.107	8.7	6.0	2.166	2.266	0.044	0.0	61	1.190
1.005	1.795	14.1	6.0	2.266	2.366	0.044	0.0	46	1.726

Pipeline Schedule

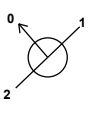
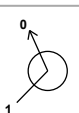
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	19.773	65.9	100	1 STANDARD	94.566	93.300	1.166	94.566	93.000	1.466
1.001	12.451	83.0	100	1 STANDARD	94.566	93.000	1.466	94.566	92.850	1.616
1.002	8.769	17.5	100	1 STANDARD	94.566	92.850	1.616	94.566	92.350	2.116
2.000	8.504	24.3	100	1 STANDARD	94.566	92.700	1.766	94.566	92.350	2.116
1.003	2.318	46.4	100	1 STANDARD	94.566	92.350	2.116	94.566	92.300	2.166
1.004	4.871	48.7	100	1 STANDARD	94.566	92.300	2.166	94.566	92.200	2.266
1.005	1.868	18.7	100	1 STANDARD	94.566	92.200	2.266	94.566	92.100	2.366

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	S1	450	Manhole	Adoptable	S2	450	Manhole	Adoptable
1.001	S2	450	Manhole	Adoptable	S3	450	Manhole	Adoptable
1.002	S3	450	Manhole	Adoptable	S5	450	Manhole	Adoptable
2.000	S4	450	Manhole	Adoptable	S5	450	Manhole	Adoptable
1.003	S5	450	Manhole	Adoptable	TANK	450	Manhole	Adoptable
1.004	TANK	450	Manhole	Adoptable	S6	600	Manhole	Adoptable
1.005	S6	600	Manhole	Adoptable	EX	450	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
S1	379127.045	410309.671	94.566	1.266	450		0	1.000	93.300	100
S2	379112.764	410295.996	94.566	1.566	450		1	1.000	93.000	100
							0	1.001	93.000	100

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
S3	379104.551	410305.354	94.566	1.716	450		1 0	1.001 1.002	92.850 92.850	100 100
S4	379117.027	410317.301	94.566	1.866	450		0	2.000	92.700	100
S5	379110.885	410311.419	94.566	2.216	450		1 2 0	2.000 1.002 1.003	92.350 92.350 92.350	100 100 100
TANK	379109.370	410313.174	94.566	2.266	450		1 0	1.003 1.004	92.300 92.300	100 100
S6	379112.773	410316.659	94.566	2.366	600		1 0	1.004 1.005	92.200 92.200	100 100
EX	379112.009	410318.364	94.566	2.466	450		1	1.005	92.100	100

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Detailed
Rainfall Events	Singular	Skip Steady State	x
FSR Region	England and Wales	Drain Down Time (mins)	240
M5-60 (mm)	20.000	Additional Storage (m³/ha)	20.0
Ratio-R	0.400	Starting Level (m)	
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

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

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

Node S6 Online Orifice Control

Flap Valve	x	Design Depth (m)	1.600	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	4.0		
Invert Level (m)	92.200	Diameter (m)	0.039		

Node TANK Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	92.300
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	25

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	10.0	0.0	0.500	10.0	0.0	0.501	0.0	0.0

Other (defaults)

Entry Loss (manhole)	0.250	Entry Loss (junction)	0.000	Apply Recommended Losses	x
Exit Loss (manhole)	0.250	Exit Loss (junction)	0.000	Flood Risk (m)	0.300

Approval Settings

Node Size	✓	Minimum Full Bore Velocity (m/s)	
Node Losses	✓	Maximum Full Bore Velocity (m/s)	3.000
Link Size	✓	Proportional Velocity	✓
Minimum Diameter (mm)	150	Return Period (years)	
Link Length	✓	Minimum Proportional Velocity (m/s)	0.750
Maximum Length (m)	100.000	Maximum Proportional Velocity (m/s)	3.000
Coordinates	✓	Surcharged Depth	✓
Accuracy (m)	1.000	Return Period (years)	
Crossings	✓	Maximum Surcharged Depth (m)	0.100
Cover Depth	✓	Flooding	✓
Minimum Cover Depth (m)		Return Period (years)	30
Maximum Cover Depth (m)	3.000	Time to Half Empty	x
Backdrops	✓	Discharge Rates	✓
Minimum Backdrop Height (m)		Discharge Volume	✓
Maximum Backdrop Height (m)	1.500	100 year 360 minute (m ³)	
Full Bore Velocity	✓		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 15 minute summer	109.521	30.991	1 year 720 minute winter	5.513	2.199
1 year 15 minute winter	76.857	30.991	1 year 960 minute summer	6.768	1.782
1 year 30 minute summer	71.439	20.215	1 year 960 minute winter	4.483	1.782
1 year 30 minute winter	50.133	20.215	1 year 1440 minute summer	4.949	1.326
1 year 60 minute summer	48.435	12.800	1 year 1440 minute winter	3.326	1.326
1 year 60 minute winter	32.179	12.800	30 year 15 minute summer	268.706	76.035
1 year 120 minute summer	30.053	7.942	30 year 15 minute winter	188.566	76.035
1 year 120 minute winter	19.966	7.942	30 year 30 minute summer	174.929	49.499
1 year 180 minute summer	23.233	5.979	30 year 30 minute winter	122.757	49.499
1 year 180 minute winter	15.102	5.979	30 year 60 minute summer	116.589	30.811
1 year 240 minute summer	18.475	4.882	30 year 60 minute winter	77.459	30.811
1 year 240 minute winter	12.274	4.882	30 year 120 minute summer	70.438	18.615
1 year 360 minute summer	14.169	3.646	30 year 120 minute winter	46.797	18.615
1 year 360 minute winter	9.210	3.646	30 year 180 minute summer	53.298	13.715
1 year 480 minute summer	11.185	2.956	30 year 180 minute winter	34.645	13.715
1 year 480 minute winter	7.431	2.956	30 year 240 minute summer	41.604	10.995
1 year 600 minute summer	9.182	2.511	30 year 240 minute winter	27.641	10.995
1 year 600 minute winter	6.274	2.511	30 year 360 minute summer	31.221	8.034
1 year 720 minute summer	8.203	2.199	30 year 360 minute winter	20.295	8.034

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year 480 minute summer	24.324	6.428	100 year 720 minute winter	15.089	6.017
30 year 480 minute winter	16.160	6.428	100 year 960 minute summer	18.166	4.784
30 year 600 minute summer	19.756	5.404	100 year 960 minute winter	12.033	4.784
30 year 600 minute winter	13.498	5.404	100 year 1440 minute summer	12.896	3.456
30 year 720 minute summer	17.490	4.687	100 year 1440 minute winter	8.667	3.456
30 year 720 minute winter	11.754	4.687	100 year +40% CC 15 minute summer	488.233	138.153
30 year 960 minute summer	14.215	3.743	100 year +40% CC 15 minute winter	342.620	138.153
30 year 960 minute winter	9.416	3.743	100 year +40% CC 30 minute summer	320.551	90.705
30 year 1440 minute summer	10.161	2.723	100 year +40% CC 30 minute winter	224.948	90.705
30 year 1440 minute winter	6.829	2.723	100 year +40% CC 60 minute summer	214.603	56.713
100 year 15 minute summer	348.738	98.681	100 year +40% CC 60 minute winter	142.577	56.713
100 year 15 minute winter	244.728	98.681	100 year +40% CC 120 minute summer	129.587	34.246
100 year 30 minute summer	228.965	64.789	100 year +40% CC 120 minute winter	86.094	34.246
100 year 30 minute winter	160.677	64.789	100 year +40% CC 180 minute summer	97.729	25.149
100 year 60 minute summer	153.288	40.510	100 year +40% CC 180 minute winter	63.526	25.149
100 year 60 minute winter	101.841	40.510	100 year +40% CC 240 minute summer	75.977	20.078
100 year 120 minute summer	92.562	24.461	100 year +40% CC 240 minute winter	50.477	20.078
100 year 120 minute winter	61.496	24.461	100 year +40% CC 360 minute summer	56.677	14.585
100 year 180 minute summer	69.806	17.964	100 year +40% CC 360 minute winter	36.841	14.585
100 year 180 minute winter	45.376	17.964	100 year +40% CC 480 minute summer	43.979	11.622
100 year 240 minute summer	54.269	14.342	100 year +40% CC 480 minute winter	29.219	11.622
100 year 240 minute winter	36.055	14.342	100 year +40% CC 600 minute summer	35.604	9.738
100 year 360 minute summer	40.484	10.418	100 year +40% CC 600 minute winter	24.327	9.738
100 year 360 minute winter	26.315	10.418	100 year +40% CC 720 minute summer	31.433	8.424
100 year 480 minute summer	31.414	8.302	100 year +40% CC 720 minute winter	21.125	8.424
100 year 480 minute winter	20.871	8.302	100 year +40% CC 960 minute summer	25.432	6.697
100 year 600 minute summer	25.431	6.956	100 year +40% CC 960 minute winter	16.847	6.697
100 year 600 minute winter	17.376	6.956	100 year +40% CC 1440 minute summer	18.055	4.839
100 year 720 minute summer	22.452	6.017	100 year +40% CC 1440 minute winter	12.134	4.839

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

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	10	93.331	0.031	1.6	0.0104	0.0000	OK
15 minute winter	S2	10	93.051	0.051	3.2	0.0154	0.0000	OK
15 minute winter	S3	10	92.889	0.039	4.7	0.0112	0.0000	OK
15 minute winter	S4	10	92.724	0.024	1.6	0.0067	0.0000	OK
30 minute winter	S5	25	92.477	0.127	4.8	0.0202	0.0000	SURCHARGED
30 minute winter	TANK	26	92.474	0.174	4.6	1.6810	0.0000	SURCHARGED
30 minute winter	S6	26	92.469	0.269	1.7	0.0763	0.0000	SURCHARGED
15 minute summer	EX	1	92.100	0.000	1.5	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)
15 minute winter	S1	1.000	S2	1.6	0.518	0.211	0.0605	
15 minute winter	S2	1.001	S3	3.1	0.909	0.468	0.0427	
15 minute winter	S3	1.002	S5	4.7	1.017	0.321	0.0453	
15 minute winter	S4	2.000	S5	1.6	0.483	0.128	0.0385	
30 minute winter	S5	1.003	TANK	4.6	0.980	0.517	0.0181	
30 minute winter	TANK	1.004	S6	1.7	0.530	0.196	0.0381	
30 minute winter	S6	Orifice	EX	1.6				3.7

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

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	10	93.350	0.050	3.8	0.0167	0.0000	OK
15 minute winter	S2	12	93.187	0.187	7.6	0.0560	0.0000	SURCHARGED
15 minute winter	S3	12	93.023	0.173	10.6	0.0495	0.0000	SURCHARGED
30 minute winter	S4	27	92.867	0.167	2.9	0.0461	0.0000	SURCHARGED
30 minute winter	S5	27	92.865	0.515	11.3	0.0820	0.0000	SURCHARGED
30 minute winter	TANK	27	92.858	0.558	10.6	4.8435	0.0000	SURCHARGED
30 minute winter	S6	27	92.846	0.646	2.9	0.1829	0.0000	SURCHARGED
15 minute summer	EX	1	92.100	0.000	2.2	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)
15 minute winter	S1	1.000	S2	3.8	0.605	0.505	0.1163	
15 minute winter	S2	1.001	S3	6.8	1.012	1.020	0.0974	
15 minute winter	S3	1.002	S5	9.8	1.314	0.672	0.0686	
30 minute winter	S4	2.000	S5	2.9	0.483	0.234	0.0665	
30 minute winter	S5	1.003	TANK	10.6	1.350	1.185	0.0181	
30 minute winter	TANK	1.004	S6	2.9	0.628	0.330	0.0381	
30 minute winter	S6	Orifice	EX	2.5				9.1

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

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	12	93.488	0.188	4.9	0.0627	0.0000	SURCHARGED
15 minute winter	S2	12	93.410	0.410	9.1	0.1230	0.0000	SURCHARGED
60 minute winter	S3	46	93.303	0.453	7.9	0.1299	0.0000	SURCHARGED
60 minute winter	S4	46	93.286	0.586	2.6	0.1622	0.0000	SURCHARGED
60 minute winter	S5	46	93.284	0.934	9.4	0.1485	0.0000	SURCHARGED
60 minute winter	TANK	46	93.272	0.972	8.7	4.9093	0.0000	SURCHARGED
60 minute winter	S6	47	93.253	1.053	4.4	0.2979	0.0000	SURCHARGED
15 minute summer	EX	1	92.100	0.000	2.6	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)
15 minute winter	S1	1.000	S2	4.5	0.646	0.601	0.1547	
15 minute winter	S2	1.001	S3	7.2	0.997	1.092	0.0974	
60 minute winter	S3	1.002	S5	7.5	0.991	0.514	0.0686	
60 minute winter	S4	2.000	S5	2.4	0.434	0.193	0.0665	
60 minute winter	S5	1.003	TANK	8.7	1.107	0.972	0.0181	
60 minute winter	TANK	1.004	S6	4.4	0.587	0.509	0.0381	
60 minute winter	S6	Orifice	EX	3.2				15.0

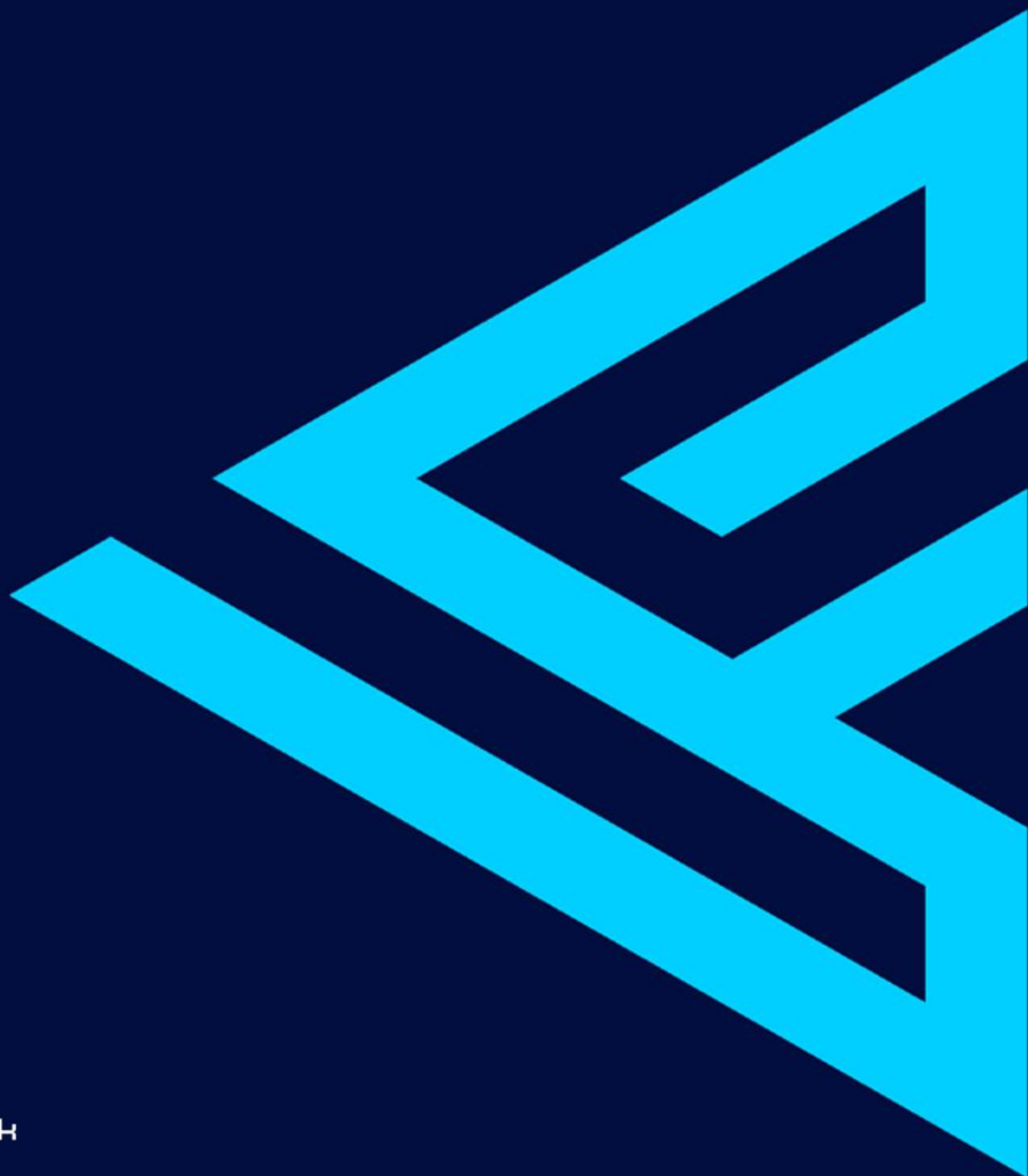
Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	13	93.970	0.670	6.9	0.2232	0.0000	SURCHARGED
60 minute winter	S2	46	93.947	0.947	7.0	0.2841	0.0000	SURCHARGED
60 minute winter	S3	46	93.926	1.076	9.2	0.3087	0.0000	SURCHARGED
60 minute winter	S4	47	93.897	1.197	3.6	0.3317	0.0000	SURCHARGED
60 minute winter	S5	47	93.895	1.545	10.4	0.2456	0.0000	SURCHARGED
60 minute winter	TANK	48	93.876	1.576	9.6	5.0054	0.0000	SURCHARGED
60 minute winter	S6	48	93.846	1.646	5.2	0.4658	0.0000	SURCHARGED
15 minute summer	EX	1	92.100	0.000	3.4	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)
15 minute winter	S1	1.000	S2	5.0	0.696	0.667	0.1547	
60 minute winter	S2	1.001	S3	6.0	0.955	0.898	0.0974	
60 minute winter	S3	1.002	S5	8.0	1.051	0.549	0.0686	
60 minute winter	S4	2.000	S5	2.6	0.483	0.208	0.0665	
60 minute winter	S5	1.003	TANK	9.6	1.230	1.080	0.0181	
60 minute winter	TANK	1.004	S6	5.2	0.670	0.603	0.0381	
60 minute winter	S6	Orifice	EX	4.0				21.0



**APPENDIX H
FLOOD EXCEEDANCE PLAN**



Unit 6

Benton Office Park

Bennett Avenue

Horbury, Wakefield

West Yorkshire

WF4 5RA

01924 654108

mail@advantengineers.co.uk

www.advantengineers.co.uk