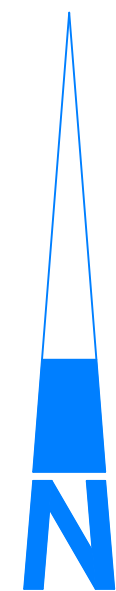


Appendix A

Topographical Survey

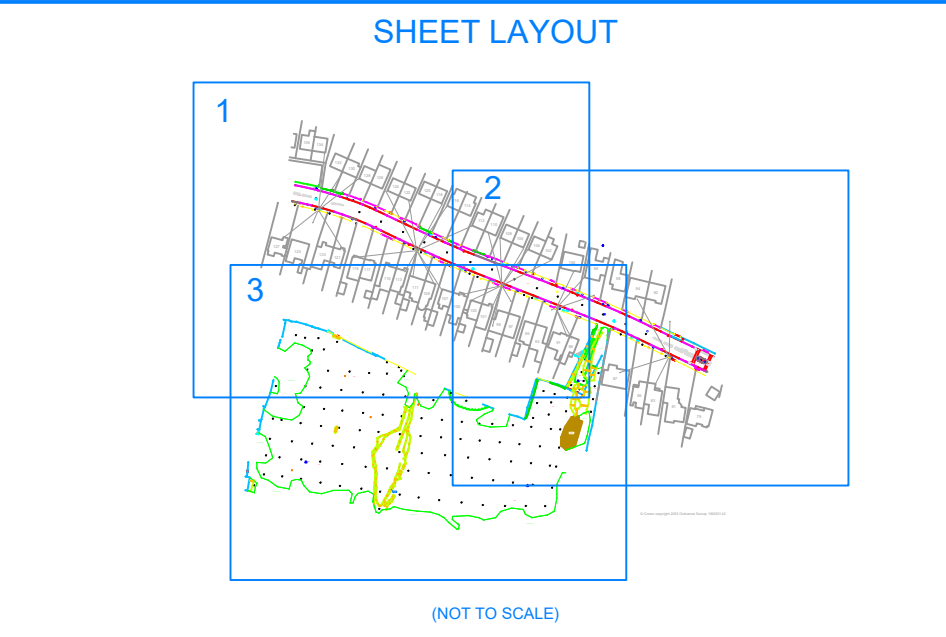
Wessex Water Asset Records



- GRID AND LEVELS BASED ON OSGB36 NATIONAL DATUM, DERIVED FROM THE NATIONAL GPS NETWORK, SUPPLIED DRAWING ALIGNED TO OS TILE
- DRAINAGE INFORMATION HAS BEEN DETERMINED WITHOUT MAN ENTRY INTO CHAMBERS AND WHILST EVERY EFFORT HAS BEEN MADE TO CORRECTLY IDENTIFY THIS INFORMATION, IT SHOULD ALWAYS BE CHECKED IN AREAS THAT ARE CRITICAL TO THE FUTURE PROPOSAL.
- ALL SEWERS ARE PRESUMED TO BE STRAIGHT BETWEEN CHAMBERS UNLESS PROVEN THROUGH TRACING TECHNIQUES.
- TREE AND HEDGE SPECIES HAVE BEEN IDENTIFIED AS ACCURATELY AS POSSIBLE BUT SHOULD BE CHECKED IN CRITICAL AREAS.

[illegible]

Coordinate Table				
Station	Description	Easting	Northing	Level
SS01	PEG	373481.117	163219.998	98.0
SS02	PEG	373597.778	163207.579	98.0
SS03	ROAD NAIL	373624.336	163262.619	89.0
SS04	ROAD NAIL	373640.183	163302.721	85.5
SS05	ROAD NAIL	373567.029	163323.861	86.5
SS06	ROAD NAIL	373486.656	163368.832	87.0



Drawing Revision		
No	Date	Description
R0	06/03/23	Topographical Survey First Visit
R1		
R2		
R3		
R4		

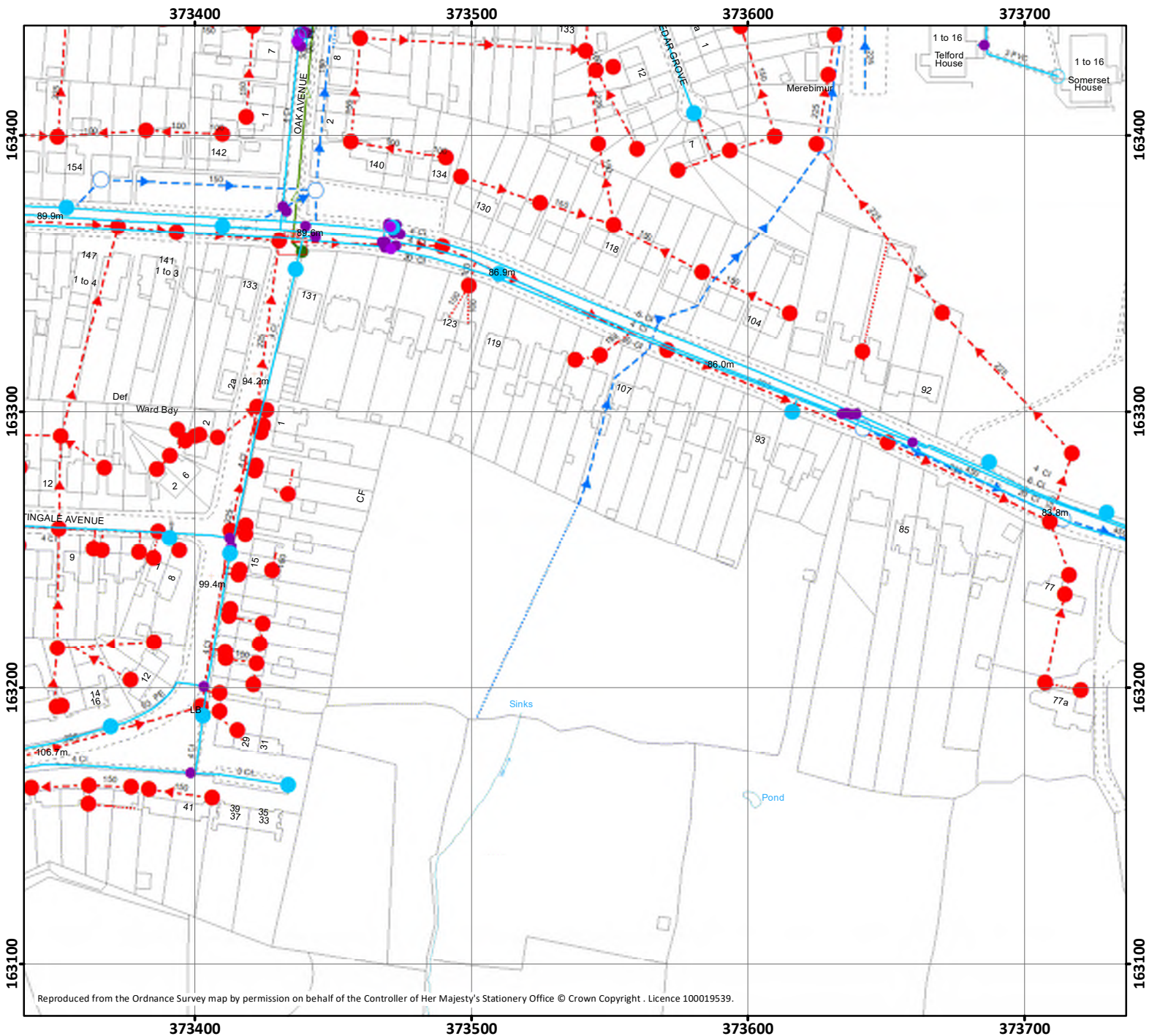
Solum Surveying Ltd

 **www.solumsurveying.com**
tel: 01454 413592
email: info@solumsurveying.com
The Old Stables
Pines Courtyard
Stone
Berkeley
GL13 9LE

BATH NES

Englishcombe Lane
Bath
BA2 2ES

3D Topographical Survey				
Scale	Sheet Size:	Sheet:	Also See:	
1:200	A0	1 of 3		
		Drawing Date:	13/03/22	
Project Number:	Rev:	Surveyed By:	Checked By:	
9975	R0	CR		
		Drawn By:	MP	
		CR/LF		



WASTE			SUPPLY
PUBLIC SEWERS Foul Sewer Surface Water Sewer Combined Sewer Rising Main Standby Rising Main Syphon Overflow Use Unknown	NON-PUBLIC SEWERS & PIPELINES 		

Information in this plan is provided for identification purposes only. No warranty as to accuracy is given or implied. The precise route of pipe work may not exactly match that shown. Wessex Water does not accept liability for inaccuracies. Sewers and lateral drains adopted by Wessex Water under the Water Industry (Schemes for Adoption of Private Sewers) Regulations 2011 are to be plotted over time and may not yet be shown. In carrying out any works, you accept liability for the cost of any repairs to Wessex Water apparatus damaged as a result of your works. You are advised to commence excavations using hand tools only. Mechanical digging equipment should not be used until pipe work has been precisely located. If you are considering any form of building works and pipe work is shown within the boundary of your property or a property to be purchased (or very close by) a surveyor should plot its exact position prior to commencing works or purchase. Building over or near Wessex Water's apparatus is not normally permitted.

Appendix B

Proposed Site Plan

Proposed Drainage Strategy

Proposed Catchment Plan

External Surface Water Strategy Section

Overland Flows Plan

Standard Details

NOTES:

This layout is indicative and fundamentally for ongoing design coordination & development post planning.
All dimensions are in millimeters.

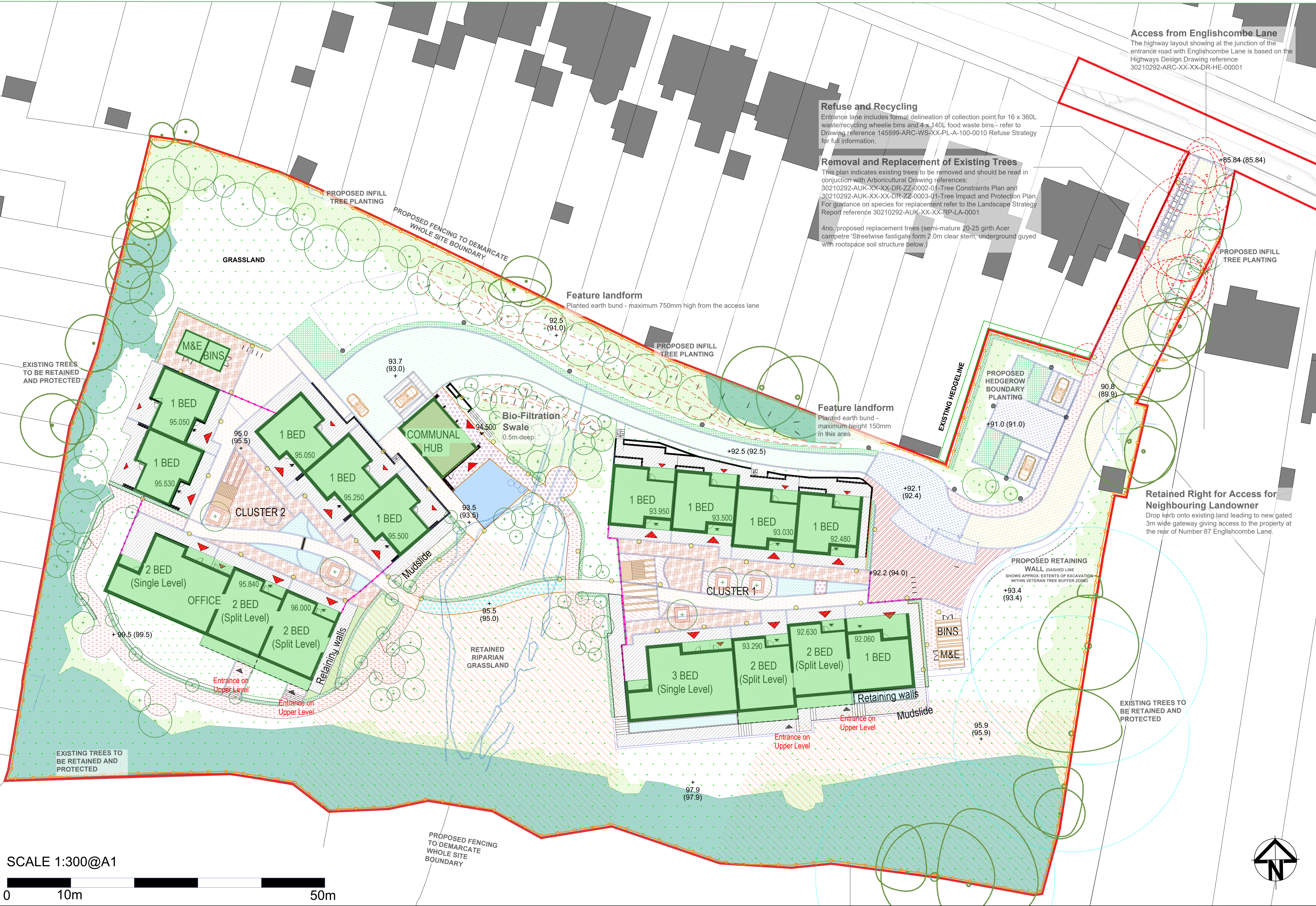
Refer to Design & Access Statement reference 145599-ARC-WS-DC-A-001 and Landscape Strategy Report reference 30210292-AUK-XX-XX-RP-LA-0001 for more details on hard and soft landscape.

Refer to Arboricultural Drawings 30210292-AUK-XX-XX-DR-ZZ-0002-01-Tree Constraints Plan and 30210292-AUK-XX-XX-DR-ZZ-0003-01-Tree Impact and Protection Plan for more details on Trees to be retained and removed.

Refer to Civil Engineers drawings & report for details on utilities, SuDs & drainage.

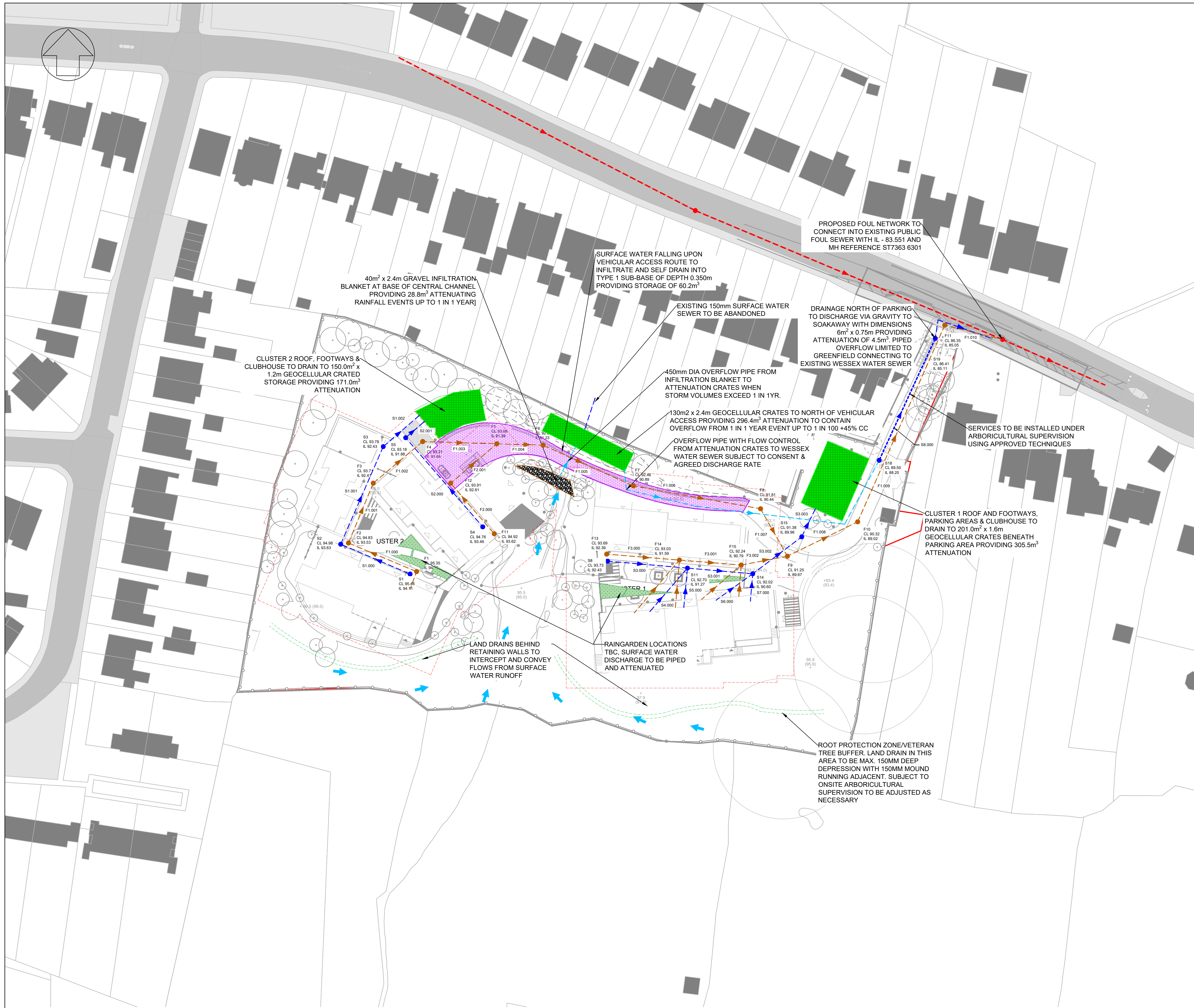
Refer to Highways Drawings 30210292-ARC-XX-XX-DR-HE-00001 for junction of Access Road
Indicative lighting only to be developed with a light specialist post planning.
For Architecture refer to Architect's suite of drawings.

Refer to the Illustrative Landscape Masterplan Drawing: 30210292_AUK_XX-XX-DR-LA-0005 and to the Landscape Strategy Report: 30210292-AUK-XX-XX-RP-LA-0001 for further details



KEY	
	Application Boundary
	+85.84 Proposed Level
	+85.84 Existing Level
PROPOSED HARD LANDSCAPING	
	Conservation kerb
	Steel path edging
	Block paving - Private garden / Defensible area
	Permeable paving - Lane Access
	Permeable paving - Access road & standard parking bays
	Permeable paving - Road - Contrasting colour surfacing
	Resin bound gravel Type 1 - Accessible footpaths
	Resin bound gravel Type 2 - Graded footpaths
	Paving - Courtyards
	Contrasting Paving - Courtyards
	Indicative lighting column / bollard locations
	External boundary fencing strengthened where necessary - 1.2m chestnut pale (stock proof)
	Steel security railings & gates 1.2m to 1.8m
	Steel mesh walkway
	Timber / Composite boardwalk
	Pergola structure/ bin store/M&E
	Entrance sign - indicative location
PROPOSED SOFT LANDSCAPING	
	Amenity grass
	Native hedging
	Existing/proposed grassland - to be managed for enhanced biodiversity
	Proposed Understorey planting
	Rain garden area
	Feature landform
	Existing tree to be removed
	Existing tree to be retained
	Existing woodland/scrub within the red line boundary to be retained
	Proposed tree
	Planters with specimen trees
	Water cascade feature and pond
	Cycle / Motor cycle stand

Client:		Bath & North East Somerset Council	
Project:		ENGLISHCOMBE LANE SUPPORTED HOUSING	
Site:		Client	
ENGLISHCOMBE LANE BATH, BA2 2EH		BATH & NORTH EAST SOMERSET COUNCIL	
ARCADIS		Registered office: 80 Fenchurch Street, London EC3M 4BY	
Coordinating office: 2 Glass Wharf, Temple Quay, Bristol BS2 0FR		Tel: 44 (0)117 372 1200	
www.arcadis.com		© Copyright reserved	
Drawing Title:		LANDSCAPE GENERAL ARRANGEMENT	
Designed: A. ARNOTT	Signed: AA	Date: 20/03/2024	
Produced: A. ARNOTT	Signed: AA	Date: 20/03/2024	
Checked: M. WINTERBOTTOM	Signed: MW	Date: 20/03/2024	
Reviewed: A. ZORLUTUNA	Signed: AP	Date: 20/03/2024	
Approved: A. ZORLUTUNA	Signed: AZ	Date: 20/03/2024	
Design Stage:		RIBA STAGE 3	
Original Size:	A1	Grid:	OS
Suitability Code:	S2	Scale:	As Shown
Datum:		AOD	
Project Number:		30210292	
Sustainability Description:		FOR PLANNING	
Drawing Number:		30210292-ARC-XX-XX-DR-LA-0012	
Revision:		P07	



- NOTES:
1. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE STATED.
 2. EXISTING LEVELS BASED OFF SOLUM SURVEYING LTD TOPOGRAPHICAL SURVEY 'A-SS-9975'
 3. DESIGN BASED OFF PROPOSED SITE LAYOUT '30210292_ARC_XX_XX_M2_LA_0012-P07'
 4. LANDSCAPE GENERAL ARRANGEMENT INFILTRATION RATE USED FOR ON SITE DRAINAGE DESIGN - 7.94x10⁻⁵m/s BASED ON ATKINS SOAKAWAY TESTING ATKS02 'ATKINSREALIS ENGLISHCOMBE LANE GI REPORT_ISSUE_V4_220124'
 5. INFILTRATION RATE USED FOR OVERLAND FLOWS DRAINAGE DESIGN - INTEGRAL SOAKAWAY TESTING 1.4X10⁻³m/s TPB 1805_01 'SUPPLEMENTARY GEOTECHNICAL AND PHASE II CONTAMINATION REPORT MARCH 2018'

- KEY:
- RAIN GARDENS
 - PERVIOUS PAVEMENT
 - GEOCELLULAR CRATES
 - 10m OFFSET FROM BUILT STRUCTURES
 - PROPOSED SW PIPE
 - PERFORATED PIPE
 - LAND DRAIN
 - PROPOSED SW PIPE (EXTERNAL CATCHMENT)
 - PROPOSED FW PIPE

02	22/07/24	CONSULTATION COMMENTS	BA	-	-
01	31/01/24	FIRST ISSUE	BA	-	-
Rev	Date	Description	Drawn	Check	Approv

Client
BANES

PROJECT:
ENGLISHCOMBE
LANE

Site	Client
Englishcombe Lane, Southdown Bath, BA2 2EH	BANES Manvers St, Lewis House Bath, BA1 1JG Phone 01225 394041 Fax -



Registered office:
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London
EC3M 4BY

Coordinating office:
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Temple Quay
Bristol BS2 0FR
Tel: +44 (0)11 7372 1200

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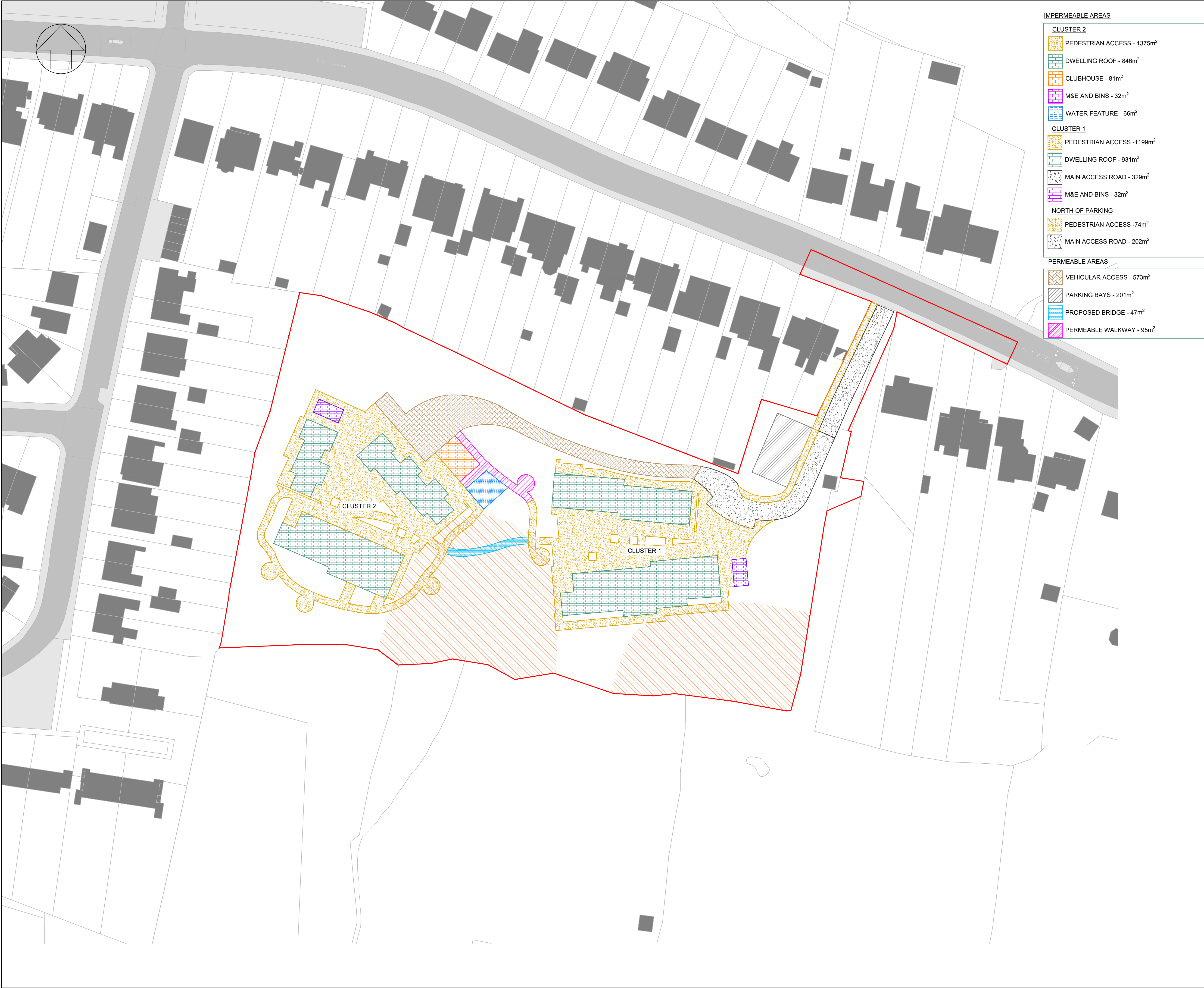
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LAYOUT

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Checked	D.HADAWAY	Signed	01/02/24
Approved	M.DAVIES	Signed	-
Scale:	1:500	Datum:	AOD
Original Size:	A1	Grid:	OS
Suitability Code:	S0	Project Number:	30210292

Suitability Description:
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Drawing Number:	Revision:
30210292-AUK-XX-XX-SK-CE-0501	02



NOTES:

01	31/01/24	FIRST ISSUE		BA	-
Rev	Date	Description	Drawn	Check	Approv

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PROJECT:
ENGLISHCOMBE
LANE

Site	Client
Englishcombe Lane, Southdown Bath, BA2 2EH	BANES Manvers St, Lewis House Bath, BA1 1JG Phone 01225 394041 Fax -



Registered office:
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80 Fenchurch Street
London
EC3M 4BY

Coordinating office:
2 Glass Wharf
Temple Quay
Bristol BS2 0FR
Tel: +44 (0)11 7372 1200

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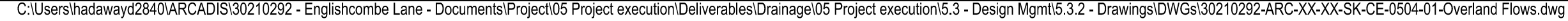
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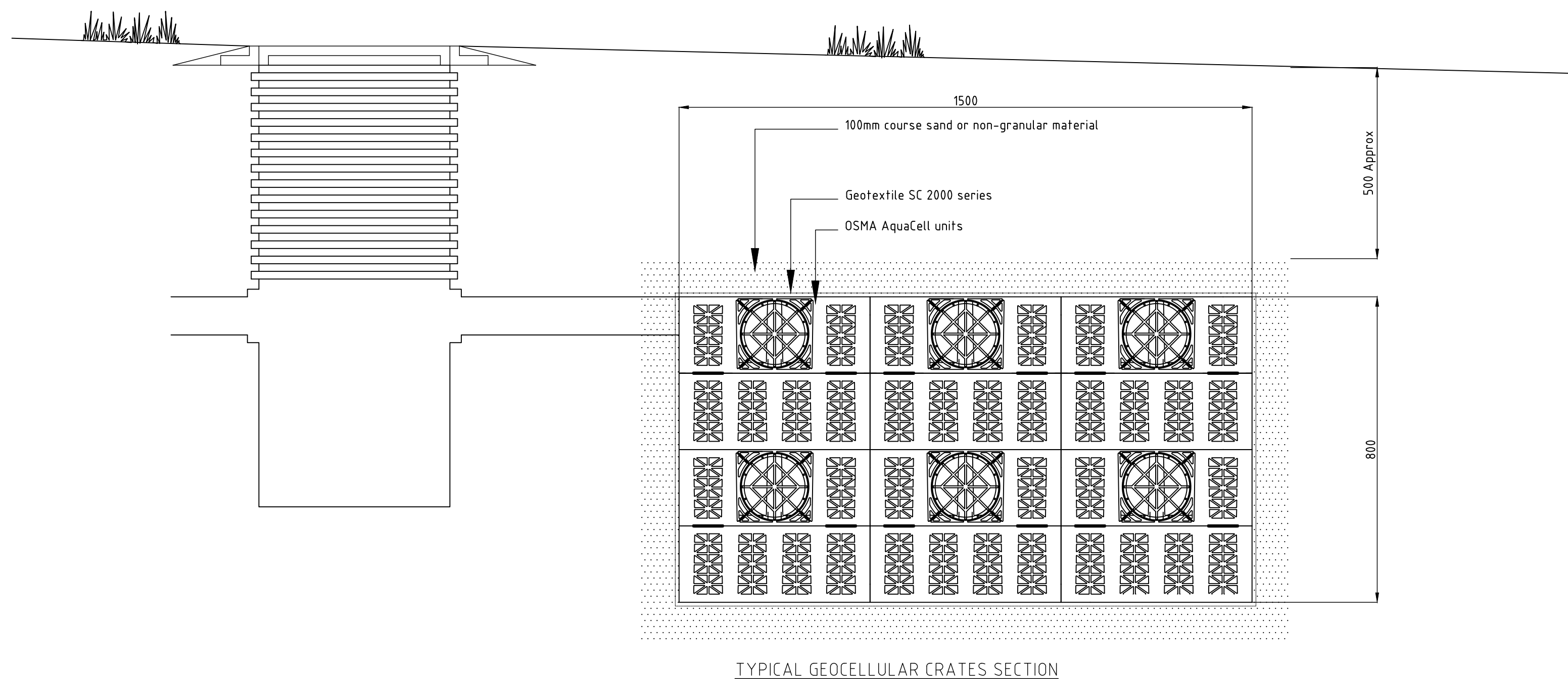
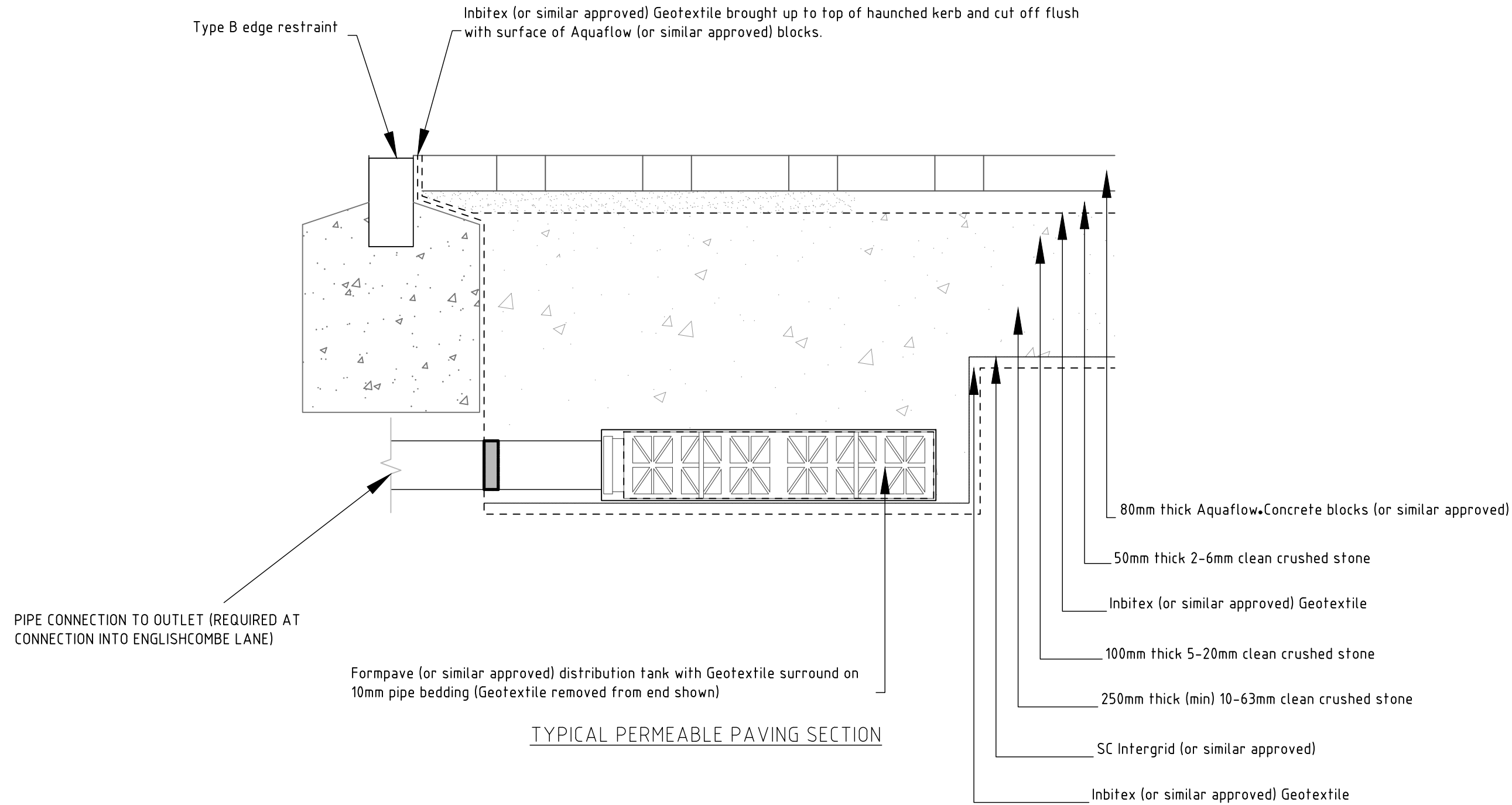
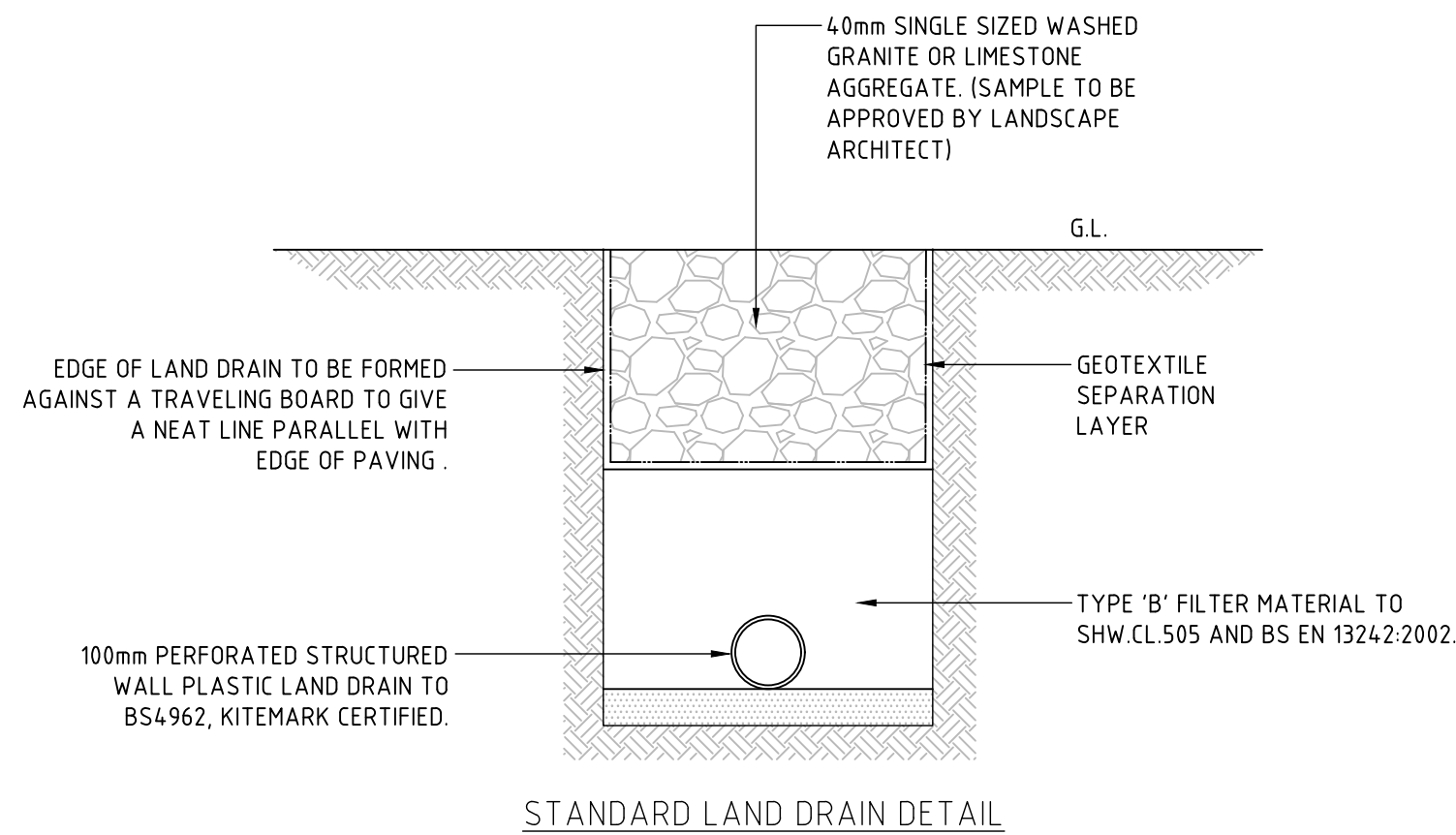
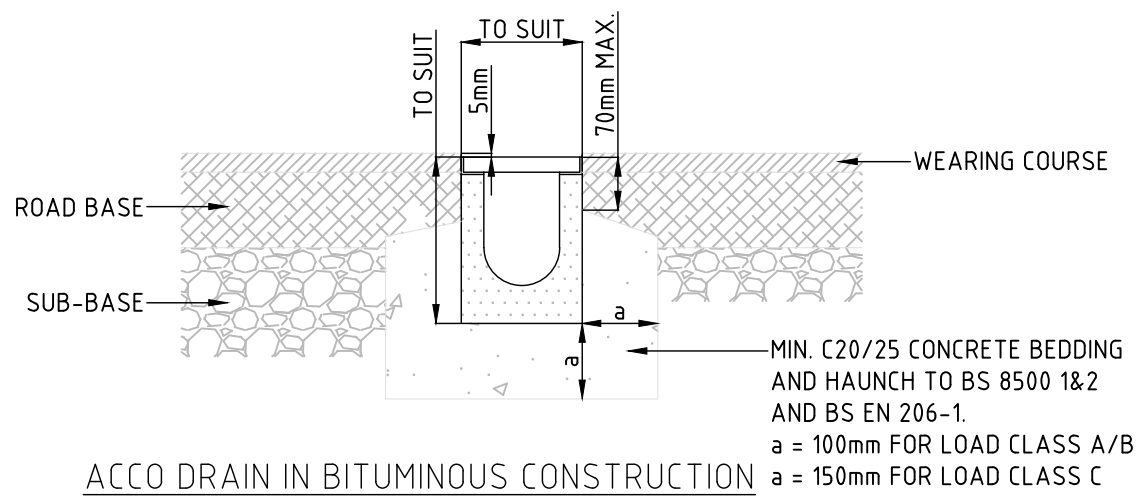
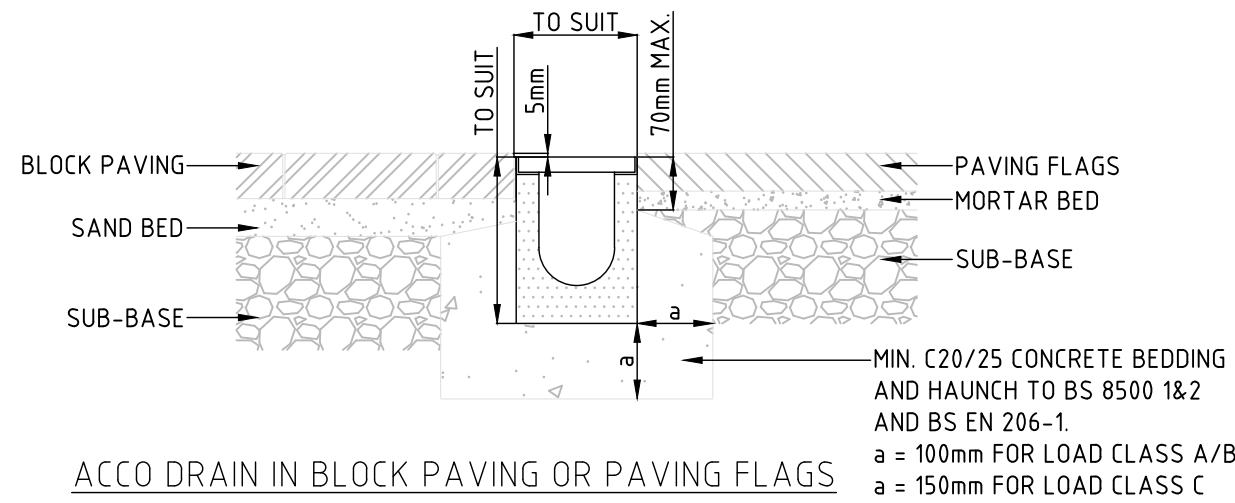
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Approved	M.DAVIES	Signed	-
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Suitability Description:
FOR INFORMATION ONLY
NOT TO BE USED FOR CONSTRUCTION

Drawing Number: 30210292-AUK-XX-XX-SK-CE-0500	Revision: 01
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vision:
01



NOTES:

1. USE FIGURED DIMENSIONS.
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
3. ALL SHORT LENGTHS OF SEWER MUST BE CAST INTEGRALLY WITH THE BASE.
4. ALL ADAPTABLE MANHOLES AND SEWERS MUST BE CONSTRUCTED TO MEET THE SPECIFICATION CONTAINED IN 'SEWERS FOR ADOPTION 6TH EDITION'.
5. MANHOLE COVERS TO BE NON ROCKING TYPE AND MARKED SWS FOR SURFACE WATER AND FWS FOR FOUL. FRAMES TO BE SET PARALLEL TO NEAREST KERBS OR BUILDING STRUCTURES AND FRAMES TO BE FLUSH WITH SURFACE +/- 5mm MAX. FRAMES FOR MANHOLE COVERS ARE TO BE BEDDED IN A POLYESTER RESIN BEDDING MORTAR WHERE COVERS ARE IN SITED IN NRSWA ROAD CATEGORIES I,II OR III. THE MAXIMUM WEIGHT OF INDIVIDUAL COVERS FOR REMOVAL SHALL NOT BE MORE THAN 25kg GENERALLY.
6. SEWERS OF 600mm DIA TO BE FITTED WITH GRADE 316L STAINLESS STEEL HOOKS FOR SAFETY CHAINS AT EXIT FROM MANHOLES, GUARD BARS AND HAND RAILING TO BE PROVIDED FOR SAFE NEGOTIATION OF ALL PARTS OF THE MANHOLE STRUCTURE FOR ROUTINE MAINTENANCE ETC.

Rev	Date	Description	Drawn	Check	Approv
01	31/01/24	FIRST ISSUE	BA	-	-

Client

BANES

PROJECT:
ENGLISHCOMBE
LANE

Site	Client
Englishcombe Lane, Southdown Bath, BA2 2EH	BANES Manvers St, Lewis House Bath, BA1 1JG Phone 01225 394041 Fax - -



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EC3M 4BY

Coordinating office:
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Temple Quay
Bristol BS2 0FR
Tel: +44 (0)11 7372 1200

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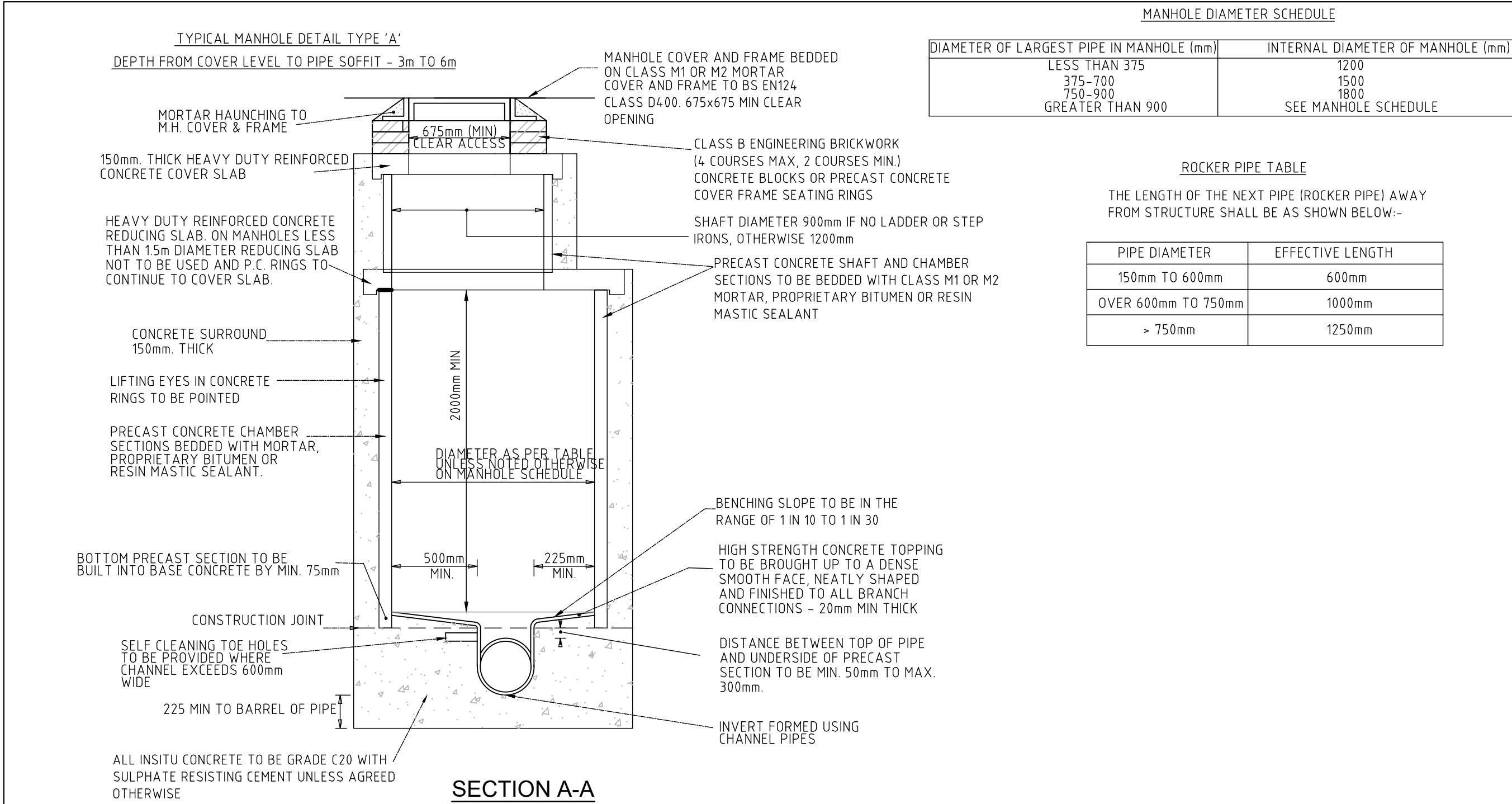
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DETAILS
SHEET 1 OF 2

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Checked	D.HADAWAY	Signed	31/01/24
Approved	M.DAVIES	Signed	-
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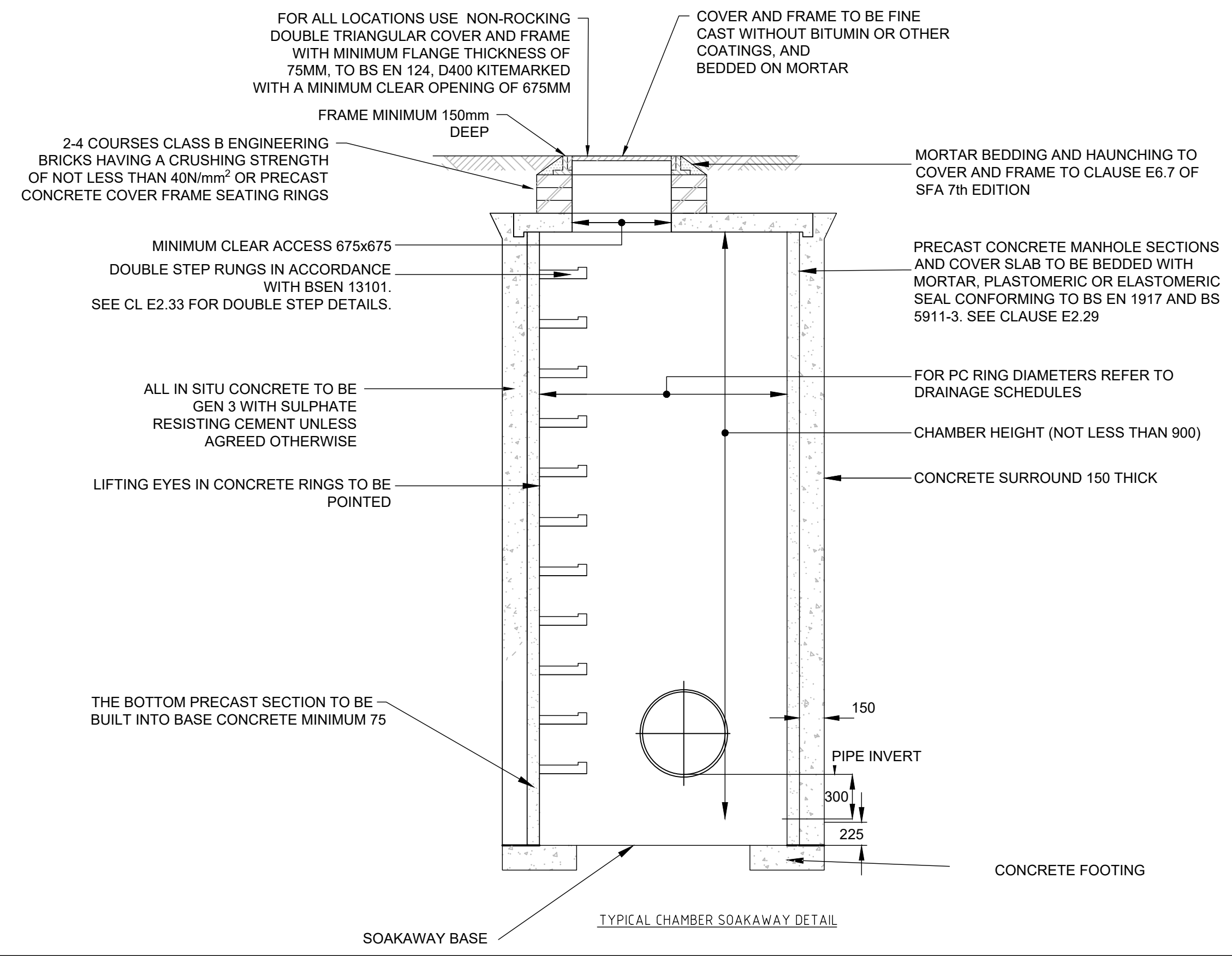
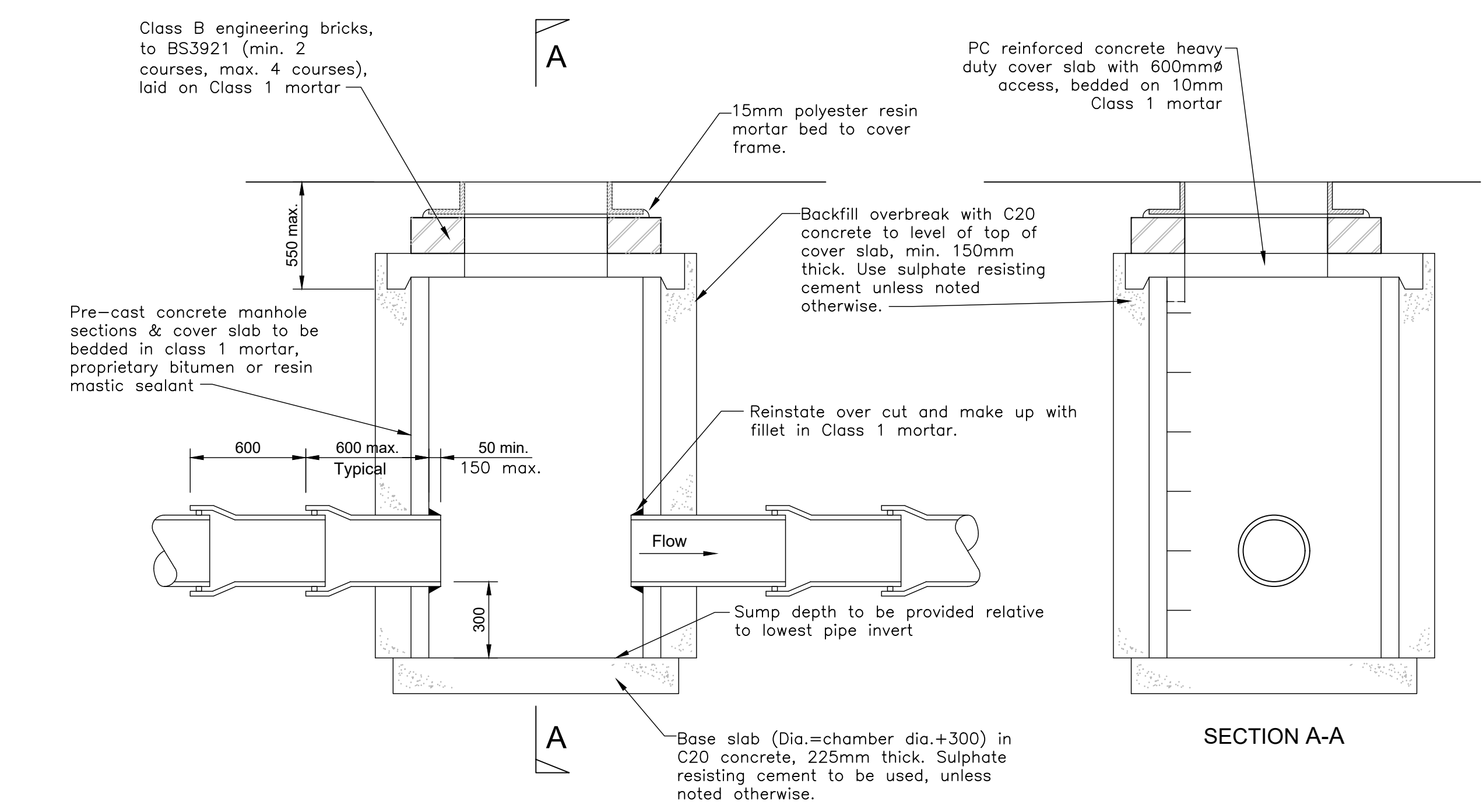
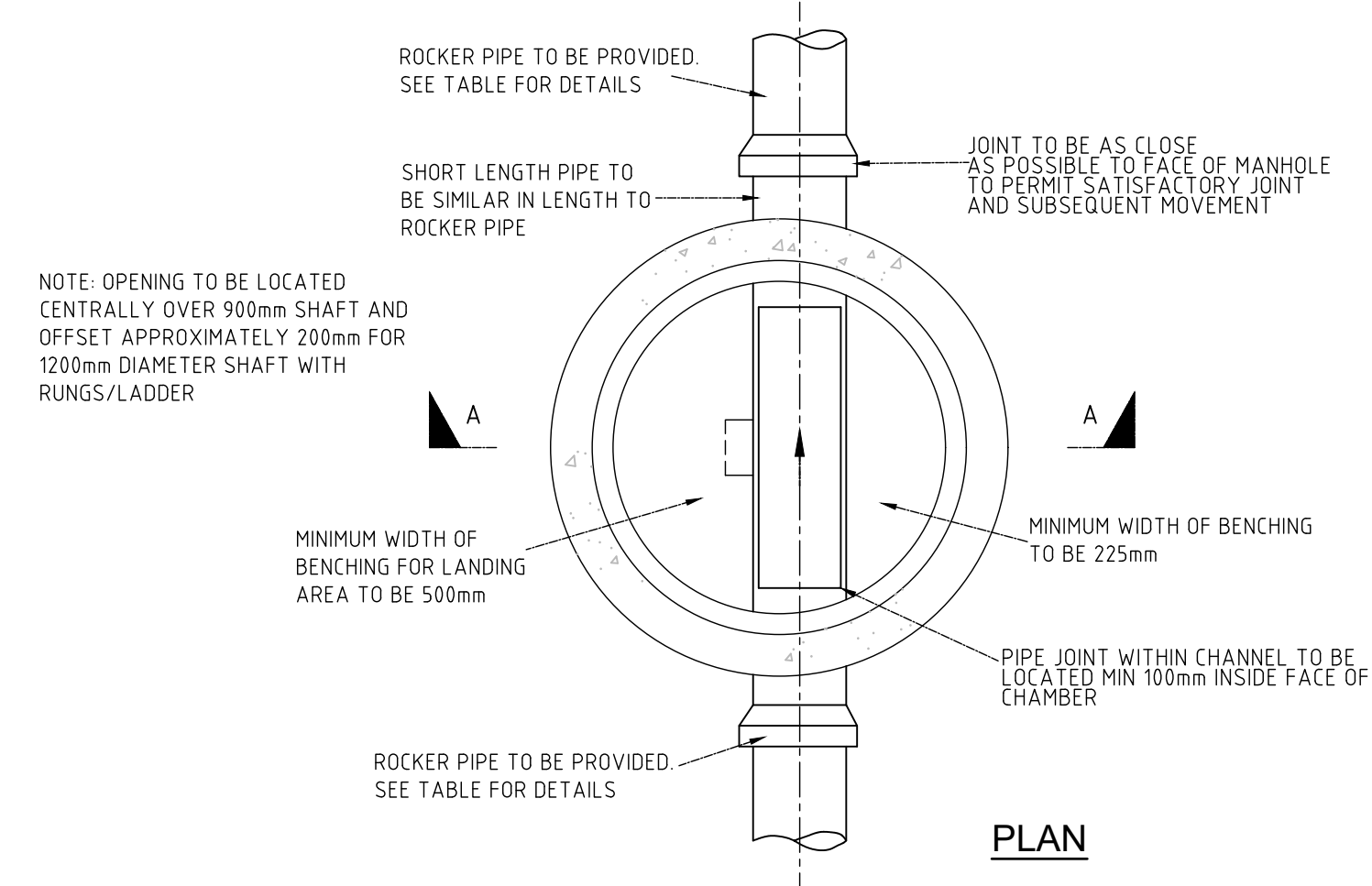
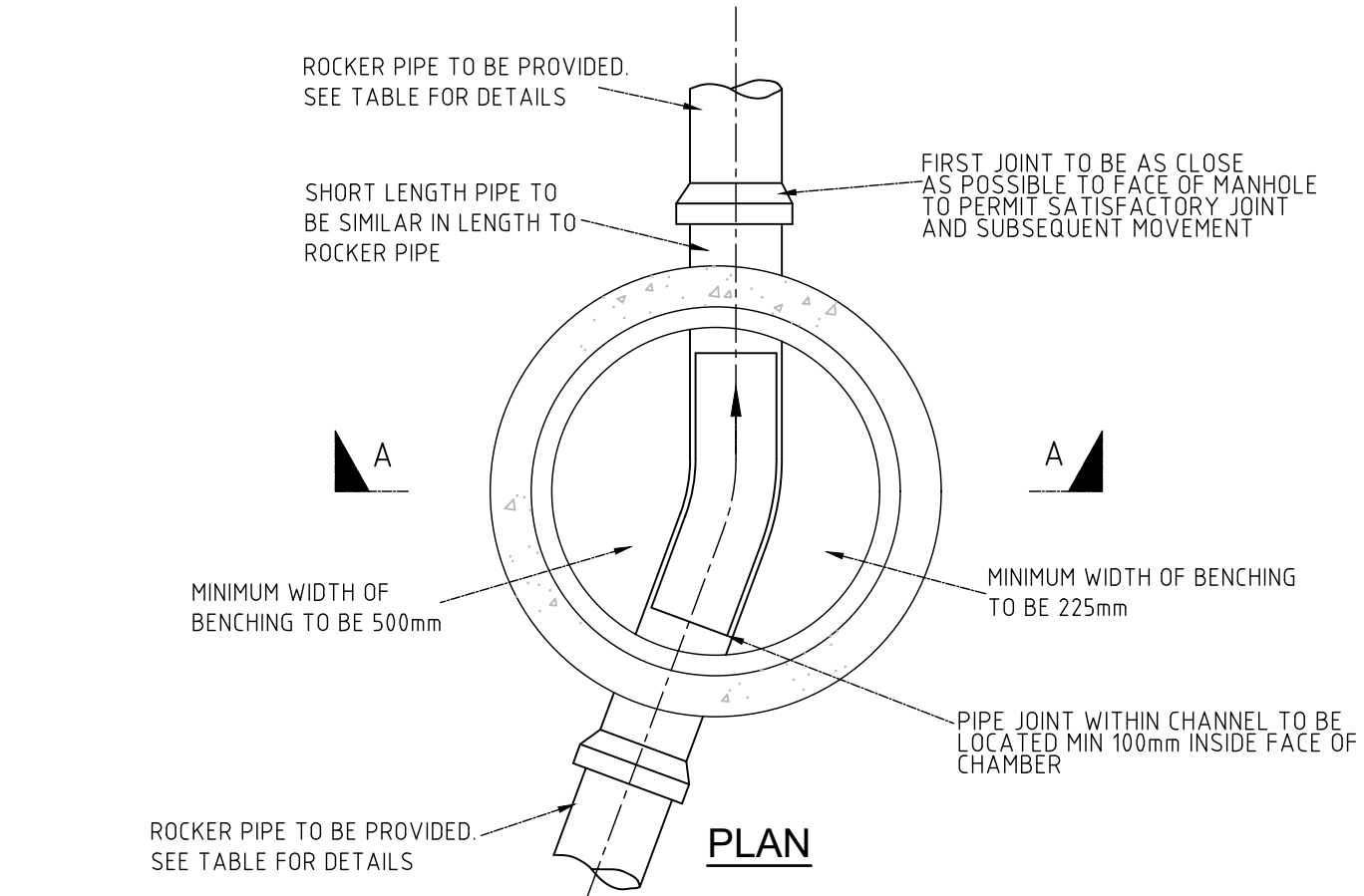
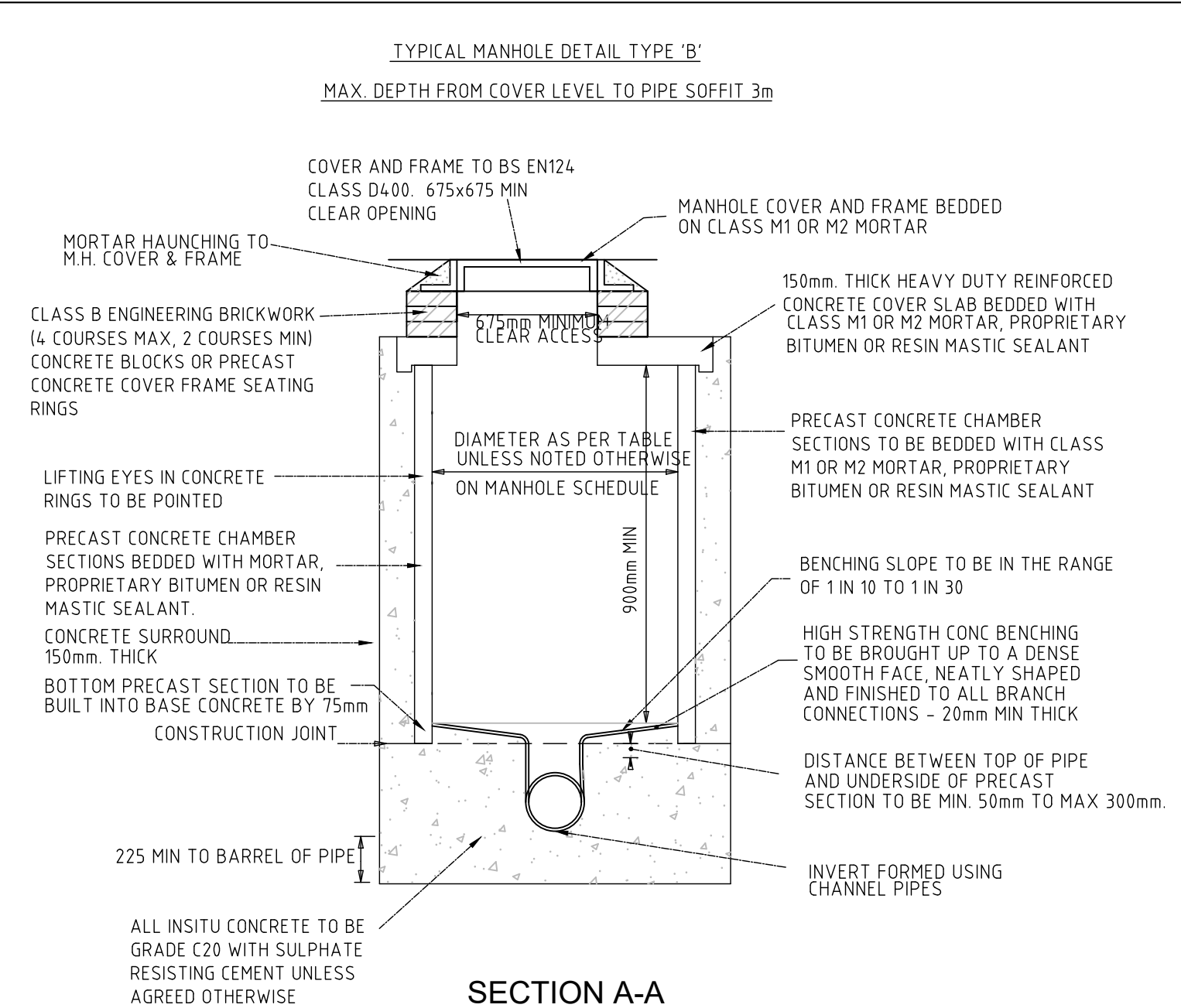
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FOR INFORMATION ONLY
NOT TO BE USED FOR CONSTRUCTION

Drawing Number: 30210292-AUK-XX-XX-SK-CE-0505	Revision: 01
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MANHOLE DIAMETER SCHEDULE	
DIAMETER OF LARGEST PIPE IN MANHOLE (mm)	INTERNAL DIAMETER OF MANHOLE (mm)
LESS THAN 375	1200
375-700	1500
750-900	1800
GREATER THAN 900	SEE MANHOLE SCHEDULE

ROCKER PIPE TABLE	
THE LENGTH OF THE NEXT PIPE (ROCKER PIPE) AWAY FROM STRUCTURE SHALL BE AS SHOWN BELOW:-	
PIPE DIAMETER	EFFECTIVE LENGTH
150mm TO 600mm	600mm
OVER 600mm TO 750mm	1000mm
> 750mm	1250mm



- NOTES:
- DO NOT SCALE FROM THIS DRAWING, USE FIGURED DIMENSIONS ONLY.
 - ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
 - ALL SHORT LENGTHS OF SEWER MUST BE CAST INTEGRALLY WITH THE BASE.
 - ALL ADAPTABLE MANHOLES AND SEWERS MUST BE CONSTRUCTED TO MEET THE SPECIFICATION CONTAINED IN 'SEWERS FOR ADOPTION 6TH EDITION'.
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LEGEND:

Rev	Date	Description	Drawn	Check	Approv
01	31/01/24	FIRST ISSUE	BA	-	-

Client

BANES

PROJECT: ENGLISHCOMBE LANE

Bath & North East Somerset Council

Site	Client
Englishcombe Lane, Southdown Bath, BA2 2EH	BANES Manvers St, Lewis House Bath, BA1 1JG Phone 01225 394041 Fax -

ARCADIS

Registered office: Arcadis 80 Fenchurch Street London EC3M 4BY

Coordinating office: 2 Glass Wharf Temple Quay Bristol BS2 0FR Tel: +44 (0)11 7372 1200

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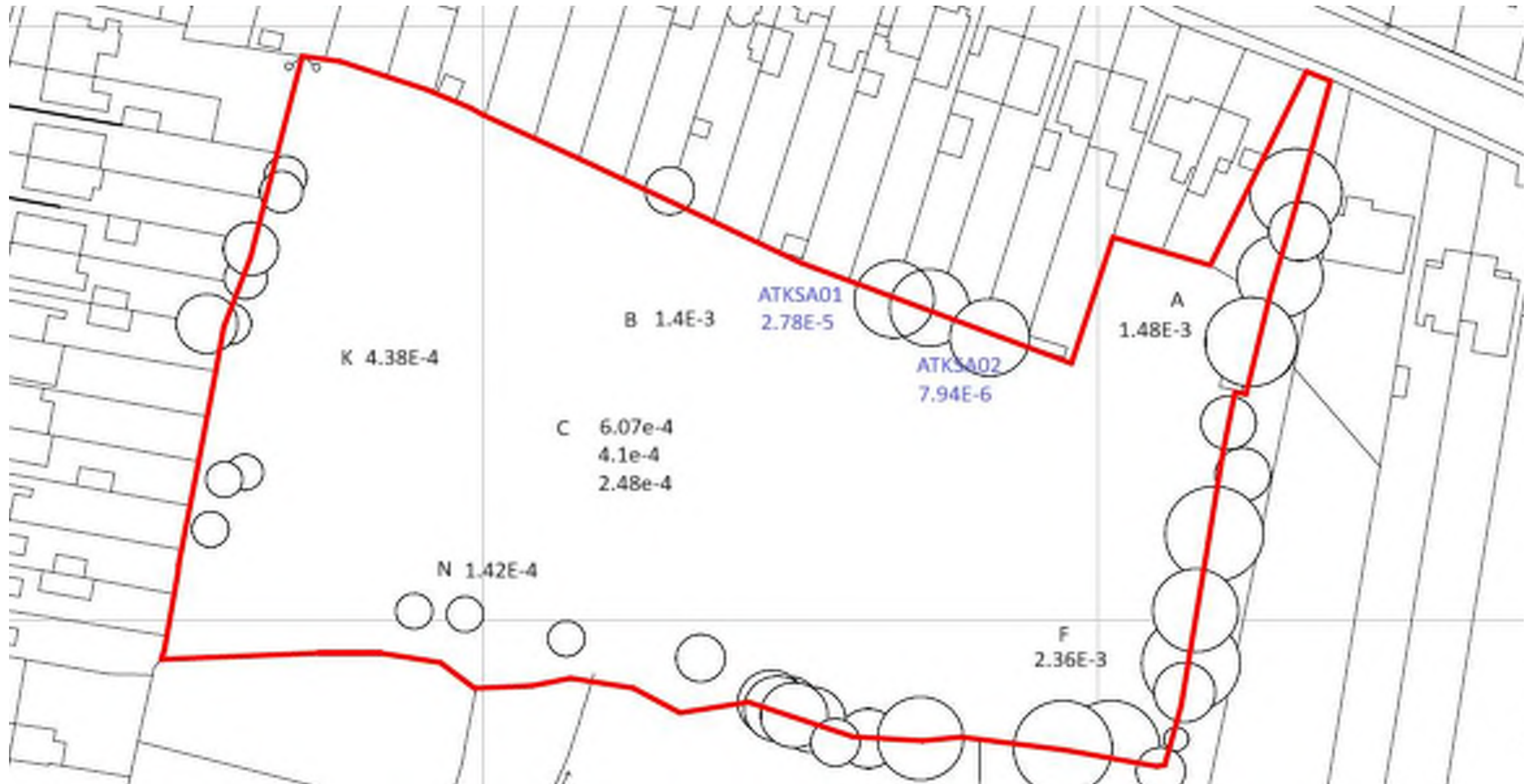
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Approved	M.DAVIES	Signed	Date -
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Suitability Code:	S0	Project Number:	30210292
Suitability Description:			
FOR INFORMATION ONLY NOT TO BE USED FOR CONSTRUCTION			
Drawing Number: 30210292-AUK-XX-XX-SK-CE-0506			Revision: 01

Appendix C

Soakaway Test Report

Soakaway Test Locations

Soakaway Test		Drawing Reference	m/s		m/hr	Depth of Soakaway test	Date Conducted
Atkins	ATKSA01	ATKSA01	2.78	1.00E-05	0.1001	0.8m	11/08/2023
	ATKSA02	ATKSA02	7.94	1.00E-06	0.0286	0.8m	11/08/2023
Integral	TPA	A	1.48	1.00E-03	5.3280	2.0m	15/06/2017
	TPB	B	1.4	1.00E-03	5.0400	2.4m	15/06/2017
	TPC-1	C	6.07	1.00E-04	2.1852	1.6m	15/06/2017
	TPC-2		4.1	1.00E-03	14.7600	1.7m	15/06/2017
	TPC-3		2.48	1.00E-04	0.8928	1.8m	15/06/2017
	TPF	F	2.36	1.00E-04	0.8496	3.5m	15/06/2017
	TPK	K	4.38	1.00E-04	1.5768	2.4m	15/06/2017
	TPN	N	1.42	1.00E-04	0.5112	2.8m	15/06/2017





Notes

OpenStreetMap Contributors ©



LEGEND

- Site Boundary
- 2018 Integrate Trial Pit Locations
- 2023 Atkins Exploratory Hole Locations
- TP
- BH
- TP



Client

Bath & North East Somerset Council

Project Title

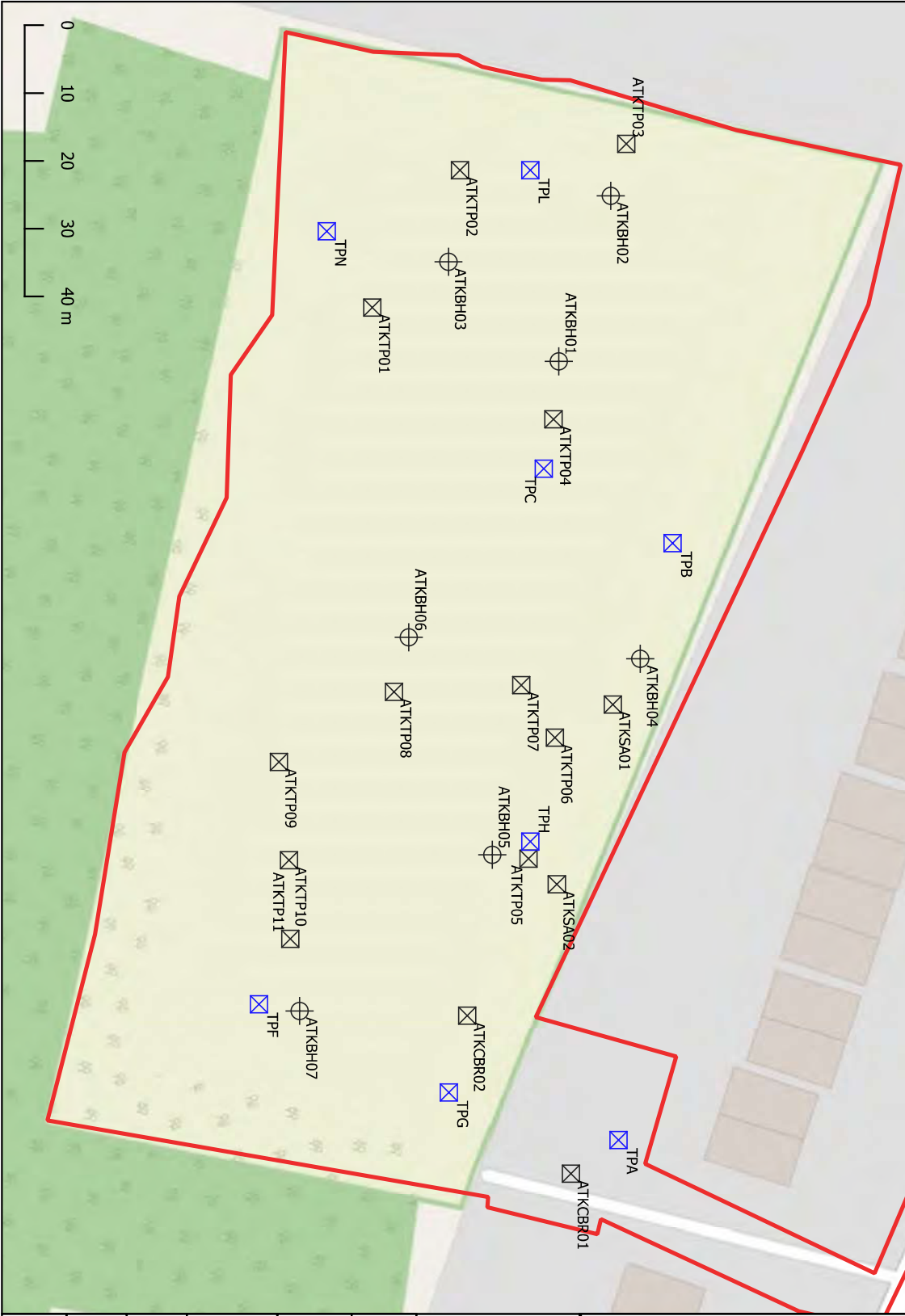
Englishcombe Lane Ground Investigation

Drawing Title

Exploratory Hole Location Plan

Scale	Designed	Drawn	Checked	Authorised
1:3000	JF	JF	EC	MB
Original Size	Date	Date	Date	Date
A4	28/09/2023	28/09/2023	28/09/2023	28/09/2023

Drawing Number	Revision
002	03



C8062: Soakaway Test Record Sheet

 CC Ground Investigations Ltd	Contract Name:	Englishcombe
	Contract ID:	C8062
	Client:	Atkins
	Instrument: used:	Dip Meter

C8062: Soakaway Test Record Sheet

C8062: Soakaway Test Record Sheet								
Soakaway Reference		SA2		Operative		SF		
Date		11.08.2023		Granular infill used			No	
Pit Depth (m)		0.85		Water Supply			IBC	
Pit Length (m)		0.30		Pump used			No	
Pit Width (m)		0.30						
Test 1			Test 2			Test 3		
25% effective depth (m)		0.78		25% effective depth (m)		0.78		25% effective depth (m)
Ground Water Level (m)		-		Ground Water Level (m)		-		Ground Water Level (m)
Volume of water used (m3)		10 Litres		Volume of water used (m3)		10 Litres		Volume of water used (m3)
Time to add water (mins)		45 secs		Time to add water (mins)		45 secs		Time to add water (mins)
Time	Time (minutes)	Water Depth (m)	Time	Time (minutes)	Water Depth (m)	Time	Time (minutes)	Water Depth (m)
12:10:00 PM	0.00	0.55	02:35:00 PM	0.00	0.55			
	1.00	0.56		1.00	0.56			
	2.00	0.57		2.00				
	3.00	0.58		3.00	0.56			
	4.00			4.00				
	5.00	0.59		5.00	0.57			
	10.00	0.61		10.00	0.57			
	15.00	0.63		15.00	0.58			
	20.00	0.64		20.00	0.60			
	25.00	0.65		25.00	0.61			
	30.00	0.66		30.00	0.62			
	35.00	0.68		35.00	0.63			
	40.00	0.69		40.00	0.64			
	45.00	0.70		45.00	0.64			
	50.00	0.71		50.00				
	55.00	0.71		55.00	0.65			
	60.00	0.72		60.00	0.65			
	90.00	0.74		90.00	0.68			
	120.00	0.78		120.00	0.69			
			Instructed to stop test by onsite Engineers					
 CC Ground Investigations Ltd			Contract Name:			Englishcombe		
			Contract ID:			C8062		
			Client:			Atkins		
			Instrument: used:			Dip Meter		

C8062: Soakaway Test Record Sheet

[illegible]

Job No:	1805	Soil Infiltration Rate Test		
		BRE 365 (2007) Soakaway Design		
Job Name:	Land South of Westleaze Road, Charminster		Hole:	TPA
Prepared By:	DB	Date:	15/06/2017	Sheet: 1 of 8
Checked By:	AH	Date:	22/06/2017	

Date of Test: 12th June 2017

Length (m): 2.60

Width (m): 0.70

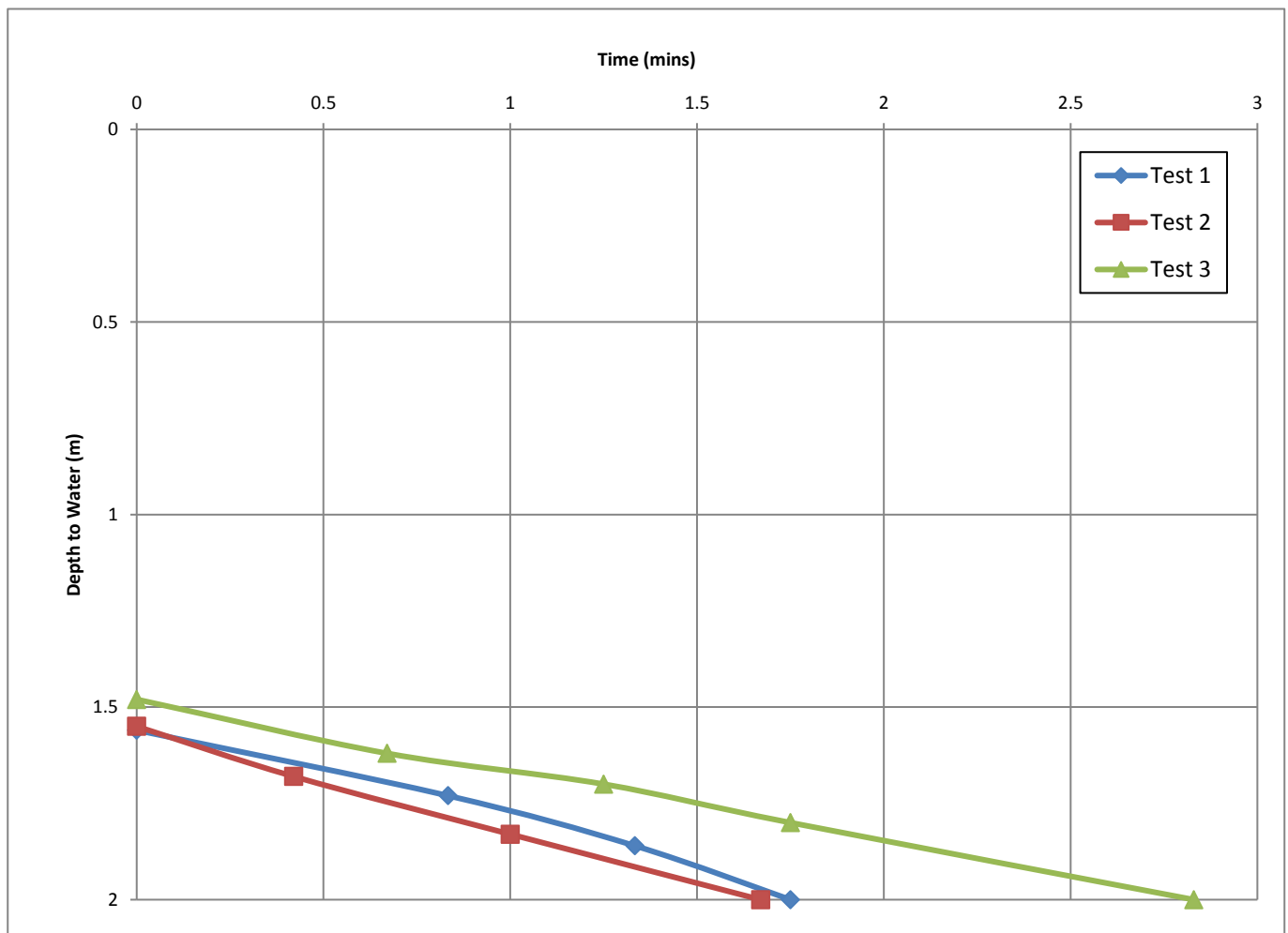
Depth (m): 2.00

Remarks:

	Test 1	Test 2	Test 3
Effective Storage Depth _{75-25%} (m)	0.22	0.23	0.26
A = Surface Area _{50%} (m ²)	3.27	3.31	3.54
V = Effective Storage Volume _{75-25%} (m ³)	0.40	0.41	0.47
t = Time _{75-25%} (mins)	0.9	0.885	1.51
Soil Infiltration Rate (m/s)	2.32E-03	2.33E-03	1.48E-03

Design Soil Infiltration Rate (m/s)

1.48E-03



Job No:	1805	Soil Infiltration Rate Test		
		BRE 365 (2007) Soakaway Design		
Job Name:	Land South of Westleaze Road, Charminster		Hole:	TPB
Prepared By:	DB	Date:	15/06/2017	Sheet: 2 of 8
Checked By:	AH	Date:	22/06/2017	

Date of Test: 12th June 2017

Length (m): 2.30

Width (m): 0.70

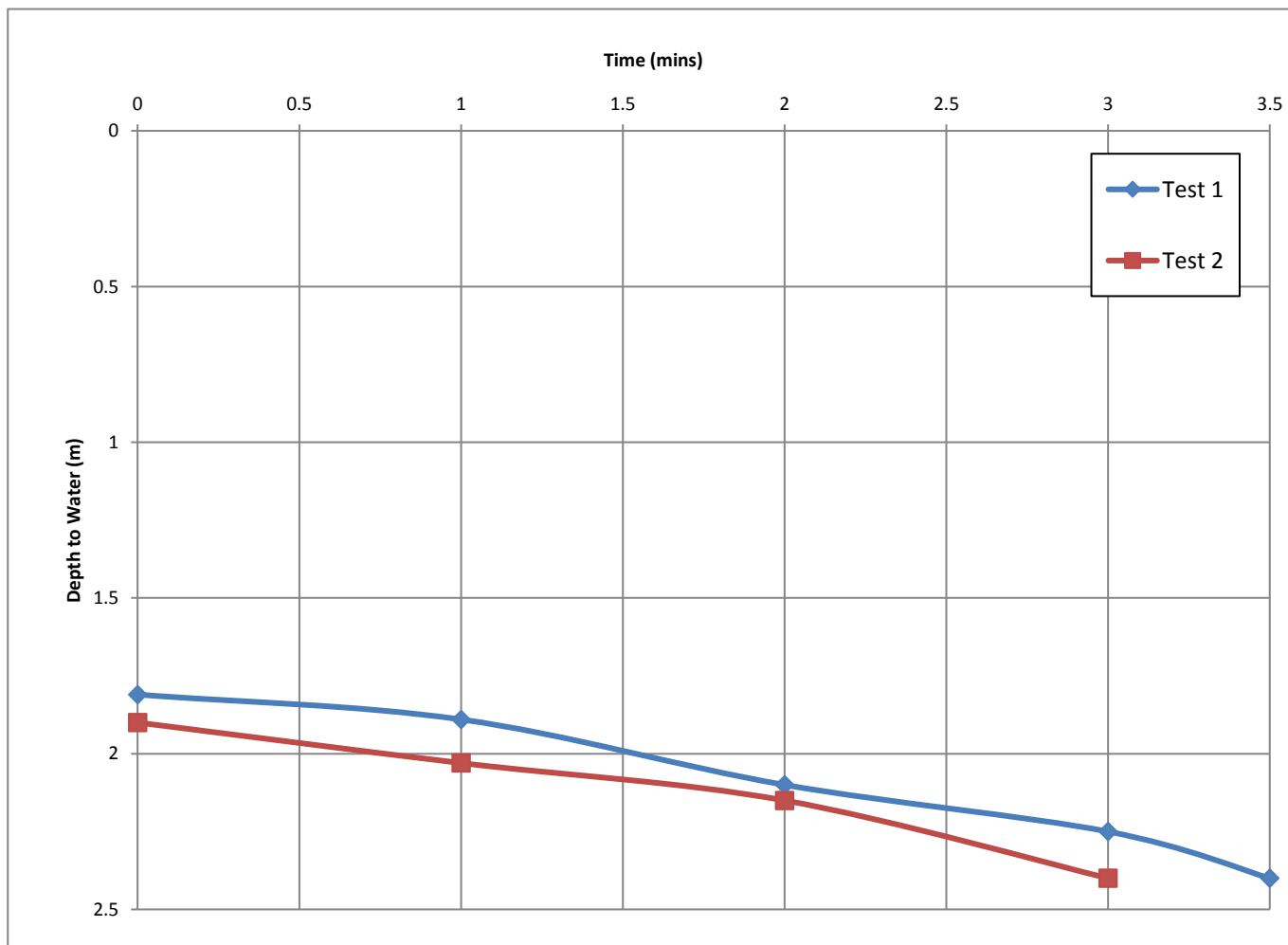
Depth (m): 2.40

Remarks:

	Test 1	Test 2	Test 3
Effective Storage Depth _{75-25%} (m)	0.30	0.25	Could only develop small head of water, drained away too quickly to monitor. Not possible to complete test, but rate no worse than Test 1 and 2
A = Surface Area _{50%} (m ²)	3.38	3.11	
V = Effective Storage Volume _{75-25%} (m ³)	0.47	0.40	
t = Time _{75-25%} (mins)	1.7	1.52	
Soil Infiltration Rate (m/s)	1.40E-03	1.42E-03	

Soil Infiltration Rate (m/s)

1.40E-03



Job No:	1805	Soil Infiltration Rate Test			
		BRE 365 (2007) Soakaway Design			
Job Name:	Land South of Westleaze Road, Charminster			Hole:	TPC-I
Prepared By:	DB	Date:	15/06/2017	Sheet:	3 of 8
Checked By:	AH	Date:	22/06/2017		

Date of Test: 12th June 2017

Length (m): 2.40

Width (m): 0.70

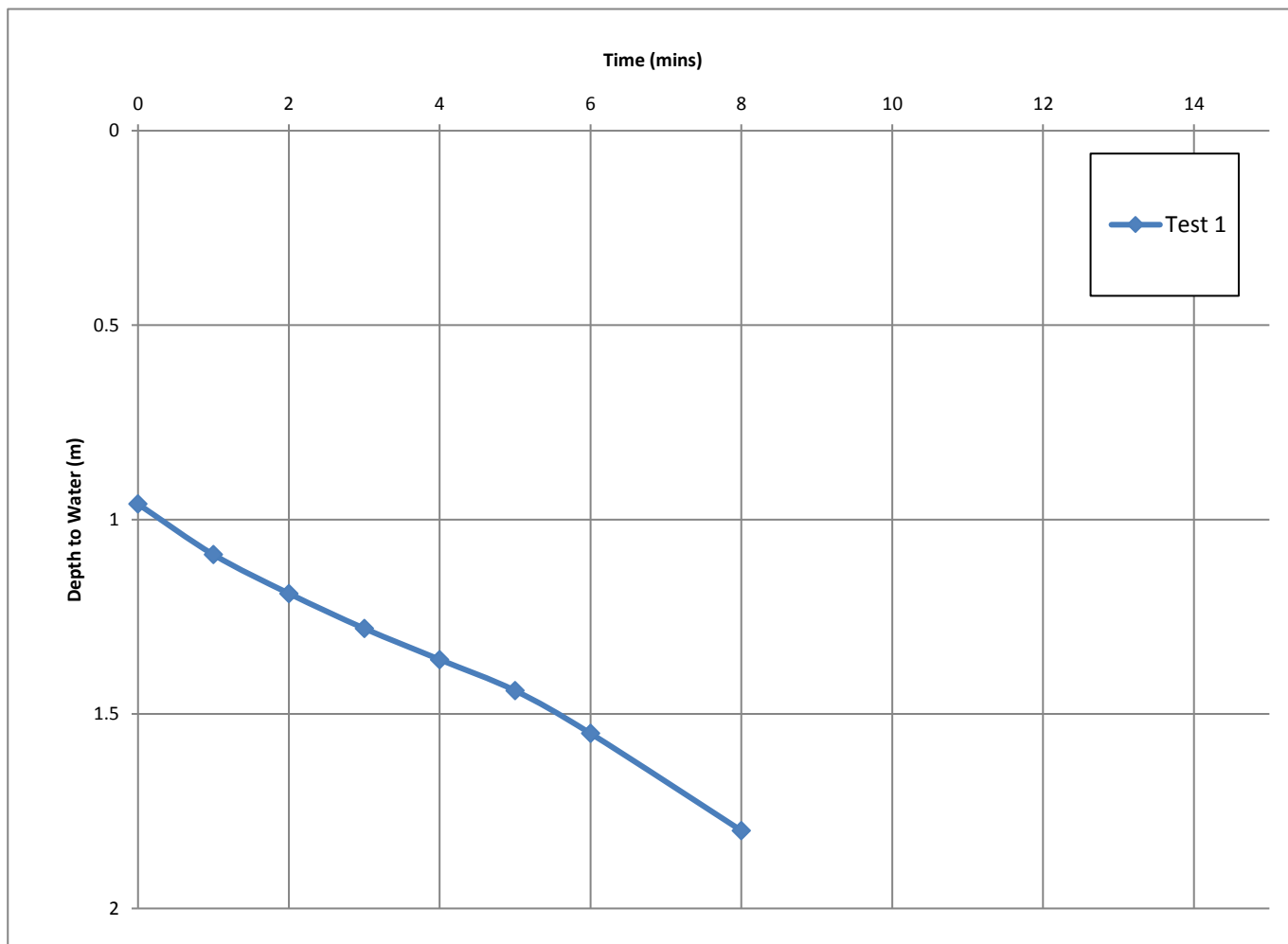
Depth (m): 1.80

Remarks: Tests within TPC shown over 3 sheets due to minor collapse and silting up, changing base depth

	Test 1	See separate sheets for other test details	See separate sheets for other test details
Effective Storage Depth _{75-25%} (m)	0.42		
A = Surface Area _{50%} (m ²)	4.28		
V = Effective Storage Volume _{75-25%} (m ³)	0.71		
t = Time _{75-25%} (mins)	4.5		
Soil Infiltration Rate (m/s)	6.07E-04		

Design Soil Infiltration Rate (m/s)

6.07E-04



Job No:	1805	Soil Infiltration Rate Test		
		BRE 365 (2007) Soakaway Design		
Job Name:	Land South of Westleaze Road, Charminster		Hole:	TPC-2
Prepared By:	DB	Date:	15/06/2017	Sheet: 4 of 8
Checked By:	AH	Date:	22/06/2017	

Date of Test: 12th June 2017

Length (m): 2.40

Width (m): 0.70

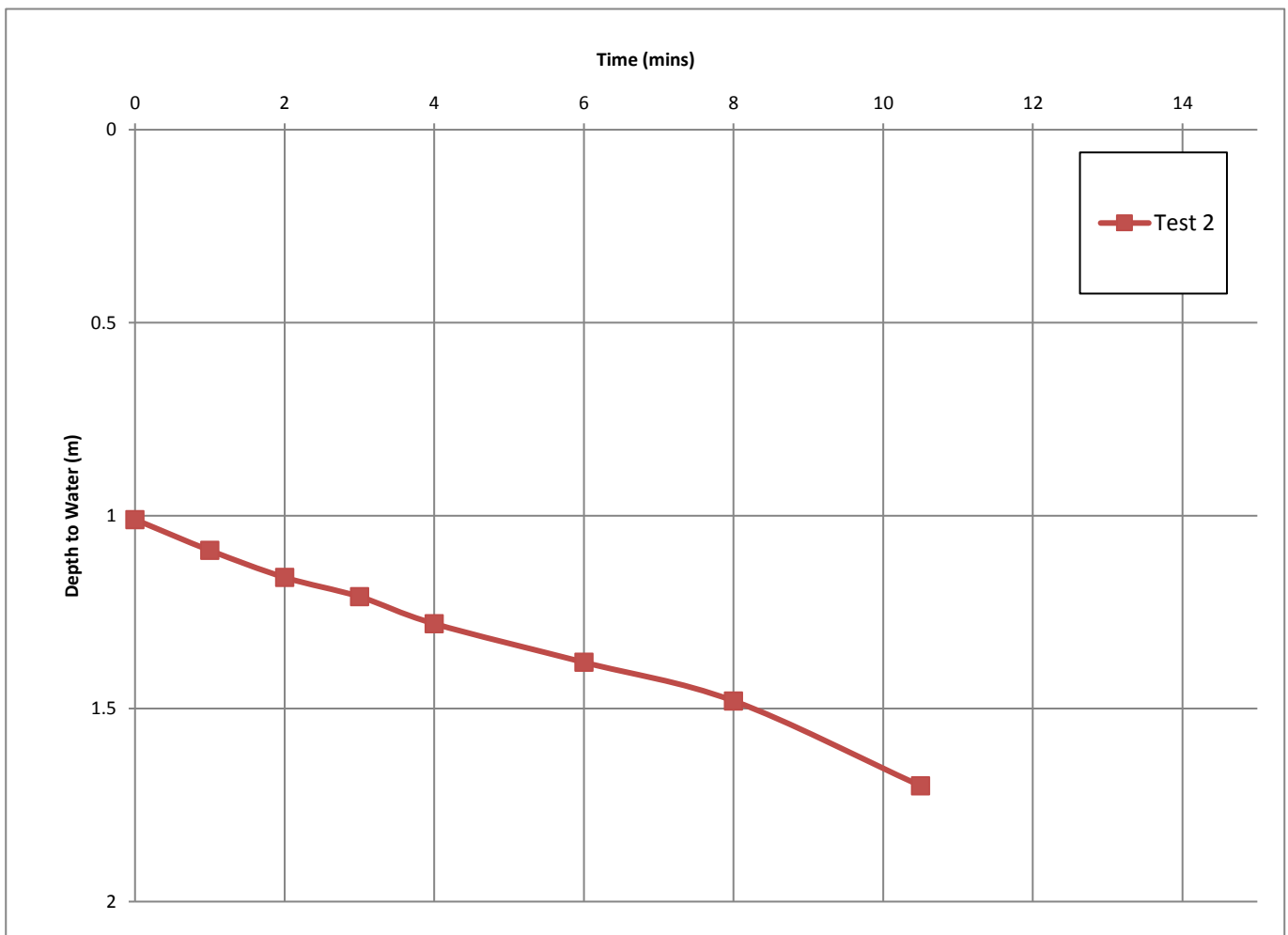
Depth (m): 1.70

Remarks: Tests within TPC shown over 3 sheets due to minor collapse and silting up, changing base depth

	See separate sheets for other test details	Test 2	See separate sheets for other test details
Effective Storage Depth _{75-25%} (m)		0.35	
A = Surface Area _{50%} (m ²)		3.82	
V = Effective Storage Volume _{75-25%} (m ³)		0.58	
t = Time _{75-25%} (mins)		6.17	
Soil Infiltration Rate (m/s)		4.10E-04	

Design Soil Infiltration Rate (m/s)

4.10E-04



Job No:	1805	Soil Infiltration Rate Test		
		BRE 365 (2007) Soakaway Design		
Job Name:	Land South of Westleaze Road, Charminster		Hole:	TPC-3
Prepared By:	DB	Date:	15/06/2017	Sheet: 5 of 8
Checked By:	AH	Date:	22/06/2017	

Date of Test: 12th June 2017

Length (m): 2.40

Width (m): 0.70

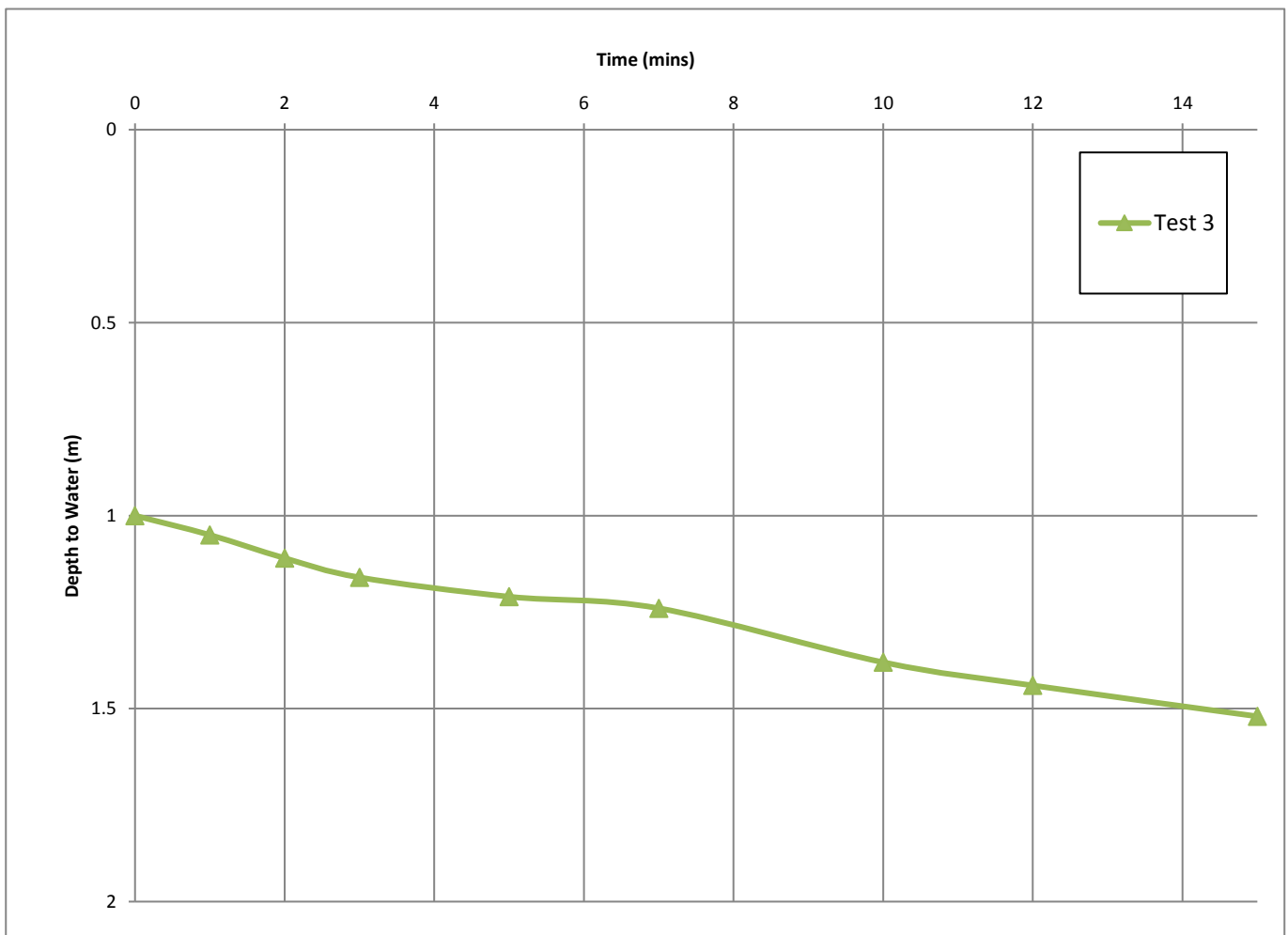
Depth (m): 1.60

Remarks: Tests within TPC shown over 3 sheets due to minor collapse and silting up, changing base depth

	See separate sheets for other test details	See separate sheets for other test details	Test 3
Effective Storage Depth _{75-25%} (m)			0.3
A = Surface Area _{50%} (m ²)			3.54
V = Effective Storage Volume _{75-25%} (m ³)			0.50
t = Time _{75-25%} (mins)			9.575
Soil Infiltration Rate (m/s)			2.48E-04

Design Soil Infiltration Rate (m/s)

2.48E-04



Job No:	1805	Soil Infiltration Rate Test		
		BRE 365 (2007) Soakaway Design		
Job Name:	Land South of Westleaze Road, Charminster		Hole:	TPF
Prepared By:	DB	Date:	15/06/2017	Sheet: 6 of 8
Checked By:	AH	Date:	22/06/2017	

Date of Test: 12th June 2017

Length (m): 3.50

Width (m): 0.70

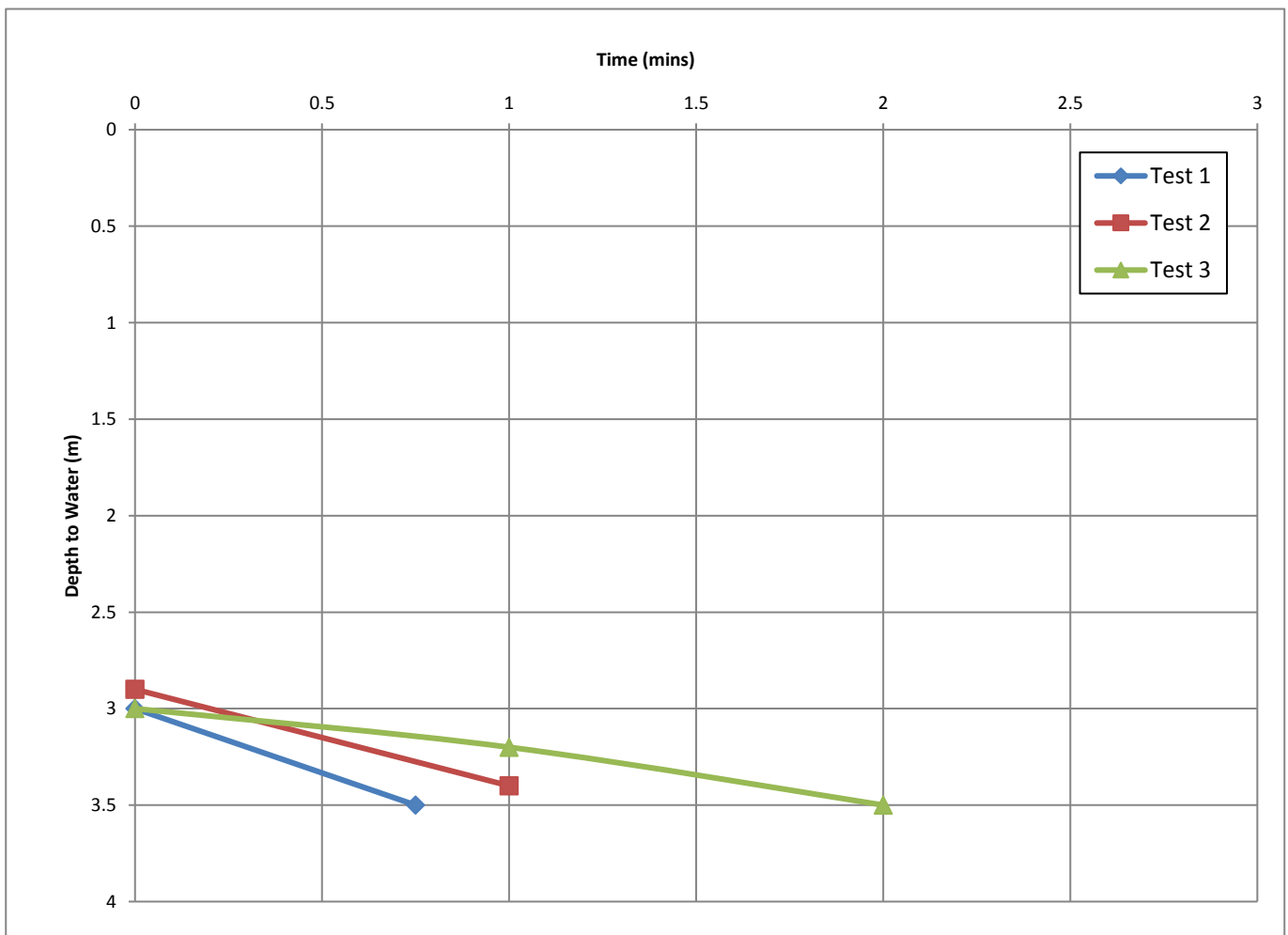
Depth (m): 3.50

Remarks:

	Test 1	Test 2	Re-Test of 1
Effective Storage Depth _{75-25%} (m)	0.25	0.30	0.25
A = Surface Area _{50%} (m ²)	4.55	4.97	4.55
V = Effective Storage Volume _{75-25%} (m ³)	0.61	0.74	0.61
t = Time _{75-25%} (mins)	0.4	0.6	0.95
Soil Infiltration Rate (m/s)	5.98E-03	4.11E-03	2.36E-03

Design Soil Infiltration Rate (m/s)

2.36E-03



Job No:	1805	Soil Infiltration Rate Test		
		BRE 365 (2007) Soakaway Design		
Job Name:	Land South of Westleaze Road, Charminster		Hole:	TPK
Prepared By:	DB	Date:	15/06/2017	Sheet: 7 of 8
Checked By:	AH	Date:	22/06/2017	

Date of Test: 12th June 2017

Length (m): 2.70

Width (m): 0.70

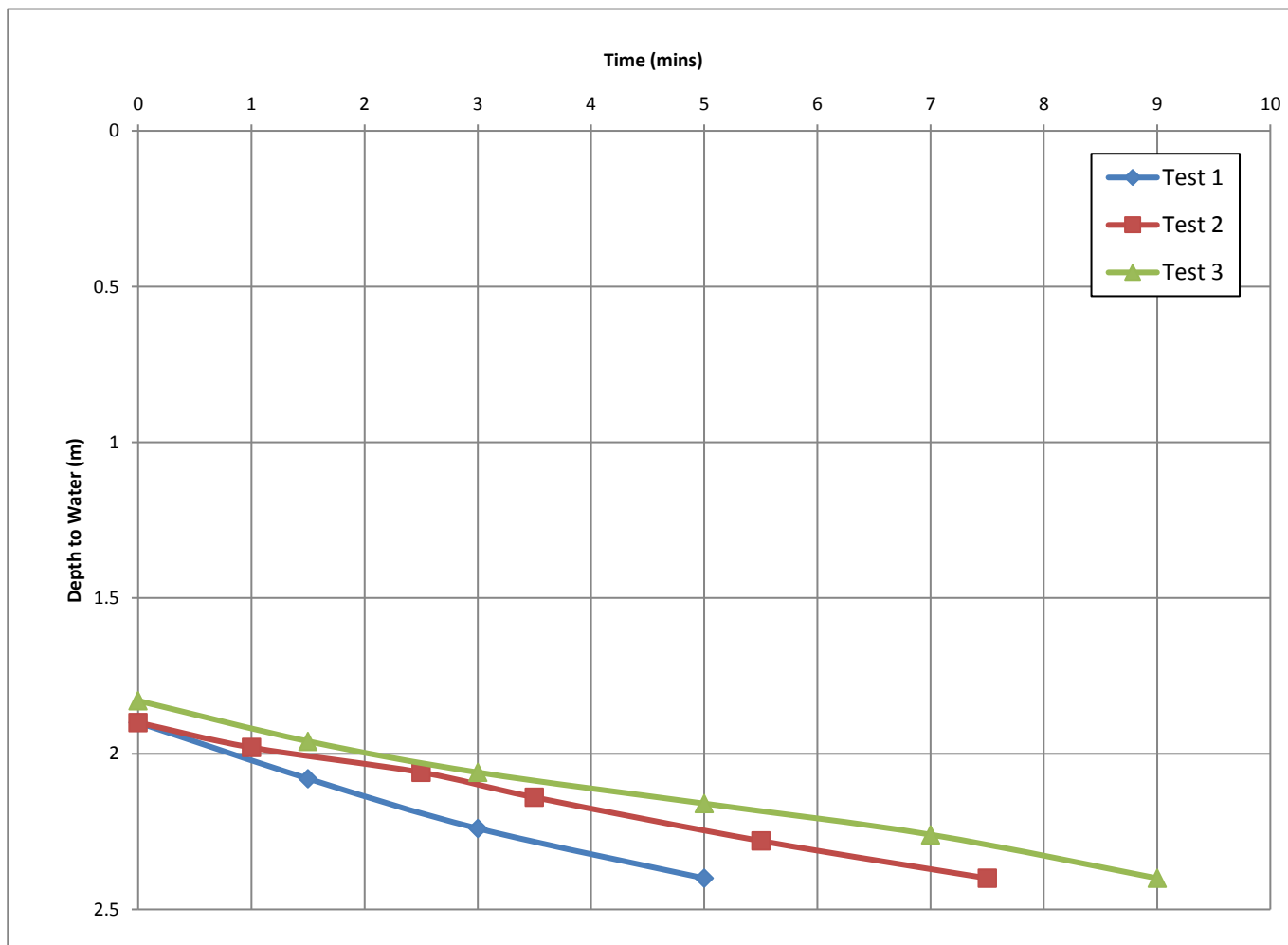
Depth (m): 2.40

Remarks:

	Test 1	Test 2	Re-Test of 1
Effective Storage Depth _{75-25%} (m)	0.25	0.25	0.285
A = Surface Area _{50%} (m ²)	3.59	3.59	3.83
V = Effective Storage Volume _{75-25%} (m ³)	0.47	0.47	0.54
t = Time _{75-25%} (mins)	2.4	3.5625	5.35
Soil Infiltration Rate (m/s)	9.08E-04	6.16E-04	4.38E-04

Design Soil Infiltration Rate (m/s)

4.38E-04



Job No:	1805	Soil Infiltration Rate Test		
		BRE 365 (2007) Soakaway Design		
Job Name:	Land South of Westleaze Road, Charminster		Hole:	TPN
Prepared By:	DB	Date:	15/06/2017	Sheet: 8 of 8
Checked By:	AH	Date:	22/06/2017	

Date of Test: 12th June 2017

Length (m): 2.60

Width (m): 0.70

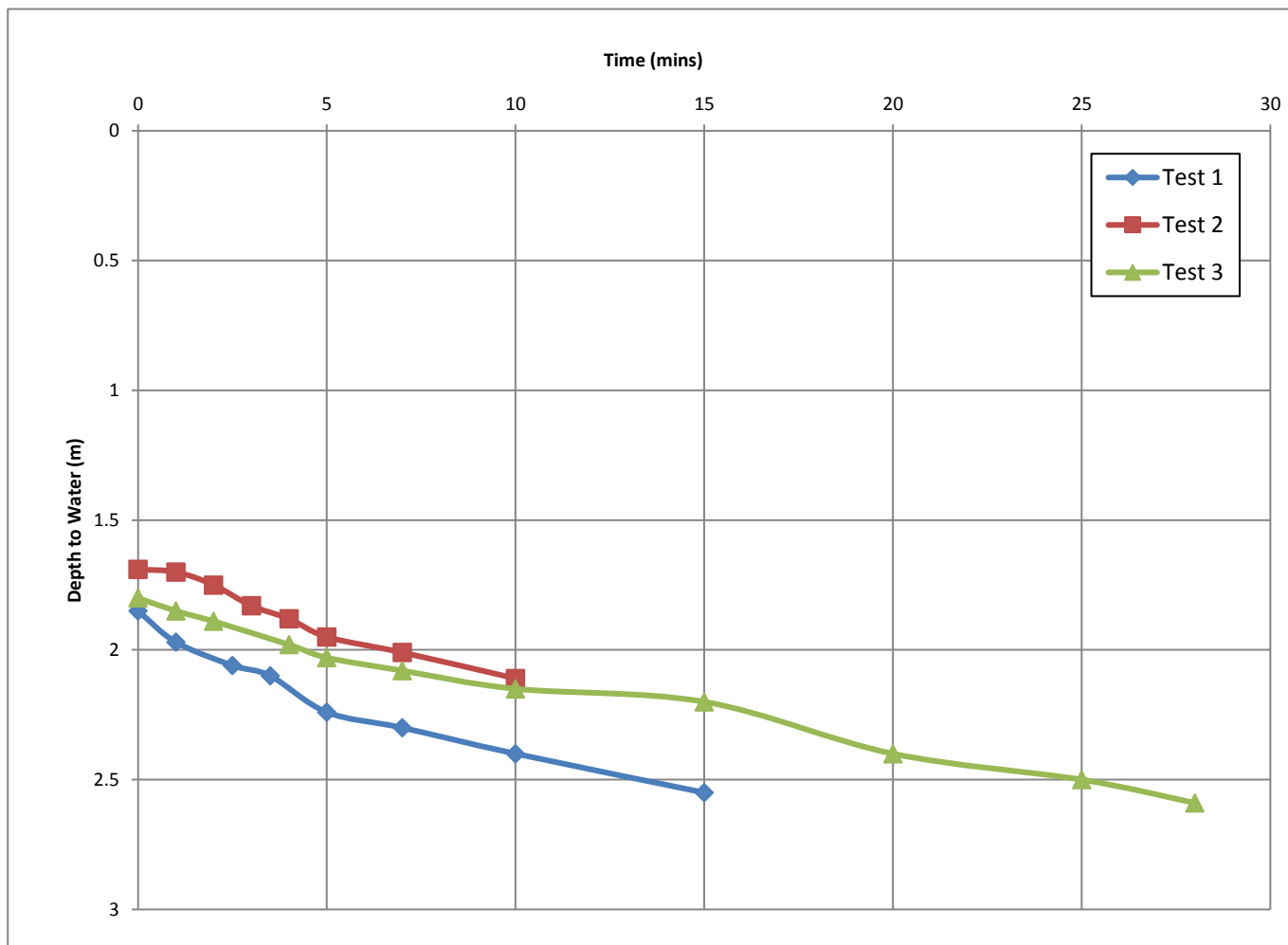
Depth (m): 2.80

Remarks:

	Test 1	Test 2	Re-Test of 1
Effective Storage Depth _{75-25%} (m)	0.48	0.56	0.5
A = Surface Area _{50%} (m ²)	4.96	5.48	5.12
V = Effective Storage Volume _{75-25%} (m ³)	0.86	1.01	0.91
t = Time _{75-25%} (mins)	12.1	21.33	20.87
Soil Infiltration Rate (m/s)	2.41E-04	1.44E-04	1.42E-04

Design Soil Infiltration Rate (m/s)

1.42E-04



Appendix D

Greenfield Runoff Rate Estimation

Hydrology Memo

Surface Water Microdrainage Calculations

Foul Drainage Calculations

Calculated by:

Daniel Hadaway

Site name:

Englishcoombe Lane

Site location:

Bath

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.

Site Details

Latitude:

51.36743° N

Longitude:

2.38148° W

Reference:

2428194180

Date:

Feb 12 2024 16:40

Runoff estimation
approach

FEH Statistical

Site characteristics

Total site area (ha):

1.42

Methodology

Q_{MED} estimation method:

Specify QMed manually

Q_{MED} (l/s):

12.4

Q_{BAR} / Q_{MED} factor:

1.08

Hydrological
characteristics

	Default	Edited
SAAR (mm):	818	818
Hydrological region:	8	8
Growth curve factor 1 year:	0.78	0.78
Growth curve factor 30 years:	1.95	1.95
Growth curve factor 100 years:	2.43	2.43
Growth curve factor 200 years:	2.78	2.78

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q _{BAR} (l/s):		13.33
1 in 1 year (l/s):		10.4
1 in 30 years (l/s):		25.99
1 in 100 year (l/s):		32.39
1 in 200 years (l/s):		37.06

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at 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 www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of 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, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

SUBJECT
Englishcombe Lane Hydrology

DATE
3 July 2024

DEPARTMENT
Catchment Modelling and Strategy

COPIES TO

TO
Daniel Hadaway (Arcadis)

OUR REF
30210292-AUK-XX-XX-RP-CW-0002-01

PROJECT NUMBER
30210292

FROM
Elliot Blount-Powell (Arcadis)
Matt Langdon (Arcadis)

1. Introduction

Arcadis Consulting (UK) Limited ("Arcadis") were instructed by Bath and North East Somerset (B&NES) Council ("the Client") to support a planning application for the development of new supported living units for adults with learning disabilities and/or autism to the rear of Englishcombe Lane in Bath (hereby referred to as 'the site').

This Technical Memo has been prepared to provide flow estimates to the Arcadis drainage team to support their work on the stream capacity downstream of the site.

This hydrology has been run using the latest Revitalised Flood Hydrograph (ReFH2.3), released in 2023, along with the latest Flood Estimation Handbook (FEH) design rainfall estimates (FEH22)¹.

2. Catchment Delineation and Descriptors

Catchment boundaries above 0.5km² can typically be derived from the FEH Web Service². However, a review of the FEH web service showed that, at the downstream end of the site (Figure 1), the catchment associated with the site is <0.5km².

The catchment boundary shown in Figure 1 is based on the catchment area derived by Edenvale Young (September 2017). This catchment area was checked against Lidar data and OS terrain contours which confirmed its suitability. The catchment area is 8.8ha (0.08km²).

¹ UK Centre for Ecology and Hydrology (2022) FEH22, accessed July 2024 via: [https://fehwebdocs.hydrosolutions.co.uk/attachments/The%20FEH22%20rainfall%20depth-duration-frequency%20\(DDF\)%20model-caa11347-4ff7-4c89-b707-bf5bb1c05d79.pdf](https://fehwebdocs.hydrosolutions.co.uk/attachments/The%20FEH22%20rainfall%20depth-duration-frequency%20(DDF)%20model-caa11347-4ff7-4c89-b707-bf5bb1c05d79.pdf)

² UK Centre for Ecology & Hydrology (2024). Flood Estimation Handbook Web Service, accessed July 2024 via: <https://fehweb.ceh.ac.uk/>

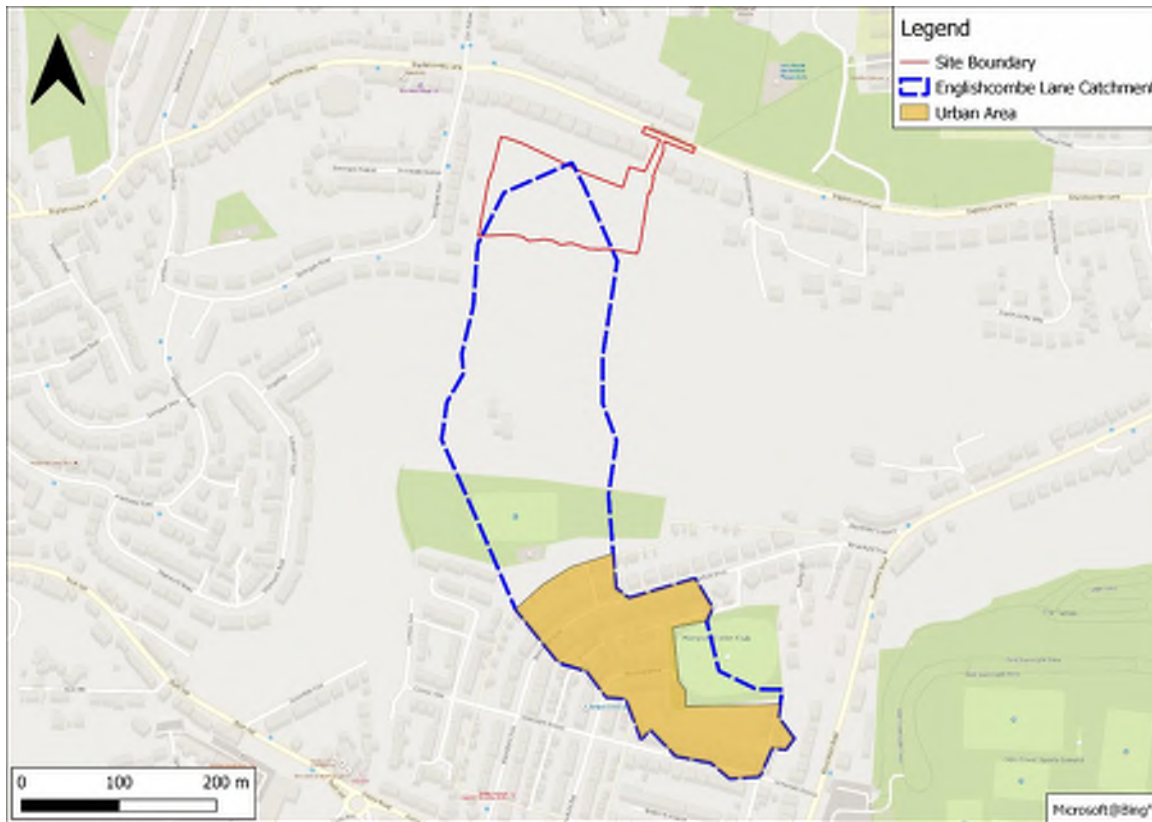


Figure 1 Catchment Overview

As there is no associated FEH catchment, point data has been obtained from the FEH Web Service² which contains details on soil and climate descriptors, and rainfall characteristics. Table 1 summarises the catchment descriptors for the site.

Table 1: Key Catchment Descriptors

Descriptor	Value
Area (km ²)	0.08 (based on catchment shown in Figure 1)
BFIHOST19	0.496
PROPWET	0.35
SAAR	819mm

Figure 1 also shows the urban area contained within the catchment (0.026km²), which has been derived based on Bing mapping. This can be input into the ReFH2.3 rainfall runoff method to generate an urban extent (URBEXT2000). Based on an urban area of 0.026km², an effective URBEXT2000 of 0.207 was calculated.

3. ReFH2 Calculations

Peak flow estimates have been generated using the ReFH2 rainfall-runoff method, for a range of return periods which can be used to support the drainage team's investigation of the capacity downstream of the site.

Two additional rainfall events were added to account for climate change in the catchment. Based on the

Department for Environment Food & Rural Affairs (DEFRA) Climate Change Allowances viewer³, the Avon Bristol and North Somerset Streams Management Catchment peak rainfall allowances for the 1 in 30 year and 1 in 100 year return periods are 40% and 45%, respectively.

As discussed in Section 2, the catchment is 0.08km² and the plot-scale equations within ReFH2 have been used and the procedure outlined within the technical guidance⁴ has been followed.

The storm durations was left as the default 3 hours and 15 minutes, with a timestep of 15 minutes. The flows produced for this storm duration is summarised in Table 2 below:

Table 2 Peak Flow Estimates

Return Period (years)	Urbanised Peak Flow (m ³ /s)
1	0.034
2	0.039
5	0.056
10	0.069
30	0.089
30 + 40% Climate Change*	0.129
50	0.099
75	0.108
100	0.114
100 + 45% Climate Change*	0.173
200	0.131
1000	0.178

*climate change has been applied to the rainfall based on the latest climate change allowances⁴ and does not translate into the same change in flows.

4. Conclusions

This memo has summarised the flood flow estimations for the drainage team to use in their capacity assessment downstream of the site. Flow estimates have been derived using the latest rainfall-runoff model and best practice.

³ Department for Environmental Food & Affairs (2019) Climate Change Allowances, accessed July 2024 via: [Climate change allowances for peak rainfall \(data.gov.uk\)](#)

⁴ ReFH2 Technical Guide. Greenfield Runoff Rates and Volumes, accessed July 2024 via: [Greenfield Runoff Rates and Volumes - ReFH Technical Guide \(hydrosolutions.co.uk\)](#)

ON-SITE SURFACE WATER NETWORK

LOW INFILTRATION RATES

Arcadis		Page 1
1210 Premeier Dr Ste 200 Chattanooga EN 37421-3747		
Date 22/07/2024 17:34 File ENGLISHCOMBE MICRODRAIN...	Designed by allenb7729 Checked by	
Innovyze	Network 2020.1.3	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm - Low Inf. Rate

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model	
Return Period (years)	100
FEH Rainfall Version	1999
Site Location GB 373900 163850 ST 73900 63850	
C (1km)	-0.025
D1 (1km)	0.384
D2 (1km)	0.402
D3 (1km)	0.227
E (1km)	0.288
F (1km)	2.470
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	45
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm - Low Inf. Rate

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	20.249	0.481	42.1	0.049	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.001	28.555	1.191	24.0	0.057	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	12.796	1.194	10.7	0.039	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	31.612	1.573	20.1	0.048	5.00	0.0	0.600	o	150	Pipe/Conduit	
S2.001	7.009	0.568	12.3	0.047	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)
S1.000	50.00	5.22	94.106	0.049	0.0	0.0	3.0	1.56	27.5	9.6
S1.001	50.00	5.39	93.625	0.106	0.0	0.0	6.5	2.68	106.7	20.8
S1.002	50.00	5.45	92.434	0.145	0.0	0.0	8.8	4.02	159.9	28.5
S2.000	50.00	5.23	93.456	0.048	0.0	0.0	2.9	2.26	39.9	9.4
S2.001	50.00	5.27	91.883	0.095	0.0	0.0	5.8	2.88	51.0	18.7

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Network 2020.1.3

Page 2



Network Design Table for Storm - Low Inf. Rate												
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	
S1.003	4.545	0.019	241.9	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit		
S3.000	21.469	1.036	20.7	0.057	5.00	0.0	0.600	o	150	Pipe/Conduit		
S4.000	15.452	1.353	11.4	0.000	5.00	0.0	0.600	o	100	Pipe/Conduit		
S5.000	10.636	0.853	12.5	0.000	5.00	0.0	0.600	o	100	Pipe/Conduit		
S3.001	17.568	0.677	25.9	0.085	0.00	0.0	0.600	o	225	Pipe/Conduit		
S6.000	12.159	1.030	11.8	0.000	5.00	0.0	0.600	o	100	Pipe/Conduit		
S7.000	7.407	0.530	14.0	0.000	5.00	0.0	0.600	o	100	Pipe/Conduit		
S3.002	16.449	0.640	25.7	0.069	0.00	0.0	0.600	o	225	Pipe/Conduit		
S3.003	8.362	0.464	18.0	0.039	0.00	0.0	0.600	o	225	Pipe/Conduit		
S3.004	6.000	0.404	14.9	0.022	0.00	0.0	0.600	o	225	Pipe/Conduit		
S8.000	35.769	3.081	11.6	0.028	5.00	0.0	0.600	o	100	Pipe/Conduit		
S8.001	0.799	0.143	5.6	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit		
Network Results Table												
PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)		
S1.003	50.00	5.52	91.165	0.240	0.0	0.0	14.6	1.01	71.1	47.1		
S3.000	50.00	5.16	92.433	0.057	0.0	0.0	3.5	2.22	39.3	11.2		
S4.000	50.00	5.11	92.750	0.000	0.0	0.0	0.0	2.30	18.1	0.0		
S5.000	50.00	5.08	92.250	0.000	0.0	0.0	0.0	2.20	17.3	0.0		
S3.001	50.00	5.27	91.272	0.142	0.0	0.0	8.7	2.58	102.5	27.9		
S6.000	50.00	5.09	91.750	0.000	0.0	0.0	0.0	2.26	17.8	0.0		
S7.000	50.00	5.06	91.250	0.000	0.0	0.0	0.0	2.08	16.3	0.0		
S3.002	50.00	5.38	90.595	0.211	0.0	0.0	12.9	2.59	103.1	41.4		
S3.003	50.00	5.43	89.955	0.250	0.0	0.0	15.2	3.10	123.2	49.1		
S3.004	50.00	5.45	89.491	0.272	0.0	0.0	16.6	3.41	135.7	53.4		
S8.000	50.00	5.26	88.195	0.028	0.0	0.0	1.7	2.28	17.9	5.5		
S8.001	50.00	5.27	85.113	0.028	0.0	0.0	1.7	3.30	25.9	5.5		
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Date 22/07/2024 17:34 File ENGLISHCOMBE MICRODRAIN...					Designed by allenb7729 Checked by						
Innovyze										Network 2020.1.3	
<u>Manhole Schedules for Storm - Low Inf. Rate</u>											
MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S1	95.456	1.350	Open Manhole	1200	S1.000	94.106	150				
S2	94.975	1.350	Open Manhole	1200	S1.001	93.625	225	S1.000	93.625	150	
S3	93.784	1.350	Open Manhole	1200	S1.002	92.434	225	S1.001	92.434	225	
S4	94.756	1.300	Open Manhole	1200	S2.000	93.456	150				
S5	93.183	1.300	Open Manhole	1200	S2.001	91.883	150	S2.000	91.883	150	
S6	92.665	1.500	Open Manhole	1200	S1.003	91.165	300	S1.002	91.240	225	
								S2.001	91.315	150	
S7	92.685	1.539	Open Manhole	0		OUTFALL		S1.003	91.146	300	
S8	93.733	1.300	Open Manhole	1200	S3.000	92.433	150				
S9	94.050	1.300	Open Manhole	1200	S4.000	92.750	100				
S10	93.550	1.300	Open Manhole	1200	S5.000	92.250	100				
S11	92.697	1.425	Open Manhole	1200	S3.001	91.272	225	S3.000	91.397	150	50
								S4.000	91.397	100	
								S5.000	91.397	100	
S12	93.050	1.300	Open Manhole	1200	S6.000	91.750	100				
S13	92.550	1.300	Open Manhole	1200	S7.000	91.250	100				
S14	92.020	1.425	Open Manhole	1200	S3.002	90.595	225	S3.001	90.595	225	
								S6.000	90.720	100	
								S7.000	90.720	100	
S15	91.380	1.425	Open Manhole	1200	S3.003	89.955	225	S3.002	89.955	225	
S16	90.916	1.425	Open Manhole	1200	S3.004	89.491	225	S3.003	89.491	225	
S17	90.512	1.425	Open Manhole	0		OUTFALL		S3.004	89.087	225	
S18	89.495	1.300	Open Manhole	1200	S8.000	88.195	100				
S19	86.413	1.300	Open Manhole	1200	S8.001	85.113	100	S8.000	85.113	100	
S19	86.270	1.300	Open Manhole	0		OUTFALL		S8.001	84.970	100	
MH Name Manhole Easting (m) Manhole Northing (m) Intersection Easting (m) Intersection Northing (m) Manhole Access Layout (North) S1 373494.037 163225.210 373494.037 163225.210 Required  S2 373475.433 163233.204 373475.433 163233.204 Required  S3 373486.833 163259.385 373486.833 163259.385 Required 											
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Manhole Schedules for Storm - Low Inf. Rate

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S19	373633.356	163288.899	373633.356	163288.899	Required	
S19	373633.728	163289.606			No Entry	

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PIPELINE SCHEDULES for Storm - Low Inf. Rate

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	150	S1	95.456	94.106	1.200	Open Manhole	1200
S1.001	o	225	S2	94.975	93.625	1.125	Open Manhole	1200
S1.002	o	225	S3	93.784	92.434	1.125	Open Manhole	1200
S2.000	o	150	S4	94.756	93.456	1.150	Open Manhole	1200
S2.001	o	150	S5	93.183	91.883	1.150	Open Manhole	1200
S1.003	o	300	S6	92.665	91.165	1.200	Open Manhole	1200
S3.000	o	150	S8	93.733	92.433	1.150	Open Manhole	1200
S4.000	o	100	S9	94.050	92.750	1.200	Open Manhole	1200
S5.000	o	100	S10	93.550	92.250	1.200	Open Manhole	1200
S3.001	o	225	S11	92.697	91.272	1.200	Open Manhole	1200
S6.000	o	100	S12	93.050	91.750	1.200	Open Manhole	1200
S7.000	o	100	S13	92.550	91.250	1.200	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	20.249	42.1	S2	94.975	93.625	1.200	Open Manhole	1200
S1.001	28.555	24.0	S3	93.784	92.434	1.125	Open Manhole	1200
S1.002	12.796	10.7	S6	92.665	91.240	1.200	Open Manhole	1200
S2.000	31.612	20.1	S5	93.183	91.883	1.150	Open Manhole	1200
S2.001	7.009	12.3	S6	92.665	91.315	1.200	Open Manhole	1200
S1.003	4.545	241.9	S7	92.685	91.146	1.239	Open Manhole	0
S3.000	21.469	20.7	S11	92.697	91.397	1.150	Open Manhole	1200
S4.000	15.452	11.4	S11	92.697	91.397	1.200	Open Manhole	1200
S5.000	10.636	12.5	S11	92.697	91.397	1.200	Open Manhole	1200
S3.001	17.568	25.9	S14	92.020	90.595	1.200	Open Manhole	1200
S6.000	12.159	11.8	S14	92.020	90.720	1.200	Open Manhole	1200
S7.000	7.407	14.0	S14	92.020	90.720	1.200	Open Manhole	1200

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PIPELINE SCHEDULES for Storm - Low Inf. Rate

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S3.002	o	225	S14	92.020	90.595	1.200	Open Manhole	1200
S3.003	o	225	S15	91.380	89.955	1.200	Open Manhole	1200
S3.004	o	225	S16	90.916	89.491	1.200	Open Manhole	1200
S8.000	o	100	S18	89.495	88.195	1.200	Open Manhole	1200
S8.001	o	100	S19	86.413	85.113	1.200	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S3.002	16.449	25.7	S15	91.380	89.955	1.200	Open Manhole	1200
S3.003	8.362	18.0	S16	90.916	89.491	1.200	Open Manhole	1200
S3.004	6.000	14.9	S17	90.512	89.087	1.200	Open Manhole	0
S8.000	35.769	11.6	S19	86.413	85.113	1.200	Open Manhole	1200
S8.001	0.799	5.6	S19	86.270	84.970	1.200	Open Manhole	0

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Network Classifications for Storm - Low Inf. Rate

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
S1.000	S1	150	1.200	1.200	Unclassified	1200	0	1.200	Unclassified
S1.001	S2	225	0.756	1.125	Unclassified	1200	0	1.125	Unclassified
S1.002	S3	225	1.085	1.200	Unclassified	1200	0	1.125	Unclassified
S2.000	S4	150	1.031	1.174	Unclassified	1200	0	1.150	Unclassified
S2.001	S5	150	1.126	1.200	Unclassified	1200	0	1.150	Unclassified
S1.003	S6	300	1.200	1.239	Unclassified	1200	0	1.200	Unclassified
S3.000	S8	150	1.131	1.150	Unclassified	1200	0	1.150	Unclassified
S4.000	S9	100	1.026	1.200	Unclassified	1200	0	1.200	Unclassified
S5.000	S10	100	1.050	1.200	Unclassified	1200	0	1.200	Unclassified
S3.001	S11	225	1.096	1.200	Unclassified	1200	0	1.200	Unclassified
S6.000	S12	100	1.044	1.291	Unclassified	1200	0	1.200	Unclassified
S7.000	S13	100	1.200	1.294	Unclassified	1200	0	1.200	Unclassified
S3.002	S14	225	0.729	1.200	Unclassified	1200	0	1.200	Unclassified
S3.003	S15	225	1.200	1.430	Unclassified	1200	0	1.200	Unclassified
S3.004	S16	225	1.146	1.200	Unclassified	1200	0	1.200	Unclassified
S8.000	S18	100	1.200	1.366	Unclassified	1200	0	1.200	Unclassified
S8.001	S19	100	1.200	1.200	Unclassified	1200	0	1.200	Unclassified

Free Flowing Outfall Details for Storm - Low Inf. Rate

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
------------------------	-----------------	-----------------	-----------------	------------------------	-------------	-----------

S1.003	S7	92.685	91.146	0.000	0	0
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Free Flowing Outfall Details for Storm - Low Inf. Rate

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
------------------------	-----------------	-----------------	-----------------	------------------------	-------------	-----------

S3.004	S17	90.512	89.087	0.000	0	0
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Free Flowing Outfall Details for Storm - Low Inf. Rate

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
------------------------	-----------------	-----------------	-----------------	------------------------	-------------	-----------

S8.001	S19	86.270	84.970	0.000	0	0
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Simulation Criteria for Storm - Low Inf. Rate

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 Coefficient	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)	21600
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	3
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	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 373900 163850 ST 73900 63850
C (1km)	-0.025
D1 (1km)	0.384
D2 (1km)	0.402
D3 (1km)	0.227
E (1km)	0.288
F (1km)	2.470
Summer Storms	Yes
Winter Storms	No
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

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Storage Structures for Storm - Low Inf. Rate

Cellular Storage Manhole: S6, DS/PN: S1.003

Invert Level (m) 89.465 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.02860 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	150.0	150.0	2.001	0.0	150.0
2.000	150.0	150.0	3.200	0.0	150.0

Cellular Storage Manhole: S16, DS/PN: S3.004

Invert Level (m) 88.116 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.02860 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

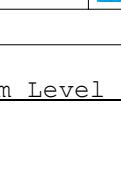
Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	201.0	201.0	1.601	0.0	201.0
1.600	201.0	201.0	2.800	0.0	201.0

Cellular Storage Manhole: S19, DS/PN: S8.001

Invert Level (m) 84.765 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.02860 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	6.0	6.0	1.201	0.0	22.4
1.200	6.0	16.4	1.950	0.0	22.4

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm - Low Inf. Rate

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m ³ /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	3
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	FEH
FEH Rainfall Version	1999
Site Location	GB 373900 163850 ST 73900 63850
C (1km)	-0.025
D1 (1km)	0.384
D2 (1km)	0.402
D3 (1km)	0.227
E (1km)	0.288
F (1km)	2.470
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 45

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	60 Summer	1	+0%					94.146
S1.001	S2	60 Summer	1	+0%					93.669
S1.002	S3	60 Summer	1	+0%					92.477
S2.000	S4	60 Summer	1	+0%					93.488
S2.001	S5	60 Summer	1	+0%					91.925
S1.003	S6	1440 Winter	1	+0%					89.775
S3.000	S8	60 Summer	1	+0%					92.468
S4.000	S9	60 Summer	1	+0%					92.750

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm - Low Inf. Rate

PN	US/MH Name	Surcharged		Flooded		Half Drain		Pipe	Level Status Exceeded	
		Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)			
S1.000	S1	-0.111	0.000	0.15			3.9		OK	
S1.001	S2	-0.181	0.000	0.08			8.2		OK	
S1.002	S3	-0.182	0.000	0.08			11.2		OK	
S2.000	S4	-0.118	0.000	0.10			3.9		OK	
S2.001	S5	-0.108	0.000	0.17			7.4		OK	
S1.003	S6	-1.689	0.000	0.00		912	0.0		OK	
S3.000	S8	-0.115	0.000	0.12			4.6		OK	
S4.000	S9	-0.100	0.000	0.00			0.0		OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm - Low Inf. Rate

PN	US/MH Name	Surcharged		Flooded		Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)				
S1.000	S1	-0.083	0.000	0.41			10.5	OK	
S1.001	S2	-0.151	0.000	0.23			23.3	OK	
S1.002	S3	-0.151	0.000	0.23			31.8	OK	
S2.000	S4	-0.097	0.000	0.27			10.3	OK	
S2.001	S5	-0.076	0.000	0.48			20.8	OK	
S1.003	S6	-1.155	0.000	0.00		1824	0.0	OK	
S3.000	S8	-0.090	0.000	0.33			12.2	OK	
S4.000	S9	-0.100	0.000	0.00			0.0	OK	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank
1) for Storm - Low Inf. Rate

PN	US/MH Name	Surcharged		Flooded		Half Drain		Pipe	Level Exceeded
		Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)	Status	
S1.000	S1	-0.043	0.000	0.83			21.6	OK	
S1.001	S2	-0.113	0.000	0.48			47.9	OK	
S1.002	S3	-0.114	0.000	0.48			65.5	OK	
S2.000	S4	-0.069	0.000	0.55			21.2	OK	
S2.001	S5	-0.005	0.000	0.97			42.3	OK	
S1.003	S6	-0.041	0.000	0.00			0.0	OK	
S3.000	S8	-0.058	0.000	0.68			25.2	OK	
S4.000	S9	-0.100	0.000	0.00			0.0	OK	

ON-SITE SURFACE WATER NETWORK

HIGH INFILTRATION RATES

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm - High Inf. Rate

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model	
Return Period (years)	100
FEH Rainfall Version	1999
Site Location GB 373900 163850 ST 73900 63850	
C (1km)	-0.025
D1 (1km)	0.384
D2 (1km)	0.402
D3 (1km)	0.227
E (1km)	0.288
F (1km)	2.470
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	45
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm - High Inf. Rate at outfall S7 (pipe S1.003)

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.205	4-8	0.035

Total Area Contributing (ha) = 0.240

Total Pipe Volume (m³) = 3.006

Time Area Diagram at outfall S17 (pipe S3.004)

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.245	4-8	0.027

Total Area Contributing (ha) = 0.272

Total Pipe Volume (m³) = 2.662

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Manhole Schedules for Storm - High Inf. Rate

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S1	95.456	1.350	Open Manhole	1200	S1.000	94.106	150				
S2	94.975	1.350	Open Manhole	1200	S1.001	93.625	225	S1.000	93.625	150	
S3	93.784	1.350	Open Manhole	1200	S1.002	92.434	225	S1.001	92.434	225	
S4	94.756	1.300	Open Manhole	1200	S2.000	93.456	150				
S5	93.183	1.300	Open Manhole	1200	S2.001	91.883	150	S2.000	91.883	150	
S6	92.665	1.500	Open Manhole	1200	S1.003	91.165	300	S1.002	91.240	225	
								S2.001	91.315	150	
S7	92.685	1.539	Open Manhole	0		OUTFALL		S1.003	91.146	300	
S8	93.733	1.300	Open Manhole	1200	S3.000	92.433	150				
S9	94.050	1.300	Open Manhole	1200	S4.000	92.750	100				
S10	93.550	1.300	Open Manhole	1200	S5.000	92.250	100				
S11	92.697	1.425	Open Manhole	1200	S3.001	91.272	225	S3.000	91.397	150	50
								S4.000	91.397	100	
								S5.000	91.397	100	
S12	93.050	1.300	Open Manhole	1200	S6.000	91.750	100				
S13	92.550	1.300	Open Manhole	1200	S7.000	91.250	100				
S14	92.020	1.425	Open Manhole	1200	S3.002	90.595	225	S3.001	90.595	225	
								S6.000	90.720	100	
								S7.000	90.720	100	
S15	91.380	1.425	Open Manhole	1200	S3.003	89.955	225	S3.002	89.955	225	
S16	90.916	1.425	Open Manhole	1200	S3.004	89.491	225	S3.003	89.491	225	
S17	90.512	1.425	Open Manhole	0		OUTFALL		S3.004	89.087	225	
S18	89.495	1.300	Open Manhole	1200	S8.000	88.195	100				
S19	86.413	1.300	Open Manhole	1200	S8.001	85.113	100	S8.000	85.113	100	
S19	86.270	1.300	Open Manhole	0		OUTFALL		S8.001	84.970	100	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S1	373494.037	163225.210	373494.037	163225.210	Required	
S2	373475.433	163233.204	373475.433	163233.204	Required	
S3	373486.833	163259.385	373486.833	163259.385	Required	

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Manhole Schedules for Storm - High Inf. Rate

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S19	373633.356	163288.899	373633.356	163288.899	Required	
S19	373633.728	163289.606			No Entry	

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PIPELINE SCHEDULES for Storm - High Inf. Rate

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	150	S1	95.456	94.106	1.200	Open Manhole	1200
S1.001	o	225	S2	94.975	93.625	1.125	Open Manhole	1200
S1.002	o	225	S3	93.784	92.434	1.125	Open Manhole	1200
S2.000	o	150	S4	94.756	93.456	1.150	Open Manhole	1200
S2.001	o	150	S5	93.183	91.883	1.150	Open Manhole	1200
S1.003	o	300	S6	92.665	91.165	1.200	Open Manhole	1200
S3.000	o	150	S8	93.733	92.433	1.150	Open Manhole	1200
S4.000	o	100	S9	94.050	92.750	1.200	Open Manhole	1200
S5.000	o	100	S10	93.550	92.250	1.200	Open Manhole	1200
S3.001	o	225	S11	92.697	91.272	1.200	Open Manhole	1200
S6.000	o	100	S12	93.050	91.750	1.200	Open Manhole	1200
S7.000	o	100	S13	92.550	91.250	1.200	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	20.249	42.1	S2	94.975	93.625	1.200	Open Manhole	1200
S1.001	28.555	24.0	S3	93.784	92.434	1.125	Open Manhole	1200
S1.002	12.796	10.7	S6	92.665	91.240	1.200	Open Manhole	1200
S2.000	31.612	20.1	S5	93.183	91.883	1.150	Open Manhole	1200
S2.001	7.009	12.3	S6	92.665	91.315	1.200	Open Manhole	1200
S1.003	4.545	241.9	S7	92.685	91.146	1.239	Open Manhole	0
S3.000	21.469	20.7	S11	92.697	91.397	1.150	Open Manhole	1200
S4.000	15.452	11.4	S11	92.697	91.397	1.200	Open Manhole	1200
S5.000	10.636	12.5	S11	92.697	91.397	1.200	Open Manhole	1200
S3.001	17.568	25.9	S14	92.020	90.595	1.200	Open Manhole	1200
S6.000	12.159	11.8	S14	92.020	90.720	1.200	Open Manhole	1200
S7.000	7.407	14.0	S14	92.020	90.720	1.200	Open Manhole	1200

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PIPELINE SCHEDULES for Storm - High Inf. Rate

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S3.002	o	225	S14	92.020	90.595	1.200	Open Manhole	1200
S3.003	o	225	S15	91.380	89.955	1.200	Open Manhole	1200
S3.004	o	225	S16	90.916	89.491	1.200	Open Manhole	1200
S8.000	o	100	S18	89.495	88.195	1.200	Open Manhole	1200
S8.001	o	100	S19	86.413	85.113	1.200	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S3.002	16.449	25.7	S15	91.380	89.955	1.200	Open Manhole	1200
S3.003	8.362	18.0	S16	90.916	89.491	1.200	Open Manhole	1200
S3.004	6.000	14.9	S17	90.512	89.087	1.200	Open Manhole	0
S8.000	35.769	11.6	S19	86.413	85.113	1.200	Open Manhole	1200
S8.001	0.799	5.6	S19	86.270	84.970	1.200	Open Manhole	0

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Area Summary for Storm - High Inf. Rate

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.049	0.049	0.049
1.001	-	-	100	0.057	0.057	0.057
1.002	-	-	100	0.039	0.039	0.039
2.000	-	-	100	0.048	0.048	0.048
2.001	-	-	100	0.047	0.047	0.047
1.003	-	-	100	0.000	0.000	0.000
3.000	-	-	100	0.057	0.057	0.057
4.000	-	-	100	0.000	0.000	0.000
5.000	-	-	100	0.000	0.000	0.000
3.001	-	-	100	0.085	0.085	0.085
6.000	-	-	100	0.000	0.000	0.000
7.000	-	-	100	0.000	0.000	0.000
3.002	-	-	100	0.069	0.069	0.069
3.003	-	-	100	0.039	0.039	0.039
3.004	-	-	100	0.022	0.022	0.022
8.000	-	-	100	0.028	0.028	0.028
8.001	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.540	0.540	0.540

Free Flowing Outfall Details for Storm - High Inf. Rate

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.003	S7	92.685	91.146	0.000	0	0

Free Flowing Outfall Details for Storm - High Inf. Rate

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S3.004	S17	90.512	89.087	0.000	0	0

Free Flowing Outfall Details for Storm - High Inf. Rate

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S8.001	S19	86.270	84.970	0.000	0	0

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Simulation Criteria for Storm - High Inf. Rate

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 Coefficient	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)	21600
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	3
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	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 373900 163850 ST 73900 63850
C (1km)	-0.025
D1 (1km)	0.384
D2 (1km)	0.402
D3 (1km)	0.227
E (1km)	0.288
F (1km)	2.470
Summer Storms	Yes
Winter Storms	No
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

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Storage Structures for Storm - High Inf. Rate

Cellular Storage Manhole: S6, DS/PN: S1.003

Invert Level (m) 89.465 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 5.04000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	150.0	150.0	2.001	0.0	150.0
2.000	150.0	150.0	3.200	0.0	150.0

Cellular Storage Manhole: S16, DS/PN: S3.004

Invert Level (m) 88.116 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 5.32800 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	201.0	201.0	1.601	0.0	201.0
1.600	201.0	201.0	2.800	0.0	201.0

Cellular Storage Manhole: S19, DS/PN: S8.001

Invert Level (m) 84.765 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 5.04000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	6.0	6.0	1.201	0.0	22.4
1.200	6.0	16.4	1.950	0.0	22.4

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Climate Change (%) 0, 0, 45																																																																																																																																				
<table><tr><th colspan="2">US/MH</th><th rowspan="2">Storm</th><th rowspan="2">Return Period</th><th rowspan="2">Climate Change</th><th rowspan="2">First (X) Surchage</th><th rowspan="2">First (Y) Flood</th><th rowspan="2">First (Z) Overflow</th><th rowspan="2">Overflow Act.</th><th>Water Level</th></tr><tr><th>PN</th><th>Name</th><th>(m)</th></tr><tr><td>S1.000</td><td>S1</td><td>60 Summer</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>94.146</td></tr><tr><td>S1.001</td><td>S2</td><td>60 Summer</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>93.669</td></tr><tr><td>S1.002</td><td>S3</td><td>60 Summer</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>92.477</td></tr><tr><td>S2.000</td><td>S4</td><td>60 Summer</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>93.488</td></tr><tr><td>S2.001</td><td>S5</td><td>60 Summer</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>91.925</td></tr><tr><td>S1.003</td><td>S6</td><td>60 Summer</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>89.474</td></tr><tr><td>S3.000</td><td>S8</td><td>60 Summer</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>92.468</td></tr><tr><td>S4.000</td><td>S9</td><td>60 Summer</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>92.750</td></tr><tr><td>S5.000</td><td>S10</td><td>60 Summer</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>92.250</td></tr><tr><td>S3.001</td><td>S11</td><td>60 Summer</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>91.324</td></tr><tr><td>S6.000</td><td>S12</td><td>60 Summer</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>91.750</td></tr></table>										US/MH		Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level	PN	Name	(m)	S1.000	S1	60 Summer	1	+0%					94.146	S1.001	S2	60 Summer	1	+0%					93.669	S1.002	S3	60 Summer	1	+0%					92.477	S2.000	S4	60 Summer	1	+0%					93.488	S2.001	S5	60 Summer	1	+0%					91.925	S1.003	S6	60 Summer	1	+0%					89.474	S3.000	S8	60 Summer	1	+0%					92.468	S4.000	S9	60 Summer	1	+0%					92.750	S5.000	S10	60 Summer	1	+0%					92.250	S3.001	S11	60 Summer	1	+0%					91.324	S6.000	S12	60 Summer	1	+0%					91.750
US/MH		Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level																																																																																																																											
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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm - High Inf. Rate

US/MH		Return Climate		First (X)	First (Y)	First (Z)	Overflow	Water
PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act. Level (m)
S7.000	S13 60	Summer	1	+0%				91.250
S3.002	S14 60	Summer	1	+0%	100/60 Summer			90.659
S3.003	S15 60	Summer	1	+0%	100/60 Summer			90.023
S3.004	S16 60	Summer	1	+0%				88.123
S8.000	S18 60	Summer	1	+0%				88.219
S8.001	S19 60	Summer	1	+0%				84.791

US/MH		Surcharged Flooded		Half Drain		Pipe	Level	
PN	Name	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)	Status Exceeded
S7.000	S13	-0.100	0.000	0.00			0.0	OK
S3.002	S14	-0.161	0.000	0.18			16.3	OK
S3.003	S15	-0.157	0.000	0.20			19.3	OK
S3.004	S16	-1.593	0.000	0.00		10	0.0	OK
S8.000	S18	-0.076	0.000	0.13			2.3	OK
S8.001	S19	-0.422	0.000	0.00		8	0.0	OK

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US/MH		Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow								Overflow Act.	Water Level																																																																																																																
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1210 Premeier Dr Ste 200 Chattanooga EN 37421-3747		
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Innovyze	Network 2020.1.3	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm - High Inf. Rate

PN	US/MH Name	Surcharged		Flooded		Flow / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Level	
		Depth (m)	Volume (m³)	Flow	Overflow				Status	Exceeded
S1.000	S1	-0.083	0.000	0.41				10.5	OK	
S1.001	S2	-0.151	0.000	0.23				23.3	OK	
S1.002	S3	-0.151	0.000	0.23				31.8	OK	
S2.000	S4	-0.097	0.000	0.27				10.3	OK	
S2.001	S5	-0.076	0.000	0.48				20.8	OK	
S1.003	S6	-1.975	0.000	0.00			10	0.0	OK	
S3.000	S8	-0.090	0.000	0.33				12.2	OK	
S4.000	S9	-0.100	0.000	0.00				0.0	OK	
S5.000	S10	-0.100	0.000	0.00				0.0	OK	
S3.001	S11	-0.133	0.000	0.34				31.3	OK	
S6.000	S12	-0.100	0.000	0.00				0.0	OK	

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<u>Simulation Criteria</u>																																																																																																																															
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 Coefficient 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 3																																																																																																																															
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C (1km) -0.025																																																																																																																															
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US/MH		Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood								First (Z) Overflow	Overflow Act.	Water Level																																																																																																															
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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm - High Inf. Rate

PN	US/MH Name	Surcharged		Flooded		Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)	Flow	Volume						
S1.000	S1	-0.043	0.000	0.83					21.6	OK	
S1.001	S2	-0.113	0.000	0.48					47.9	OK	
S1.002	S3	-0.114	0.000	0.48					65.5	OK	
S2.000	S4	-0.069	0.000	0.55					21.2	OK	
S2.001	S5	-0.005	0.000	0.97					42.3	OK	
S1.003	S6	-1.949	0.000	0.00				10	0.0	OK	
S3.000	S8	-0.058	0.000	0.68					25.2	OK	
S4.000	S9	-0.100	0.000	0.00					0.0	OK	
S5.000	S10	-0.100	0.000	0.00					0.0	OK	
S3.001	S11	-0.083	0.000	0.70					64.5	OK	
S6.000	S12	-0.100	0.000	0.00					0.0	OK	

ON-SITE SURFACE WATER - PERMEABLE ACCESS ROAD
LOW INFILTRATION RATES

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Summary of Results for 100 year Return Period (+45%)

Half Drain Time : 799 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
60 min Summer	0.137	0.137	0.5	23.6	Flood Risk
120 min Summer	0.164	0.164	0.5	28.1	Flood Risk
180 min Summer	0.179	0.179	0.5	30.8	Flood Risk
240 min Summer	0.190	0.190	0.5	32.6	Flood Risk
360 min Summer	0.202	0.202	0.5	34.8	Flood Risk
480 min Summer	0.209	0.209	0.5	36.0	Flood Risk
600 min Summer	0.212	0.212	0.5	36.5	Flood Risk
720 min Summer	0.214	0.214	0.5	36.8	Flood Risk
960 min Summer	0.217	0.217	0.5	37.4	Flood Risk
1440 min Summer	0.218	0.218	0.5	37.5	Flood Risk
2160 min Summer	0.212	0.212	0.5	36.4	Flood Risk
2880 min Summer	0.202	0.202	0.5	34.7	Flood Risk
4320 min Summer	0.158	0.158	0.5	27.1	Flood Risk
5760 min Summer	0.122	0.122	0.5	21.0	Flood Risk
7200 min Summer	0.094	0.094	0.5	16.2	Flood Risk
8640 min Summer	0.073	0.073	0.5	12.6	Flood Risk
10080 min Summer	0.059	0.059	0.5	10.1	Flood Risk
60 min Winter	0.156	0.156	0.5	26.9	Flood Risk
120 min Winter	0.186	0.186	0.5	32.0	Flood Risk
180 min Winter	0.204	0.204	0.5	35.1	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
60 min Summer	64.483	0.0	64
120 min Summer	38.850	0.0	122
180 min Summer	28.885	0.0	182
240 min Summer	23.407	0.0	242
360 min Summer	17.403	0.0	362
480 min Summer	14.102	0.0	480
600 min Summer	11.980	0.0	584
720 min Summer	10.485	0.0	630
960 min Summer	8.540	0.0	760
1440 min Summer	6.396	0.0	1024
2160 min Summer	4.790	0.0	1444
2880 min Summer	3.902	0.0	1848
4320 min Summer	2.722	0.0	2636
5760 min Summer	2.109	0.0	3352
7200 min Summer	1.729	0.0	4040
8640 min Summer	1.471	0.0	4752
10080 min Summer	1.283	0.0	5344
60 min Winter	64.483	0.0	62
120 min Winter	38.850	0.0	120
180 min Winter	28.885	0.0	180

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<u>Summary of Results for 100 year Return Period (+45%)</u>						
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	
240 min Winter	0.217	0.217	0.5	37.2	Flood Risk	
360 min Winter	0.232	0.232	0.5	39.9	Flood Risk	
480 min Winter	0.241	0.241	0.5	41.5	Flood Risk	
600 min Winter	0.246	0.246	0.5	42.4	Flood Risk	
720 min Winter	0.249	0.249	0.5	42.8	Flood Risk	
960 min Winter	0.251	0.251	0.5	43.2	Flood Risk	
1440 min Winter	0.249	0.249	0.5	42.9	Flood Risk	
2160 min Winter	0.238	0.238	0.5	40.9	Flood Risk	
2880 min Winter	0.221	0.221	0.5	37.9	Flood Risk	
4320 min Winter	0.157	0.157	0.5	27.0	Flood Risk	
5760 min Winter	0.106	0.106	0.5	18.3	Flood Risk	
7200 min Winter	0.070	0.070	0.5	12.0	Flood Risk	
8640 min Winter	0.050	0.050	0.5	8.5	O K	
10080 min Winter	0.044	0.044	0.4	7.5	O K	
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)			
240 min Winter	23.407	0.0	238			
360 min Winter	17.403	0.0	352			
480 min Winter	14.102	0.0	466			
600 min Winter	11.980	0.0	578			
720 min Winter	10.485	0.0	686			
960 min Winter	8.540	0.0	886			
1440 min Winter	6.396	0.0	1110			
2160 min Winter	4.790	0.0	1576			
2880 min Winter	3.902	0.0	2020			
4320 min Winter	2.722	0.0	2812			
5760 min Winter	2.109	0.0	3520			
7200 min Winter	1.729	0.0	4176			
8640 min Winter	1.471	0.0	4584			
10080 min Winter	1.283	0.0	5256			
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Innovyze	Source Control 2020.1.3																									
Model Details Storage is Online Cover Level (m) 0.350 Porous Car Park Structure <table><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.02860</td><td>Width (m)</td><td>573.0</td></tr><tr><td>Membrane Percolation (mm/hr)</td><td>1000</td><td>Length (m)</td><td>1.0</td></tr><tr><td>Max Percolation (l/s)</td><td>159.2</td><td>Slope (1:X)</td><td>0.0</td></tr><tr><td>Safety Factor</td><td>10.0</td><td>Depression Storage (mm)</td><td>5</td></tr><tr><td>Porosity</td><td>0.30</td><td>Evaporation (mm/day)</td><td>3</td></tr><tr><td>Invert Level (m)</td><td>0.000</td><td>Cap Volume Depth (m)</td><td>0.350</td></tr></table>			Infiltration Coefficient Base (m/hr)	0.02860	Width (m)	573.0	Membrane Percolation (mm/hr)	1000	Length (m)	1.0	Max Percolation (l/s)	159.2	Slope (1:X)	0.0	Safety Factor	10.0	Depression Storage (mm)	5	Porosity	0.30	Evaporation (mm/day)	3	Invert Level (m)	0.000	Cap Volume Depth (m)	0.350
Infiltration Coefficient Base (m/hr)	0.02860	Width (m)	573.0																							
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Porosity	0.30	Evaporation (mm/day)	3																							
Invert Level (m)	0.000	Cap Volume Depth (m)	0.350																							
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EXTERNAL CATCHMENT OVERLAND FLOWS
GRAVEL INFILTRATION BLANKET (1 IN 1 YEAR EVENT)

Arcadis		Page 1																		
1210 Premeier Dr Ste 200 Chattanooga EN 37421-3747																				
Date 25/07/2024 09:24 File Gravel basin - 1 in 1.SRCX	Designed by allenb7729 Checked by																			
Innovyze																				
<u>Summary of Results for Input Hydrograph</u> Half Drain Time : 8 minutes. <table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: left;">Storm Event</th> <th style="text-align: right;">Max Level (m)</th> <th style="text-align: right;">Max Depth (m)</th> <th style="text-align: right;">Max Infiltration (l/s)</th> <th style="text-align: right;">Max Volume (m³)</th> <th style="text-align: left;">Status</th> </tr> </thead> <tbody> <tr> <td style="text-align: left;">Input Hydrograph</td> <td style="text-align: right;">1.750</td> <td style="text-align: right;">1.750</td> <td style="text-align: right;">28.0</td> <td style="text-align: right;">21.0</td> <td style="text-align: left;">O K</td> </tr> </tbody> </table> <table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: left;">Storm Event</th> <th style="text-align: right;">Flooded Volume (m³)</th> <th style="text-align: right;">Time-Peak (mins)</th> </tr> </thead> <tbody> <tr> <td style="text-align: left;">Input Hydrograph</td> <td style="text-align: right;">0.0</td> <td style="text-align: right;">255</td> </tr> </tbody> </table>			Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	Input Hydrograph	1.750	1.750	28.0	21.0	O K	Storm Event	Flooded Volume (m³)	Time-Peak (mins)	Input Hydrograph	0.0	255
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status															
Input Hydrograph	1.750	1.750	28.0	21.0	O K															
Storm Event	Flooded Volume (m³)	Time-Peak (mins)																		
Input Hydrograph	0.0	255																		
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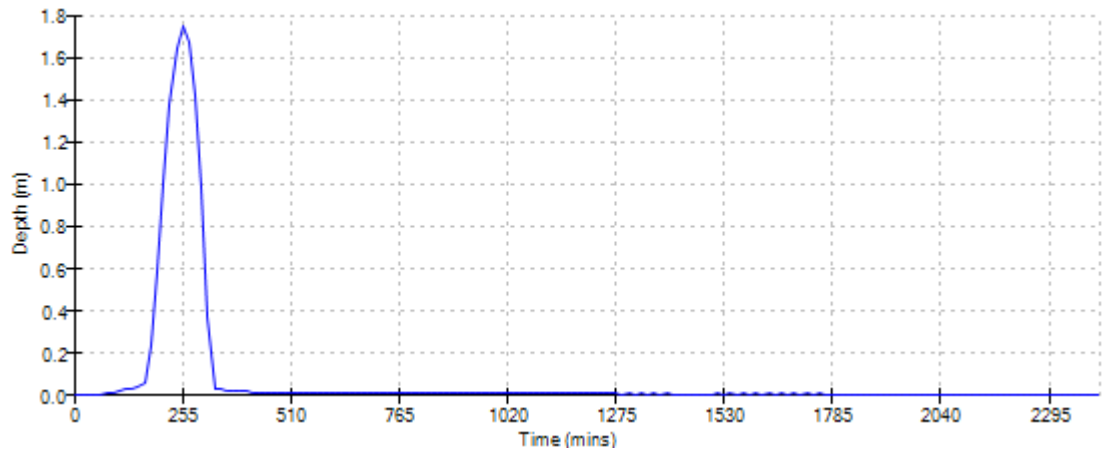
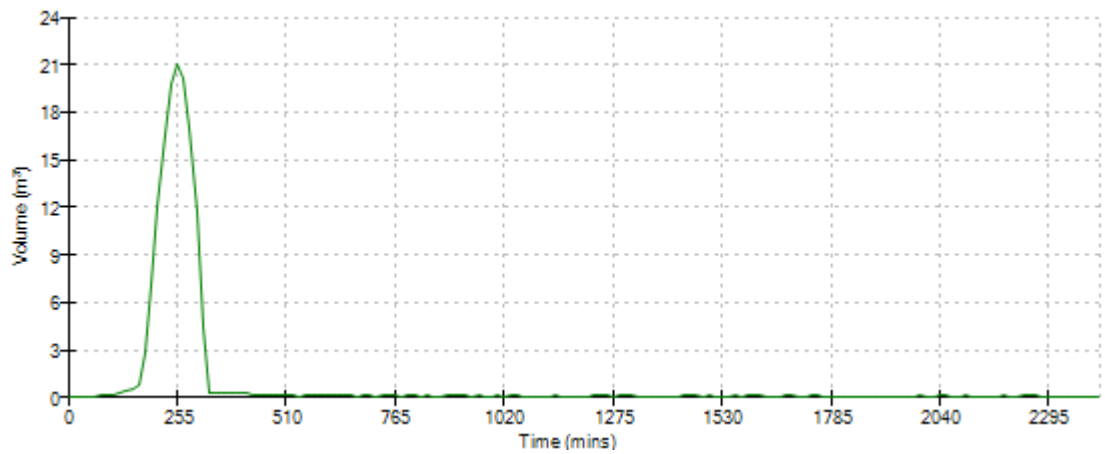
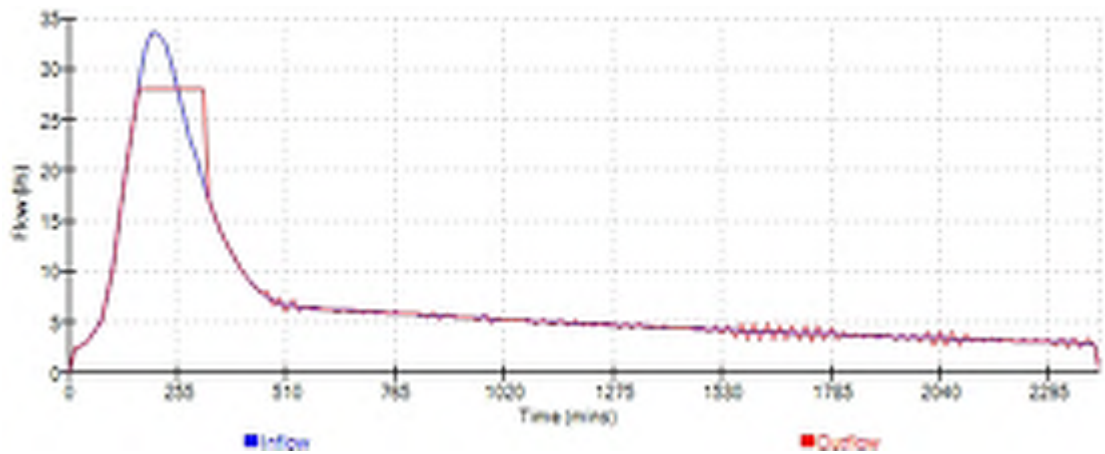
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1210 Premeier Dr Ste 200 Chattanooga EN 37421-3747		
Date 25/07/2024 09:24 File Gravel basin - 1 in 1.SRCX	Designed by allenb7729 Checked by	
Innovyze	Source Control 2020.1.3	

Input Hydrograph

Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)
15	2.5	420	9.4	825	5.7	1230	4.8	1635	4.0	2040	3.4
30	2.6	435	8.6	840	5.7	1245	4.7	1650	4.0	2055	3.3
45	3.1	450	8.0	855	5.6	1260	4.7	1665	4.0	2070	3.3
60	3.9	465	7.5	870	5.6	1275	4.7	1680	3.9	2085	3.3
75	5.2	480	7.1	885	5.5	1290	4.7	1695	3.9	2100	3.3
90	7.4	495	6.8	900	5.5	1305	4.6	1710	3.9	2115	3.3
105	10.7	510	6.7	915	5.5	1320	4.6	1725	3.9	2130	3.2
120	15.0	525	6.5	930	5.4	1335	4.6	1740	3.8	2145	3.2
135	19.7	540	6.5	945	5.4	1350	4.5	1755	3.8	2160	3.2
150	24.5	555	6.4	960	5.4	1365	4.5	1770	3.8	2175	3.2
165	28.7	570	6.4	975	5.3	1380	4.5	1785	3.8	2190	3.2
180	31.9	585	6.3	990	5.3	1395	4.5	1800	3.7	2205	3.1
195	33.5	600	6.3	1005	5.3	1410	4.4	1815	3.7	2220	3.1
210	33.6	615	6.2	1020	5.2	1425	4.4	1830	3.7	2235	3.1
225	32.5	630	6.2	1035	5.2	1440	4.4	1845	3.7	2250	3.1
240	30.6	645	6.2	1050	5.2	1455	4.3	1860	3.6	2265	3.1
255	28.2	660	6.1	1065	5.1	1470	4.3	1875	3.6	2280	3.0
270	25.8	675	6.1	1080	5.1	1485	4.3	1890	3.6	2295	3.0
285	23.3	690	6.0	1095	5.1	1500	4.3	1905	3.6	2310	3.0
300	21.0	705	6.0	1110	5.0	1515	4.2	1920	3.5	2325	3.0
315	18.9	720	6.0	1125	5.0	1530	4.2	1935	3.5	2340	3.0
330	17.0	735	5.9	1140	5.0	1545	4.2	1950	3.5	2355	2.9
345	15.2	750	5.9	1155	4.9	1560	4.1	1965	3.5	2370	2.9
360	13.7	765	5.8	1170	4.9	1575	4.1	1980	3.5	2385	2.9
375	12.4	780	5.8	1185	4.9	1590	4.1	1995	3.4	2400	2.9
390	11.2	795	5.8	1200	4.8	1605	4.1	2010	3.4		
405	10.2	810	5.7	1215	4.8	1620	4.0	2025	3.4		

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1210 Premeier Dr Ste 200 Chattanooga EN 37421-3747																		
Date 25/07/2024 09:24	Designed by allenb7729																	
File Gravel basin - 1 in 1.SRCX	Checked by																	
Innovyze	Source Control 2020.1.3																	
Model Details Storage is Online Cover Level (m) 2.400 Infiltration Blanket Structure <table><tr><td>Infiltration Coefficient Base (m/hr)</td><td>5.04000</td><td>Diameter/Width (m)</td><td>5.0</td></tr><tr><td>Safety Factor</td><td>2.0</td><td>Length (m)</td><td>8.0</td></tr><tr><td>Porosity</td><td>0.30</td><td>Cap Volume Depth (m)</td><td>1.850</td></tr><tr><td>Invert Level (m)</td><td>0.000</td><td></td><td></td></tr></table>			Infiltration Coefficient Base (m/hr)	5.04000	Diameter/Width (m)	5.0	Safety Factor	2.0	Length (m)	8.0	Porosity	0.30	Cap Volume Depth (m)	1.850	Invert Level (m)	0.000		
Infiltration Coefficient Base (m/hr)	5.04000	Diameter/Width (m)	5.0															
Safety Factor	2.0	Length (m)	8.0															
Porosity	0.30	Cap Volume Depth (m)	1.850															
Invert Level (m)	0.000																	
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Event: Input Hydrograph



EXTERNAL CATCHMENT OVELRAND FLOWS GRAVEL INFILTRATION BLANKET (1 IN 100 YEAR +45% CC EVENT)

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Cascade Summary of Results for Gravel basin - 1 in 100+45% CC.SRCX

Upstream Structures

Outflow To

Overflow To

(None) Geocellular Storage (5.0 SF).SRCX Geocellular Storage (5.0 SF).SRCX

Half Drain Time : 9 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Overflow (l/s)	Max E (l/s)	Max Outflow Volume (m³)	Status
15 min Summer	2.272	2.272	28.0	145.2	173.2	27.3	Flood Risk
30 min Summer	2.272	2.272	28.0	145.2	173.2	27.3	Flood Risk
60 min Summer	2.272	2.272	28.0	144.9	172.9	27.3	Flood Risk
120 min Summer	2.272	2.272	28.0	144.9	172.9	27.3	Flood Risk
180 min Summer	2.272	2.272	28.0	144.9	172.9	27.3	Flood Risk
240 min Summer	2.272	2.272	28.0	144.9	172.9	27.3	Flood Risk
360 min Summer	2.272	2.272	28.0	144.9	172.9	27.3	Flood Risk
480 min Summer	2.272	2.272	28.0	144.9	172.9	27.3	Flood Risk
600 min Summer	2.272	2.272	28.0	144.9	172.9	27.3	Flood Risk
720 min Summer	2.272	2.272	28.0	144.9	172.9	27.3	Flood Risk
960 min Summer	2.272	2.272	28.0	144.9	172.9	27.3	Flood Risk
1440 min Summer	2.272	2.272	28.0	144.9	172.9	27.3	Flood Risk
2160 min Summer	2.272	2.272	28.0	144.9	172.9	27.2	Flood Risk
2880 min Summer	2.272	2.272	28.0	144.9	172.9	27.2	Flood Risk
4320 min Summer	2.272	2.272	28.0	144.9	172.9	27.2	Flood Risk
5760 min Summer	2.271	2.271	28.0	144.7	172.7	27.3	Flood Risk
7200 min Summer	2.271	2.271	28.0	144.7	172.7	27.3	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	177.646	0.0	1499.2	210
30 min Summer	107.029	0.0	1499.2	210
60 min Summer	64.483	0.0	1499.2	210
120 min Summer	38.850	0.0	1499.2	210
180 min Summer	28.885	0.0	1499.2	210
240 min Summer	23.407	0.0	1499.2	210
360 min Summer	17.403	0.0	1499.2	210
480 min Summer	14.102	0.0	1499.2	210
600 min Summer	11.980	0.0	1499.2	210
720 min Summer	10.485	0.0	1499.2	210
960 min Summer	8.540	0.0	1499.2	210
1440 min Summer	6.396	0.0	1499.2	210
2160 min Summer	4.790	0.0	1499.2	208
2880 min Summer	3.902	0.0	1499.2	208
4320 min Summer	2.722	0.0	1499.2	208
5760 min Summer	2.109	0.0	1499.1	208
7200 min Summer	1.729	0.0	1499.1	208

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Cascade Summary of Results for Gravel basin - 1 in 100+45% CC.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
8640 min Summer	2.271	2.271	28.0	144.7	172.7	27.3	Flood Risk
10080 min Summer	2.271	2.271	28.0	144.7	172.7	27.3	Flood Risk
15 min Winter	2.272	2.272	28.0	145.2	173.2	27.3	Flood Risk
30 min Winter	2.272	2.272	28.0	145.2	173.2	27.3	Flood Risk
60 min Winter	2.272	2.272	28.0	144.9	172.9	27.3	Flood Risk
120 min Winter	2.272	2.272	28.0	144.9	172.9	27.3	Flood Risk
180 min Winter	2.272	2.272	28.0	144.9	172.9	27.3	Flood Risk
240 min Winter	2.272	2.272	28.0	144.9	172.9	27.3	Flood Risk
360 min Winter	2.272	2.272	28.0	144.9	172.9	27.3	Flood Risk
480 min Winter	2.272	2.272	28.0	144.9	172.9	27.3	Flood Risk
600 min Winter	2.272	2.272	28.0	144.9	172.9	27.3	Flood Risk
720 min Winter	2.272	2.272	28.0	144.9	172.9	27.3	Flood Risk
960 min Winter	2.272	2.272	28.0	144.9	172.9	27.3	Flood Risk
1440 min Winter	2.272	2.272	28.0	144.9	172.9	27.3	Flood Risk
2160 min Winter	2.272	2.272	28.0	144.9	172.9	27.2	Flood Risk
2880 min Winter	2.272	2.272	28.0	144.9	172.9	27.2	Flood Risk
4320 min Winter	2.272	2.272	28.0	144.9	172.9	27.2	Flood Risk
5760 min Winter	2.271	2.271	28.0	144.7	172.7	27.3	Flood Risk
7200 min Winter	2.271	2.271	28.0	144.7	172.7	27.3	Flood Risk
8640 min Winter	2.271	2.271	28.0	144.7	172.7	27.3	Flood Risk
10080 min Winter	2.271	2.271	28.0	144.7	172.7	27.3	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
8640 min Summer	1.471	0.0	1499.1	208
10080 min Summer	1.283	0.0	1499.1	208
15 min Winter	177.646	0.0	1499.2	210
30 min Winter	107.029	0.0	1499.2	210
60 min Winter	64.483	0.0	1499.2	210
120 min Winter	38.850	0.0	1499.2	210
180 min Winter	28.885	0.0	1499.2	210
240 min Winter	23.407	0.0	1499.2	210
360 min Winter	17.403	0.0	1499.2	210
480 min Winter	14.102	0.0	1499.2	210
600 min Winter	11.980	0.0	1499.2	210
720 min Winter	10.485	0.0	1499.2	210
960 min Winter	8.540	0.0	1499.2	210
1440 min Winter	6.396	0.0	1499.2	210
2160 min Winter	4.790	0.0	1499.2	208
2880 min Winter	3.902	0.0	1499.2	208
4320 min Winter	2.722	0.0	1499.2	208
5760 min Winter	2.109	0.0	1499.1	208
7200 min Winter	1.729	0.0	1499.1	208
8640 min Winter	1.471	0.0	1499.1	208
10080 min Winter	1.283	0.0	1499.1	208

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Innovyze	Source Control 2020.1.3	
<u>Cascade Rainfall Details for Gravel basin - 1 in 100+45% CC.SRCX</u>		
Rainfall Model	FEH	
Return Period (years)	100	
FEH Rainfall Version	1999	
Site Location	GB 373900 163850 ST 73900 63850	
C (1km)	-0.025	
D1 (1km)	0.384	
D2 (1km)	0.402	
D3 (1km)	0.227	
E (1km)	0.288	
F (1km)	2.470	
Summer Storms	Yes	
Winter Storms	Yes	
Cv (Summer)	0.750	
Cv (Winter)	0.840	
Shortest Storm (mins)	15	
Longest Storm (mins)	10080	
Climate Change %	+45	
<u>Time Area Diagram</u>		
Total Area (ha) 0.000		
Time (mins) Area		
From: To: (ha)		
0 4 0.000		
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<u>Cascade Model Details for Gravel basin - 1 in 100+45% CC.SRCX</u> Storage is Online Cover Level (m) 2.400 <u>Infiltration Blanket Structure</u> <table><tr><td>Infiltration Coefficient Base (m/hr)</td><td>5.04000</td><td>Diameter/Width (m)</td><td>5.0</td></tr><tr><td>Safety Factor</td><td>2.0</td><td>Length (m)</td><td>8.0</td></tr><tr><td>Porosity</td><td>0.30</td><td>Cap Volume Depth (m)</td><td>2.400</td></tr><tr><td>Invert Level (m)</td><td>0.000</td><td></td><td></td></tr></table> <u>Pipe Overflow Control</u> <table><tr><td>Diameter (m)</td><td>0.450</td><td>Entry Loss Coefficient</td><td>0.500</td></tr><tr><td>Slope (1:X)</td><td>20.0</td><td>Coefficient of Contraction</td><td>0.600</td></tr><tr><td>Length (m)</td><td>15.000</td><td>Upstream Invert Level (m)</td><td>1.850</td></tr><tr><td>Roughness k (mm)</td><td>0.600</td><td></td><td></td></tr></table>			Infiltration Coefficient Base (m/hr)	5.04000	Diameter/Width (m)	5.0	Safety Factor	2.0	Length (m)	8.0	Porosity	0.30	Cap Volume Depth (m)	2.400	Invert Level (m)	0.000			Diameter (m)	0.450	Entry Loss Coefficient	0.500	Slope (1:X)	20.0	Coefficient of Contraction	0.600	Length (m)	15.000	Upstream Invert Level (m)	1.850	Roughness k (mm)	0.600		
Infiltration Coefficient Base (m/hr)	5.04000	Diameter/Width (m)	5.0																															
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Invert Level (m)	0.000																																	
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Roughness k (mm)	0.600																																	
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Cascade Additional Hydrograph #1 for Gravel basin - 1 in 100+45% CC.SRCX

Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)
15	2.7	420	39.2	825	19.4	1230	16.3	1635	13.6	2040	11.5
30	3.7	435	34.9	840	19.2	1245	16.1	1650	13.6	2055	11.4
45	5.8	450	31.1	855	19.1	1260	16.0	1665	13.5	2070	11.3
60	9.7	465	28.0	870	19.0	1275	15.9	1680	13.4	2085	11.2
75	16.5	480	25.7	885	18.9	1290	15.8	1695	13.3	2100	11.2
90	27.5	495	24.1	900	18.7	1305	15.7	1710	13.2	2115	11.1
105	44.3	510	23.1	915	18.6	1320	15.6	1725	13.1	2130	11.0
120	66.7	525	22.5	930	18.5	1335	15.5	1740	13.0	2145	10.9
135	92.4	540	22.0	945	18.4	1350	15.4	1755	13.0	2160	10.9
150	118.5	555	21.8	960	18.3	1365	15.3	1770	12.9	2175	10.8
165	142.2	570	21.6	975	18.1	1380	15.2	1785	12.8	2190	10.7
180	160.5	585	21.5	990	18.0	1395	15.1	1800	12.7	2205	10.7
195	171.0	600	21.3	1005	17.9	1410	15.0	1815	12.6	2220	10.6
210	173.1	615	21.2	1020	17.8	1425	14.9	1830	12.5	2235	10.5
225	168.0	630	21.1	1035	17.7	1440	14.8	1845	12.5	2250	10.5
240	158.2	645	20.9	1050	17.6	1455	14.7	1860	12.4	2265	10.4
255	145.7	660	20.8	1065	17.4	1470	14.7	1875	12.3	2280	10.3
270	132.0	675	20.6	1080	17.3	1485	14.6	1890	12.2	2295	10.3
285	118.2	690	20.5	1095	17.2	1500	14.5	1905	12.1	2310	10.2
300	104.9	705	20.4	1110	17.1	1515	14.4	1920	12.1	2325	10.1
315	92.9	720	20.3	1125	17.0	1530	14.3	1935	12.0	2340	10.1
330	82.2	735	20.1	1140	16.9	1545	14.2	1950	11.9	2355	10.0
345	72.5	750	20.0	1155	16.8	1560	14.1	1965	11.8	2370	9.9
360	63.8	765	19.9	1170	16.7	1575	14.0	1980	11.8	2385	9.9
375	56.2	780	19.7	1185	16.6	1590	13.9	1995	11.7	2400	9.8
390	49.7	795	19.6	1200	16.5	1605	13.8	2010	11.6		
405	44.1	810	19.5	1215	16.4	1620	13.7	2025	11.5		

EXTERNAL CATCHMENT OVERLAND FLOWS GEOCELLAR CRATES (1 IN 100 YEAR +45% CC EVENT)

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Cascade Summary of Results for Geocellular Storage (5.0 SF).SRCX

Upstream Structures

Outflow To Overflow To

Gravel basin - 1 in 100+45% CC.SRCX (None) (None)

Half Drain Time : 65 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	2.281	2.281	66.1	511.3	Flood Risk
30 min Summer	2.281	2.281	66.1	511.3	Flood Risk
60 min Summer	2.280	2.280	66.1	511.3	Flood Risk
120 min Summer	2.280	2.280	66.1	511.3	Flood Risk
180 min Summer	2.280	2.280	66.1	511.3	Flood Risk
240 min Summer	2.280	2.280	66.1	511.3	Flood Risk
360 min Summer	2.280	2.280	66.1	511.3	Flood Risk
480 min Summer	2.280	2.280	66.1	511.3	Flood Risk
600 min Summer	2.280	2.280	66.1	511.3	Flood Risk
720 min Summer	2.280	2.280	66.1	511.3	Flood Risk
960 min Summer	2.280	2.280	66.1	511.3	Flood Risk
1440 min Summer	2.280	2.280	66.1	511.3	Flood Risk
2160 min Summer	2.280	2.280	66.1	511.1	Flood Risk
2880 min Summer	2.280	2.280	66.1	511.1	Flood Risk
4320 min Summer	2.280	2.280	66.1	511.1	Flood Risk
5760 min Summer	2.280	2.280	66.1	511.2	Flood Risk
7200 min Summer	2.280	2.280	66.1	511.2	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	177.646	0.0	314
30 min Summer	107.029	0.0	314
60 min Summer	64.483	0.0	314
120 min Summer	38.850	0.0	314
180 min Summer	28.885	0.0	314
240 min Summer	23.407	0.0	314
360 min Summer	17.403	0.0	314
480 min Summer	14.102	0.0	314
600 min Summer	11.980	0.0	314
720 min Summer	10.485	0.0	314
960 min Summer	8.540	0.0	314
1440 min Summer	6.396	0.0	314
2160 min Summer	4.790	0.0	316
2880 min Summer	3.902	0.0	316
4320 min Summer	2.722	0.0	316
5760 min Summer	2.109	0.0	312
7200 min Summer	1.729	0.0	312

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<u>Cascade Summary of Results for Geocellular Storage (5.0 SF).SRCX</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
8640 min Summer	2.280	2.280	66.1	511.2	Flood Risk
10080 min Summer	2.280	2.280	66.1	511.2	Flood Risk
15 min Winter	2.281	2.281	66.1	511.3	Flood Risk
30 min Winter	2.281	2.281	66.1	511.3	Flood Risk
60 min Winter	2.280	2.280	66.1	511.3	Flood Risk
120 min Winter	2.280	2.280	66.1	511.3	Flood Risk
180 min Winter	2.280	2.280	66.1	511.3	Flood Risk
240 min Winter	2.280	2.280	66.1	511.3	Flood Risk
360 min Winter	2.280	2.280	66.1	511.3	Flood Risk
480 min Winter	2.280	2.280	66.1	511.3	Flood Risk
600 min Winter	2.280	2.280	66.1	511.3	Flood Risk
720 min Winter	2.280	2.280	66.1	511.3	Flood Risk
960 min Winter	2.280	2.280	66.1	511.3	Flood Risk
1440 min Winter	2.280	2.280	66.1	511.3	Flood Risk
2160 min Winter	2.280	2.280	66.1	511.1	Flood Risk
2880 min Winter	2.280	2.280	66.1	511.1	Flood Risk
4320 min Winter	2.280	2.280	66.1	511.1	Flood Risk
5760 min Winter	2.280	2.280	66.1	511.2	Flood Risk
7200 min Winter	2.280	2.280	66.1	511.2	Flood Risk
8640 min Winter	2.280	2.280	66.1	511.2	Flood Risk
10080 min Winter	2.280	2.280	66.1	511.2	Flood Risk
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
8640 min Summer	1.471	0.0	312		
10080 min Summer	1.283	0.0	312		
15 min Winter	177.646	0.0	314		
30 min Winter	107.029	0.0	314		
60 min Winter	64.483	0.0	314		
120 min Winter	38.850	0.0	314		
180 min Winter	28.885	0.0	314		
240 min Winter	23.407	0.0	314		
360 min Winter	17.403	0.0	314		
480 min Winter	14.102	0.0	314		
600 min Winter	11.980	0.0	314		
720 min Winter	10.485	0.0	314		
960 min Winter	8.540	0.0	314		
1440 min Winter	6.396	0.0	314		
2160 min Winter	4.790	0.0	316		
2880 min Winter	3.902	0.0	316		
4320 min Winter	2.722	0.0	316		
5760 min Winter	2.109	0.0	312		
7200 min Winter	1.729	0.0	312		
8640 min Winter	1.471	0.0	312		
10080 min Winter	1.283	0.0	312		
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<u>Cascade Rainfall Details for Geocellular Storage (5.0 SF).SRCX</u> <table><tr><td>Rainfall Model</td><td>FEH</td></tr><tr><td>Return Period (years)</td><td>100</td></tr><tr><td>FEH Rainfall Version</td><td>1999</td></tr><tr><td>Site Location</td><td>GB 373900 163850 ST 73900 63850</td></tr><tr><td>C (1km)</td><td>-0.025</td></tr><tr><td>D1 (1km)</td><td>0.384</td></tr><tr><td>D2 (1km)</td><td>0.402</td></tr><tr><td>D3 (1km)</td><td>0.227</td></tr><tr><td>E (1km)</td><td>0.288</td></tr><tr><td>F (1km)</td><td>2.470</td></tr><tr><td>Summer Storms</td><td>Yes</td></tr><tr><td>Winter Storms</td><td>Yes</td></tr><tr><td>Cv (Summer)</td><td>0.750</td></tr><tr><td>Cv (Winter)</td><td>0.840</td></tr><tr><td>Shortest Storm (mins)</td><td>15</td></tr><tr><td>Longest Storm (mins)</td><td>10080</td></tr><tr><td>Climate Change %</td><td>+45</td></tr></table> <u>Time Area Diagram</u> Total Area (ha) 0.000 <table><tr><th>Time (mins)</th><th>Area</th></tr><tr><th>From:</th><th>To: (ha)</th></tr><tr><td>0</td><td>4 0.000</td></tr></table>			Rainfall Model	FEH	Return Period (years)	100	FEH Rainfall Version	1999	Site Location	GB 373900 163850 ST 73900 63850	C (1km)	-0.025	D1 (1km)	0.384	D2 (1km)	0.402	D3 (1km)	0.227	E (1km)	0.288	F (1km)	2.470	Summer Storms	Yes	Winter Storms	Yes	Cv (Summer)	0.750	Cv (Winter)	0.840	Shortest Storm (mins)	15	Longest Storm (mins)	10080	Climate Change %	+45	Time (mins)	Area	From:	To: (ha)	0	4 0.000
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<u>Cascade Model Details for Geocellular Storage (5.0 SF).SRCX</u> Storage is Online Cover Level (m) 2.400 <u>Cellular Storage Structure</u> Invert Level (m) 0.000 Safety Factor 5.0 Infiltration Coefficient Base (m/hr) 5.04000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>236.0</td><td>236.0</td><td>2.400</td><td>236.0</td><td>236.0</td></tr></table>			Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	236.0	236.0	2.400	236.0	236.0
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)									
0.000	236.0	236.0	2.400	236.0	236.0									
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FOUL WATER NETWORK

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FOUL SEWERAGE DESIGN

Design Criteria for Foul - Main

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	0
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.200
Flow Per Person (l/per/day)	222.00	Maximum Backdrop Height (m)	1.500
Persons per House	3.00	Min Design Depth for Optimisation (m)	1.200
Domestic (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	0.75
Domestic Peak Flow Factor	6.00	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F1.000	19.813	0.514	38.5	0.000	3	0.0	1.500	o	100	Pipe/Conduit	
F1.001	17.374	1.124	15.5	0.000	2	0.0	1.500	o	100	Pipe/Conduit	
F1.002	17.326	0.764	22.7	0.000	0	0.0	1.500	o	100	Pipe/Conduit	
F1.003	19.863	0.256	77.7	0.000	0	0.0	1.500	o	100	Pipe/Conduit	
F2.000	17.901	1.009	17.7	0.000	4	0.0	1.500	o	100	Pipe/Conduit	
F2.001	16.263	0.836	19.4	0.000	0	0.0	1.500	o	100	Pipe/Conduit	
F1.004	12.432	0.161	77.3	0.000	0	0.0	1.500	o	100	Pipe/Conduit	
F1.005	26.576	0.344	77.3	0.000	0	0.0	1.500	o	100	Pipe/Conduit	
F1.006	34.629	0.448	77.3	0.000	0	0.0	1.500	o	100	Pipe/Conduit	
F1.007	14.618	0.632	23.1	0.000	0	0.0	1.500	o	100	Pipe/Conduit	
F3.000	19.555	0.800	24.4	0.000	4	0.0	1.500	o	100	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	E Area (ha)	E Base Flow (l/s)	E Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.000	94.049	0.000	0.0	3	0.0	9	0.38	1.07	8.4	0.1
F1.001	93.534	0.000	0.0	5	0.0	9	0.62	1.70	13.3	0.2
F1.002	92.410	0.000	0.0	5	0.0	10	0.54	1.40	11.0	0.2
F1.003	91.646	0.000	0.0	5	0.0	14	0.35	0.76	5.9	0.2
F2.000	93.623	0.000	0.0	4	0.0	9	0.55	1.59	12.5	0.2
F2.001	92.614	0.000	0.0	4	0.0	9	0.53	1.51	11.9	0.2
F1.004	91.390	0.000	0.0	9	0.0	18	0.43	0.76	5.9	0.4
F1.005	91.230	0.000	0.0	9	0.0	18	0.43	0.76	5.9	0.4
F1.006	90.886	0.000	0.0	9	0.0	18	0.43	0.76	5.9	0.4
F1.007	90.438	0.000	0.0	9	0.0	14	0.65	1.39	10.9	0.4
F3.000	92.387	0.000	0.0	4	0.0	9	0.49	1.35	10.6	0.2

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Manhole Schedules for Foul - Main

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
F1	95.349	1.300	Open Manhole	1200	F1.000	94.049	100				
F2	94.834	1.300	Open Manhole	1200	F1.001	93.534	100	F1.000	93.534	100	
F3	93.710	1.300	Open Manhole	1200	F1.002	92.410	100	F1.001	92.410	100	
F4	93.205	1.559	Open Manhole	1200	F1.003	91.646	100	F1.002	91.646	100	
F5	94.923	1.300	Open Manhole	1200	F2.000	93.623	100				
F6	93.914	1.300	Open Manhole	1200	F2.001	92.614	100	F2.000	92.614	100	
F5	93.077	1.687	Open Manhole	1200	F1.004	91.390	100	F1.003	91.390	100	
								F2.001	91.777	100	387
F6	92.865	1.635	Open Manhole	1200	F1.005	91.230	100	F1.004	91.230	100	
F7	92.463	1.577	Open Manhole	1200	F1.006	90.886	100	F1.005	90.886	100	
F8	91.812	1.374	Open Manhole	1200	F1.007	90.438	100	F1.006	90.438	100	
F11	93.687	1.300	Open Manhole	1200	F3.000	92.387	100				
F12	93.031	1.444	Open Manhole	1200	F3.001	91.587	100	F3.000	91.587	100	
F13	92.238	1.451	Open Manhole	1200	F3.002	90.787	100	F3.001	90.787	100	
F9	91.245	1.571	Open Manhole	1200	F1.008	89.674	100	F1.007	89.806	100	132
								F3.002	89.674	100	
F10	90.320	1.300	Open Manhole	1200	F1.009	89.020	100	F1.008	89.020	100	
F11	86.350	1.300	Open Manhole	1200	F1.010	85.050	100	F1.009	85.050	100	
F	93.000	8.161	Open Manhole	0		OUTFALL		F1.010	84.839	100	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
F1	373495.779	163225.859	373495.779	163225.859	Required	
F2	373477.513	163233.533	373477.513	163233.533	Required	
F3	373484.159	163249.585	373484.159	163249.585	Required	
F4	373497.410	163260.748	373497.410	163260.748	Required	
F5	373516.603	163236.002	373516.603	163236.002	Required	

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PIPELINE SCHEDULES for Foul - Main

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F1.000	o	100	F1	95.349	94.049	1.200	Open Manhole	1200
F1.001	o	100	F2	94.834	93.534	1.200	Open Manhole	1200
F1.002	o	100	F3	93.710	92.410	1.200	Open Manhole	1200
F1.003	o	100	F4	93.205	91.646	1.459	Open Manhole	1200
F2.000	o	100	F5	94.923	93.623	1.200	Open Manhole	1200
F2.001	o	100	F6	93.914	92.614	1.200	Open Manhole	1200
F1.004	o	100	F5	93.077	91.390	1.587	Open Manhole	1200
F1.005	o	100	F6	92.865	91.230	1.535	Open Manhole	1200
F1.006	o	100	F7	92.463	90.886	1.477	Open Manhole	1200
F1.007	o	100	F8	91.812	90.438	1.274	Open Manhole	1200
F3.000	o	100	F11	93.687	92.387	1.200	Open Manhole	1200
F3.001	o	100	F12	93.031	91.587	1.344	Open Manhole	1200
F3.002	o	100	F13	92.238	90.787	1.351	Open Manhole	1200
F1.008	o	100	F9	91.245	89.674	1.471	Open Manhole	1200
F1.009	o	100	F10	90.320	89.020	1.200	Open Manhole	1200
F1.010	o	100	F11	86.350	85.050	1.200	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F1.000	19.813	38.5	F2	94.834	93.534	1.200	Open Manhole	1200
F1.001	17.374	15.5	F3	93.710	92.410	1.200	Open Manhole	1200
F1.002	17.326	22.7	F4	93.205	91.646	1.459	Open Manhole	1200
F1.003	19.863	77.7	F5	93.077	91.390	1.587	Open Manhole	1200
F2.000	17.901	17.7	F6	93.914	92.614	1.200	Open Manhole	1200
F2.001	16.263	19.4	F5	93.077	91.777	1.200	Open Manhole	1200
F1.004	12.432	77.3	F6	92.865	91.230	1.535	Open Manhole	1200
F1.005	26.576	77.3	F7	92.463	90.886	1.477	Open Manhole	1200
F1.006	34.629	77.3	F8	91.812	90.438	1.273	Open Manhole	1200
F1.007	14.618	23.1	F9	91.245	89.806	1.339	Open Manhole	1200
F3.000	19.555	24.4	F12	93.031	91.587	1.344	Open Manhole	1200
F3.001	16.620	20.8	F13	92.238	90.787	1.351	Open Manhole	1200
F3.002	12.607	11.3	F9	91.245	89.674	1.471	Open Manhole	1200
F1.008	20.203	30.9	F10	90.320	89.020	1.200	Open Manhole	1200
F1.009	57.607	14.5	F11	86.350	85.050	1.200	Open Manhole	1200
F1.010	16.562	78.5	F	93.000	84.839	8.061	Open Manhole	0

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Free Flowing Outfall Details for Foul - Main

Outfall Pipe Number	Outfall C. Level Name (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
F1.010	F 93.000	84.839	0.000	0	0

Simulation Criteria for Foul - Main

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 Coefficient	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)	21600
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 373900 163850 ST 73900 63850
C (1km)	-0.025
D1 (1km)	0.384
D2 (1km)	0.402
D3 (1km)	0.227
E (1km)	0.288
F (1km)	2.470
Summer Storms	Yes
Winter Storms	No
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

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Appendix E

SuDS Components Performance

The effectiveness of various SuDS components in improving development surface water runoff quality is summarised in the table below. Combinations of treatments can be used to reduce potential pollutants from reaching the receiving watercourse.

	Inter-ception	Peak flow control: Low	Peak flow control: High	Volume reduction	Volume control	Gross sediments	Fine sediments	Hydrocarbons/PAHs	Metals	Nutrients
Rainwater Harvesting	Y	Y	S	Y	N	N	N	N	N	N
Pervious Pavement	Y	Y	Y	Y	Y	Y	Y	Y	Y	Var
Filter Strips	Y	N	N	N	N	Y	N	Y	Y	Var
Swales	Y	Y	S	Y(+)	N	Y	Y(+)	Y	Y	Y(-)
Trenches	Y	Y	S	Y(+)	N	N	N	Y	Y	Y(-)
Detention Basins	Y	Y	Y	N	Y	Y	Y(+)	Y	Y	Var
Ponds	N	Y	Y	N	Y	N(~)	Y	Limited	Y	Var
Wetlands	N	Y	S	N	Y	N(~)	Y	Limited	Y	Y
Green Roofs	Y	Y	N	N	N	N	N	Y	N	N
Bio-retention Systems	Y	Y	S	Y(+)	N	N(~)	Y	Y	Y	Y
Proprietary Treatment Systems	N	N	N	N	N	Y	Y	Y (!)	Y (!)	Y (!)
Subsurface Storage	N	Y	Y	N	Y	N(~)	N	N	N	N
Subsurface Conveyance Pipes	N	N	N	N	Y	N(~)	N	N	N	N

Notes:

- S Not normally with standard designs, but possible where space is available, and designs mitigate impact of high flow rates.
- Y (*) Where infiltration is facilitated by the design.
- N (~) Gross sediment retention is possible, but not recommended due to negative maintenance and performance implications.
- Y (+) Where designs minimise the risk of fine sediment mobilisation during larger events.
- Y (!) Where designs specifically promote the trapping and breakdown of oils and PAH based constituents.
- Y (") Where subsurface soil structure facilitates the trapping and breakdown of oils and PAH based constituents.
- Var. The nutrient removal performance is variable and can be negative in some situations.
- Y (-) Good nutrient removal performance where subsurface bio-filtration systems with a permanently saturated zone included within the design.

Hydraulic Design Criteria

Best practice criteria for hydraulic control requires interception, runoff rate control and volume control.

Interception

To fulfil the requirements for interception, there should normally be no runoff from the site for an initial depth of rainfall – usually 5 mm. This is achieved through the use of infiltration, evapotranspiration, or rainwater harvesting. Permeable paving is recognised in the SuDS Manual as providing interception, as are bio-retention features such as rain gardens and raised planters.

Flow and Volume Control

Discharge rates to the sewer are to be limited to a maximum of 3.0l/s, in line with the QBAR greenfield runoff rate. Both peak rates and volumes of discharge to the adjacent watercourse are reduced as much as is reasonably practicable given the ground conditions on the site preclude the use of infiltration features.

Attenuation and Hydraulic Controls

The use of long-term storage can be used to achieve greenfield runoff volume control. Where volume control is not practicable, flows discharged from the site will be constrained to as close as is reasonably practicable to QBAR, as is the case here.

Water Quality Design Criteria

Current best practice takes a risk-based approach to managing discharges of surface runoff to the receiving environment. The following text provides guidance on the extent of water quality management likely to be appropriate for the site.

Hazard Classification

Runoff from clean roof surfaces (i.e. not metal roofs, roofs close to polluted atmospheric discharges, or roofs close to populations of flocking birds) is classified as Low in terms of hazard status.

Runoff from hardstanding area within the site is also classified as Low in terms of hazard status. This includes the site access road, given that the development is essentially designed as car free, meaning that the access road will have very low levels of traffic.

Treatment Requirements for Disposal

Roof runoff will require 1 treatment stage prior to discharge, which would be provided by the use of rain gardens / bioretention features.

Runoff from the hardstanding areas within the site will also require 1 treatment stage prior to discharge, which will be provided by the widespread use of permeable paving.

Appendix F

Wessex Water Application

Foul drainage

This is confirmation of our acceptance in principle of the proposed foul flows, layout, and method of conveyance, pending planning consent to solidify the proposed design. In this stage, it is noted that existing private surface **water** flows will be removed from the public surface **water** system; it is necessary to seal the connection via the northern catchment/private back gardens before work begins onsite, and the LLFA must also approve flood risk measures and improvements.

Recorded manhole levels for MH Reference ST7363 (620) are provided below and must be verified with a survey as details come forward.

Cover Level (m AOD)	85.661
Lowest Invert (m AOD)	83.551
Depth (m)	2.110

I hope the above is enough to proceed your end, please let me know if anything else is required at this stage.

Kind regards,

Teddy Amuah

wessexwater.co.uk



These comments are based upon known circumstances prevailing at the time of writing. A review of the contents of this email is required where 18 months or more have elapsed since the issue or in the light of significant changes likely to impact upon the response (e.g., changes in development numbers or phasing). Please email review requests to planning liaison@wessexwater.co.uk

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