

CROMPTON AVENUE, ROCHDALE

Drainage Strategy

APRIL 2023

REV B

Tempus
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REF 9806/DRA/001



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1 EXECUTIVE SUMMARY

Tempus have been asked to provide a drainage strategy relating to the proposed development of 18 No. new dwellings at Crompton Avenue, Rochdale.

This strategy is informed by the existing sewer network, Flood Risk Assessment (FRA), Site Investigation (SI) and proposed site layout.

It is proposed, following a detailed assessment, that the site is drained by gravity sewers to connection points in Broad Lane to the north of the site and the existing surface water drainage ditch adjacent Broad Lane. Foul water is proposed to be connected to the existing adopted sewer network. Surface water will connect to an existing watercourse which is a tributary of Sudden Brook. An alternative surface water connection point is to the combined sewer in Broad Lane, although this option will only be explored if agreement cannot be reached with regards connection to the existing watercourse.

Attenuation for the surface water is to be provided on site by way of cellular storage and flow control manhole to restrict runoff to below the recommended values stipulated in the Tempus Flood Risk Assessment ref 9806/FRA/001 dated March 2023.

2 INTRODUCTION

Tempus have been asked to assess the feasibility and provide a strategy for the drainage of 18 new dwellings, off Crompton Avenue, Rochdale.

Tempus made pre-development enquiries with the surrounding sewer asset owners, United Utilities and were advised on preferred connection points from the proposed site as follows:

Foul Water – to the 525mm diameter public foul sewer within Broad Lane located to the north of the proposed development at an unrestricted rate;

Surface Water – to an existing water body – the open culvert adjacent Broad Lane.

Existing sewer network plans can be found at Appendix B.

The proposed development is for 18 dwellings of 2 storey. The proposed development layout is included at Appendix A.

The existing site of approximately 1.05 hectares, comprises disused land containing grass, rough vegetation and some shrubs and trees around the perimeter. The site is bounded by housing to the west, an area of vegetation to the north west, sheltered housing accommodation to the north east and fields to the south and south east.

The co-ordinates of the centre of the site are approximately: Easting: 390744, Northing: 411210 (SD907112 / SD9074411210).

2.1 SCOPE OF REPORT

2.1.1 Tempus' engagement with regards the drainage strategy was principally one of review and report. The following scope was therefore developed:

Review existing drainage information in relation to the proposed development site - both on site and surrounding roads/footpaths.

Assess the need for any diversion or abandonment of any existing drains.

Carry out an assessment of the existing runoff from the development.

Assess possibility of re-use, discharge into ground, discharge to watercourse and discharge to surface water sewer in accordance with the hierarchy set out in Sewerage Sector Guidance Appendix C to the Design and Construction Guidance for Foul and Surface Water Sewers dated March 2020.

Assess the likely runoff from the proposed site and provide an outline drainage strategy and layout.

3 FOUL WATER

3.1 ASSET OWNER & CONTACT DETAILS

- 3.1.1 United Utilities (UU) operate the existing network within the immediate vicinity of the site. The proposed site was designated the reference number 02327155 by UU, following an initial pre-development enquiry by Tempus in June 2022. There is no specific contact dealing with the proposed site at UU but their contact address is Developer Services and Planning, Warrington North Wastewater Treatment Works, Gatewarth Industrial Estate, Off Liverpool Road, Warrington, WA5 1DS

3.2 EXISTING INFRASTRUCTURE (SEE APPENDIX B)

- 3.2.1 No existing foul water sewers are known to enter or cross the site.
- 3.2.2 The nearest combined sewers are located within Broad Lane, to the north of the site. The nearest foul water sewers are located within Crompton Avenue to the south west of the site.
- 3.2.3 Due to the potential inaccuracy of the sewer records, care should be taken to avoid any damage to the sewers which are indicated close to the proposed development and which may encroach within the boundaries.

3.3 DIVERSIONS & DISCONNECTIONS

- 3.3.1 No diversion works are anticipated as a result of the proposed development works.

3.4 PROPOSED DEVELOPMENT

- 3.4.1 The proposed foul sewer connection point is to the existing 450 diameter VC pipe between manholes reference 6304 & 7301 on the United Utilities sewer records and located within Broad Lane to the north of the site.

- 3.4.2 Detailed modelling will be carried out once the plot drainage has been fully designed, but based on initial calculations, using a 4000 litres/dwelling/day rate as per Sewerage Sector Guidance Appendix C and a peak flow rate of 0.83l/sec from the site, the site will drain adequately via a 150mm sewer.

4 SURFACE WATER

4.1 ASSET OWNER & CONTACT DETAILS

- 4.1.1 United Utilities (UU) operate the existing network within the immediate vicinity of the site. The proposed site was designated the reference number 02327155 by UU, following an initial pre-development enquiry by Tempus in June 2022. There is no specific contact dealing with the proposed site at UU but their contact address is Developer Services and Planning, Warrington North Wastewater Treatment Works, Gatewarth Industrial Estate, Off Liverpool Road, Warrington, WA5 1DS

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4.3 DIVERSIONS & DISCONNECTIONS

- 4.3.1 No diversion works are anticipated as a result of the proposed development works.

4.4 PROPOSED DEVELOPMENT

- 4.4.1 Government Guidance to local authorities, as set out in Sewerage Sector Guidance Appendix C to the Design and Construction Guidance for Foul and Surface Water Sewers dated March 2020 requires an assessment of the surface water disposal hierarchy. The hierarchy for connection can be summarised as follow:

- a) surface water runoff is collected for use;***
- b) discharge into the ground via infiltration;***
- c) discharge to a watercourse or other surface water body;***
- d) discharge to a surface water sewer, highway drain or other drainage system, discharging to a watercourse or other surface water body;***
- e) discharge to a combined sewer.***

- 4.4.2 Collection for re-use could be provided by green roofing systems and/or rainwater harvesting. Both have been dismissed in relation to the subject site as the traditional pitched roof construction proposed and also predominant in the area, does not lend itself to green roof systems and rainwater harvesting would be unsuitable given the volumes of water needed to be re-used and the uncertainty of capacity.
- 4.4.3 The use of soakaways and infiltration have been considered but dismissed due to the results of the infiltration testing undertaken by bEk Enviro Ltd. on 15th June 2022 and detailed in their letter dated 22nd June 2022, ref. BEK/22081/220622/ACL (See Appendix D).
- 4.4.4 It has therefore been assumed that all generated surface water will be stored and released at a discharge rate no more than 5 l/sec, as stipulated in the pre-development enquiry response from United Utilities (see Flood Risk Assessment). Cellular storage has been proposed, beneath areas of parking/driveways, along with a small pond to the northern section of the site, to provide attenuation to the volumes suggested in the FRA. The pond will provide SUDS benefits in that minor rainfall events may result in no discharge due to interception and evaporation. Detailed modelling has indicated that this proposal will prevent any flooding of the site within the 1 in 100 year + 40% climate change event.

- 4.4.5 An existing watercourse exists to the north east of the site and it is believed that this would be a preferred point of discharge for surface water, following discussion with the LLFA and following the hierarchy for connections. Permission from the adjacent land owner will be required to allow connection, although it is anticipated that this should be straightforward given the ownership by Rochdale Housing.
- 4.4.6 The proposed surface sewer connection point is therefore to the existing open surface water culvert adjacent Broad Lane at a rate of discharge not exceeding 5 l/sec.
- 4.4.7 The proposed foul water connection is to the existing combined sewer network within Broad Lane.
- 4.4.8 Preliminary model calculations and proposals are included at Appendix C.
- 4.4.9 Connections within Crompton Avenue have been discounted due to insufficient invert levels.

APPENDIX A

PROPOSED SITE LAYOUT

Proposed foul water collection system with 3m easement.

Proposed surface water outfall to brook.

Proposed diverted public right of way.

Proposed SUDS basin within wildflower meadow.



EXISTING PLAYING FIELDS

- | KEY | |
|---|--|
|  | Denotes proposed original paved areas |
|  | Denotes bin collection area |
|  | Denotes access gates to private property |
|  | Denotes 1.5m high screen brick wall & piers to match adjacent property |
|  | Denotes 1.5m high close-boarded timber screen fence with 0.3m high rails, 2.1m total height |
|  | Denotes 1.2m high iron railings - painted black |
|  | Denotes retaining wall A
Low rendered wall within gardens |
|  | Denotes retaining wall B
Brick retaining wall within gardens |
|  | Denotes retaining wall C
Brick retaining wall with piers and timber fence rail |
|  | Denotes retaining wall D
Low timber retaining wall |
|  | Denotes proposed steps in gardens. Location and size shown indicatively, refer to details for more information |

NOTE:
Layout to be read in conjunction with boundary treatment layout, boundary treatment details, materials layout and engineer's drawing for retaining wall heights.

[illegible]

APPENDIX B

EXISTING SEWER RECORDS

APPENDIX C

DRAINAGE PROPOSALS



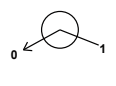
B	14/04/23	REV TO OUTFALL POSITION, GULLIES ADDED TO TRACK
	13/04/23	REV TO OUTFALL POSITION, GULLIES ADDED TO TRACK
A		
REVISION	DATE	DESCRIPTION
CLIENT: LANCET HOMES		
PROJECT: RESIDENTIAL DEVELOPMENT - CROMPTON AVE		
ADDRESS: CROMPTON AVE, BURSIL ROCHDALE		
DRAWING TITLE: DRAINAGE STRATEGY PLAN		
SCALE: 1:500		
DRAWING NO: CROM_0005_501		
DATE: MAR 2023		

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Office 1, Acorn Business Centre,
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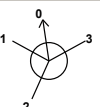
Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.750
Ratio-R	0.300	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
11	390711.215	411253.134	148.279	3.348	1200				
						0	1.000	144.931	150
10	390701.056	411255.728	147.886	3.254	1200		1	1.000	144.632
						0	1.001	144.632	150
9	390690.272	411286.050	146.172	2.460	1200		1	1.001	143.712
						0	1.002	143.712	150
8	390693.509	411302.584	145.401	2.170	1200		1	1.002	143.231
						0	1.003	143.231	150
7	390677.081	411309.068	144.729	2.003	1200		1	1.003	142.726
						0	1.004	142.726	150
23	390658.153	411237.243	148.306	2.212	1200				
						0	2.000	146.094	150
22	390648.644	411264.171	147.085	1.767	1200		1	2.000	145.318
						0	2.001	145.318	150
21	390641.495	411282.952	145.650	1.275	1200		1	2.001	144.375
						0	2.002	144.375	150
20	390656.819	411288.778	145.982	1.771	1200		1	2.002	144.211
						0	2.003	144.211	150
30	390648.372	411308.548	144.842	1.807	1200				
						0	3.000	143.035	150

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
6	390662.262	411300.927	145.619	3.451	1200		1 3.000 2 2.003 3 1.004 0 1.005	142.243 143.368 142.243 142.168	150 150 150 225
5	390659.877	411316.954	143.002	1.644	1200		1 1.005 0 1.006	141.358 141.358	225 225
4	390680.306	411332.906	142.605	1.571	1200		1 1.006 0 1.007	141.034 141.034	225 225
3	390686.707	411338.529	142.391	1.464	1200		1 1.007 0 1.008	140.927 140.927	225 225
2	390697.432	411360.449	141.000	0.453	1200		1 1.008 0 1.009	140.622 140.547	225 300
1	390693.761	411366.392	141.000	0.500	1200		1 1.009	140.500	300

Simulation Settings

Rainfall Methodology	FSR	Drain Down Time (mins)	240
FSR Region	England and Wales	Additional Storage (m³/ha)	20.0
M5-60 (mm)	20.000	Check Discharge Rate(s)	✓
Ratio-R	0.300	1 year (l/s)	0.3
Summer CV	0.750	30 year (l/s)	0.5
Winter CV	0.840	100 year (l/s)	0.6
Analysis Speed	Normal	Check Discharge Volume	✓
Skip Steady State	✓	100 year 360 minute (m³)	110

Storm Durations

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

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

Pre-development Discharge Rate

Site Makeup	Greenfield	Region	10
Greenfield Method	IH124	Growth Factor 1 year	0.87
Positively Drained Area (ha)	1.050	Growth Factor 30 year	1.70
SAAR (mm)	1137	Growth Factor 100 year	2.08
Soil Index	1	Betterment (%)	0
SPR	0.10	QBar	0.3

	Tempus Design & Build Ltd	File: CROMPTON MAR23 A.PFC Network: Storm Network 1 Paul Blezard 02/03/2023	Page 3																														
<u>Pre-development Discharge Rate</u> <table><tr><td>Q 1 year (l/s)</td><td>0.3</td><td>Q 100 year (l/s)</td><td>0.6</td></tr><tr><td>Q 30 year (l/s)</td><td>0.5</td><td></td><td></td></tr></table>				Q 1 year (l/s)	0.3	Q 100 year (l/s)	0.6	Q 30 year (l/s)	0.5																								
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0.000	90.0	0.0	0.800	90.0	0.0	0.801	0.0	0.0																									
<u>Approval Results</u> The network has been designed for a 1 in 2 year storm using FSR rainfall It contains 16 nodes (1 outfall) and 15 links The total impermeable area is 0.411 ha 2 online controls have been defined 2 structures have been defined, providing 251m³ of storage below the flood risk level Infiltration has not been utilised Simulations have been completed using FSR summer and winter storms from 15 to 1440 minute duration																																	
Flow+ v10.5.1 Copyright © 1988-2023 Causeway Technologies Ltd																																	

No manholes are smaller than that required by the library

5 connections have combined exit and entry losses less than the recommended total

Node	US Link	DS Link	US Exit Loss	DS Entry Loss	Angle (degrees)	Recommended Node Losses
8	1.002	1.003	0.250	0.250	80	0.900
21	2.001	2.002	0.250	0.250	90	1.200
6	3.000	1.005	0.250	0.250	127	1.200
6	1.004	1.005	0.250	0.250	110	1.200
5	1.005	1.006	0.250	0.250	60	0.900

No circular links have diameters < 150mm

No links have lengths > 100.000m

No links have lengths that differ from their coordinated length by more than 1.000m

No links cross one or more other links

10 links have cover depth outside the range 1.200-3.000m

US Node	DS Node	Link	Minimum Depth (m)	Maximum Depth (m)
11	10	1.000	3.104	3.253
10	9	1.001	2.310	3.104
7	6	1.004	1.853	3.226
22	21	2.001	1.125	1.709
21	20	2.002	1.125	1.692
30	6	3.000	1.657	3.226
6	5	1.005	1.419	3.235
4	3	1.007	1.133	1.346
3	2	1.008	0.153	1.719
2	1	1.009	0.153	0.200

No nodes have backdrops outside the range 0.750-1.500m

No links have full bore velocity outside the range 1.000-3.000m/s

2 links have peak proportional velocity outside the range 0.750-3.000m/s during the 2 year return period

US Node	DS Node	Link	Velocity (m/s)	Event
23	22	2.000	0.655	2 year 15 minute winter
2	1	1.009	0.662	2 year 360 minute winter

No links have a surcharged depth greater than 0.100m during the 2 year return period

No nodes flood during the 30 year return period

No infiltrating structures failed to half empty in 1440 minutes during the 2 year return period

No outfalls have a discharge rate greater than 5.0l/s during the 1 year return period

No outfalls have a discharge rate greater than 5.0l/s during the 30 year return period

No outfalls have a discharge rate greater than 5.0l/s during the 100 year return period

	Tempus Design & Build Ltd	File: CROMPTON MAR23 A.PFC Network: Storm Network 1 Paul Blezard 02/03/2023	Page 5																																																																																																																																																																																																																																																																																																								
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summer</td><td>16.369</td><td>4.212</td></tr><tr><td>1 year 360 minute winter</td><td>10.640</td><td>4.212</td></tr><tr><td>1 year 480 minute summer</td><td>13.246</td><td>3.501</td></tr><tr><td>1 year 480 minute winter</td><td>8.801</td><td>3.501</td></tr><tr><td>1 year 600 minute summer</td><td>11.089</td><td>3.033</td></tr><tr><td>1 year 600 minute winter</td><td>7.577</td><td>3.033</td></tr><tr><td>1 year 720 minute summer</td><td>10.069</td><td>2.699</td></tr><tr><td>1 year 720 minute winter</td><td>6.767</td><td>2.699</td></tr><tr><td>1 year 960 minute summer</td><td>8.526</td><td>2.245</td></tr><tr><td>1 year 960 minute winter</td><td>5.648</td><td>2.245</td></tr><tr><td>1 year 1440 minute summer</td><td>6.448</td><td>1.728</td></tr><tr><td>1 year 1440 minute winter</td><td>4.334</td><td>1.728</td></tr><tr><td>2 year 15 minute summer</td><td>128.797</td><td>36.445</td></tr><tr><td>2 year 15 minute winter</td><td>90.384</td><td>36.445</td></tr><tr><td>2 year 30 minute summer</td><td>87.307</td><td>24.705</td></tr><tr><td>2 year 30 minute winter</td><td>61.268</td><td>24.705</td></tr><tr><td>2 year 60 minute summer</td><td>61.301</td><td>16.200</td></tr><tr><td>2 year 60 minute winter</td><td>40.727</td><td>16.200</td></tr><tr><td>2 year 120 minute summer</td><td>39.487</td><td>10.435</td></tr><tr><td>2 year 120 minute winter</td><td>26.234</td><td>10.435</td></tr><tr><td>2 year 180 minute summer</td><td>31.221</td><td>8.034</td></tr><tr><td>2 year 180 minute winter</td><td>20.295</td><td>8.034</td></tr><tr><td>2 year 240 minute summer</td><td>25.171</td><td>6.652</td></tr><tr><td>2 year 240 minute winter</td><td>16.723</td><td>6.652</td></tr><tr><td>2 year 360 minute summer</td><td>19.759</td><td>5.085</td></tr><tr><td>2 year 360 minute winter</td><td>12.844</td><td>5.085</td></tr><tr><td>2 year 480 minute summer</td><td>15.896</td><td>4.201</td></tr><tr><td>2 year 480 minute winter</td><td>10.561</td><td>4.201</td></tr><tr><td>2 year 600 minute summer</td><td>13.242</td><td>3.622</td></tr><tr><td>2 year 600 minute winter</td><td>9.048</td><td>3.622</td></tr><tr><td>2 year 720 minute summer</td><td>11.973</td><td>3.209</td></tr><tr><td>2 year 720 minute winter</td><td>8.047</td><td>3.209</td></tr><tr><td>2 year 960 minute summer</td><td>10.067</td><td>2.651</td></tr><tr><td>2 year 960 minute winter</td><td>6.669</td><td>2.651</td></tr><tr><td>2 year 1440 minute summer</td><td>7.548</td><td>2.023</td></tr><tr><td>2 year 1440 minute winter</td><td>5.073</td><td>2.023</td></tr></tbody></table>			Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	1 year 15 minute summer	99.562	28.172	1 year 15 minute winter	69.868	28.172	1 year 30 minute summer	67.776	19.178	1 year 30 minute winter	47.562	19.178	1 year 60 minute summer	48.435	12.800	1 year 60 minute winter	32.179	12.800	1 year 120 minute summer	31.831	8.412	1 year 120 minute winter	21.148	8.412	1 year 180 minute summer	25.499	6.562	1 year 180 minute winter	16.575	6.562	1 year 240 minute summer	20.693	5.468	1 year 240 minute winter	13.748	5.468	1 year 360 minute summer	16.369	4.212	1 year 360 minute winter	10.640	4.212	1 year 480 minute summer	13.246	3.501	1 year 480 minute winter	8.801	3.501	1 year 600 minute summer	11.089	3.033	1 year 600 minute winter	7.577	3.033	1 year 720 minute summer	10.069	2.699	1 year 720 minute winter	6.767	2.699	1 year 960 minute summer	8.526	2.245	1 year 960 minute winter	5.648	2.245	1 year 1440 minute summer	6.448	1.728	1 year 1440 minute winter	4.334	1.728	2 year 15 minute summer	128.797	36.445	2 year 15 minute winter	90.384	36.445	2 year 30 minute summer	87.307	24.705	2 year 30 minute winter	61.268	24.705	2 year 60 minute summer	61.301	16.200	2 year 60 minute winter	40.727	16.200	2 year 120 minute summer	39.487	10.435	2 year 120 minute winter	26.234	10.435	2 year 180 minute summer	31.221	8.034	2 year 180 minute winter	20.295	8.034	2 year 240 minute summer	25.171	6.652	2 year 240 minute winter	16.723	6.652	2 year 360 minute summer	19.759	5.085	2 year 360 minute winter	12.844	5.085	2 year 480 minute summer	15.896	4.201	2 year 480 minute winter	10.561	4.201	2 year 600 minute summer	13.242	3.622	2 year 600 minute winter	9.048	3.622	2 year 720 minute summer	11.973	3.209	2 year 720 minute winter	8.047	3.209	2 year 960 minute summer	10.067	2.651	2 year 960 minute winter	6.669	2.651	2 year 1440 minute summer	7.548	2.023	2 year 1440 minute winter	5.073	2.023	<table><thead><tr><th>Event</th><th>Peak Intensity (mm/hr)</th><th>Average Intensity (mm/hr)</th></tr></thead><tbody><tr><td>30 year 15 minute summer</td><td>243.818</td><td>68.992</td></tr><tr><td>30 year 15 minute winter</td><td>171.101</td><td>68.992</td></tr><tr><td>30 year 30 minute summer</td><td>166.387</td><td>47.082</td></tr><tr><td>30 year 30 minute winter</td><td>116.763</td><td>47.082</td></tr><tr><td>30 year 60 minute summer</td><td>116.589</td><td>30.811</td></tr><tr><td>30 year 60 minute winter</td><td>77.459</td><td>30.811</td></tr><tr><td>30 year 120 minute summer</td><td>73.902</td><td>19.530</td></tr><tr><td>30 year 120 minute winter</td><td>49.099</td><td>19.530</td></tr><tr><td>30 year 180 minute summer</td><td>57.313</td><td>14.749</td></tr><tr><td>30 year 180 minute winter</td><td>37.255</td><td>14.749</td></tr><tr><td>30 year 240 minute summer</td><td>45.598</td><td>12.050</td></tr><tr><td>30 year 240 minute winter</td><td>30.295</td><td>12.050</td></tr><tr><td>30 year 360 minute summer</td><td>35.178</td><td>9.053</td></tr><tr><td>30 year 360 minute winter</td><td>22.867</td><td>9.053</td></tr><tr><td>30 year 480 minute summer</td><td>27.920</td><td>7.379</td></tr><tr><td>30 year 480 minute winter</td><td>18.550</td><td>7.379</td></tr><tr><td>30 year 600 minute summer</td><td>23.001</td><td>6.291</td></tr><tr><td>30 year 600 minute winter</td><td>15.716</td><td>6.291</td></tr><tr><td>30 year 720 minute summer</td><td>20.598</td><td>5.520</td></tr><tr><td>30 year 720 minute winter</td><td>13.843</td><td>5.520</td></tr><tr><td>30 year 960 minute summer</td><td>17.043</td><td>4.488</td></tr><tr><td>30 year 960 minute winter</td><td>11.289</td><td>4.488</td></tr><tr><td>30 year 1440 minute summer</td><td>12.485</td><td>3.346</td></tr><tr><td>30 year 1440 minute winter</td><td>8.390</td><td>3.346</td></tr><tr><td>100 year +40% CC 15 minute summer</td><td>441.486</td><td>124.925</td></tr><tr><td>100 year +40% CC 15 minute winter</td><td>309.815</td><td>124.925</td></tr><tr><td>100 year +40% CC 30 minute summer</td><td>304.460</td><td>86.152</td></tr><tr><td>100 year +40% CC 30 minute winter</td><td>213.656</td><td>86.152</td></tr><tr><td>100 year +40% CC 60 minute summer</td><td>214.603</td><td>56.713</td></tr><tr><td>100 year +40% CC 60 minute winter</td><td>142.577</td><td>56.713</td></tr><tr><td>100 year +40% CC 120 minute summer</td><td>135.791</td><td>35.885</td></tr><tr><td>100 year +40% CC 120 minute winter</td><td>90.216</td><td>35.885</td></tr><tr><td>100 year +40% CC 180 minute summer</td><td>104.615</td><td>26.921</td></tr><tr><td>100 year +40% CC 180 minute winter</td><td>68.003</td><td>26.921</td></tr><tr><td>100 year +40% CC 240 minute summer</td><td>82.776</td><td>21.875</td></tr><tr><td>100 year +40% CC 240 minute winter</td><td>54.994</td><td>21.875</td></tr><tr><td>100 year +40% CC 360 minute summer</td><td>63.377</td><td>16.309</td></tr><tr><td>100 year +40% CC 360 minute winter</td><td>41.197</td><td>16.309</td></tr><tr><td>100 year +40% CC 480 minute summer</td><td>50.006</td><td>13.215</td></tr><tr><td>100 year +40% CC 480 minute winter</td><td>33.223</td><td>13.215</td></tr><tr><td>100 year +40% CC 600 minute summer</td><td>40.997</td><td>11.214</td></tr><tr><td>100 year +40% CC 600 minute winter</td><td>28.011</td><td>11.214</td></tr><tr><td>100 year +40% CC 720 minute summer</td><td>36.560</td><td>9.799</td></tr><tr><td>100 year +40% CC 720 minute 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winter	22.867	9.053	30 year 480 minute summer	27.920	7.379	30 year 480 minute winter	18.550	7.379	30 year 600 minute summer	23.001	6.291	30 year 600 minute winter	15.716	6.291	30 year 720 minute summer	20.598	5.520	30 year 720 minute winter	13.843	5.520	30 year 960 minute summer	17.043	4.488	30 year 960 minute winter	11.289	4.488	30 year 1440 minute summer	12.485	3.346	30 year 1440 minute winter	8.390	3.346	100 year +40% CC 15 minute summer	441.486	124.925	100 year +40% CC 15 minute winter	309.815	124.925	100 year +40% CC 30 minute summer	304.460	86.152	100 year +40% CC 30 minute winter	213.656	86.152	100 year +40% CC 60 minute summer	214.603	56.713	100 year +40% CC 60 minute winter	142.577	56.713	100 year +40% CC 120 minute summer	135.791	35.885	100 year +40% CC 120 minute winter	90.216	35.885	100 year +40% CC 180 minute summer	104.615	26.921	100 year +40% CC 180 minute winter	68.003	26.921	100 year +40% CC 240 minute summer	82.776	21.875	100 year +40% CC 240 minute winter	54.994	21.875	100 year +40% CC 360 minute summer	63.377	16.309	100 year +40% CC 360 minute winter	41.197	16.309	100 year +40% CC 480 minute summer	50.006	13.215	100 year +40% CC 480 minute winter	33.223	13.215	100 year +40% CC 600 minute summer	40.997	11.214	100 year +40% CC 600 minute winter	28.011	11.214	100 year +40% CC 720 minute summer	36.560	9.799	100 year +40% CC 720 minute winter	24.571	9.799	100 year +40% CC 960 minute summer	30.041	7.911	100 year +40% CC 960 minute winter	19.900	7.911	100 year +40% CC 1440 minute summer	21.775	5.836	100 year +40% CC 1440 minute winter	14.634	5.836
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30 year 240 minute summer	45.598	12.050																																																																																																																																																																																																																																																																																																									
30 year 240 minute winter	30.295	12.050																																																																																																																																																																																																																																																																																																									
30 year 360 minute summer	35.178	9.053																																																																																																																																																																																																																																																																																																									
30 year 360 minute winter	22.867	9.053																																																																																																																																																																																																																																																																																																									
30 year 480 minute summer	27.920	7.379																																																																																																																																																																																																																																																																																																									
30 year 480 minute winter	18.550	7.379																																																																																																																																																																																																																																																																																																									
30 year 600 minute summer	23.001	6.291																																																																																																																																																																																																																																																																																																									
30 year 600 minute winter	15.716	6.291																																																																																																																																																																																																																																																																																																									
30 year 720 minute summer	20.598	5.520																																																																																																																																																																																																																																																																																																									
30 year 720 minute winter	13.843	5.520																																																																																																																																																																																																																																																																																																									
30 year 960 minute summer	17.043	4.488																																																																																																																																																																																																																																																																																																									
30 year 960 minute winter	11.289	4.488																																																																																																																																																																																																																																																																																																									
30 year 1440 minute summer	12.485	3.346																																																																																																																																																																																																																																																																																																									
30 year 1440 minute winter	8.390	3.346																																																																																																																																																																																																																																																																																																									
100 year +40% CC 15 minute summer	441.486	124.925																																																																																																																																																																																																																																																																																																									
100 year +40% CC 15 minute winter	309.815	124.925																																																																																																																																																																																																																																																																																																									
100 year +40% CC 30 minute summer	304.460	86.152																																																																																																																																																																																																																																																																																																									
100 year +40% CC 30 minute winter	213.656	86.152																																																																																																																																																																																																																																																																																																									
100 year +40% CC 60 minute summer	214.603	56.713																																																																																																																																																																																																																																																																																																									
100 year +40% CC 60 minute winter	142.577	56.713																																																																																																																																																																																																																																																																																																									
100 year +40% CC 120 minute summer	135.791	35.885																																																																																																																																																																																																																																																																																																									
100 year +40% CC 120 minute winter	90.216	35.885																																																																																																																																																																																																																																																																																																									
100 year +40% CC 180 minute summer	104.615	26.921																																																																																																																																																																																																																																																																																																									
100 year +40% CC 180 minute winter	68.003	26.921																																																																																																																																																																																																																																																																																																									
100 year +40% CC 240 minute summer	82.776	21.875																																																																																																																																																																																																																																																																																																									
100 year +40% CC 240 minute winter	54.994	21.875																																																																																																																																																																																																																																																																																																									
100 year +40% CC 360 minute summer	63.377	16.309																																																																																																																																																																																																																																																																																																									
100 year +40% CC 360 minute winter	41.197	16.309																																																																																																																																																																																																																																																																																																									
100 year +40% CC 480 minute summer	50.006	13.215																																																																																																																																																																																																																																																																																																									
100 year +40% CC 480 minute winter	33.223	13.215																																																																																																																																																																																																																																																																																																									
100 year +40% CC 600 minute summer	40.997	11.214																																																																																																																																																																																																																																																																																																									
100 year +40% CC 600 minute winter	28.011	11.214																																																																																																																																																																																																																																																																																																									
100 year +40% CC 720 minute summer	36.560	9.799																																																																																																																																																																																																																																																																																																									
100 year +40% CC 720 minute winter	24.571	9.799																																																																																																																																																																																																																																																																																																									
100 year +40% CC 960 minute summer	30.041	7.911																																																																																																																																																																																																																																																																																																									
100 year +40% CC 960 minute winter	19.900	7.911																																																																																																																																																																																																																																																																																																									
100 year +40% CC 1440 minute summer	21.775	5.836																																																																																																																																																																																																																																																																																																									
100 year +40% CC 1440 minute winter	14.634	5.836																																																																																																																																																																																																																																																																																																									
Flow+ v10.5.1 Copyright © 1988-2023 Causeway Technologies Ltd																																																																																																																																																																																																																																																																																																											

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.67%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	11	86	145.060	0.129	7.0	11.3228	0.0000	OK
60 minute winter	10	37	144.666	0.034	3.4	0.0413	0.0000	OK
30 minute winter	9	20	143.750	0.038	4.4	0.0470	0.0000	OK
15 minute winter	8	11	143.277	0.046	6.1	0.0583	0.0000	OK
15 minute winter	7	11	142.785	0.058	9.1	0.0808	0.0000	OK
15 minute winter	23	10	146.119	0.025	1.8	0.0314	0.0000	OK
15 minute winter	22	10	145.359	0.041	6.5	0.0640	0.0000	OK
15 minute winter	21	11	144.449	0.074	7.7	0.0950	0.0000	OK
15 minute winter	20	11	144.258	0.047	8.9	0.0592	0.0000	OK
15 minute winter	30	10	143.059	0.024	2.2	0.0319	0.0000	OK
240 minute winter	6	188	142.446	0.278	10.9	32.2356	0.0000	SURCHARGED
240 minute winter	5	188	141.401	0.043	4.6	0.0485	0.0000	OK
240 minute winter	4	188	141.078	0.044	4.6	0.0502	0.0000	OK
240 minute winter	3	188	140.970	0.043	4.6	0.0489	0.0000	OK
240 minute winter	2	188	140.595	0.048	4.6	0.0542	0.0000	OK
240 minute winter	1	192	140.545	0.045	4.6	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	11	Hydro-Brake®	10	2.8				
60 minute winter	10	1.001	9	3.4	1.068	0.113	0.1039	
30 minute winter	9	1.002	8	4.3	1.098	0.143	0.0667	
15 minute winter	8	1.003	7	6.1	1.124	0.201	0.0960	
15 minute winter	7	1.004	6	9.1	1.461	0.300	0.1048	
15 minute winter	23	2.000	22	1.8	0.612	0.060	0.0836	
15 minute winter	22	2.001	21	6.4	1.031	0.165	0.1257	
15 minute winter	21	2.002	20	7.6	1.146	0.429	0.1094	
15 minute winter	20	2.003	6	9.0	1.942	0.199	0.0615	
15 minute winter	30	3.000	6	2.2	1.199	0.054	0.0439	
240 minute winter	6	Hydro-Brake®	5	4.6				
240 minute winter	5	1.006	4	4.6	0.848	0.079	0.1397	
240 minute winter	4	1.007	3	4.6	0.843	0.078	0.0462	
240 minute winter	3	1.008	2	4.6	0.870	0.079	0.1282	
240 minute winter	2	1.009	1	4.6	0.658	0.050	0.0486	72.2

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.67%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	11	88	145.098	0.167	8.7	14.6302	0.0000	SURCHARGED
30 minute winter	10	20	144.670	0.038	4.2	0.0456	0.0000	OK
15 minute winter	9	11	143.756	0.044	5.7	0.0542	0.0000	OK
15 minute winter	8	11	143.284	0.053	8.2	0.0681	0.0000	OK
15 minute winter	7	11	142.795	0.069	12.0	0.0951	0.0000	OK
15 minute winter	23	10	146.122	0.028	2.3	0.0355	0.0000	OK
15 minute winter	22	10	145.365	0.047	8.4	0.0731	0.0000	OK
15 minute winter	21	11	144.461	0.086	10.0	0.1108	0.0000	OK
15 minute winter	20	11	144.265	0.054	11.6	0.0682	0.0000	OK
15 minute winter	30	10	143.062	0.027	2.8	0.0360	0.0000	OK
360 minute winter	6	272	142.529	0.361	10.6	41.7893	0.0000	SURCHARGED
360 minute winter	5	272	141.401	0.043	4.7	0.0491	0.0000	OK
360 minute winter	4	272	141.079	0.045	4.7	0.0509	0.0000	OK
360 minute winter	3	280	140.971	0.044	4.7	0.0495	0.0000	OK
360 minute winter	2	280	140.596	0.049	4.7	0.0549	0.0000	OK
360 minute winter	1	280	140.546	0.046	4.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	11	Hydro-Brake®	10	2.9				
30 minute winter	10	1.001	9	4.2	1.085	0.138	0.1235	
15 minute winter	9	1.002	8	5.7	1.159	0.188	0.0835	
15 minute winter	8	1.003	7	8.1	1.214	0.270	0.1190	
15 minute winter	7	1.004	6	12.0	1.570	0.398	0.1295	
15 minute winter	23	2.000	22	2.3	0.655	0.077	0.1004	
15 minute winter	22	2.001	21	8.3	1.097	0.213	0.1523	
15 minute winter	21	2.002	20	9.9	1.220	0.555	0.1328	
15 minute winter	20	2.003	6	11.6	2.080	0.258	0.0744	
15 minute winter	30	3.000	6	2.8	1.287	0.069	0.0887	
360 minute winter	6	Hydro-Brake®	5	4.7				
360 minute winter	5	1.006	4	4.7	0.854	0.081	0.1424	
360 minute winter	4	1.007	3	4.7	0.849	0.080	0.0471	
360 minute winter	3	1.008	2	4.7	0.877	0.081	0.1305	
360 minute winter	2	1.009	1	4.7	0.662	0.052	0.0495	106.2

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.67%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	11	140	145.302	0.371	12.3	32.4707	0.0000	SURCHARGED
15 minute winter	10	10	144.680	0.048	6.8	0.0583	0.0000	OK
15 minute winter	9	11	143.773	0.061	10.5	0.0744	0.0000	OK
15 minute winter	8	11	143.306	0.075	15.2	0.0960	0.0000	OK
480 minute winter	7	464	142.996	0.270	5.9	0.3728	0.0000	SURCHARGED
15 minute winter	23	10	146.133	0.039	4.4	0.0490	0.0000	OK
15 minute winter	22	10	145.385	0.067	15.9	0.1033	0.0000	OK
15 minute winter	21	11	144.521	0.146	18.8	0.1875	0.0000	OK
15 minute winter	20	11	144.290	0.079	21.7	0.0986	0.0000	OK
15 minute winter	30	10	143.072	0.037	5.3	0.0486	0.0000	OK
480 minute winter	6	472	142.990	0.822	14.6	95.1234	0.0000	SURCHARGED
60 minute winter	5	40	141.402	0.044	4.7	0.0492	0.0000	OK
60 minute winter	4	41	141.079	0.045	4.7	0.0510	0.0000	OK
30 minute winter	3	33	140.971	0.044	4.7	0.0497	0.0000	OK
30 minute winter	2	33	140.596	0.049	4.7	0.0550	0.0000	OK
30 minute winter	1	33	140.546	0.046	4.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
180 minute winter	11	Hydro-Brake®	10	3.0				
15 minute winter	10	1.001	9	6.7	1.167	0.222	0.1852	
15 minute winter	9	1.002	8	10.3	1.336	0.343	0.1303	
15 minute winter	8	1.003	7	15.1	1.418	0.502	0.1926	
480 minute winter	7	1.004	6	5.9	0.998	0.195	0.2977	
15 minute winter	23	2.000	22	4.3	0.783	0.147	0.1596	
15 minute winter	22	2.001	21	15.7	1.244	0.406	0.2495	
15 minute winter	21	2.002	20	18.4	1.359	1.037	0.2196	
15 minute winter	20	2.003	6	21.7	2.427	0.483	0.1193	
15 minute winter	30	3.000	6	5.3	1.506	0.132	0.1622	
480 minute winter	6	Hydro-Brake®	5	4.7				
60 minute winter	5	1.006	4	4.7	0.855	0.081	0.1429	
60 minute winter	4	1.007	3	4.7	0.850	0.081	0.0472	
30 minute winter	3	1.008	2	4.7	0.878	0.081	0.1310	
30 minute winter	2	1.009	1	4.7	0.663	0.052	0.0496	68.3

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.67%

Node Event	US	Peak	Level	Depth	Inflow	Node	Flood	Status
	Node	(mins)	(m)	(m)	(l/s)	Vol (m³)	(m³)	
180 minute winter	11	168	146.205	1.274	22.4	70.9720	0.0000	SURCHARGED
15 minute winter	10	10	144.693	0.060	10.4	0.0732	0.0000	OK
15 minute winter	9	11	143.795	0.082	17.1	0.1014	0.0000	OK
480 minute winter	8	464	143.788	0.557	6.0	0.7119	0.0000	SURCHARGED
480 minute winter	7	464	143.781	1.055	7.9	1.4575	0.0000	SURCHARGED
15 minute winter	23	10	146.147	0.053	8.0	0.0669	0.0000	OK
15 minute winter	22	11	145.444	0.125	28.9	0.1945	0.0000	OK
15 minute winter	21	11	144.978	0.603	33.0	0.7762	0.0000	SURCHARGED
15 minute winter	20	11	144.327	0.116	37.1	0.1453	0.0000	OK
480 minute winter	30	464	143.775	0.740	1.3	0.9757	0.0000	SURCHARGED
480 minute winter	6	464	143.775	1.607	23.3	185.3263	0.0000	SURCHARGED
480 minute winter	5	464	141.403	0.045	5.0	0.0508	0.0000	OK
480 minute winter	4	464	141.081	0.047	5.0	0.0527	0.0000	OK
480 minute winter	3	464	140.972	0.045	5.0	0.0513	0.0000	OK
480 minute winter	2	464	140.597	0.050	5.0	0.0568	0.0000	OK
480 minute winter	1	464	140.547	0.047	5.0	0.0000	0.0000	OK

Link Event	US	Link	DS	Outflow	Velocity	Flow/Cap	Link	Discharge
(Upstream Depth)	Node		Node	(l/s)	(m/s)		Vol (m³)	Vol (m³)
180 minute winter	11	Hydro-Brake®	10	3.7				
15 minute winter	10	1.001	9	10.3	1.270	0.342	0.2646	
15 minute winter	9	1.002	8	16.9	1.399	0.561	0.2319	
480 minute winter	8	1.003	7	6.0	1.201	0.200	0.3109	
480 minute winter	7	1.004	6	7.6	1.006	0.252	0.2977	
15 minute winter	23	2.000	22	7.9	0.857	0.269	0.3020	
15 minute winter	22	2.001	21	27.3	1.595	0.704	0.3350	
15 minute winter	21	2.002	20	31.2	1.826	1.759	0.2639	
15 minute winter	20	2.003	6	36.9	2.680	0.820	0.1833	
480 minute winter	30	3.000	6	1.3	0.584	0.033	0.2789	
480 minute winter	6	Hydro-Brake®	5	5.0				
480 minute winter	5	1.006	4	5.0	0.870	0.086	0.1495	
480 minute winter	4	1.007	3	5.0	0.864	0.086	0.0495	
480 minute winter	3	1.008	2	5.0	0.894	0.086	0.1369	
480 minute winter	2	1.009	1	5.0	0.674	0.055	0.0520	181.1

APPENDIX D

INFILTRATION TESTING RESULTS

Our Ref: BEK/22081/220622/ACL

22nd June 2022

BROOKHOUSE GROUP

168-170 Washway Rd

Sale

M33 6RH

BRE 365 Infiltration Test – Land at Crompton Avenue, Rochdale

BEK Enviro (BEK) has been commissioned by Brookhouse Group to provide soil infiltration rates at the above site using the BRE 365 methodology (2016) to assess the viability of disposal of surface water from the site via infiltration.

Infiltration testing was undertaken in accordance with the requirements set out in BRE 365 (2016). Two test pits were excavated at the site with infiltration testing undertaken in each pit. The test was undertaken on 15th June 2022 in dry conditions.

In accordance with BRE 365 (2016) 'the trial pit should be 0.3 to 1 m wide and 1 to 3 m long. It should have vertical sides trimmed square and, if necessary for stability, should be filled with granular material. The pit is filled with water and allowed to drain three times to near empty; each time recording the water level and time filling. The calculations for the soil infiltration rate is taken from the time taken for the water level to fall from 75% to 25% effective storage depth in the pit, using the lowest f value of the three test results for design.'

The trial pits were excavated using a tracked excavator to a maximum depth of 1.50 m with the sides trimmed square. Water was discharged into pit using an ICB water container. Photographs of the test pits and infiltration tests are included within Annex A.

The test pit dimensions are as follows:

Trial Pit No.	Length (m)	Width (m)	Depth (m)	Volume (m ³)
TP1	1.50	0.70	1.00	1.05
TP2	1.50	0.70	1.50	1.58

Table 1. Test Pit Dimensions

The ground conditions at the site were generally described as made ground to a depth of 0.6 m in Trial Pit 1 and fine to medium sand to a depth of 0.4 m in Trial Pit 2. Underlying this strata there was gravelly fine to coarse sand. It is noted that Trial Pit 1 was damp at approximately 1 m below ground level and Trial Pit 2 was damp at 2.2 m below ground level.

Water was discharged into the pit via IBCs containers and the time taken for the water to infiltration into the soil was recorded as shown within the table below:

Infiltration Test Results

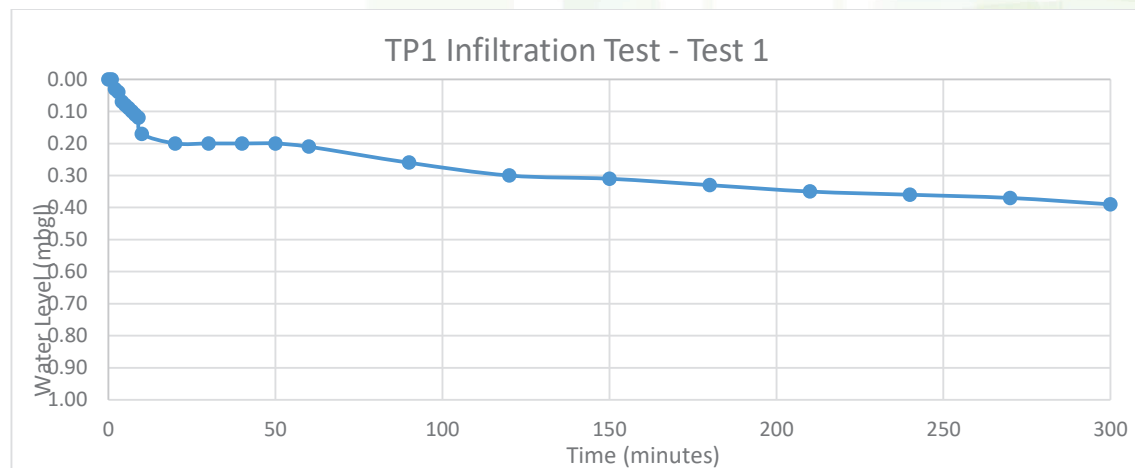
Soakaway Test 1

Depth of water below ground level at start of test: 0.00 m

A summary of the percolation test is shown within the table below:

Time (minutes)	Depth of Water (mbgl)	Notes
0	0.00	Start of Test
5	0.08	
10	0.17	
20	0.20	
30	0.20	
60	0.21	
120	0.30	
180	0.33	
240	0.36	
360	0.39	End of test

Table 2: TP1 (Test 1) Infiltration Test



It can be seen from the above table that the water level failed to reach 25% effective depth after approximately 5 hours of the test therefore the infiltration rate was unable to be determined. However an infiltration rate has been determined by extrapolating the available data. It is suggested that the relatively shallow damp ground conditions at the location of Trial Pit 1 resulted in the slow infiltration rate.

Soakaway Test 2-1

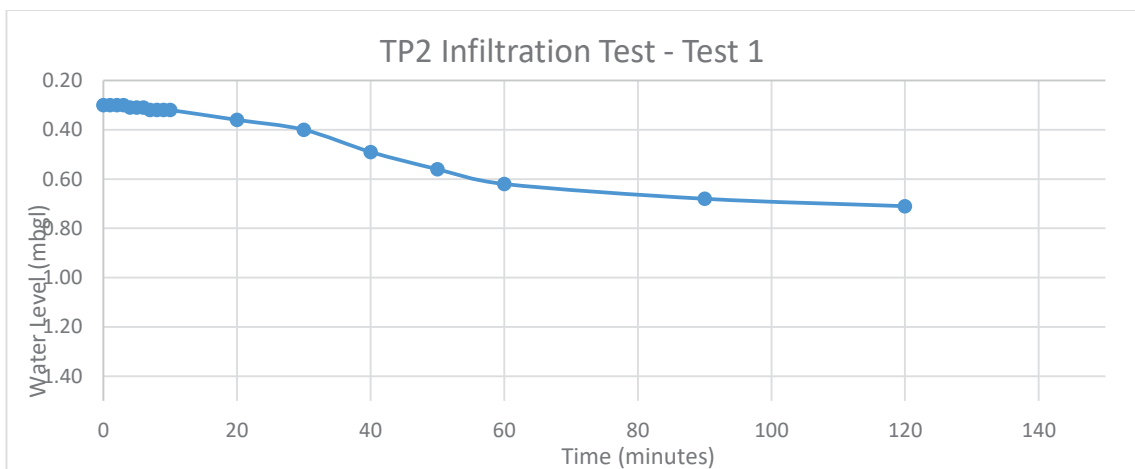
Depth of water below ground level at start of test: 0.30 m

A summary of the percolation test is shown within the table below:

Time (minutes)	Depth of Water (mbgl)	Notes
0	0.30	Start of Test
5	0.31	
10	0.32	
20	0.36	
30	0.40	
60	0.62	
120	0.71	End of test

Table 3: TP2 (Test 2) Infiltration Test

Due to time constraints on site, the test was terminated after 2 hours with the time taken for the water to reach 25% effective depth extrapolated from the available data.



Soakaway Test 2-2

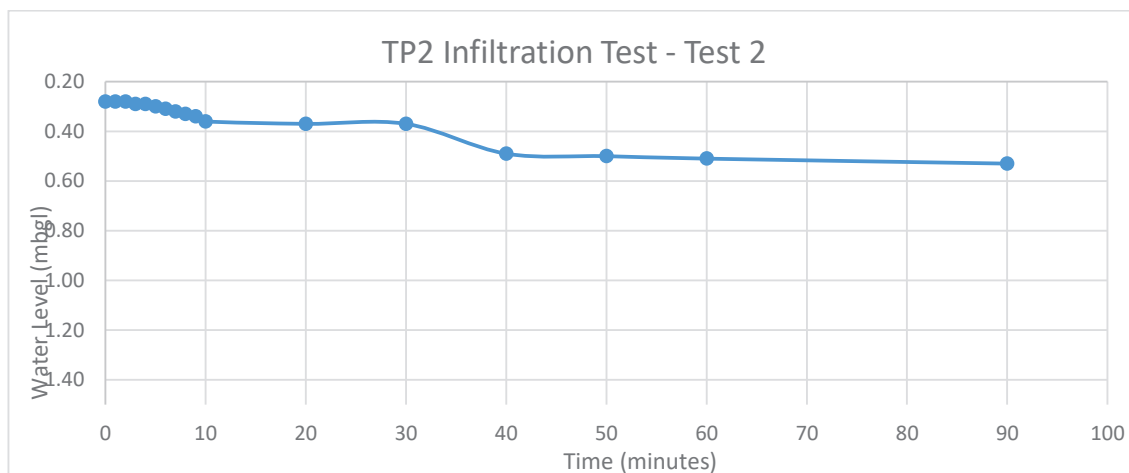
Depth of water below ground level at start of test: 0.28 m

A summary of the percolation test is shown within the table below:

Time (minutes)	Depth of Water (mbgl)	Notes
0	0.28	Start of Test
5	0.30	
10	0.36	
20	0.37	
30	0.37	
60	0.51	
90	0.53	End of test

Table 4: TP2 (Test 2) Infiltration Test

Due to time constraints on site, the test was terminated after 1.5 hours with the time taken for the water to reach 25% effective depth extrapolated from the available data.



Soakaway Test 2-3

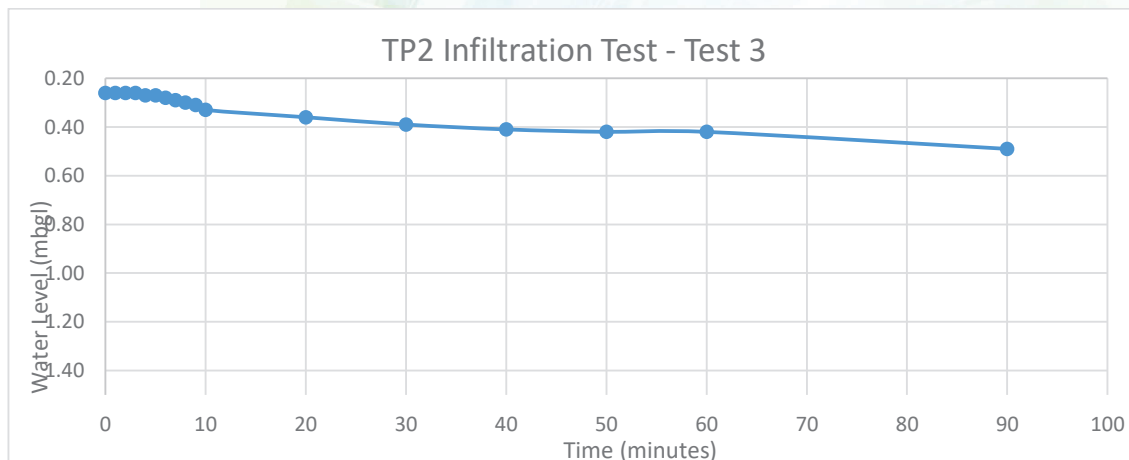
Depth of water below ground level at start of test: 0.26 m

A summary of the percolation test is shown within the table below:

Time (minutes)	Depth of Water (mbgl)	Notes
0	0.26	Start of Test
10	0.33	
20	0.36	
30	0.39	
60	0.42	
90	0.49	End of test

Table 5: TP2 (Test 3) Infiltration Test

Due to time constraints on site, the test was terminated after 1.5 hours with the time taken for the water to reach 25% effective depth extrapolated from the available data.



Trial Pit No.	Infiltration Test Number	Infiltration Rate (m/s)
TP1	1	7.68×10^{-6}
TP2	1	2.04×10^{-5}
	2	1.72×10^{-5}
	3	1.38×10^{-5}

Table 6: Extrapolated Infiltration Test Results

Conclusion

Two infiltration test pits were excavated at the Crompton Avenue, Rochdale with infiltration testing undertaken. The time taken for the water to reach 25% effective depth was calculated using extrapolated values in order to determine an infiltration rate. The results of which are shown above.

It is noted that damp ground conditions were encountered within Trial Pit 1 at a depth of 1 m and at a depth of 2.2 m below ground level in Trial Pit 2.

I trust the above is satisfactory. Should you require anything further please do not hesitate to contact the undersigned.

Yours sincerely



Michael Buckley
BSc (Hons) MSc MEnvSci

ANNEX A
Photographs



P1: TP1



P2: TP2

Comments:



Photographs 1 to 2

This appendix is for illustrative purposes only and is for use only in conjunction with associated reports relating to the project details adjacent. BEK accepts no liability for the misinterpretation or use of this illustration by any other parties.	Site: Crompton Avenue, Rochdale	Project No: 22081	Created By: DE	Date: 22/06/22
	Title: Appendix A - Photographs	Client: Brookhouse Group		

ANNEX B
Infiltration Test Results

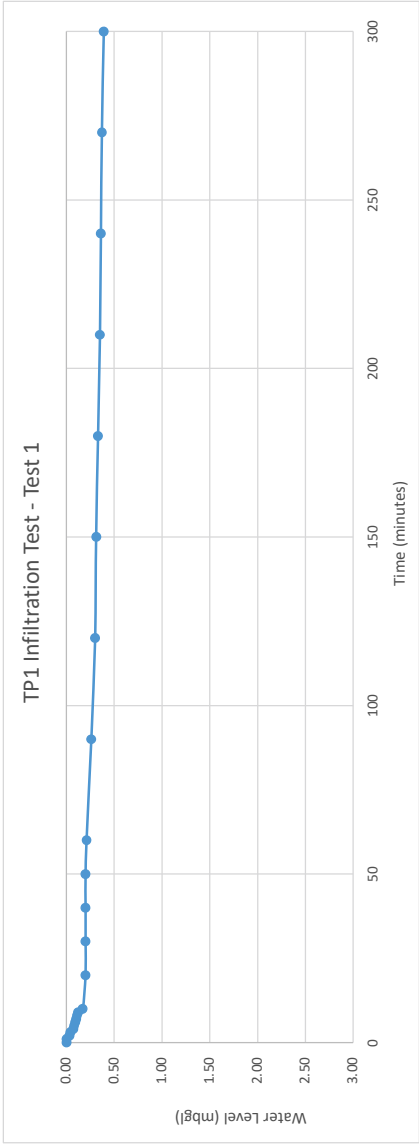
Crompton Avenue - Infiltration TP1 - Test 1

Date: 15/06/2022
Weather: Dry, Sunny

Time (minutes)	Depth (mbgl)
0	0.00
1	0.00
2	0.03
3	0.04
4	0.07
5	0.08
6	0.09
7	0.10
8	0.11
9	0.12
10	0.17
20	0.20
30	0.20
40	0.20
50	0.20
60	0.21
90	0.26
120	0.30
150	0.31
180	0.33
210	0.35
240	0.36
270	0.37
300	0.39

Pit Dimensions:	Length (m)	Width (m)	Depth (m)	Area (m ³)
	1.50	0.70	1.00	1.05

Start water level (mbgl) = 0.00
Total Depth of test = 1.00
50% Effective Depth = 0.5
75% Effective Depth (mbgl) = 0.25
25% Effective Depth (mbgl) = 0.75



Soil Infiltration Rate (f) =

$$\frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

$$= \frac{0.53 \text{ m}^3}{3.25 \text{ m}^2 \times 21028 \text{ seconds}}$$

$$= 0.00000768 \text{ m/s}$$

$$= 0.028 \text{ m/hour}$$

effective storage volume of water in the trial pit between 75% and 25% effective depth

$$= 0.53 \text{ m}^3$$

internal surface area of the trial pit up to 50% effective depth and including base area

$$= 3.25 \text{ m}^2$$

time for water to fall from 75% to 25% effective depth

$$= 21028 \text{ seconds}$$

$$= 350.47 \text{ mins}$$

Soil Infiltration Rate (f) =

$$= \frac{7.68\text{E-}06}{0.00000768 \text{ m/s}}$$

$$= 0.028 \text{ m/hour}$$



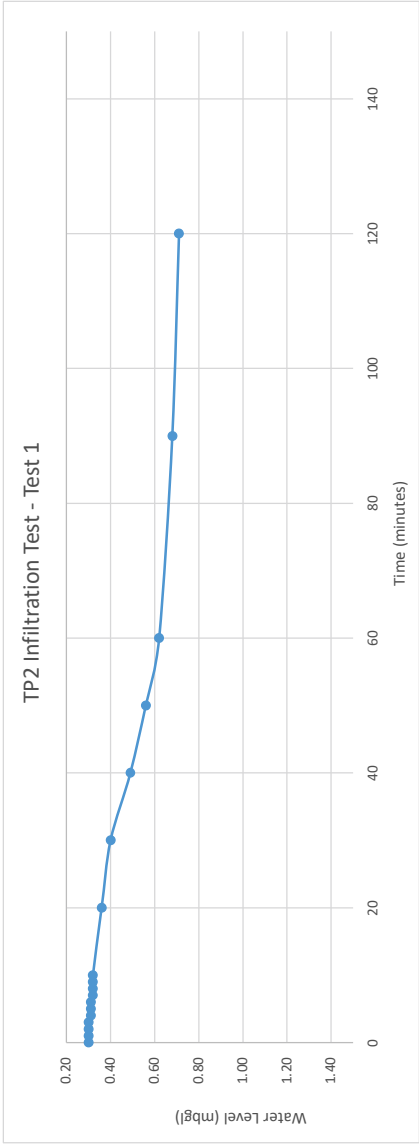
Crompton Avenue - Infiltration TP2 - Test 1

Date: 15/06/2022
Weather: Hot, Sunny

Time (minutes)	Depth (mbgl)
0	0.30
1	0.30
2	0.30
3	0.30
4	0.31
5	0.31
6	0.31
7	0.32
8	0.32
9	0.32
10	0.32
20	0.36
30	0.40
40	0.49
50	0.56
60	0.62
90	0.68
120	0.71
150	
180	
210	

Pit Dimensions:	Length (m)	Width (m)	Depth (m)	Area (m ³)
	1.50	0.70	1.50	1.58

Start water level (mbgl) = 0.30
Total Depth of test = 1.20
50% Effective Depth = 0.6
75% Effective Depth (mbgl) = 0.60
25% Effective Depth (mbgl) = 1.20



Soil Infiltration Rate (f) = $\frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$

V_{p75-25} = effective storage volume of water in the trial pit between 75% and 25% effective depth = 0.63 m³

a_{p50} = internal surface area of the trial pit up to 50% effective depth and including base area = 3.69 m²

t_{p75-25} = time for water to fall from 75% to 25% effective depth = 139.56 mins = 8373 seconds

Soil Infiltration Rate (f) = $\frac{2.04E-05 \text{ m/s}}{0.00002039 \text{ m/s}} = 0.073 \text{ m/hour}$



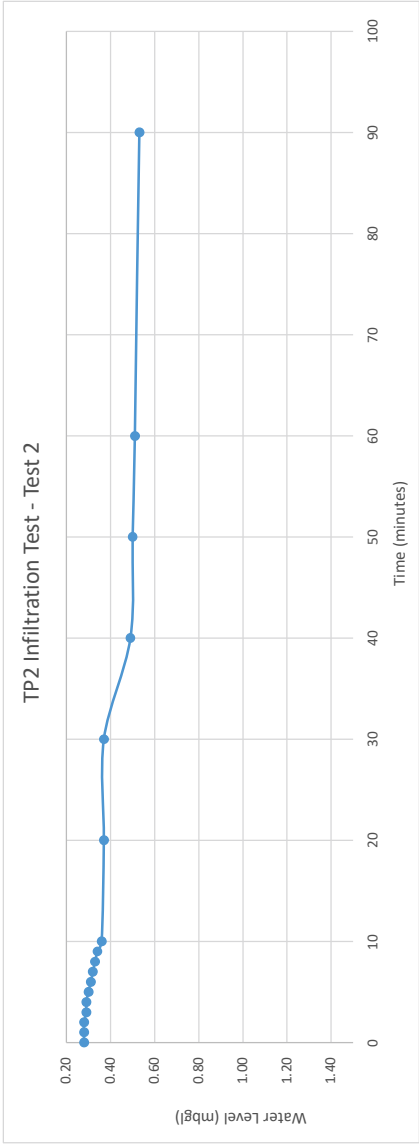
Crompton Avenue - Infiltration TP2 - Test 2

Date: 15/06/2022
Weather: Hot, Sunny

Time (minutes)	Depth (mbgl)
0	0.28
1	0.28
2	0.28
3	0.29
4	0.29
5	0.30
6	0.31
7	0.32
8	0.33
9	0.34
10	0.36
20	0.37
30	0.37
40	0.49
50	0.50
60	0.51
90	0.53
120	
150	
180	
210	

Pit Dimensions:	Length (m)	Width (m)	Depth (m)	Area (m ³)
	1.50	0.70	1.50	1.58

Start water level (mbgl) = 0.28
Total Depth of test = 1.22
50% Effective Depth = 0.61
75% Effective Depth (mbgl) = 0.59
25% Effective Depth (mbgl) = 1.20



Soil Infiltration Rate (f) =	$\frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$	
V_{p75-25}	=	effective storage volume of water in the trial pit between 75% and 25% effective depth
	=	0.64 m ³
a_{p50}	=	internal surface area of the trial pit up to 50% effective depth and including base area
	=	3.734 m ²
t_{p75-25}	=	time for water to fall from 75% to 25% effective depth
	=	166.29 mins
	=	9977 seconds
Soil Infiltration Rate (f) =	=	1.72E-05 m/s
	=	0.00001719 m/s
	=	0.062 m/hour



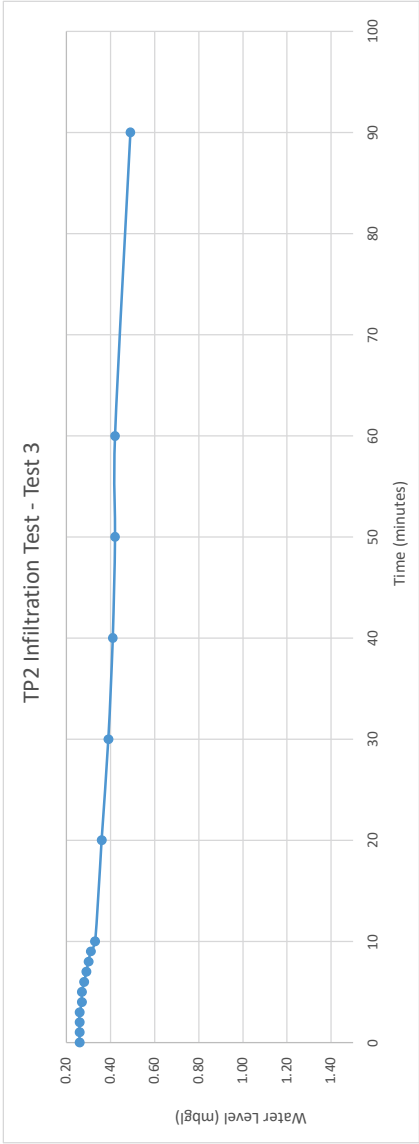
Crompton Avenue - Infiltration TP2 - Test 3

Date: 15/06/2022
Weather: Hot, Sunny

Time (minutes)	Depth (mbgl)
0	0.26
1	0.26
2	0.26
3	0.26
4	0.27
5	0.27
6	0.28
7	0.29
8	0.30
9	0.31
10	0.33
20	0.36
30	0.39
40	0.41
50	0.42
60	0.42
90	0.49
120	
150	
180	
210	

Pit Dimensions:	Length (m)	Width (m)	Depth (m)	Area (m ³)
	1.50	0.70	1.50	1.58

Start water level (mbgl) = 0.26
Total Depth of test = 1.24
50% Effective Depth = 0.62
75% Effective Depth (mbgl) = 0.57
25% Effective Depth (mbgl) = 1.19



Soil Infiltration Rate (f) =

$$V_{p75-25} = \text{effective storage volume of water in the trial pit between 75% and 25% effective depth}$$

$$a_{p50} \times t_{p75-25}$$

$$0.65 \text{ m}^3$$

$$a_{p50} = \text{internal surface area of the trial pit up to 50% effective depth and including base area}$$

$$3.778 \text{ m}^2$$

$$t_{p75-25} = \text{time for water to fall from 75% to 25% effective depth}$$

$$208.61 \text{ mins}$$

$$12517 \text{ seconds}$$

Soil Infiltration Rate (f) =

$$\frac{1.38\text{E-}05 \text{ m/s}}{0.00001377 \text{ m/s}}$$

$$0.00001377 \text{ m/s}$$

$$0.050 \text{ m/hour}$$

