SHIELDS WILSON
e: info@shieldswilson.co.uk t: 01775 729252
STRUCTURAL AND CIVIL ENGINEERING

SURFACE WATER DRIANAGE CALCULATIONS

UPON

LAND OFF

CHURCH STREET, BICKER ROAD DONNINGTON

LINCOLNSHIRE

PROJECT No: SW 21-133

DOCUMENT REF: SW 21-133-REP-01



BURMOR CONSTRUCTION

burmor construction

CONTENTS

1. INTRODUCTION 2
2. LOCATION & DESCRIPTION OF SITE 3
2.1. Site Description 3
2.2. Geological Description 3
3. PERCOLATION TESTS 4
4. INFILTRATION TEST RESULTS 4
5. SURFACE WATER DRAINAGE 5
APPENDIX A 6
APPENDIX B 8
APPENDIX C 17
APPENDIX D 20

© Shields Wilson Limited.

1. INTRODUCTION

Acting upon the instruction of Burmor Construction, we attended site on 08th April 2021, the purpose being to observe the underlying ground conditions and determine the percolation characteristics and infiltration rates of the soil strata.

Percolation tests were undertaken in accordance with the method described within BRE digest 365 (2007 edition)

The opinions and comments expressed within this report are based upon ground conditions encountered in the trial pits excavated at the time of our visit and records contained within the Geomatters ground investigation report.

This report has been prepared for the named client above and should not be relied upon by any other parties, with the exception of the client's professional advisors, for any use without the express written permission of Shields Wilson Limited.

© Shields Wilson Limited.

2. LOCATION & DESCRIPTION OF SITE

2.1. Site Description

The site currently stands as a commercial vehicle retailer.

The North of the site will be bound by the A52.

The Eastern Boundary is boarded by dense hedge with a residential property.

The West of the site is boarded by Church Street.

The Southern boundary is formed with a line of fences to residential properties.

At the time of our visit the weather was dry and clear.

2.2. Geological Description

The Geomatters ground investigation report indicates the site to be underlain with a mixture of Sands and silts of a granular nature, which should be suitable for infiltration drainage techniques.

The ground water is generally recorded at 2.0m below ground level on the site.

Our own site investigations confirmed results within the Geomatters report with no groundwater encountered during any excavation, hand auger boreholes were extended to beyond 2m below ground level, and the site being consistently underlain with silty sand.

© Shields Wilson Limited.

3. PERCOLATION TESTS

Two No. percolation tests were undertaken in accordance with the test methodology within BRE digest 365 (2007 edition).

The ground conditions are proven to be consistent across the site by the original ground investigation report and as such two test holes one either side of the site was deemed an appropriate test sample.

SA01 was Undertaken in the middle of the site and SA02 was undertaken to the West of the site. Both locations being in areas which are intended for use for infiltration.

Logs of the test and subsequent result calculations are contained within Appendix B, Appendix C contains a photographic record.

4. INFILTRATION TEST RESULTS

Results are summarised and tabulated below

Test Pit	Test 1	Test 2
Eastern Pit	1.06×10^{-5}	1.12×10^{-5}
Western Pit	1.41×10^{-5}	2.44×10^{-5}

The results are average for infiltration in the South Holland area and demonstrate that the underlying geology on the site is suitable for an infiltration system.

The lowest result rate should be utilised for design purposes.

© Shields Wilson Limited.

5. SURFACE WATER DRAINAGE

The proposed development involves the construction of a retail unit, associated car parking, access road and service yard.

The proposed car parking will be surfaced with permeable block paving and not require an active run-off water collection and drainage system.

The retail unit roof, access road and service yard will utilise shallow sub-surface soakaways to discharge the run-off water.

The proposed soakaways have been designed for a 1 in 100 year storm plus 30% climate change plus 10% creep utilising a factor of safety of 2.

The soakaways have been designed using causeway Flow drainage modelling software.

The calculation model outputs are contained within Appendix D.

The modelling results demonstrate a small amount of flooding during the worst case event, 1 in 100 year climate change and creep.

This surface flooding occurs from the soakaways which are contained within the car parking area, this area is underlain with a minimum of 300mm of Type 3 voided stone.

The total flooding is 10.16 m^3, the space available in the central zone of the car park is 300m^2 x 0.3m deep x 30% voids = 27m^3 > 10m^3 modelled flooding therefore even during the worst case event no water will appear at the surface.

The system is illustrated on our drawings SW21-133 100 thru 102.

The drawings and contents of this report demonstrate that a viable infiltration surface water system is suitable for the proposed development.

For and on behalf of **SHIELDS WILSON LIMITED**

A.P.Wilson CEng MIStructE **30th April 2021**.

© Shields Wilson Limited.

APPENDIX A

© Shields Wilson Limited.



© Shields Wilson Limited.

APPENDIX B

© Shields Wilson Limited.

SA01	
TIME (Mins)	DEPTH mm (d)
0	650
10	630
25	600
40	580
55	570
85	540
115	510
145	480
175	450
205	420

Trial Dimensions

A =	1.2	m
B =	0.6	m
C =	1.2	m
C.S.Area of SA01 =	0.72	m^2
Total Volume =	0.166	m^3
75% Volume =	0.124	m^3
25%Volume =	0.041	m^3

Time Taken From 75% Volume to 25% Volume

115 Mins

Effective Depth From 75% Volume to 25% Volume

0.115 m

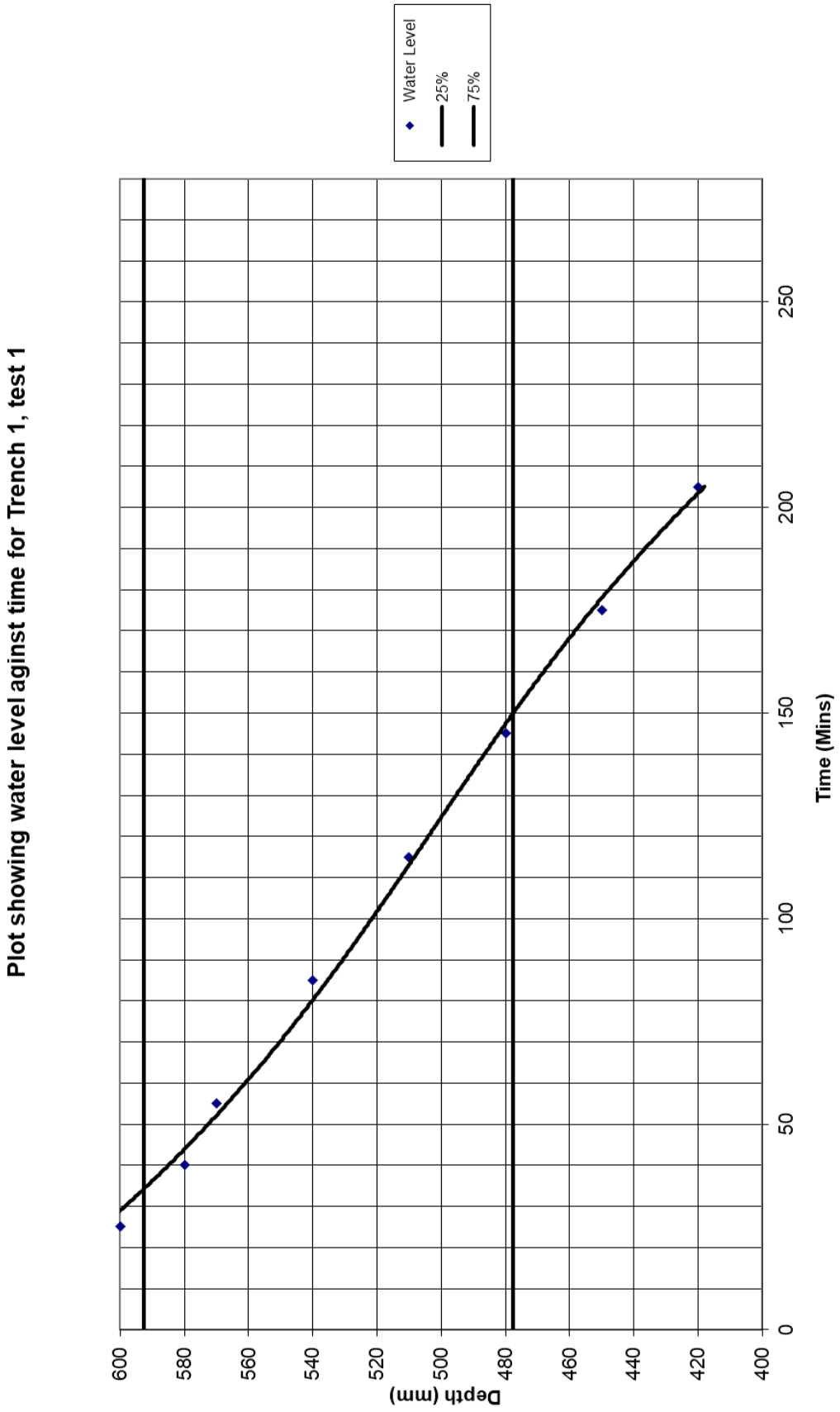
50% Effective Internal Surface Area Including Base area

1.134 m^2

Soil Infiltration rate, f

1.058E-05 m/s

© Shields Wilson Limited.



© Shields Wilson Limited.

SA01	
TIME (Mins)	DEPTH mm (d)
0	810
10	790
25	760
40	740
55	720
85	680
105	640
135	600
155	550
180	540

Trial Dimensions

A =	1.2	m
B =	0.6	m
C =	1.2	m
C.S.Area of SA01 =	0.72	m^2
Total Volume =	0.194	m^3
75% Volume =	0.146	m^3
25%Volume =	0.049	m^3

Time Taken From 75% Volume to 25% Volume

95 Mins

Effective Depth From 75% Volume to 25% Volume

0.135 m

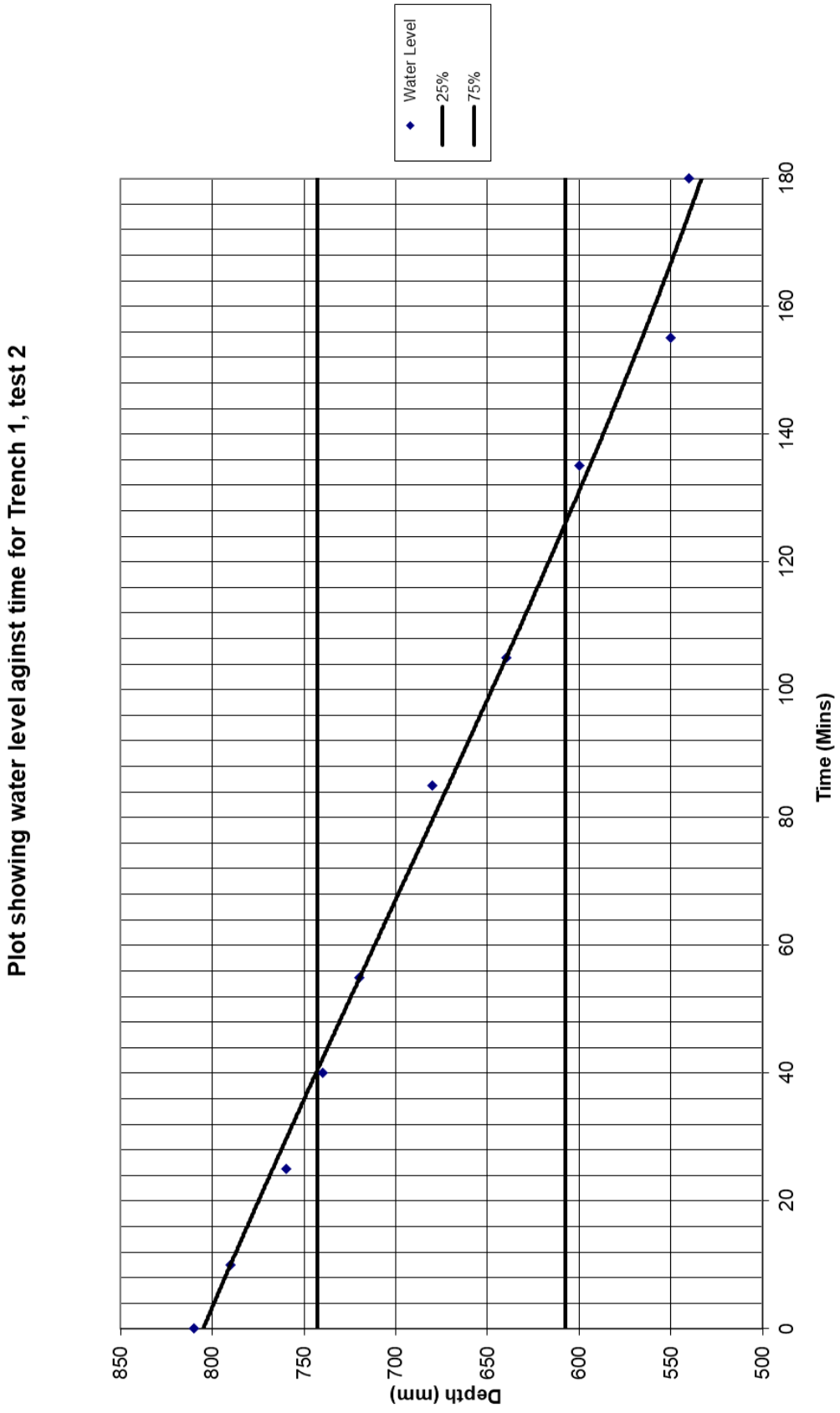
50% Effective Internal Surface Area Including Base area

1.206 m^2

Soil Infiltration rate, f

1.41E-05 m/s

© Shields Wilson Limited.



© Shields Wilson Limited.

SA02	
TIME (Mins)	DEPTH mm (d)
0	590
10	560
20	530
30	510
45	490
60	470
90	450
120	420
150	390
180	350

Trial Dimensions

A =	1.25	m
B =	0.6	m
C =	1.25	m
C.S.Area of SA01 =	0.75	m^2
Total Volume =	0.180	m^3
75% Volume =	0.135	m^3
25%Volume =	0.045	m^3

Time Taken From 75% Volume to 25% Volume

112 Mins

Effective Depth From 75% Volume to 25% Volume

0.12 m

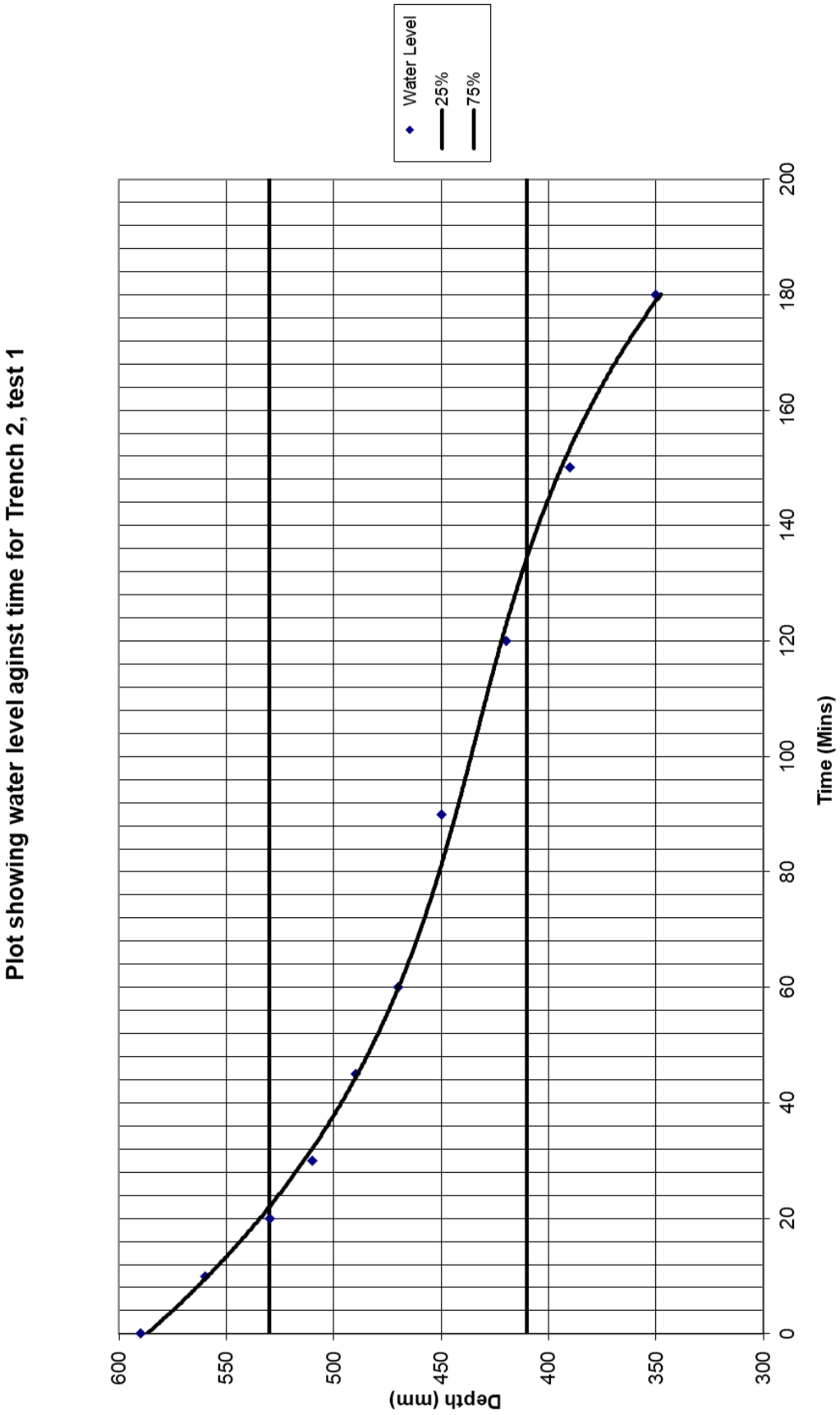
50% Effective Internal Surface Area Including Base area

1.194 m^2

Soil Infiltration rate, f

1.122E-05 m/s

© Shields Wilson Limited.



© Shields Wilson Limited.

SA02	
TIME (Mins)	DEPTH mm (d)
0	780
10	720
20	660
30	620
45	580
60	540
90	510
120	480
150	450
180	420

Trial Dimensions

A =	1.25	m
B =	0.6	m
C =	1.25	m
C.S.Area of SA01 =	0.75	m^2
Total Volume =	0.270	m^3
75% Volume =	0.203	m^3
25%Volume =	0.068	m^3

Time Taken From 75% Volume to 25% Volume

65 Mins

Effective Depth From 75% Volume to 25% Volume

0.18 m

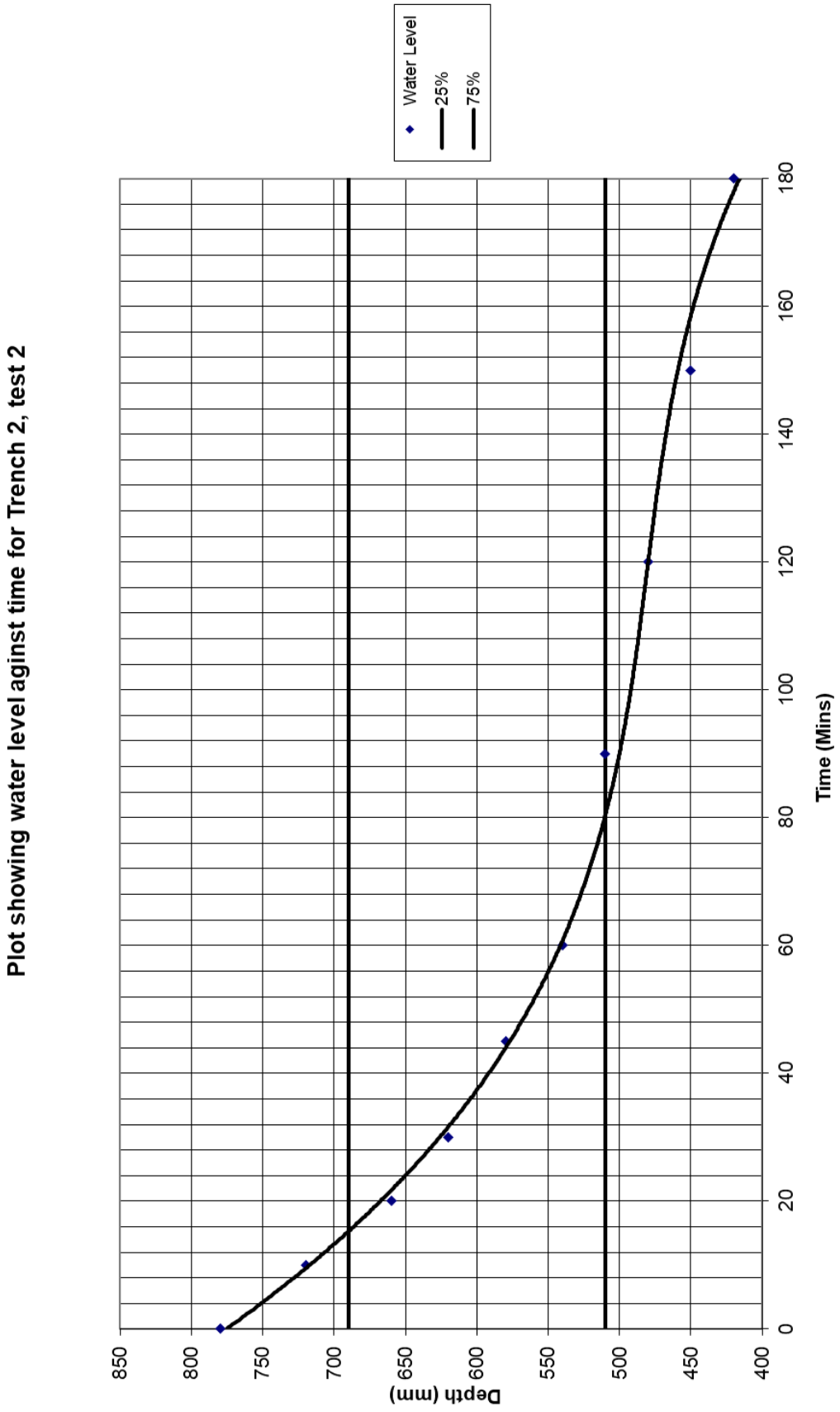
50% Effective Internal Surface Area Including Base area

1.416 m^2

Soil Infiltration rate, f

2.44E-05 m/s

© Shields Wilson Limited.



© Shields Wilson Limited.

APPENDIX C

© Shields Wilson Limited.





© Shields Wilson Limited.





© Shields Wilson Limited.

APPENDIX D

© Shields Wilson Limited.

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	10	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	0.500
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
RE01	0.013	4.00	4.270	600	0.650
S01	0.006	4.00	4.270	600	0.723
S02	0.000	4.00	4.150	600	0.762
S03	0.000	4.00	4.150	600	0.829
SA1	0.000	4.00	3.950	1	0.669
RE02	0.007	4.00	4.270	150	0.650
S04	0.007	4.00	4.270	600	0.727
S05	0.003	4.00	4.300	600	0.892
S06	0.017	4.00	4.250	600	0.895
SA2	0.000	4.00	4.150	1	0.809
CH01	0.025	4.00	4.355	1	0.500
SA3	0.000	4.00	4.300	1	0.500
CH02	0.023	4.00	3.950	1	0.650
CH02a	0.023	4.00	3.950	1	0.650
S07	0.000	4.00	4.050	600	0.785
SA4	0.000	4.00	4.100	1	0.852

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	RE01	S01	11.000	0.600	3.620	3.547	0.073	150.0	150	4.22	50.0
1.001	S01	S02	23.920	0.600	3.547	3.388	0.159	150.0	150	4.71	50.0
1.002	S02	S03	10.000	0.600	3.388	3.321	0.067	150.0	150	4.92	50.0
1.003	S03	SA1	6.000	0.600	3.321	3.281	0.040	150.0	150	5.04	50.0
2.000	RE02	S04	11.500	0.600	3.620	3.543	0.077	150.0	150	4.23	50.0
2.001	S04	S05	20.250	0.600	3.543	3.408	0.135	150.0	150	4.65	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	0.818	14.5	1.9	0.500	0.573	0.013	0.0	37	0.571
1.001	0.818	14.5	2.8	0.573	0.612	0.019	0.0	45	0.635
1.002	0.818	14.5	2.8	0.612	0.679	0.019	0.0	45	0.635
1.003	0.818	14.5	2.8	0.679	0.519	0.019	0.0	45	0.635
2.000	0.818	14.5	1.0	0.500	0.577	0.007	0.0	27	0.474
2.001	0.818	14.5	2.1	0.577	0.742	0.014	0.0	38	0.582

Flow+ v10.0 Copyright © 1988-2021 Causeway Software Solutions Limited

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
2.002	S05	S06	7.900	0.600	3.408	3.355	0.053	150.0	150	4.81	50.0
2.003	S06	SA2	2.150	0.600	3.355	3.341	0.014	150.0	150	4.85	50.0
5.000	CH01	SA3	3.000	0.600	3.855	3.800	0.055	54.5	150	4.04	50.0
3.000	CH02	S07	5.200	0.600	3.300	3.265	0.035	150.0	150	4.11	50.0
4.000	CH02a	S07	5.200	0.600	3.300	3.265	0.035	150.0	150	4.11	50.0
3.001	S07	SA4	2.500	0.600	3.265	3.248	0.017	150.0	150	4.16	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
2.002	0.818	14.5	2.5	0.742	0.745	0.017	0.0	42	0.616
2.003	0.818	14.5	5.1	0.745	0.659	0.034	0.0	61	0.746
5.000	1.365	24.1	3.7	0.350	0.350	0.025	0.0	40	0.989
3.000	0.818	14.5	3.4	0.500	0.635	0.023	0.0	50	0.670
4.000	0.818	14.5	3.4	0.500	0.635	0.023	0.0	50	0.670
3.001	0.818	14.5	6.9	0.635	0.702	0.046	0.0	73	0.808

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	11.000	150.0	150	Circular	4.270	3.620	0.500	4.270	3.547	0.573
1.001	23.920	150.0	150	Circular	4.270	3.547	0.573	4.150	3.388	0.612
1.002	10.000	150.0	150	Circular	4.150	3.388	0.612	4.150	3.321	0.679
1.003	6.000	150.0	150	Circular	4.150	3.321	0.679	3.950	3.281	0.519
2.000	11.500	150.0	150	Circular	4.270	3.620	0.500	4.270	3.543	0.577
2.001	20.250	150.0	150	Circular	4.270	3.543	0.577	4.300	3.408	0.742
2.002	7.900	150.0	150	Circular	4.300	3.408	0.742	4.250	3.355	0.745
2.003	2.150	150.0	150	Circular	4.250	3.355	0.745	4.150	3.341	0.659
5.000	3.000	54.5	150	Circular	4.355	3.855	0.350	4.300	3.800	0.350

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	RE01	600	Manhole	Adoptable	S01	600	Manhole	Adoptable
1.001	S01	600	Manhole	Adoptable	S02	600	Manhole	Adoptable
1.002	S02	600	Manhole	Adoptable	S03	600	Manhole	Adoptable
1.003	S03	600	Manhole	Adoptable	SA1	1	Manhole	Adoptable
2.000	RE02	150	Manhole	Adoptable	S04	600	Manhole	Adoptable
2.001	S04	600	Manhole	Adoptable	S05	600	Manhole	Adoptable
2.002	S05	600	Manhole	Adoptable	S06	600	Manhole	Adoptable
2.003	S06	600	Manhole	Adoptable	SA2	1	Manhole	Adoptable
5.000	CH01	1	Manhole	Adoptable	SA3	1	Manhole	Adoptable

Flow+ v10.0 Copyright © 1988-2021 Causeway Software Solutions Limited

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
3.000	5.200	150.0	150	Circular	3.950	3.300	0.500	4.050	3.265	0.635
4.000	5.200	150.0	150	Circular	3.950	3.300	0.500	4.050	3.265	0.635
3.001	2.500	150.0	150	Circular	4.050	3.265	0.635	4.100	3.248	0.702

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
3.000	CH02	1	Manhole	Adoptable	S07	600	Manhole	Adoptable
4.000	CH02a	1	Manhole	Adoptable	S07	600	Manhole	Adoptable
3.001	S07	600	Manhole	Adoptable	SA4	1	Manhole	Adoptable

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
RE01	4.270	0.650	600	0	1.000	3.620	150
S01	4.270	0.723	600	1	1.000	3.547	150
				0	1.001	3.547	150
S02	4.150	0.762	600	1	1.001	3.388	150
				0	1.002	3.388	150
S03	4.150	0.829	600	1	1.002	3.321	150
				0	1.003	3.321	150
SA1	3.950	0.669	1	1	1.003	3.281	150
RE02	4.270	0.650	150	0	2.000	3.620	150
S04	4.270	0.727	600	1	2.000	3.543	150
				0	2.001	3.543	150
S05	4.300	0.892	600	1	2.001	3.408	150
				0	2.002	3.408	150
S06	4.250	0.895	600	1	2.002	3.355	150
				0	2.003	3.355	150

Flow+ v10.0 Copyright © 1988-2021 Causeway Software Solutions Limited

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SA2	4.150	0.809	1	1	2.003	3.341	150
CH01	4.355	0.500	1	0	5.000	3.855	150
SA3	4.300	0.500	1	1	5.000	3.800	150
CH02	3.950	0.650	1	0	3.000	3.300	150
CH02a	3.950	0.650	1	0	4.000	3.300	150
S07	4.050	0.785	600	1	4.000	3.265	150
				2	3.000	3.265	150
				0	3.001	3.265	150
SA4	4.100	0.852	1	1	3.001	3.248	150

Simulation Settings

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

Storm Durations

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

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	10	0
30	0	0	0
100	30	10	0

Node SA1 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.03816	Invert Level (m)	3.281	Depth (m)	0.400
Side Inf Coefficient (m/hr)	0.03816	Time to half empty (mins)	465	Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	3.000	Number Required	1
Porosity	0.95	Pit Length (m)	6.000		

Flow+ v10.0 Copyright © 1988-2021 Causeway Software Solutions Limited

Node SA2 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.03816	Invert Level (m)	3.341	Depth (m)	0.400
Side Inf Coefficient (m/hr)	0.03816	Time to half empty (mins)	553	Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	5.000	Number Required	1
Porosity	1.00	Pit Length (m)	7.000		

Node SA3 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.03816	Invert Level (m)	3.800	Depth (m)	0.400
Side Inf Coefficient (m/hr)	0.03816	Time to half empty (mins)	293	Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	6.000	Number Required	1
Porosity	1.00	Pit Length (m)	5.000		

Node SA4 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.03816	Invert Level (m)	3.248	Depth (m)	0.400
Side Inf Coefficient (m/hr)	0.03816	Time to half empty (mins)	568	Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	6.000	Number Required	1
Porosity	1.00	Pit Length (m)	10.000		

Other (defaults)

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

Approval Settings

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

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year +10% A 15 minute summer	141.566	40.058
2 year +10% A 15 minute winter	99.345	40.058
2 year +10% A 30 minute summer	91.753	25.963
2 year +10% A 30 minute winter	64.388	25.963
2 year +10% A 60 minute summer	61.301	16.200
2 year +10% A 60 minute winter	40.727	16.200
2 year +10% A 120 minute summer	37.449	9.897

Flow+ v10.0 Copyright © 1988-2021 Causeway Software Solutions Limited

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year +10% A 120 minute winter	24.880	9.897
2 year +10% A 180 minute summer	28.672	7.378
2 year +10% A 180 minute winter	18.637	7.378
2 year +10% A 240 minute summer	22.636	5.982
2 year +10% A 240 minute winter	15.039	5.982
2 year +10% A 360 minute summer	17.235	4.435
2 year +10% A 360 minute winter	11.203	4.435
2 year +10% A 480 minute summer	13.550	3.581
2 year +10% A 480 minute winter	9.003	3.581
2 year +10% A 600 minute summer	11.088	3.033
2 year +10% A 600 minute winter	7.576	3.033
2 year +10% A 720 minute summer	9.878	2.647
2 year +10% A 720 minute winter	6.639	2.647
2 year +10% A 960 minute summer	8.113	2.136
2 year +10% A 960 minute winter	5.374	2.136
2 year +10% A 1440 minute summer	5.891	1.579
2 year +10% A 1440 minute winter	3.959	1.579
30 year 15 minute summer	268.706	76.035
30 year 15 minute winter	188.566	76.035
30 year 30 minute summer	174.929	49.499
30 year 30 minute winter	122.757	49.499
30 year 60 minute summer	116.589	30.811
30 year 60 minute winter	77.459	30.811
30 year 120 minute summer	70.438	18.615
30 year 120 minute winter	46.797	18.615
30 year 180 minute summer	53.298	13.715
30 year 180 minute winter	34.645	13.715
30 year 240 minute summer	41.604	10.995
30 year 240 minute winter	27.641	10.995
30 year 360 minute summer	31.221	8.034
30 year 360 minute winter	20.295	8.034
30 year 480 minute summer	24.324	6.428
30 year 480 minute winter	16.160	6.428
30 year 600 minute summer	19.756	5.404
30 year 600 minute winter	13.498	5.404
30 year 720 minute summer	17.490	4.687
30 year 720 minute winter	11.754	4.687
30 year 960 minute summer	14.215	3.743
30 year 960 minute winter	9.416	3.743
30 year 1440 minute summer	10.161	2.723
30 year 1440 minute winter	6.829	2.723
100 year +30% CC +10% A 15 minute summer	453.359	128.285
100 year +30% CC +10% A 15 minute winter	318.147	128.285
100 year +30% CC +10% A 30 minute summer	297.655	84.226
100 year +30% CC +10% A 30 minute winter	208.881	84.226
100 year +30% CC +10% A 60 minute summer	199.275	52.662
100 year +30% CC +10% A 60 minute winter	132.393	52.662
100 year +30% CC +10% A 120 minute summer	120.330	31.800
100 year +30% CC +10% A 120 minute winter	79.945	31.800
100 year +30% CC +10% A 180 minute summer	90.748	23.353
100 year +30% CC +10% A 180 minute winter	58.989	23.353
100 year +30% CC +10% A 240 minute summer	70.550	18.644

Flow+ v10.0 Copyright © 1988-2021 Causeway Software Solutions Limited

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +30% CC +10% A 240 minute winter	46.872	18.644
100 year +30% CC +10% A 360 minute summer	52.629	13.543
100 year +30% CC +10% A 360 minute winter	34.210	13.543
100 year +30% CC +10% A 480 minute summer	40.838	10.792
100 year +30% CC +10% A 480 minute winter	27.132	10.792
100 year +30% CC +10% A 600 minute summer	33.061	9.043
100 year +30% CC +10% A 600 minute winter	22.589	9.043
100 year +30% CC +10% A 720 minute summer	29.188	7.823
100 year +30% CC +10% A 720 minute winter	19.616	7.823
100 year +30% CC +10% A 960 minute summer	23.616	6.219
100 year +30% CC +10% A 960 minute winter	15.643	6.219
100 year +30% CC +10% A 1440 minute summer	16.765	4.493
100 year +30% CC +10% A 1440 minute winter	11.267	4.493

Flow+ v10.0 Copyright © 1988-2021 Causeway Software Solutions Limited

Results for 2 year +10% A Critical Storm Duration. Lowest mass balance: 98.02%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	RE01	10	3.665	0.045	2.8	0.0328	0.0000	OK
15 minute summer	S01	10	3.603	0.056	4.1	0.0259	0.0000	OK
15 minute winter	S02	10	3.444	0.056	4.1	0.0159	0.0000	OK
360 minute winter	S03	272	3.440	0.119	0.6	0.0336	0.0000	OK
360 minute winter	SA1	272	3.440	0.159	0.5	2.7139	0.0000	OK
15 minute winter	RE02	10	3.652	0.032	1.5	0.0083	0.0000	OK
15 minute winter	S04	10	3.590	0.047	3.0	0.0231	0.0000	OK
240 minute winter	S05	200	3.486	0.078	0.7	0.0279	0.0000	OK
240 minute winter	S06	200	3.486	0.131	1.4	0.0920	0.0000	OK
240 minute winter	SA2	200	3.486	0.145	1.3	5.0836	0.0000	OK
240 minute winter	CH01	224	3.926	0.071	1.0	0.0784	0.0000	OK
240 minute winter	SA3	224	3.926	0.126	2.6	3.7888	0.0000	OK
15 minute winter	CH02	7	3.408	0.108	4.9	0.0839	0.0000	OK
15 minute winter	CH02a	7	3.408	0.108	4.9	0.0839	0.0000	OK
15 minute winter	S07	7	3.402	0.137	10.3	0.0389	0.0000	OK
240 minute winter	SA4	220	3.362	0.114	1.8	6.8599	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute winter	RE01	1.000	S01	2.8	0.539	0.194	0.0573
15 minute summer	S01	1.001	S02	4.1	0.686	0.283	0.1427
15 minute winter	S02	1.002	S03	4.0	0.662	0.277	0.0604
360 minute winter	S03	1.003	SA1	0.5	0.405	0.038	0.0977
360 minute winter	SA1	Infiltration		0.1			
15 minute winter	RE02	2.000	S04	1.5	0.404	0.104	0.0430
15 minute winter	S04	2.001	S05	3.0	0.604	0.206	0.1000
240 minute winter	S05	2.002	S06	0.7	0.280	0.048	0.1012
240 minute winter	S06	2.003	SA2	1.3	0.463	0.093	0.0363
240 minute winter	SA2	Infiltration		0.2			
240 minute winter	CH01	5.000	SA3	2.6	0.637	0.110	0.0361
240 minute winter	SA3	Infiltration		0.2			
15 minute winter	CH02	3.000	S07	5.1	0.507	0.355	0.0792
15 minute winter	CH02a	4.000	S07	5.1	0.507	0.355	0.0792
15 minute winter	S07	3.001	SA4	10.8	1.513	0.746	0.0214
240 minute winter	SA4	Infiltration		0.3			

Flow+ v10.0 Copyright © 1988-2021 Causeway Software Solutions Limited

Results for 30 year Critical Storm Duration. Lowest mass balance: 98.02%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	RE01	10	3.682	0.062	4.8	0.0420	0.0000	OK
15 minute summer	S01	10	3.623	0.076	7.0	0.0339	0.0000	OK
360 minute winter	S02	328	3.569	0.181	0.9	0.0513	0.0000	SURCHARGED
360 minute winter	S03	328	3.569	0.248	0.9	0.0702	0.0000	SURCHARGED
360 minute winter	SA1	328	3.569	0.288	0.8	4.9272	0.0000	OK
15 minute winter	RE02	10	3.663	0.043	2.6	0.0100	0.0000	OK
240 minute winter	S04	232	3.607	0.064	1.0	0.0302	0.0000	OK
240 minute winter	S05	232	3.607	0.199	1.2	0.0695	0.0000	SURCHARGED
240 minute winter	S06	236	3.607	0.252	2.1	0.1668	0.0000	SURCHARGED
240 minute winter	SA2	236	3.607	0.266	2.1	9.2932	0.0000	OK
180 minute winter	CH01	176	4.034	0.179	2.0	0.1790	0.0000	SURCHARGED
180 minute winter	SA3	176	4.034	0.234	4.4	7.0191	0.0000	OK
240 minute winter	CH02	232	3.456	0.156	1.5	0.1107	0.0000	SURCHARGED
240 minute winter	CH02a	232	3.456	0.156	1.5	0.1107	0.0000	SURCHARGED
240 minute winter	S07	232	3.456	0.191	2.9	0.0542	0.0000	SURCHARGED
240 minute winter	SA4	232	3.456	0.208	2.8	12.5019	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute summer	RE01	1.000	S01	4.8	0.613	0.332	0.0863
15 minute summer	S01	1.001	S02	7.0	0.778	0.484	0.2153
360 minute winter	S02	1.002	S03	0.9	0.351	0.059	0.1760
360 minute winter	S03	1.003	SA1	0.8	0.405	0.054	0.1056
360 minute winter	SA1	Infiltration		0.1			
15 minute winter	RE02	2.000	S04	2.6	0.471	0.180	0.0638
240 minute winter	S04	2.001	S05	1.0	0.407	0.069	0.2501
240 minute winter	S05	2.002	S06	1.0	0.265	0.072	0.1391
240 minute winter	S06	2.003	SA2	2.1	0.624	0.142	0.0379
240 minute winter	SA2	Infiltration		0.2			
180 minute winter	CH01	5.000	SA3	4.4	0.732	0.183	0.0528
180 minute winter	SA3	Infiltration		0.2			
240 minute winter	CH02	3.000	S07	1.4	0.305	0.100	0.0915
240 minute winter	CH02a	4.000	S07	1.4	0.305	0.100	0.0915
240 minute winter	S07	3.001	SA4	2.8	0.673	0.194	0.0440
240 minute winter	SA4	Infiltration		0.4			

Flow+ v10.0 Copyright © 1988-2021 Causeway Software Solutions Limited

Results for 100 year +30% CC +10% A Critical Storm Duration. Lowest mass balance: 98.02%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	RE01	304	3.955	0.335	0.9	0.2421	0.0000	SURCHARGED
480 minute winter	S01	304	3.954	0.407	1.3	0.1894	0.0000	SURCHARGED
180 minute winter	S02	132	3.952	0.564	2.9	0.1596	0.0000	FLOOD RISK
180 minute winter	S03	132	3.951	0.630	2.6	0.1782	0.0000	FLOOD RISK
480 minute winter	SA1	304	3.950	0.669	1.1	6.8486	2.6086	FLOOD
960 minute winter	RE02	600	4.153	0.533	0.3	0.1358	0.0000	FLOOD RISK
120 minute winter	S04	104	4.154	0.611	2.8	0.3022	0.0000	FLOOD RISK
120 minute winter	S05	104	4.152	0.744	3.4	0.2657	0.0000	FLOOD RISK
180 minute winter	S06	132	4.151	0.796	4.7	0.5578	0.0000	FLOOD RISK
600 minute winter	SA2	375	4.150	0.809	1.7	14.0175	4.6608	FLOOD
480 minute winter	CH01	304	4.301	0.446	2.6	0.4904	0.0000	FLOOD RISK
360 minute winter	SA3	232	4.300	0.500	2.7	12.0150	2.8921	FLOOD
360 minute winter	CH02	272	3.950	0.650	2.0	0.5057	0.7791	FLOOD
360 minute winter	CH02a	272	3.950	0.650	2.0	0.5057	0.7791	FLOOD
240 minute winter	S07	224	3.952	0.687	5.4	0.1944	0.0000	FLOOD RISK
240 minute winter	SA4	212	3.952	0.704	5.4	24.0300	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
480 minute winter	RE01	1.000	S01	0.9	0.400	0.062	0.1937
480 minute winter	S01	1.001	S02	1.3	0.423	0.089	0.4211
180 minute winter	S02	1.002	S03	2.6	0.414	0.182	0.1760
180 minute winter	S03	1.003	SA1	2.5	0.570	0.172	0.1056
480 minute winter	SA1	Infiltration		0.1			
960 minute winter	RE02	2.000	S04	0.3	0.254	0.021	0.2025
120 minute winter	S04	2.001	S05	2.8	0.505	0.194	0.3565
120 minute winter	S05	2.002	S06	3.1	0.327	0.214	0.1391
180 minute winter	S06	2.003	SA2	4.6	0.745	0.315	0.0379
600 minute winter	SA2	Infiltration		0.2			
480 minute winter	CH01	5.000	SA3	1.6	0.647	0.068	0.0528
360 minute winter	SA3	Infiltration		0.2			
360 minute winter	CH02	3.000	S07	1.9	0.268	0.134	0.0915
360 minute winter	CH02a	4.000	S07	1.9	0.268	0.134	0.0915
240 minute winter	S07	3.001	SA4	5.4	0.804	0.370	0.0440
240 minute winter	SA4	Infiltration		0.4			

Flow+ v10.0 Copyright © 1988-2021 Causeway Software Solutions Limited