

Recommended soil infiltration rate	
6.1E-05	m/s
Note: Where water level reaches nearly empty (5% full), soil infiltration based on 'Full' depth. Where water level did not reach nearly empty (5% full), soil infiltration rate is based on 'Effective' drainage achieved only. Where water level did not fall below 25% of the maximum fill level, this is considered to be a 'Failed' test.	

units	Infill 1	Infill 2	Infill 3
Length			
Width		2.40	
Depth		0.80	
Gravel type		1.62	
		Standard	
Voids ratio		0.35	
Resting groundwater level at time of testing		2.45	
Depth of first reading		1.10	1.12
Depth of final reading		1.62	1.62
Did soakage test reach near empty?		Yes	Yes
Did soakage test reach 25% of maximum fill depth?		Yes	Yes
Depth at 75% full/effective depth		1.25	1.25
Depth at 25% full/effective depth		1.50	1.50
Time at 75% full/effective depth		2.17	2.17
Time at 25% full/effective depth		13.61	13.46
Vp75 - 25 (volume outflowing between 75% and 25% full/effective depth)		0.17	0.17
Mean surface area for outflow (50% full/effective depth)		3.52	3.52
tp75 (time for the water level to fall from 75% to 25% full/effective depth)		11.44	11.29
Soil infiltration rate, f =		2.50E-05	2.50E-05
or		2.5E-05	2.5E-05

LOG

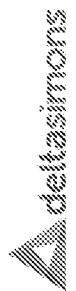
DEPTH (m)	DEPTH (m)
Dark brown SAND 0.5	0.5
Dark brown sandy CLAY 0.4	0.4
Brown clayey SAND 0.3	0.3
Clayey	1.0

BACKFILL

DEPTH (m)	DEPTH (m)
1.7	1.7

Time (minutes)

Legend:
 - - - Infill 1
 --- Infill 2
 . . . Infill 3
 --- Resting Groundwater Level
 - - - 75% Full
 - - - 25% Full



TITLE: Soakaway Test Results
 Amazon, Littlehampton
 Gleeve Partnership

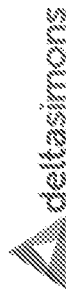
In accordance with BRE Digest 365 (2016)

DRAWN BY CS	SCALE Not to Scale	PROJECT NUMBER 19-0138.08	SOAKAWAY NUMBER SA101
CHECKED BY SS	REVISION 1		
DATE 27/01/2020			

Recommended soil infiltration rate	
1.7E-05	m/s
Note: Where water level reaches nearly empty (5% full), soil infiltration based on 'Failed' depth. Where water level did not reach nearly empty (5% full), soil infiltration rate is based on 'Effective' drainage achieved only. Where water level did not fall below 25% of the maximum fill level, this is considered to be a 'Failed' test.	

	units	Infill 1	Infill 2	Infill 3
Length	m	2.10		
Width	m	0.56		
Depth	m	2.00		
Gravel type		Standard		
Voids ratio		0.35		
Resting groundwater level at time of testing	m	1.23	2.45	1.20
Depth of first reading	m	2.00	2.00	2.00
Did soakage test reach 25% of maximum fill depth?		Yes	Yes	Yes
Did soakage test reach near empty?		Yes	Yes	Yes
Depth at 75% full/effective depth	m	1.52	1.42	1.40
Depth at 25% full/effective depth	m	1.84	1.81	1.90
Time at 75% full/effective depth	mins	4.00	8.93	8.25
Time at 25% full/effective depth	mins	45.00	44.79	55.00
Vp75 - 25 (volume outflowing between 75% and 25% full/effective depth)	m ³	0.13	0.16	0.16
Mean surface area for outflow (50% full/effective depth)	m ²	2.88	3.22	3.30
tp75 (time for the water level to fall from 75% to 25% full/effective depth)	mins	41.00	37.86	48.75
Soil infiltration rate, f =	m/s	2.50E-06	2.50E-06	2.50E-06
or	m/s	1.3E-05	1.3E-05	1.3E-05

LOG		BACKFILL	
	DEPTH (m)		DEPTH (m)
Dark brown clayey SAND	0.0	Dark brown clayey SAND	0.0
Dark brown slightly sandy CLAY	0.2	Dark brown slightly sandy CLAY	0.2
Bluish brown CLAY	0.4	Bluish brown CLAY	0.4
		Gravel	1.2
		Brown clayey SAND	1.5
			2.0



TITLE: Soakaway Test Results
Amazon, Littlehampton
Gleave Partnership

In accordance with BRE Digest 365 (2016)

DRAWN BY: CS	SCALE: Not to Scale	PROJECT NUMBER: 19-0138.08	SOAKAWAY NUMBER: SA102
CHECKED BY: SS	REVISION: 1		
DATE: 27/01/2020			

Appendix F – Drainage Calculations

Alchemy		Page 1
Bessemer Road Welwyn Garden City Hertfordshire AL7 1HE	Soakaway S101 Littlehampton	
Date 14/02/2020 12:16 File Soakaway S101.MDX	Designed by Richard Pearson Checked by Jawsy Jabbar	
XP Solutions	Network 2019.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model	
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 504150 103950 TQ 04150 03950
C (1km)	-0.026
D1 (1km)	0.387
D2 (1km)	0.278
D3 (1km)	0.404
E (1km)	0.313
F (1km)	2.347
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 (%)	0
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 Inverts

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.001	4-8	0.026	8-12	0.005

Total Area Contributing (ha) = 0.032

Total Pipe Volume (m³) = 2.396

Network Design Table for Storm

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
2.000	30.125	0.180	167.4	0.032	5.00	0.0	0.600	o	225	Pipe/Conduit	⊗
2.001	3.504	0.020	175.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	⊗

Network Results Table

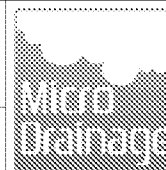
PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
2.000	50.00	5.50	3.980	0.032	0.0	0.0	0.0	1.01	40.1	4.3
2.001	50.00	5.56	3.890	0.032	0.0	0.0	0.0	0.98	39.2	4.3

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Alchemy										Page 2		
Bessemer Road Welwyn Garden City Hertfordshire AL7 1HE					Soakaway S101 Littlehampton							
Date 14/02/2020 12:16					Designed by Richard Pearson							
File Soakaway S101.MDX					Checked by Jawsy Jabbar							
XP Solutions					Network 2019.1							
<u>Network Design Table for Storm</u>												
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	
2.002	3.196	0.020	159.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit		
2.003	10.074	0.000	0.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit		
2.004	13.351	0.000	0.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit		
<u>Network Results Table</u>												
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)		
2.002	50.00	5.61	3.720	0.032	0.0	0.0	0.0	1.03	41.0	4.3		
2.003	50.00	6.98	3.700	0.032	0.0	0.0	0.0	0.12	4.9	4.3		
2.004	50.00	8.79	4.200	0.032	0.0	0.0	0.0	0.12	4.9	4.3		
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Alchemy								Page 3			
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Date 14/02/2020 12:16 File Soakaway S101.MDX				Designed by Richard Pearson Checked by Jawsy Jabbar							
XP Solutions				Network 2019.1							
<u>Manhole Schedules for Storm</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)
S1.0	5.107	1.127	Open Manhole	1200	2.000	3.980	225				
S1.1	5.098	1.298	Open Manhole	1200	2.001	3.890	225	2.000	3.800	225	
PI	5.098	1.378	Open Manhole	1200	2.002	3.720	225	2.001	3.780	225	60
S1.2D	5.098	1.398	Open Manhole	1200	2.003	3.790	225	2.002	3.700	225	
S1.3	5.088	1.388	Open Manhole	1200	2.004	4.200	225	2.003	3.700	225	
	5.088	0.888	Open Manhole	1200		OUTFALL		2.004	4.200	225	
MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)					
S1.0	503862.204	103722.032	503862.204	103722.032	Required						
S1.1	503832.275	103725.462	503832.275	103725.462	Required						
PI	503828.798	103725.893	503828.798	103725.893	Required						
S1.2D	503825.619	103726.220	503825.619	103726.220	Required						
S1.3	503815.619	103727.439	503815.619	103727.439	Required						
	503802.346	103728.891			No Entry						
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XP Solutions	Network 2019.1



PIPELINE SCHEDULES for Storm

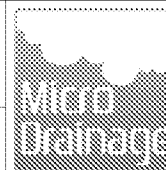
Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
2.000	o	225	S1.0	5.197	3.988	0.982	Open Manhole	1200
2.001	o	225	S1.1	5.098	3.800	1.073	Open Manhole	1200
2.002	o	225	PI	5.098	3.720	1.153	Open Manhole	1200
2.003	o	225	S1.2D	5.098	3.700	1.173	Open Manhole	1200
2.004	o	225	S1.3	5.088	4.200	0.663	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)
2.000	30.125	167.4	S1.1	5.098	3.800	1.073	Open Manhole	1200
2.001	3.504	175.2	PI	5.098	3.780	1.093	Open Manhole	1200
2.002	3.196	159.8	S1.2D	5.098	3.700	1.173	Open Manhole	1200
2.003	10.074	0.0	S1.3	5.088	3.700	1.163	Open Manhole	1200
2.004	13.351	0.0		5.088	4.200	0.663	Open Manhole	1200

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Bessemer Road Welwyn Garden City Hertfordshire AL7 1HE	Soakaway S101 Littlehampton
Date 14/02/2020 12:16 File Soakaway S101.MDX	Designed by Richard Pearson Checked by Jawsy Jabbar
XP Solutions	Network 2019.1



Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
2.000	-	-	100	0.032	0.032	0.032
2.001	-	-	100	0.000	0.000	0.000
2.002	-	-	100	0.000	0.000	0.000
2.003	-	-	100	0.000	0.000	0.000
2.004	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.032	0.032	0.032

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
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2.004		5.088	4.200	3.700	1200	0
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Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /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)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 504150 103950 TQ 04150 03950
C (1km)	-0.026
D1 (1km)	0.387
D2 (1km)	0.278
D3 (1km)	0.404
E (1km)	0.313
F (1km)	2.347
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

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Bessemer Road Welwyn Garden City Hertfordshire AL7 1HE	Soakaway S101 Littlehampton	
Date 14/02/2020 12:16 File Soakaway S101.MDX	Designed by Richard Pearson Checked by Jawsy Jabbar	
XP Solutions	Network 2019.1	
<u>Online Controls for Storm</u>		
<u>Weir Manhole: S1.2D, DS/PN: 2.003, Volume (m³): 1.7</u>		
Discharge Coef 0.544 Width (m) 1.200 Invert Level (m) 5.098		
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Bessemer Road		Soakaway S101	
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Bessemer Road Welwyn Garden City Hertfordshire AL7 1HE	Soakaway S102 Littlehampton	
Date 14/02/2020 12:15 File Soakaway S102.MDX	Designed by Richard Pearson Checked by Jawsy Jabbar	
XP Solutions	Network 2019.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model	
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 504150 103950 TQ 04150 03950
C (1km)	-0.026
D1 (1km)	0.387
D2 (1km)	0.278
D3 (1km)	0.404
E (1km)	0.313
F (1km)	2.347
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 (%)	0
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 Inverts

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.001	4-8	0.026	8-12	0.005

Total Area Contributing (ha) = 0.032

Total Pipe Volume (m³) = 2.393

Network Design Table for Storm

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
1.000	30.125	0.180	167.4	0.032	5.00	0.0	0.600	o	225	Pipe/Conduit	⊗
1.001	3.350	0.020	167.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	⊗

Network Results Table

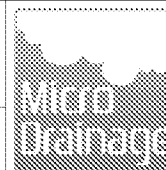
PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.50	3.980	0.032	0.0	0.0	0.0	1.01	40.1	4.3
1.001	50.00	5.55	3.880	0.032	0.0	0.0	0.0	1.01	40.1	4.3

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Bessemer Road Welwyn Garden City Hertfordshire AL7 1HE					Soakaway S102 Littlehampton						
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File Soakaway S102.MDX					Checked by Jawsy Jabbar						
XP Solutions					Network 2019.1						
<u>Network Design Table for Storm</u>											
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
1.002	3.350	0.020	167.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	12.992	0.000	0.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.004	10.357	0.001	10357.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
<u>Network Results Table</u>											
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)	
1.002	50.00	5.61	3.720	0.032	0.0	0.0	0.0	1.01	40.1	4.3	
1.003	50.00	7.37	3.700	0.032	0.0	0.0	0.0	0.12	4.9	4.3	
1.004	50.00	8.82	4.200	0.032	0.0	0.0	0.0	0.12	4.8	4.3	
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Date 14/02/2020 12:15 File Soakaway S102.MDX					Designed by Richard Pearson Checked by Jawsy Jabbar																																																							
XP Solutions					Network 2019.1																																																							
<u>Manhole Schedules for Storm</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)																																																	
S2.0	5.107	1.127	Open Manhole	1200	1.000	3.980	225																																																					
S2.1	5.086	1.286	Open Manhole	1200	1.001	3.800	225	1.000	3.800	225																																																		
PI	5.086	1.366	Open Manhole	1200	1.002	3.720	225	1.001	3.780	225	10																																																	
S2.2	5.086	1.386	Open Manhole	1200	1.003	3.700	225	1.002	3.700	225																																																		
S2.3D	5.086	1.386	Open Manhole	1200	1.004	4.200	225	1.003	3.700	225																																																		
	5.100	0.901	Open Manhole	1200		OUTFALL		1.004	4.100	225																																																		
<table><tr><th>MH Name</th><th>Manhole Easting (m)</th><th>Manhole Northing (m)</th><th>Intersection Easting (m)</th><th>Intersection Northing (m)</th><th>Manhole Access</th><th>Layout (North)</th></tr><tr><td>S2.0</td><td>503892.134</td><td>103718.606</td><td>503892.134</td><td>103718.606</td><td>Required</td><td></td></tr><tr><td>S2.1</td><td>503922.063</td><td>103715.177</td><td>503922.063</td><td>103715.177</td><td>Required</td><td></td></tr><tr><td>PI</td><td>503925.392</td><td>103714.797</td><td>503925.392</td><td>103714.797</td><td>Required</td><td></td></tr><tr><td>S2.2</td><td>503928.720</td><td>103714.418</td><td>503928.720</td><td>103714.418</td><td>Required</td><td></td></tr><tr><td>S2.3D</td><td>503941.634</td><td>103712.990</td><td>503941.634</td><td>103712.990</td><td>Required</td><td></td></tr><tr><td></td><td>503951.918</td><td>103711.766</td><td></td><td></td><td>No Entry</td><td></td></tr></table>												MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)	S2.0	503892.134	103718.606	503892.134	103718.606	Required		S2.1	503922.063	103715.177	503922.063	103715.177	Required		PI	503925.392	103714.797	503925.392	103714.797	Required		S2.2	503928.720	103714.418	503928.720	103714.418	Required		S2.3D	503941.634	103712.990	503941.634	103712.990	Required			503951.918	103711.766			No Entry	
MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)																																																						
S2.0	503892.134	103718.606	503892.134	103718.606	Required																																																							
S2.1	503922.063	103715.177	503922.063	103715.177	Required																																																							
PI	503925.392	103714.797	503925.392	103714.797	Required																																																							
S2.2	503928.720	103714.418	503928.720	103714.418	Required																																																							
S2.3D	503941.634	103712.990	503941.634	103712.990	Required																																																							
	503951.918	103711.766			No Entry																																																							
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Alchemy	Page 4
Bessemer Road Welwyn Garden City Hertfordshire AL7 1HE	Soakaway S102 Littlehampton
Date 14/02/2020 12:15 File Soakaway S102.MDX	Designed by Richard Pearson Checked by Jawsy Jabbar
XP Solutions	Network 2019.1



PIPELINE SCHEDULES for Storm

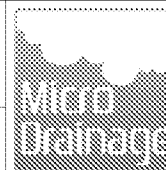
Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	225	S2.0	5.107	3.980	0.902	Open Manhole	1200
1.001	o	225	S2.1	5.086	3.800	1.061	Open Manhole	1200
1.002	o	225	PI	5.086	3.720	1.091	Open Manhole	1200
1.003	o	225	S2.2	5.086	3.700	1.161	Open Manhole	1200
1.004	o	225	S2.3D	5.086	4.200	0.661	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)
1.000	30.125	167.4	S2.1	5.086	3.800	1.061	Open Manhole	1200
1.001	3.350	167.5	PI	5.086	3.780	1.081	Open Manhole	1200
1.002	3.350	167.5	S2.2	5.086	3.700	1.111	Open Manhole	1200
1.003	12.992	0.0	S2.3D	5.086	3.700	1.161	Open Manhole	1200
1.004	10.357	10357.0		5.100	4.199	0.676	Open Manhole	1200

Alchemy	Page 5
Bessemer Road Welwyn Garden City Hertfordshire AL7 1HE	Soakaway S102 Littlehampton
Date 14/02/2020 12:15 File Soakaway S102.MDX	Designed by Richard Pearson Checked by Jawsy Jabbar
XP Solutions	Network 2019.1



Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.032	0.032	0.032
1.001	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.032	0.032	0.032

Free Flowing Outfall Details for Storm

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

1.004		5.100	4.199	3.700	1200	0
-------	--	-------	-------	-------	------	---

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /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)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 504150 103950 TQ 04150 03950
C (1km)	-0.026
D1 (1km)	0.387
D2 (1km)	0.278
D3 (1km)	0.404
E (1km)	0.313
F (1km)	2.347
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

Alchemy		Page 6
Bessemer Road Welwyn Garden City Hertfordshire AL7 1HE	Soakaway S102 Littlehampton	
Date 14/02/2020 12:15 File Soakaway S102.MDX	Designed by Richard Pearson Checked by Jawsy Jabbar	
XP Solutions	Network 2019.1	
<u>Online Controls for Storm</u> <u>Weir Manhole: S2.2, DS/PN: 1.003, Volume (m³): 1.7</u> Discharge Coef 0.544 Width (m) 1.200 Invert Level (m) 4.200		
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Alchemy		Page 8							
Bessemer Road Welwyn Garden City Hertfordshire AL7 1HE		Soakaway S102 Littlehampton							
Date 14/02/2020 12:15 File Soakaway S102.MDX		Designed by Richard Pearson Checked by Jawsy Jabbar							
XP Solutions		Network 2019.1							
<u>Summary of Critical Results by Maximum Level (Rank 1) for Storm</u>									
<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 Offline Controls 0 Number of Time/Area Diagrams 0 Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0									
<u>Synthetic Rainfall Details</u>									
Rainfall Model FEH FEH Rainfall Version 1999 Site Location GB 504150 103950 TQ 04150 03950 C (1km) -0.026 D1 (1km) 0.387 D2 (1km) 0.278 D3 (1km) 0.404 E (1km) 0.313 F (1km) 2.347 Cv (Summer) 0.750 Cv (Winter) 0.840									
Margin for Flood Risk Warning (mm) 450.0 DVD Status OFF Analysis Timestep Fine Inertia Status OFF DTS Status ON									
Profile(s) Summer and Winter Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440 Return Period(s) (years) 1, 30, 100 Climate Change (%) 0, 0, 40									
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S2.0	720 Winter	100	+40%					4.197
1.001	S2.1	720 Winter	100	+40%	100/60 Winter				4.196
1.002	PI	720 Winter	100	+40%	100/30 Summer				4.196
1.003	S2.2	720 Winter	100	+40%	30/360 Winter				4.196
1.004	S2.3D	1440 Winter	1	+0%					3.700
PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded	
1.000	S2.0	-0.008	0.000	0.05		1.9	OK		
1.001	S2.1	0.171	0.000	0.06		1.7	SURCHARGED		
1.002	PI	0.251	0.000	0.06		1.6	SURCHARGED		
1.003	S2.2	0.271	0.000	0.00		0.0	SURCHARGED		
1.004	S2.3D	-0.725	0.000	0.00		0.0	OK		
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Alchemy		Page 1
Bessemer Road	Soakaway S103	
Welwyn Garden City	Littlehampton	
Hertfordshire AL7 1HE		
Date 14/02/2020 12:11	Designed by Richard Pearson	
File Soakaway S103.MDX	Checked by Jawsy Jabbar	
XP Solutions	Network 2019.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 504150 103950 TQ 04150 03950
C (1km)	-0.026
D1 (1km)	0.387
D2 (1km)	0.278
D3 (1km)	0.404
E (1km)	0.313
F (1km)	2.347
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 (%)	0
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 Inverts

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.008	4-8	0.006

Total Area Contributing (ha) = 0.014

Total Pipe Volume (m³) = 0.230

Network Design Table for Storm

« - Indicates pipe capacity < flow

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
----	------------	----------	-------------	-------------	-------------	-----------------	--------	----------	----------	--------------	-------------

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)
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Alchemy										Page 2	
Bessemer Road Welwyn Garden City Hertfordshire AL7 1HE						Soakaway S103 Littlehampton					
Date 14/02/2020 12:11 File Soakaway S103.MDX						Designed by Richard Pearson Checked by Jawsy Jabbar					
XP Solutions						Network 2019.1					
<u>Network Design Table for Storm</u>											
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
1.000	8.061	0.080	100.8	0.014	5.00	0.0	0.600	o	150	Pipe/Conduit	●
1.001	4.982	0.000	0.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	●
<u>Network Results Table</u>											
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)	
1.000	50.00	5.13	3.480	0.014	0.0	0.0	0.0	1.00	17.7	1.9	
1.001	50.00	6.03	3.400	0.014	0.0	0.0	0.0	0.00	1.60	1.9	
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Alchemy								Page 3				
Bessemer Road Welwyn Garden City Hertfordshire AL7 1HE					Soakaway S103 Littlehampton							
Date 14/02/2020 12:11					Designed by Richard Pearson							
File Soakaway S103.MDX					Checked by Jawsy Jabbar							
XP Solutions					Network 2019.1							
<u>Manhole Schedules for Storm</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)	
Gully	4.153	0.673	Open Manhole	1200	1.000	3.480	150					
S3.0	4.500	1.100	Open Manhole	1200	1.001	3.400	150	1.000	3.400	150		
S3.1	4.500	1.100	Open Manhole	600		OUTFALL		1.001	3.400	150		
MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)						
Gully	503942.678	103565.875	503942.678	103565.875	Required							
S3.0	503935.531	103569.605	503935.531	103569.605	Required							
S3.1	503931.101	103571.883			No Entry							
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XP Solutions	Network 2019.1	

PIPELINE SCHEDULES for Storm

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)
1.000	o	150	Gully	4.153	3.430	0.523	Open Manhole	1200
1.001	o	150	S3.0	4.500	3.400	0.950	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)
1.000	8.061	100.8	S3.0	4.500	3.400	0.950	Open Manhole	1200
1.001	4.982	0.0	S3.1	4.500	3.400	0.950	Open Manhole	600

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Bessemer Road Welwyn Garden City Hertfordshire AL7 1HE	Soakaway S103 Littlehampton	
Date 14/02/2020 12:11 File Soakaway S103.MDX	Designed by Richard Pearson Checked by Jawsy Jabbar	
XP Solutions Network 2019.1		

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.014	0.014	0.014
1.001	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.014	0.014	0.014

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D, L (mm)	W (mm)
1.001	S3.1	4.500	3.400	3.400	600	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /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)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 504150 103950 TQ 04150 03950
C (1km)	-0.026
D1 (1km)	0.387
D2 (1km)	0.278
D3 (1km)	0.404
E (1km)	0.313
F (1km)	2.347
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

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Alchemy		Page 6
Bessemer Road Welwyn Garden City Hertfordshire AL7 1HE	Soakaway S103 Littlehampton	
Date 14/02/2020 12:11	Designed by Richard Pearson	
File Soakaway S103.MDX	Checked by Jawsy Jabbar	
XP Solutions	Network 2019.1	
<u>Online Controls for Storm</u> <u>Weir Manhole: S3.0, DS/PN: 1.001, Volume (m³): 1.4</u> Discharge Coef 0.544 Width (m) 0.600 Invert Level (m) 3.900		
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Bessemer Road Welwyn Garden City Hertfordshire AL7 1HE	Soakaway S103 Littlehampton	
Date 14/02/2020 12:11 File Soakaway S103.MDX	Designed by Richard Pearson Checked by Jawsy Jabbar	
XP Solutions Network 2019.1		

Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

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 Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH
 FEH Rainfall Version 1999
 Site Location GB 504150 103950 TQ 04150 03950
 C (1km) -0.026
 D1 (1km) 0.387
 D2 (1km) 0.278
 D3 (1km) 0.404
 E (1km) 0.313
 F (1km) 2.347
 Cv (Summer) 0.750
 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 450.0 DVD Status OFF
 Analysis Timestep Fine Inertia Status OFF
 DTS Status ON

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	Gully	180 Winter	100	+40%	100/15 Summer				3.824
1.001	S3.0	180 Winter	100	+40%	30/30 Winter				3.822

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap. (l/s)	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	Gully	0.194	0.000	0.13		2.1	FLOOD RISK	
1.001	S3.0	0.272	0.000	0.00		0.0	SURCHARGED	

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C190213-Littlehampton DBN3 Refurbishment - Half-drain Time Calculation

Soakaway 101 - Half-drain time for 1 in 10-year event plus 40% climate change is around 249 minutes for a 0.5m depth soakaway.

Quick Design - Infiltration Systems

Variables

Rainfall and Runoff

FEH Rainfall

Return Period (years) 10

Version 1999

Site GB 504150 103950 TQ 04150 03950

C (1km) 0.028 D3 (1km) 0.404

D1 (1km) 0.387 E (1km) 0.313

D2 (1km) 0.278 F (1km) 2.347

Cv (Summer) 0.750

Cv (Winter) 0.840

Impermeable Area (ha) 0.032

Climate Change (%) 40

Infiltration Structure

Cellular Storage

Infiltration Coefficient Base (m/hr) 0.21600

Infiltration Coefficient Side (m/hr) 0.21600

Safety Factor 4.0

Porosity 0.95

☒ With Outflow

Maximum Discharge (l/s) 0.0

Analyse OK Cancel Help

Enter Safety Factor between 1.0 and 50.0

Quick Design - Infiltration Systems

Results

Results are presented in paired rows. These represent maximum and minimum storage requirements for each size of structure.

Depth (m)	Net Vol (m³)	Surface Area (m²)	Ex/Fill Vol (m³)	Half Drain (mins)
0.2	8.1	42.4	8.5	133
	7.0	36.8	7.4	133
0.3	8.4	29.3	8.8	175
	7.7	26.9	8.1	174
0.4	8.7	23.0	9.2	214
	8.2	21.7	8.7	213
0.5	9.6	16.9	10.1	285
	9.0	15.8	9.5	283
1.0	10.9	11.4	11.4	393
	10.1	10.7	10.7	389
1.5	11.9	8.3	12.5	478

Analyse OK Cancel Help

Enter Safety Factor between 1.0 and 50.0

Soakaway 101 - Half-drain time for 1 in 100-year event plus 40% climate change is around 260 minutes for a 0.5m depth soakaway.

Quick Design - Infiltration Systems

Variables

Rainfall and Runoff

FEH Rainfall

Return Period (years) 100

Version 1999

Site GB 504150 103950 TO 04150 03950

C (1km) 0.026 D3 (1km) 0.404

D1 (1km) 0.307 E (1km) 0.313

D2 (1km) 0.278 F (1km) 2.347

Cv (Summer) 0.750

Cv (Winter) 0.840

Impervious Area (ha) 0.032

Climate Change (%) 40

Infiltration Structure

Cellular Storage

Infiltration Coefficient Base (m/hr) 0.21600

Infiltration Coefficient Side (m/hr) 0.21600

Safety Factor 4.0

Porosity 0.95

☒ With Outflow

Maximum Discharge (l/s) 0.0

Analyse OK Cancel Help

Select Rainfall Version

Quick Design - Infiltration Systems

Results

Results are presented in paired rows. These represent maximum and minimum storage requirements for each size of structure.

Depth (m)	Net Vol (m³)	Surface Area (m²)	Ex-Fill Vol (m³)	Half Drain (mins)
0.2	15.8	82.3	18.5	135
	14.0	73.8	14.8	135
0.3	16.3	57.1	17.1	179
	15.1	53.0	15.9	178
0.4	16.9	44.4	17.7	221
	16.0	42.0	18.8	221
0.6	18.3	32.1	19.2	299
	17.4	30.6	18.3	298
1.0	20.1	21.2	21.2	426
	19.1	20.1	20.1	423
1.5	21.8	15.3	22.9	536

Analyse OK Cancel Help

Select Rainfall Version

Soakaway 102 - Half-drain time for 1 in 10-year event plus 40% climate change is around 934 minutes for a 0.5m depth soakaway.

Quick Design - Infiltration Systems

Variables

Rainfall and Runoff

FEH Rainfall

Return Period (years) 100

Version 1999

Site GB 504150 103950 TQ 04150 03950

C (1km) 0.026 D3 (1km) 0.404

D1 (1km) 0.387 E (1km) 0.313

D2 (1km) 0.273 F (1km) 2.347

Cy (Summer) 0.750

Cy (Winter) 0.840

Impervious Area (ha) 0.032

Climate Change (%) 40

Infiltration Structure

Cellular Storage

Infiltration Coefficient Base (m/hr) 0.05120

Infiltration Coefficient Side (m/hr) 0.05120

Safety Factor 4.0

Porosity 0.95

☒ With Outflow

Maximum Discharge (l/s) 0.0

Analyse OK Cancel Help

Enter Return Period between 1 and 1000

Quick Design - Infiltration Systems

Results

Results are presented in paired rows. These represent maximum and minimum storage requirements for each size of structure.

Depth (m)	Net Vol (m³)	Surface Area (m²)	Ex-Fill Vol (m³)	Half Drain (mins)
0.2	22.2	116.7	23.3	481
	19.7	103.9	20.8	460
0.3	22.8	79.9	24.0	637
	21.2	74.3	22.3	635
0.4	23.8	62.5	25.0	791
	22.7	58.6	23.9	789
0.5	25.3	44.4	26.6	1078
	24.4	42.8	25.7	1076
1.0	27.4	26.0	28.0	1555
	26.4	27.8	27.8	1549
1.5	28.4	20.0	28.9	1977

Analyse OK Cancel Help

Enter Return Period between 1 and 1000

Soakaway 102 - Half-drain time for 1 in 100-year event plus 40% climate change is around 934 minutes for a 0.5m depth soakaway.

Quick Design - Infiltration Systems

Variables

Rainfall and Runoff

FEH Rainfall

Return Period (years) 100

Version 1999

Site GB 504150 103950 TQ 64150 03950

C (1km) 0.026 D3 (1km) 0.404

D1 (1km) 0.387 E (1km) 0.313

D2 (1km) 0.278 F (1km) 2.347

Cv (Summer) 0.750

Cv (Winter) 0.840

Impermeable Area (ha) 0.032

Climate Change (%) 40

Infiltration Structure

Cellular Storage

Infiltration Coefficient Base (m/hr) 0.06120

Infiltration Coefficient Side (m/hr) 0.06120

Safety Factor 4.0

Porosity 0.95

☒ With Outflow

Maximum Discharge (l/s) 0.0

Analyse OK Cancel Help

Enter Safety Factor between 1.0 and 50.0

Quick Design - Infiltration Systems

Results

Results are presented in paired rows. These represent maximum and minimum storage requirements for each size of structure.

Depth (m)	Net Vol (m³)	Surface Area (m²)	Ex/Fill Vol (m³)	Half Drain (mins)
0.2	22.2	116.7	23.3	481
	19.7	103.9	20.8	480
0.3	22.8	79.9	24.0	637
	21.2	74.3	22.3	635
0.4	23.8	62.5	25.0	791
	22.7	59.8	23.9	789
0.6	25.3	44.4	26.6	1078
	24.4	42.8	25.7	1076
1.0	27.4	28.8	28.8	1555
	26.4	27.8	27.8	1549
1.5	28.4	20.0	29.9	1977

Analyse OK Cancel Help

Enter Safety Factor between 1.0 and 50.0

Soakaway 103 - Half-drain time for 1 in 10-year event plus 40% climate change is around 231 minutes for a 0.5m depth soakaway.

Quick Design : Infiltration Systems

Variables

Rainfall and Runoff

FEH Rainfall

Return Period (years): 10

Version: 1999

Site: GB 504150 103950 TQ 04150 03950

C (1km): 0.026 D3 (1km): 0.404

D1 (1km): 0.367 E (1km): 0.313

D2 (1km): 0.278 F (1km): 2.347

Cv (Summer): 0.750

Cv (Winter): 0.840

Impervious Area (ha): 0.014

Climate Change (%): 40

Infiltration Structure

Cellular Storage

Infiltration Coefficient Base (m/hr): 0.21600

Infiltration Coefficient Side (m/hr): 0.21600

Safety Factor: 4.0

Porosity: 0.95

☒ With Outflow

Maximum Discharge (l/s): 0.0

Analyse OK Cancel Help

Enter Climate Change between -100 and 500

Quick Design : Infiltration Systems

Results

Results are presented in paired rows. These represent maximum and minimum storage requirements for each size of structure.

Depth (m)	Net Vol (m³)	Surface Area (m²)	Ex/Fill Vol (m³)	Half Drain (mins)
0.2	3.5	18.4	3.7	130
	3.0	15.9	3.2	129
0.3	3.6	12.8	3.8	168
	3.3	11.8	3.5	167
0.4	3.8	10.0	4.0	202
	3.5	9.2	3.7	201
0.6	4.1	7.3	4.4	261
	3.8	6.7	4.0	259
1.0	4.6	4.8	4.8	340
	4.2	4.4	4.4	334
1.5	5.0	3.5	5.3	390

Analyse OK Cancel Help

Enter Climate Change between -100 and 500

Soakaway 103 - Half-drain time for 1 in 100-year event plus 40% climate change is around 246 minutes for a 0.5m depth soakaway.

Quick Design - Infiltration Systems

Variables

Rainfall and Runoff

FEH Rainfall

Return Period (years) 100

Version 1999

Site GB 504150 103950 TQ 04150 03950

C (1km) 0.026 D3 (1km) 0.404

D1 (1km) 0.387 E (1km) 0.313

D2 (1km) 0.278 F (1km) 2.347

Cv (Summer) 0.750

Cv (Winter) 0.840

Impermeable Area (ha) 0.014

Climate Change (%) 40

Infiltration Structure

Cellular Storage

Infiltration Coefficient Base (m/hr) 0.21600

Infiltration Coefficient Side (m/hr) 0.21600

Safety Factor 4.0

Porosity 0.35

☒ With Outflow

Maximum Discharge (l/s) 0.0

Analyse OK Cancel Help

Enter Return Period between 1 and 1000

Quick Design - Infiltration Systems

Results

Results are presented in paired rows. These represent maximum and minimum storage requirements for each size of structure.

Depth (m)	Net Vol (m³)	Surface Area (m²)	Ex/Fill Vol (m³)	Half Drain (mins)
0.2	6.8	35.9	7.2	133
	6.1	32.0	6.4	132
0.3	7.1	24.8	7.5	173
	6.5	22.9	6.9	173
0.4	7.3	19.3	7.7	212
	6.9	18.2	7.3	211
0.6	7.9	13.8	8.3	280
	7.5	13.1	7.9	278
1.0	8.7	9.1	9.1	360
	8.1	8.5	8.5	376
1.5	9.3	6.5	9.8	453

Analyse OK Cancel Help

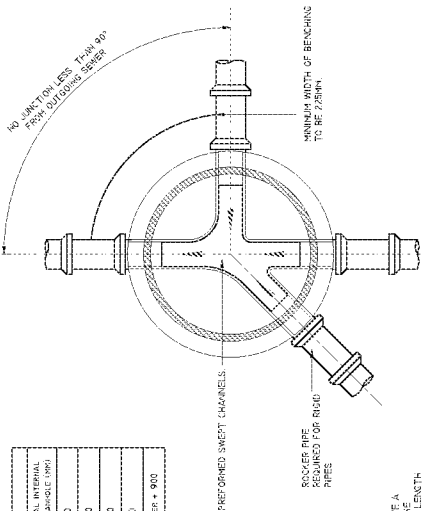
Enter Return Period between 1 and 1000

Appendix G – Proposed Drainage Strategy

Appendix H –Drainage Construction Details

GENERAL NOTES

- DO NOT SCALE THIS DRAWING. WORK ONLY TO DIMENSIONS.
- FOR ALL RELEVANT NOTES, REFER TO THE DRAWING FOR THE SPECIFIC WORKING PERFORMANCE SPECIFICATION.
- ANY DISCREPANCIES ARE TO BE REPORTED TO THE DRAWING ENGINEER IMMEDIATELY.
- THE DRAWING IS TO BE READ IN CONJUNCTION WITH THE SPECIFICATION, THE DRAWING, THE ARCHITECT'S AND SUB CONTRACTOR'S DRAWINGS AND DETAILS.



TYPICAL ARRANGEMENT OF
PIPE JUNCTION WITHIN
MANHOLE PLAN

PIPE DIAMETER	Y MINIMUM		L
	Y1 MIN	Y2 MIN	
100	100	200	18
150	100	200	18
200	100	200	18
225	100	200	18
250	100	200	18
300	100	200	18
350	100	200	18
375	100	200	18
400	150	200	18
450	150	200	36

DIMENSIONS FOR PIPE BEDDING

1. 100mm x 100mm x 100mm	100	100	100
2. 150mm x 150mm x 150mm	150	150	150
3. 200mm x 200mm x 200mm	200	200	200
4. 225mm x 225mm x 225mm	225	225	225
5. 250mm x 250mm x 250mm	250	250	250
6. 300mm x 300mm x 300mm	300	300	300
7. 350mm x 350mm x 350mm	350	350	350
8. 375mm x 375mm x 375mm	375	375	375
9. 400mm x 400mm x 400mm	400	400	400
10. 450mm x 450mm x 450mm	450	450	450

amazon

ANGULAR MATERIALS SHOULD BE CHOSEN
TO PROVIDE SUFFICIENT SUPPORT TO
PREVENT PIPE FROM MOVING. CLASS 2
SULPHATE RESISTING CONCRETE SHALL BE USED WITH FLEXIBLE
PIPES.

DRAINAGE CONSTRUCTION
DETAILS SHEET 1

PINNACLE
CONSULTING ENGINEERS

PROJECT NO.	10013-ARUN-00-AR-08-0-0226
DATE	FEB 19
SCALE	1:100
DESIGNED BY	RC
CHECKED BY	JU
APPROVED BY	CS

MANHOLE DIAMETERS	MINIMUM NOMINAL INTERNAL DIAMETER OF MANHOLE (mm)
LESS THAN 75	100
75-150	150
150-200	200
200-250	250
250-300	300
300-350	350
350-400	400
400-450	450
450-500	500
500-600	600
600-750	750
750-900	900
900-1000	1000

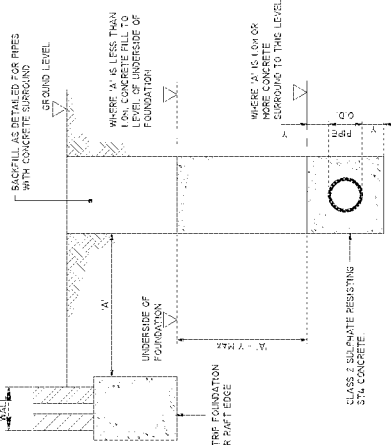
PRECAST SWEET CHANNEL

ROCKER PIPE
REQUIRED FOR RIGID
PIPES

RIGID PIPES, BUT INTO MANHOLE SHOULD HAVE A
MINIMUM NOMINAL INTERNAL DIAMETER OF 100mm
EXTERNAL FACE OF THE STRUCTURE AND THE LENGTH
OF THE NEXT ROCKER PIPE SHOULD BE AS SHOWN.

Normal Diameter (mm)	Minimum Effective Length (m)
100 - 600	0.6
600 - 750	1.0
Over 750	1.25

ALL PIPES ENTERING THE BOTTOM OF
THE MANHOLE TO HAVE SUFFICIENT LEVEL.



PLAN OF MANHOLE TYPE 2

SCALE 1:25

CLASS 2 SULPHATE RESISTING
CONCRETE

WHERE 'X' IS LESS THAN
1.0m, CONCRETE FILL TO
UNDERSIDE OF
FOUNDATION

WHERE 'X' IS 1.0m OR
MORE CONCRETE
SURROUNDING TO THE LEVEL.

BACKFILL AS DETAILED FOR PIPES
WITH CONCRETE SURROUNDING

GROUND LEVEL

WHERE 'X' IS LESS THAN
1.0m, CONCRETE FILL TO
UNDERSIDE OF
FOUNDATION

WHERE 'X' IS 1.0m OR
MORE CONCRETE
SURROUNDING TO THE LEVEL.

BACKFILL AS DETAILED FOR PIPES
WITH CONCRETE SURROUNDING

GROUND LEVEL

WHERE 'X' IS LESS THAN
1.0m, CONCRETE FILL TO
UNDERSIDE OF
FOUNDATION

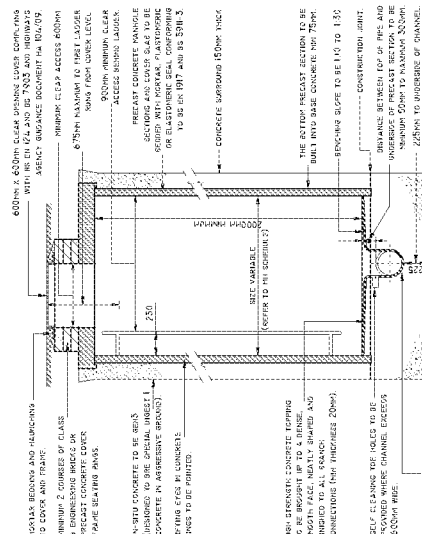
WHERE 'X' IS 1.0m OR
MORE CONCRETE
SURROUNDING TO THE LEVEL.

BACKFILL AS DETAILED FOR PIPES
WITH CONCRETE SURROUNDING

GROUND LEVEL

WHERE 'X' IS LESS THAN
1.0m, CONCRETE FILL TO
UNDERSIDE OF
FOUNDATION

WHERE 'X' IS 1.0m OR
MORE CONCRETE
SURROUNDING TO THE LEVEL.



TYPICAL MANHOLE DETAIL TYPE 1B

DEPTH FROM COVER LEVEL TO SOFTEN OF PIPE 50 TO 60

SCALE 1:25

CLASS 2 SULPHATE RESISTING
CONCRETE

WHERE 'X' IS LESS THAN
1.0m, CONCRETE FILL TO
UNDERSIDE OF
FOUNDATION

WHERE 'X' IS 1.0m OR
MORE CONCRETE
SURROUNDING TO THE LEVEL.

BACKFILL AS DETAILED FOR PIPES
WITH CONCRETE SURROUNDING

GROUND LEVEL

WHERE 'X' IS LESS THAN
1.0m, CONCRETE FILL TO
UNDERSIDE OF
FOUNDATION

WHERE 'X' IS 1.0m OR
MORE CONCRETE
SURROUNDING TO THE LEVEL.

BACKFILL AS DETAILED FOR PIPES
WITH CONCRETE SURROUNDING

GROUND LEVEL

WHERE 'X' IS LESS THAN
1.0m, CONCRETE FILL TO
UNDERSIDE OF
FOUNDATION

WHERE 'X' IS 1.0m OR
MORE CONCRETE
SURROUNDING TO THE LEVEL.

BACKFILL AS DETAILED FOR PIPES
WITH CONCRETE SURROUNDING

GROUND LEVEL

WHERE 'X' IS LESS THAN
1.0m, CONCRETE FILL TO
UNDERSIDE OF
FOUNDATION

WHERE 'X' IS 1.0m OR
MORE CONCRETE
SURROUNDING TO THE LEVEL.

BACKFILL AS DETAILED FOR PIPES
WITH CONCRETE SURROUNDING

GROUND LEVEL

WHERE 'X' IS LESS THAN
1.0m, CONCRETE FILL TO
UNDERSIDE OF
FOUNDATION

WHERE 'X' IS 1.0m OR
MORE CONCRETE
SURROUNDING TO THE LEVEL.

BACKFILL AS DETAILED FOR PIPES
WITH CONCRETE SURROUNDING

GROUND LEVEL

WHERE 'X' IS LESS THAN
1.0m, CONCRETE FILL TO
UNDERSIDE OF
FOUNDATION

WHERE 'X' IS 1.0m OR
MORE CONCRETE
SURROUNDING TO THE LEVEL.

BACKFILL AS DETAILED FOR PIPES
WITH CONCRETE SURROUNDING

GROUND LEVEL

WHERE 'X' IS LESS THAN
1.0m, CONCRETE FILL TO
UNDERSIDE OF
FOUNDATION

WHERE 'X' IS 1.0m OR
MORE CONCRETE
SURROUNDING TO THE LEVEL.

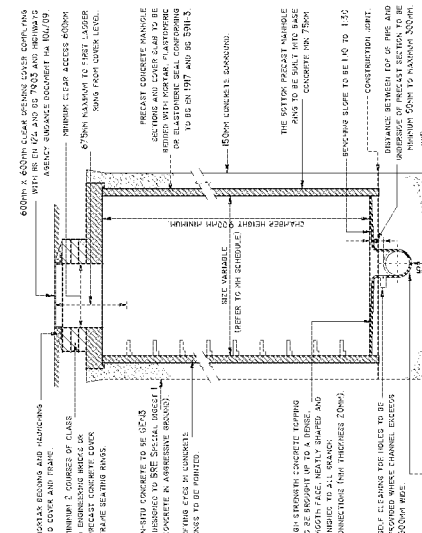
BACKFILL AS DETAILED FOR PIPES
WITH CONCRETE SURROUNDING

GROUND LEVEL

WHERE 'X' IS LESS THAN
1.0m, CONCRETE FILL TO
UNDERSIDE OF
FOUNDATION

WHERE 'X' IS 1.0m OR
MORE CONCRETE
SURROUNDING TO THE LEVEL.

BACKFILL AS DETAILED FOR PIPES
WITH CONCRETE SURROUNDING



TYPICAL MANHOLE DETAIL TYPE 2

DEPTH FROM COVER LEVEL TO SOFTEN OF PIPE 50

SCALE 1:25

CLASS 2 SULPHATE RESISTING
CONCRETE

WHERE 'X' IS LESS THAN
1.0m, CONCRETE FILL TO
UNDERSIDE OF
FOUNDATION

WHERE 'X' IS 1.0m OR
MORE CONCRETE
SURROUNDING TO THE LEVEL.

BACKFILL AS DETAILED FOR PIPES
WITH CONCRETE SURROUNDING

GROUND LEVEL

WHERE 'X' IS LESS THAN
1.0m, CONCRETE FILL TO
UNDERSIDE OF
FOUNDATION

WHERE 'X' IS 1.0m OR
MORE CONCRETE
SURROUNDING TO THE LEVEL.

BACKFILL AS DETAILED FOR PIPES
WITH CONCRETE SURROUNDING

GROUND LEVEL

WHERE 'X' IS LESS THAN
1.0m, CONCRETE FILL TO
UNDERSIDE OF
FOUNDATION

WHERE 'X' IS 1.0m OR
MORE CONCRETE
SURROUNDING TO THE LEVEL.

BACKFILL AS DETAILED FOR PIPES
WITH CONCRETE SURROUNDING

GROUND LEVEL

WHERE 'X' IS LESS THAN
1.0m, CONCRETE FILL TO
UNDERSIDE OF
FOUNDATION

WHERE 'X' IS 1.0m OR
MORE CONCRETE
SURROUNDING TO THE LEVEL.

BACKFILL AS DETAILED FOR PIPES
WITH CONCRETE SURROUNDING

GROUND LEVEL

WHERE 'X' IS LESS THAN
1.0m, CONCRETE FILL TO
UNDERSIDE OF
FOUNDATION

WHERE 'X' IS 1.0m OR
MORE CONCRETE
SURROUNDING TO THE LEVEL.

BACKFILL AS DETAILED FOR PIPES
WITH CONCRETE SURROUNDING

GROUND LEVEL

WHERE 'X' IS LESS THAN
1.0m, CONCRETE FILL TO
UNDERSIDE OF
FOUNDATION

WHERE 'X' IS 1.0m OR
MORE CONCRETE
SURROUNDING TO THE LEVEL.

BACKFILL AS DETAILED FOR PIPES
WITH CONCRETE SURROUNDING

GROUND LEVEL

WHERE 'X' IS LESS THAN
1.0m, CONCRETE FILL TO
UNDERSIDE OF
FOUNDATION

WHERE 'X' IS 1.0m OR
MORE CONCRETE
SURROUNDING TO THE LEVEL.

BACKFILL AS DETAILED FOR PIPES
WITH CONCRETE SURROUNDING

GROUND LEVEL

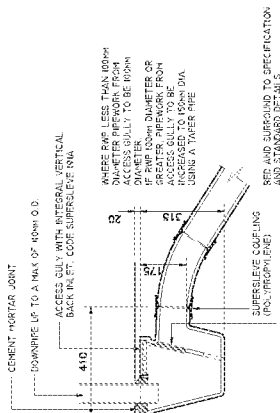
WHERE 'X' IS LESS THAN
1.0m, CONCRETE FILL TO
UNDERSIDE OF
FOUNDATION

WHERE 'X' IS 1.0m OR
MORE CONCRETE
SURROUNDING TO THE LEVEL.

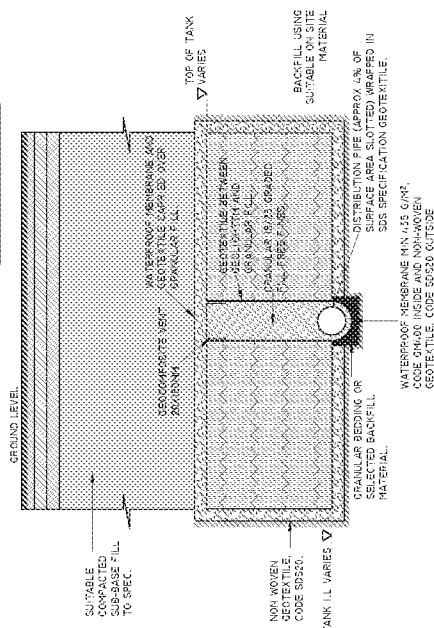
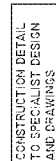
BACKFILL AS DETAILED FOR PIPES
WITH CONCRETE SURROUNDING

1. DO NOT SCALE THIS DRAWING. WORK ONLY TO FIGURED DIMENSIONS.
2. FOR ALL RELEVANT NOTES, REFER TO STRUCTURAL AND CIVIL ENGINEERING PERFORMANCE SPECIFICATION.
3. ANY DISCREPANCIES ARE TO BE REPORTED TO PRINCIPAL CONSULTING ENGINEERS IMMEDIATELY.
4. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS, ARCHITECTS, AND SUB CONTRACTORS DRAWINGS AND DETAILS.

1. DO NOT SCALE THIS DRAWING. WORK ONLY TO FIGURED DIMENSIONS.
2. FOR ALL RELEVANT NOTES, REFER TO STRUCTURAL AND CIVIL ENGINEERING PERFORMANCE SPECIFICATION.
3. ANY DISCREPANCIES ARE TO BE REPORTED TO PRINCIPAL CONSULTING ENGINEERS IMMEDIATELY.
4. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS, ARCHITECTS, AND SUB CONTRACTORS DRAWINGS AND DETAILS.



CONNECTION TO RWP



SOAKAWAYS - TYPICAL CROSS SECTION



	S/N	DESCRIPTION	BY	CHK	DATE
	D1	FOR CORRECTIONS	BZ	JJ	9-26-78
	F00	FOR CORRECTION	BZ	EQ	9-26-78
	T1	TOP TROOPER	BZ	JJ	9-26-78
	SX	DESCRIPTION			

amazon

PROJECT
LITTLEHAMPTON
UGNS REFURBISHMENT

DRAWING TITLE
DRAINAGE CONSTRUCTION
DETAIL SHEET 2

PINNACLE
CONSULTING ENGINEERS

AGENCY: ESSENER RJO,

2875,
RELYING GARDEN CITY,
TEL: 887-0170 827630

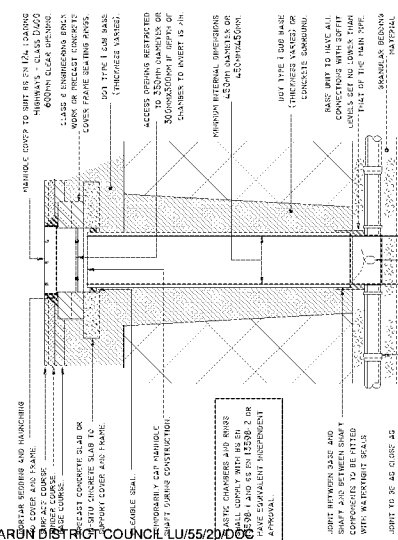
THE MARCH	THE MARCH	THE MARCH	THE MARCH
1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16
17	18	19	20
21	22	23	24
25	26	27	28
29	30	31	

CRAWLING STATUS

DATE	DEPT. NO.	TIME	LOCATION	REMARKS
10/1/77	101	10:00	101	101

UNITED STATES OF AMERICA	3	U.S.	91	STN
--------------------------	---	------	----	-----

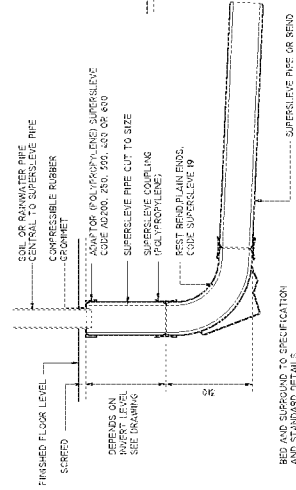
ORGANIZATION OF THE CONFERENCE



TYPICAL INSPECTION CHAMBER DETAIL - TYPE 3
(FLEXIBLE MATERIAL DETAIL)

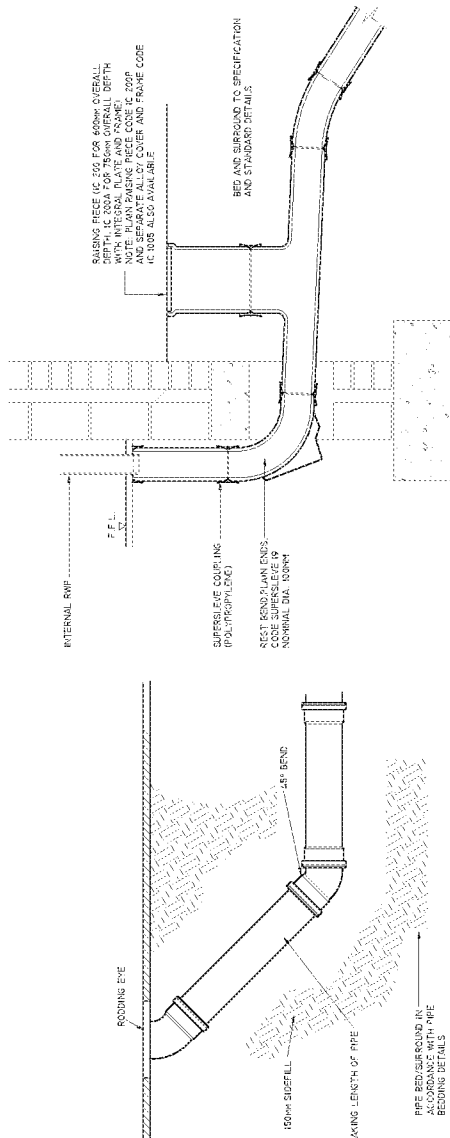
MAXIMUM DEPTH FROM COVER LEVEL TO SOFFIT OF PIPE IN AREAS SUBJECT TO VEHICLE LOADING 3M NON-ENTRY

521 1915



CONNECTION TO SOIL OR RAINWATER PIPES

NOT TO SCALE



TYPICAL RODDING EYE DETAIL.

PIPE RED/SURROUND IN—
ACCORDANCE WITH PIPE
SPACING DETAILS

TYPICAL DETAIL OF RWP RODDING FACILITY

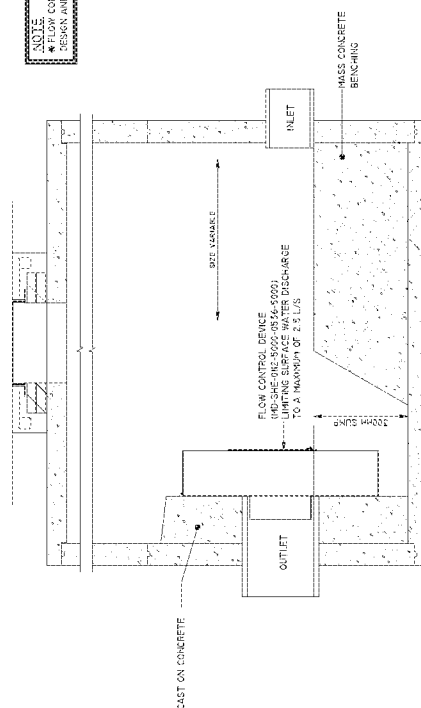
NOT TO SCALE

SECTION THROUGH TYPICAL GULLY

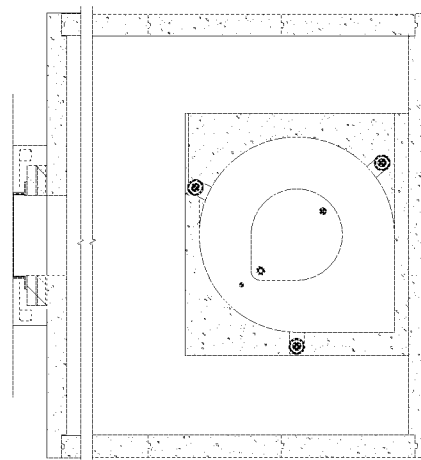
SECTION 11.000 - 11.000.000

NOT TO SCALE

1. DO NOT SCALE THIS DRAWING. WORK ONLY TO FIGURED DIMENSIONS.
2. FOR ALL RELEVANT NOTES, REFER TO STRUCTURAL AND CIVIL ENGINEERING PERFORMANCE SPECIFICATION.
3. ANY DISCREPANCIES ARE TO BE REPORTED TO PINNACLE CONSULTING ENGINEERS IMMEDIATELY.
4. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS, ARCHITECTS AND SUB CONTRACTORS DRAWINGS AND DETAILS.



SECTION B-3



SECTION B-3

DATE	BY	AM	DESCRIPTION
02.05.09	AD	AN	FOR CONSTRUCTION
01.05.09	AN	AN	FOR OPERATION
01.05.09	SC	FI	FOR TRAFFIC

amazon:books

PROJECT
LITTLEHAMPTON
DEANS REFURBISHMENT

DRAINAGE CONSTRUCTION
DETAILS SHEET 5

PINNACLE
CONSULTING ENGINEERS

CHENYI,
JESSEMER ROAD,
JELLYMAN GARDEN CITY,

DRAWING STATUS		CONSTRUCTION	
SCALE & A1	DATE	DRAWN BY	CHECKED
NTS	FEB '90	RC	JU
PROJECT NO.		REVISION	
190233-EN-00-AN-08-C-0227		C1	

Appendix I – Arun District Council Drainage Checklist



Surface Water Drainage Proposal Checklist

This 'Surface Water Drainage Proposals Checklist' has been designed to clearly define Arun District Council's and Chichester District Council's expectations and requirements for any surface water drainage proposals, submitted for appraisal by the council's Engineers, during the planning process.

Please be aware that it is in your interest to provide all of the requested information, as this will allow the council's Engineers to quickly and efficiently review your proposals. The omission of any requested information may lead to delays in the planning process.

This document will be of help to any applicant, or drainage consultant, preparing to submit a 'Discharge of Conditions Application' relating to surface water drainage conditions. Alternatively, it can also be used earlier in the planning process, if the applicant wishes to avoid pre-commencement conditions relating to surface water drainage. The Town and Country Planning Regulations now require pre-commencement conditions to have the prior agreement of the applicant regarding their wording and use. Therefore, if you wish to avoid pre-commencement conditions, in relation to surface water drainage, you will need to submit proposals that provide the information requested in this checklist and also align with the requirements of the following documents:

'Supplementary Requirements for Surface Water Drainage Proposals'. (Arun DC)

'Supplementary Requirements for Surface Water Drainage Proposals'. (Chichester DC)

By submitting all of the information requested by this checklist you will enable the council's Engineers to determine whether your proposals follow the hierarchy for sustainable drainage and will adequately drain the site.

Please be aware that it will be difficult for the council's Engineers to undertake a timely assessment of your application if you fail to provide any of the information requested.



Surface Water Drainage Proposal Checklist

Ground Investigation Results				
Results Required		Results Provided?		
Winter groundwater monitoring results (Please refer to guidance note 1 below)		Yes	☒	No
Period of winter groundwater monitoring Note 1		From	20/12/2019	
		To	13/01/2020	
Maximum recorded groundwater level			3.69 mAOD	
			2.48 MBGL	
Winter infiltration test results Note 2		Yes	☒	No
Date of winter infiltration testing			27/01/2020	
Details of the location and depth of the infiltration testing Note 3		Yes	☒	No
Minimum infiltration rate Note 4			Varies m/s	

Guidance Notes

- Groundwater monitoring should be undertaken during the wet winter months, (October to March) to enable the peak annual groundwater levels to be established. The extent of winter monitoring should be discussed with the council's Engineers.
- Infiltration testing should be undertaken during the wet winter months, (October to March) and in line with BRE365, or a similar approved method. Tests should be repeated 3x, to replicate saturated ground conditions.
- Infiltration testing should be undertaken at the location and depth of any proposed infiltration structures. This must be above the maximum recorded groundwater level in that vicinity.
- The minimum infiltration rate obtained at the location and depth of the proposed infiltration structures should be used to inform the design of the structures.

Refer to test report.

Proposed Method of Surface Water Disposal				
Infiltration	Yes	☒	No	
On-site, via soak-away structures				
If on-site infiltration is not to be used, has justification for this been provided? Note 5	Yes		No	
Attenuation (on-site) with a restricted discharge to a watercourse on, or adjacent to, the site	Yes		No	☒
Attenuation (on-site) with a restricted discharge to a surface water sewer on, or adjacent to, the site	Yes		No	☒
Attenuation (on-site) with a restricted discharge to a foul water sewer on, or adjacent to, the site	Yes		No	☒

Guidance Notes

- If on-site infiltration is not being used to drain the site you will need to provide evidence that demonstrates on-site infiltration is unviable.

Drainage Design: Supporting Calculations					
Calculations Required			Calculations Provided?		
Infiltration Structures	Half-drain time for 10 year event (plus climate change allowance)	Yes ☒	No ☐	Hours	
	Half-drain time for 100 year event (plus climate change allowance)	Yes ☒	No ☐	Hours	
	Calculations demonstrating that the 1 in 100 year event, plus climate change allowance can be accommodated on-site. Note 7	Yes ☒	No ☐		
	Lowest base level of infiltration structure	3.40 mAOD 1.10 mBGL			
	Has the design sought to provide treatment of potential contaminants? i.e. hydrocarbons.	Yes ☒	No ☐		
N/A Attenuation and Subsequent Restricted Discharge	Pre-development run-off rate calculations	Yes ☐	No ☐		
	Proposed discharge rate Note 6	1/s			
	Calculations demonstrating that the 1 in 100 year event, plus climate change allowance can be accommodated on-site. Note 7	Yes ☐	No ☐		
	Has the design sought to provide treatment of potential contaminants? i.e. hydrocarbons.	Yes ☐	No ☐		
	If your proposed scheme incorporates any impermeable lined attenuation features we require calculations to demonstrate that appropriate resistance to floatation (due to groundwater levels) is catered for in the design	Yes ☐	No ☐		
	If you propose discharging into or altering an ordinary watercourse; have you sought Ordinary Watercourse/Land Drainage Consent? Note 8	Yes ☐	No ☐		
	If discharging to a watercourse, piped system or the sea, has the proposed drainage network been modelled against predicted top water levels for the 1 in 100 year storm event plus climate change allowance, within the existing system? Note 9	Yes ☐	No ☐		

Refer to Calculation Sheet

Guidance Notes

- Any proposed discharge rate must be less than, or equal to, the pre-development rate. Greenfield sites must use the mean flow rate (Qbar). Additionally, if you are developing a brownfield site, we expect you to provide fully detailed plans of the existing surface water drainage arrangements on site, including impermeable areas, gullies, outfalls, pipes & diameters, manholes, etc.
- The appropriate factor of safety from the table below must be applied to your calculations to ensure your design is fully in accordance with CIRIA R156/ CIRIA C609.

Factor of Safety Table						
Size of Area to be Drained	Consequences of failure					
	No damage or inconvenience		Minor inconvenience, e.g. surface water on car park		Damage to buildings or structures or roads.	
	Cv=1.0	Cv=0.75	Cv=1.0	Cv=0.75	Cv=1.0	Cv=0.75
<100 m ²	1.5	2	2	3	10	13
100m ² to 1000m ²	1.5	2	3	4	10	13
>1000m ²	1.5	2	5	6.5	10	13

8. Ordinary Watercourse/Land Drainage Consent will need to be sought, ideally in parallel with planning permission, if you propose discharging into, culverting or altering a watercourse.
9. Modelling is required to ensure that problems, such as surcharged outfalls, are addressed.

Plans/Drawings/Diagrams				
Required	Provided?			
Plan detailing the location of groundwater monitoring and infiltration testing	Yes	☒	No	☐
Detailed drainage layout plan Note 10	Yes	☒	No	☐
Construction detail plans Note 11	Yes	☒	No	☐
Exceedance flow route plans Note 12	Yes	☐	No	☒
Impermeable area plan	Yes	☒	No	☐
If ground levels are being raised $\geq 300\text{mm}$ above existing levels and is unavoidable, have fully detailed plans been provided, together with drainage proposals, to address any potential drainage related issues.	Yes	☐	No	☐
If any part of the development site is within recognised flood plain i.e. 1 in 100 & 1 in 200 year fluvial/tidal events, have plans been provided showing the extents, together with any proposals for ground raising/displacement within these areas. Note 13	Yes	☐	No	☒

Guidance Notes

10. Drainage layout plans should include:
 - All surface water drainage pipes labelled with; diameters, pipe materials, falls and invert levels.
 - All infiltrating and attenuating structures (including permeable paving) labelled with; dimensions, invert and cover levels.
 - All manholes labelled with; cover levels, invert levels, cover types detailed.
 - All silt traps clearly labelled with sump depths.
 - Control structures with outflow rates and invert levels.
 - Proposed/existing levels of any areas subject to ground raising, together with suitable measures/detailed drawings for the associated management of surface water runoff. Please note that ground raising should be avoided unless there are exceptional circumstances.
11. Site specific construction detail plans should be supplied if your proposed drainage scheme includes any of the following elements: pipe bed and surround; infiltrating structures; attenuating structures; manholes; catch-pits/silt traps; control devices; permeable paving; headwalls.
12. Unless specifically requested by the council's drainage engineers 'Exceedance Flow Route Plans' are only required for developments of more than 5 properties.
13. Product 4 'Detailed flood risk assessment mapping data' (available from the Environment Agency) must also be provided in support. Plans/details will be required to mitigate any unavoidable loss of flood plain/storage. Please also be aware that Environment Agency approval of such proposals will also be required.

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