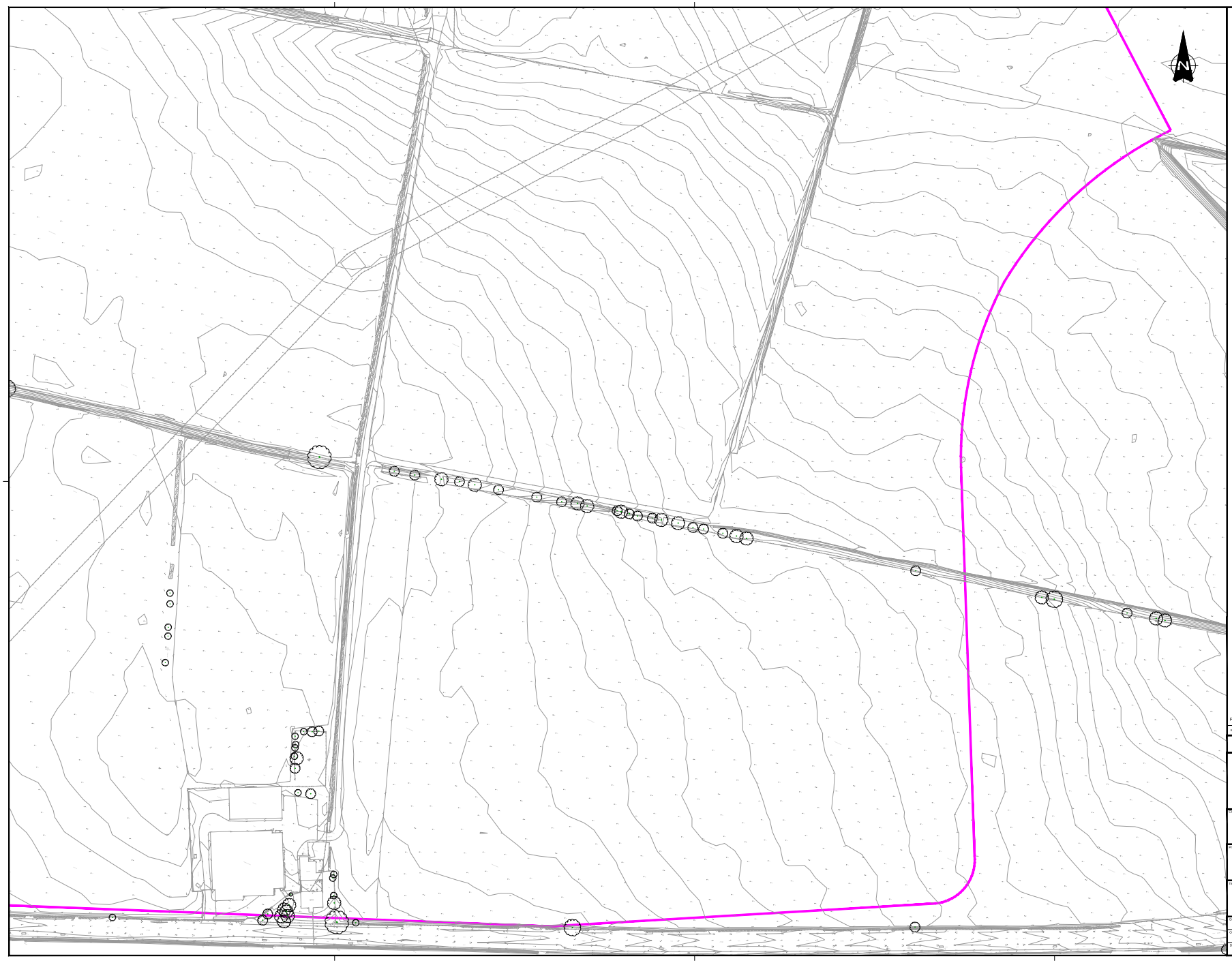
Appendix A: Drawings

Appendix A: Contents

- SYSTRA dwg 21B34-SK001 - Existing ground elevations and contour lines



Rev	Date	Revision details	Drawn	Checked	Approved
P0	02/02/21	FIRST ISSUE	JP	GP	TD

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Client
ENVISION

Project
PROPOSED BATTERY PLANT

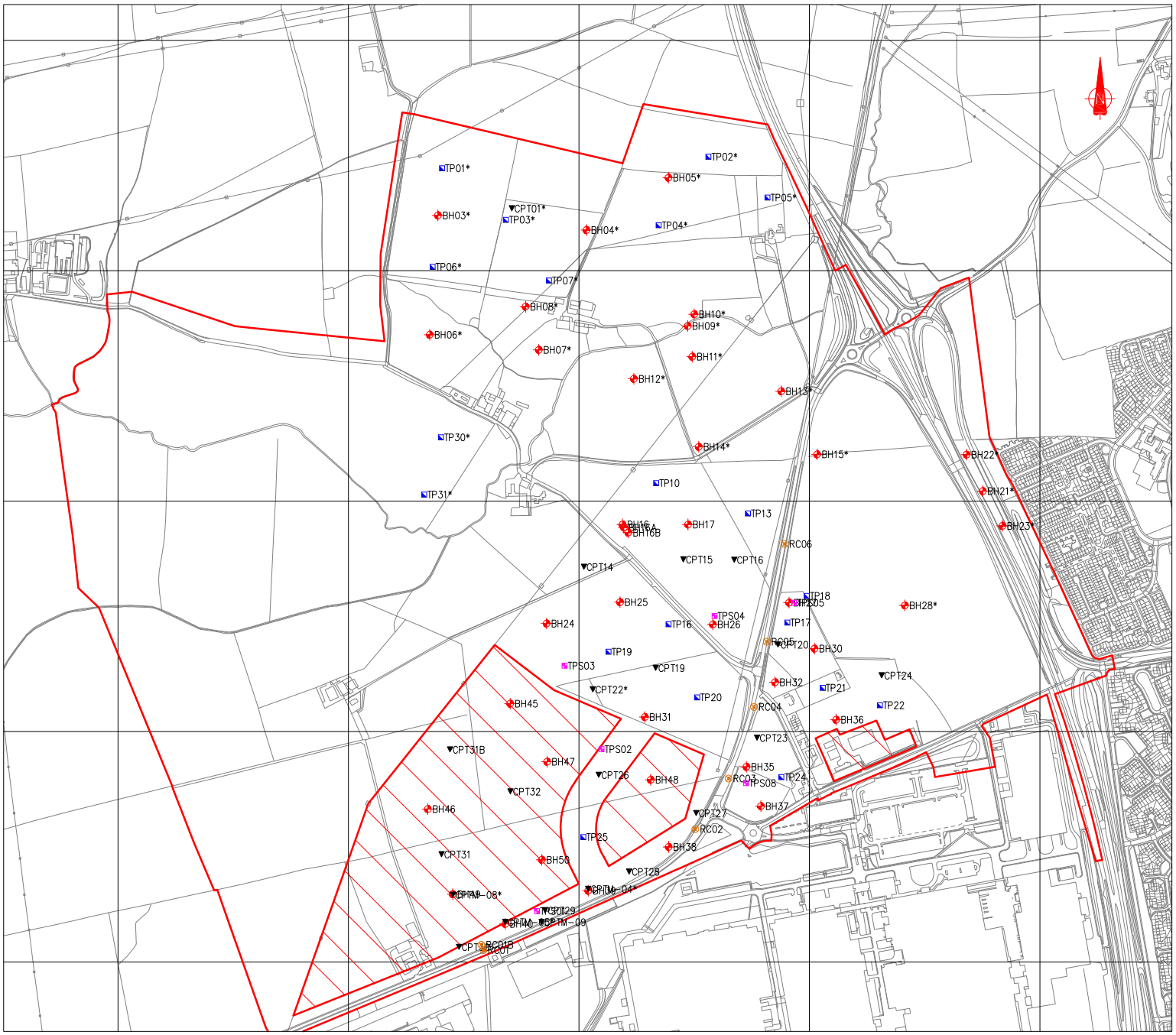
Title
TOPOGRAPHICAL SURVEY
AND
CONTOUR LINES

Drawn	Checked	Approved
JP	GP	TD
Original drg. size: A1	Date: 01.07.21	Scale: 1:1000
Drawing Status: INFORMATION	Drawing Number: 21B34-SK001	Rev: P0

Appendix B: Ground investigation information

Appendix B: Contents

- Dunelm GI plan and borehole logs
- Dunelm GI soakaway tests



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NOT TO SCALE: Contractor to check all dimensions on site before commencement of any works. No dimensions to be scaled from this drawing.

NOTES:

- BH Location of Cable Percussive Borehole
- CPT Location of Cone Penetration Test
- RC Location of Road Core
- TP Location of Machine Excavated Trial Pit
- TPS Location of Machine Excavated Soakaway Test

CLIENT:

SUNDERLAND COUNTY COUNCIL

PROJECT TITLE:

IAMP - PRELIMINARY GROUND INVESTIGATION

DRAWING TITLE:

Exploratory Hole Location Plan

DRAWING NUMBER:

D8044/02

BOREHOLE RECORD

Borehole BH45

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 35.63 | Scale 1:50

Easting: 433350.81 | Northing: 559060.39

Client: Sunderland City Council | Driller: PK/DC | Logged By: BC | Sheet 1 of 2

Method: Cable Percussive Drilling with Rotary Core Drilling | Checked By: BL | Dates: 02/08/2017 - 17/08/2017

SAMPLE DETAILS Type	Depth From-To (m)	Insitu Testing	(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
D	0.10			Dark brown slightly sandy slightly gravelly clayey TOPSOIL. Gravel is subangular to rounded, fine to coarse of sandstone, limestone, mudstone and coal.	(0.25)			
ES	0.10				0.25	35.38		
D	0.30							
B	0.50 - 1.00			Firm brown slightly sandy slightly gravelly CLAY of high plasticity. Gravel is subangular to subrounded, fine to coarse of sandstone, mudstone and coal.	(0.95)			
			1					
B	1.20 - 1.65				1.20	34.43		
UF	1.20 - 1.65	49 blows		Firm greyish brown slightly sandy slightly gravelly silty CLAY of intermediate plasticity. Gravel is subangular to subrounded, fine to coarse of sandstone, limestone and mudstone.				
BRE	1.70							
B	2.00 - 2.45		2	(1.60) Dry				
D	2.00							
SPT (S)	2.00 - 2.45	N=15 (3,5/4,4,3,3,4)						
BRE	2.50							
U	3.00 - 3.45	22 blows	3					
D	3.45							
BRE	3.70							
B	4.00 - 4.45		4	(1.60) Dry				
D	4.00							
SPT (S)	4.00 - 4.45	N=7 (1,2/2,2,1,2)						
BRE	4.50							
U	5.00 - 5.45	16 blows	5					
D	5.45				(8.30)			
BRE	5.70							
B	6.00 - 6.45		6	(1.60) Dry				
D	6.00							
SPT (S)	6.00 - 6.45	N=9 (3,2/3,2,2,2)						
BRE	6.50							
U	7.00 - 7.45	12 blows	7	*7.00m: Clay of high plasticity.*				
D	7.45							
BRE	7.70							
B	8.00 - 8.45		8	(1.60) Dry				
D	8.00							
SPT (S)	8.00 - 8.45	N=7 (3,2/2,1,2,2)						
BRE	8.50							
B	9.00 - 9.45		9	(1.60) Dry				
D	9.00							
SPT (S)	9.00 - 9.45	N=9 (2,3/2,2,3,2)						
BRE	9.50				9.50	26.13		
D	9.50			Firm, greyish brown slightly sandy clayey SILT. Sand is fine to coarse.				
B	10.00 - 10.65		10					

Continued on next sheet

Ground Water (m)

Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)
13.20	12.00	3.4	20	

Chiselling / Hard Strata

From (m)	To (m)	Time (hr)
13.60	13.80	01:00

Casing Depths

Diameter (mm)	Depth (m)
200	1.60
150	13.80
140	13.80

Hole Diameter

Diameter (mm)	Depth (m)
200	1.60
150	13.60
121	19.10

General Remarks

1. Hand dug inspection pit to 1.20m.

Log last updated 24/01/2018

BOREHOLE RECORD

Borehole BH45

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 35.63 | Scale 1:50

Easting: 433350.81 | Northing: 559060.39

Client: Sunderland City Council | Driller: PK/DC | Logged By: BC | Sheet 2 of 2

Method: Cable Percussive Drilling with Rotary Core Drilling | Checked By: BL | Dates: 02/08/2017 - 17/08/2017

SAMPLE DETAILS							(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
Type	Depth From-To (m)	Insitu Testing	TCR%	SCR%	RQD%	FI						
UF	10.00 - 10.64	4 blows						Firm, greyish brown slightly sandy clayey SILT. Sand is fine to coarse.	(1.20)			
BRE	10.70								10.70	24.93		
D	10.70							Soft, slightly sandy slightly gravelly silty CLAY of intermediate plasticity. Gravel is subangular to rounded, fine to coarse of sandstone, mudstone and coal.				
U	11.00 - 11.45	7 blows					11					
D	11.45											
BRE	11.70								(2.00)			
D	11.90											
B	12.00 - 12.45						12 (11.90) Dry	*12.00m: Stiff.*				
D	12.00											
SPT (S)	12.00 - 12.45	N=30 (4,5/6,7,8,9)										
BRE	12.50											
D	12.80							Stiff reddish brown slightly sandy slightly gravelly CLAY of low plasticity. Gravel is subangular to rounded, fine to coarse of sandstone, mudstone and coal.	12.70	22.93		
B	13.20 - 13.65						13 (12.10) Dry		(0.90)			
D	13.20											
SPT (S)	13.20 - 13.65	N=39 (4,4/6,8,10,15)										
BRE	13.60								13.60	22.03		
D	13.70							Very dense light brown sandy GRAVEL. Gravel is angular to subangular, fine to coarse of sandstone. (Weathered				
D	13.80						03/08/2017 1700		(0.45)			
SPT (S)	13.80 - 14.00	N=50+ (8,17/40,10 for 10mm)				NI	(13.80) 3.10	13.80 - 17.70 rockhead).				
C	14.00 - 14.90						14 (13.80) 3.10	0 % Water	14.05	21.58		
			100	80	80	1		Medium strong, partially weathered, light brown fine to medium grained SANDSTONE. Fractures are closely spaced, subhorizontal, planar, smooth, undulose with light brown clay infill.				
C	14.70 - 14.90					NI		*14.62 - 14.72m: Fracture is subhorizontal, planar, rough, undulating with reddish brown sandstone gravel infill.*				
	14.90 - 15.90					0						
						A...		*14.90 - 14.99m: AZCL.*				
			91	91	49	3	15					
C	15.80 - 15.90							*15.66 - 15.77m: Fracture is 30 degrees, planar and smooth.*	(3.80)			
	15.90 - 16.30					A...		*15.90 - 15.94m: AZCL.*				
			90	90	90		16					
	16.30 - 17.70							*16.46m: Fracture is 10 degrees, planar, smooth with grey clay infill.*				
								16.46 - 16.56m: Fractures are 30 degrees, planar, rough with grey clay infill.				
C	16.90 - 17.20		100	100	91	1	17					
	17.70 - 19.10						17.70 - 19.10		17.70	17.93		
						NA	75 % Water	Firm to stiff light brown slightly sandy slightly gravelly CLAY.	(0.23)			
C	18.00					6	18	Gravel is angular to subangular, fine to coarse of sandstone.	17.93	17.70		
								Medium strong to strong, partially weathered light brown fine	(0.27)			
C	18.20 - 18.40							to medium grained SANDSTONE. Fractures are closely	18.20	17.43		
			100	80	62	4		spaced, subhorizontal, planar, smooth and clean.	(0.50)			
								Medium strong, partially weathered, light grey fine grained				
								SANDSTONE. Fractures are closely to medium spaced,	18.70	16.93		
						5		subhorizontal, planar, smooth and clean.				
							19	Medium strong to strong, partially weathered, light brown fine	(0.40)			
								to coarse grained SANDSTONE. Fractures are closely	19.10	16.53		
								spaced, subhorizontal, planar, smooth and clean.				
								18.82m: Fractures are 20 degree, planar, smooth with black clay infill.				
								18.92 - 18.99m: Fractures are subhorizontal, planar, smooth with reddish brown slightly gravelly clay infill. Gravel is angular to subangular, fine to medium of sandstone.				
								End of Borehole at 19.10 m				
							20					

Ground Water (m)

Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)
13.20	12.00	3.4	20	

Chiselling / Hard Strata

From (m)	To (m)	Time (hr)
13.60	13.80	01:00

Casing Depths

Diameter (mm)	Depth (m)
200	1.60
150	13.80
140	13.80

Hole Diameter

Diameter (mm)	Depth (m)
200	1.60
150	13.60
121	19.10

General Remarks

1. Hand dug inspection pit to 1.20m.

Log last updated 24/01/2018

BOREHOLE RECORD

Borehole BH46

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 38.56 | Scale 1:50

Easting: 433172.22 | Northing: 558831.72

Client: Sunderland City Council | Driller: RH/DC | Logged By: BC | Sheet 1 of 4

Method: Cable Percussive Drilling with Rotary Core Drilling | Checked By: JH | Dates: 10/08/2017

SAMPLE DETAILS Type	Depth From-To (m)	Insitu Testing	(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
				Dark brown slightly sandy slightly gravelly slightly clayey TOPSOIL. Gravel is subangular to rounded, fine to coarse of sandstone, mudstone, siltstone and coal.	(0.10)	38.46		
ES	0.20				0.10			
	0.40	HVP=57 kPa			(0.40)			
ES	0.50			Firm brownish grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded, fine to coarse of sandstone, mudstone, siltstone and coal. Occasional rootlets noted.	0.50	38.06		
B	0.60 - 1.20							
D	0.60							
BRE	1.00		1					
D	1.00			Stiff orangish brown, mottled grey, slightly sandy slightly gravelly CLAY of intermediate plasticity. Gravel is subangular to subrounded, fine to coarse of sandstone, mudstone and coal.				
UT	1.20 - 1.65	54 blows			(1.70)			
D	1.65							
BRE	2.00		2					
D	2.00							
B	2.20 - 2.70		(2.00) Dry		2.20	36.36		
D	2.20			Stiff greyish brown slightly sandy slightly gravelly CLAY with occasional cobbles. Gravel is subangular to rounded, fine to coarse of sandstone, mudstone, siltstone and coal. Cobbles are of sandstone.				
SPT (S)	2.20 - 2.29	N=50+ (25 for 40mm/50 for 50mm)						
B	3.00		3					
BRE	3.00							
D	3.00			*3.20m: Clay of low plasticity.*				
B	3.20 - 3.70							
UT	3.20 - 3.65	94 blows						
U	3.80 - 4.25	150 blows	4					
D	4.25							
BRE	4.80							
D	4.80							
B	5.00 - 5.50		5 (4.50) Dry		(5.70)			
D	5.00							
SPT (S)	5.00 - 5.45	N=31 (5,7/7,7,8,9)						
BRE	5.80							
D	5.80							
U	6.00 - 6.45	135 blows	6	*6.00m: Clay of intermediate plasticity.*				
D	6.45			*6.45 - 6.80m: Firm.*				
BRE	6.80							
D	6.80							
B	7.00 - 7.50		7 (6.00) Dry					
D	7.00							
SPT (S)	7.00 - 7.44	N=50+ (7,9/9,12,15,14 for 60mm)						
BRE	7.80							
D	7.80				7.90	30.66		
D	7.90		8 (7.50) Dry	Very dense reddish brown sandy GRAVEL. Gravel is angular to subangular, fine to coarse of siltstone. (Weathered SILTSTONE).	(0.30)			
D	8.00		(6.60) 2.00		8.20			
SPT (S)	8.00 - 8.10	N=50+ (12,13 for 10mm/50 for 20mm)	NI	8.20 - 11.10 75 % Water		30.36		
SPT (C)	8.10 - 8.17	N=0 (25 for 40mm,0 for 30mm/)		Very weak to weak, partially weathered, brownish grey SILTSTONE. Fractures are closely spaced subhorizontal planar, smooth, clean.				
	8.20 - 9.60		TCR% 100	SCR% 92 RQD% 61 FI 4				
				8.22 - 8.53m: Subvertical, stepped, smooth, clean with light brown discolouration on fracture surface.				
			9	*8.91 - 8.95m: 10 degree, planar, smooth with light grey siltstone gravel.*	(1.87)			
C	9.50 - 9.60							
	9.60 - 11.10							
			10					

Continued on next sheet

Ground Water (m)

Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)

Chiselling / Hard Strata

From (m)	To (m)	Time (hr)
2.20	2.60	00:45
8.00	8.20	01:00

Casing Depths

Diameter (mm)	Depth (m)
200	7.50
140	11.00

Hole Diameter

Diameter (mm)	Depth (m)
200	8.20
116	30.60

General Remarks

1. Hand dug inspection pit to 1.20m.
2. No groundwater encountered.

Log last updated 24/01/2018

BOREHOLE RECORD

Borehole BH46

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 38.56 Scale 1:50

Easting: 433172.22 Northing: 558831.72

Client: Sunderland City Council | Driller: RH/DC | Logged By: BC | Sheet 2 of 4

Method: Cable Percussive Drilling with Rotary Core Drilling | Checked By: JH | Dates: 10/08/2017

SAMPLE DETAILS							(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %	FI						
C	10.10 - 10.22		100	100	97	3		Very weak to weak, partially weathered, thinly laminated, brownish dark grey MUDSTONE. Fractures are closely to medium spaced subhorizontal, planar, smooth, undulose, clean.	10.07	28.49		
	11.10 - 12.60		100	95	84	11	11.10 - 30.60 95 % Water	*11.32 - 11.34m: Subhorizontal, planar, smooth with light grey clay infill.*	(1.84)			
C	12.20 - 12.35					4 NI	12	*11.88 - 11.91m: Subhorizontal, planar, smooth with light grey clay infill.* Very weak to weak, partially weathered, thinly laminated grey MUDSTONE. Fractures are closely spaced subhorizontal, planar, smooth, clean. (Drillers description).	11.91	26.65		
	12.60 - 14.10		100	100	97		13	*12.53 - 12.60m: Fractures are frequent, interlock and orientated.* *12.93 - 12.95m: 15 degree, planar, smooth with light grey clay infill.*	(2.95)			
C	13.30 - 13.40					3						
C	14.10 - 15.60 14.20 - 14.30		100	100	100		14	*13.96 - 13.98m: 15 degree, planar, smooth with light grey clay infill.* *14.37m: Subhorizontal, stepped, smooth, clean fractures.* *14.70 - 14.71m: 20 degree planar, smooth with light grey sandstone gravel infill.*	14.86	23.70		
							15	Medium strong to strong, unweathered, grey fine grained SANDSTONE. Fractures are closely to medium spaced between 20-30 degrees, planar, smooth, clean. *15.28 - 15.33m: Very weak to weak blue, grey mudstone band.*				
C	15.60 - 17.10 15.70 - 16.05		100	100	87		16	*16.05 - 16.08m: Subhorizontal planar, smooth with light grey clay infill.* *16.58 - 16.62m: Weak blue, grey mudstone band.*				
	17.10 - 18.60		100	100	61	2	17	*17.10 - 17.27m: Subvertical, planar, smooth, undulose, clean fracture*	(5.48)			
	18.60 - 20.10		100	100	93		18 19	*19.70 - 19.74m: Weak thinly laminated blue, grey mudstone band.*				
	20.10 - 21.60						20					

Continued on next sheet

Ground Water (m)

Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)

Chiselling / Hard Strata

From (m)	To (m)	Time (hr)
2.20	2.60	00:45
8.00	8.20	01:00

Casing Depths

Diameter (mm)	Depth (m)
200	7.50
140	11.00

Hole Diameter

Diameter (mm)	Depth (m)
200	8.20
116	30.60

General Remarks

1. Hand dug inspection pit to 1.20m.
2. No groundwater encountered.

Log last updated 24/01/2018

BOREHOLE RECORD

Borehole BH46

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 38.56 Scale 1:50

Easting: 433172.22 Northing: 558831.72

Client: Sunderland City Council | Driller: RH/DC | Logged By: BC | Sheet 3 of 4

Method: Cable Percussive Drilling with Rotary Core Drilling | Checked By: JH | Dates: 10/08/2017

SAMPLE DETAILS							(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %	FI						
						4		Very weak, partially weathered, grey MUDSTONE. Fractures are closely spaced between 5 - 20 degree, planar, smooth, clean.	20.34	18.22		
			100	100	90				(0.51)			
								Medium strong to strong, partially weathered, grey fine to medium grained SANDSTONE. Fractures are subhorizontal, planar, smooth, clean.	20.85	17.71		
	21.60 - 23.10		100	100	67		21					
							22	*22.38m: Fractures are subhorizontal, planar, smooth, undulose with grey clay infill.* *22.59 - 22.88m: Subvertical planar, smooth, undulose, clean fractures.*				
	23.10 - 24.60		100	100	100		23					
							24					
	24.60 - 26.10		100	100	0	2	25					
								25.60m: Fractures are subhorizontal, planar, smooth, undulose with light grey clay infill.	(9.75)			
	26.10 - 27.60		100	100	0		26					
							27	*26.89m: Fractures are subhorizontal, planar, smooth with light grey clay infill.* *26.96m: Fractures are subhorizontal, planar, rough with grey clay infill.* *27.20m: Fractures are subhorizontal, planar, smooth with light grey sandstone gravel infill.*				
	27.60 - 29.10		100	100	100		28					
	29.10 - 30.60		100	100	100		29					
							30					

Continued on next sheet

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter		General Remarks
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)	1. Hand dug inspection pit to 1.20m. 2. No groundwater encountered.
					2.20	2.60	00:45	200	7.50	200	8.20	
					8.00	8.20	01:00	140	11.00	116	30.60	

Log last updated 24/01/2018

BOREHOLE RECORD

Borehole BH46

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 38.56 | Scale 1:50

Easting: 433172.22 | Northing: 558831.72

Client: Sunderland City Council | Driller: RH/DC | Logged By: BC | Sheet 4 of 4

Method: Cable Percussive Drilling with Rotary Core Drilling | Checked By: JH | Dates: 10/08/2017

SAMPLE DETAILS							(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %	FI						
								End of Borehole at 30.60 m	30.60	7.96		

31 32 33 34 35 36 37 38 39 40

Ground Water (m)

Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)

Chiselling / Hard Strata

From (m)	To (m)	Time (hr)
2.20	2.60	00:45
8.00	8.20	01:00

Casing Depths

Diameter (mm)	Depth (m)
200	7.50
140	11.00

Hole Diameter

Diameter (mm)	Depth (m)
200	8.20
116	30.60

General Remarks

1. Hand dug inspection pit to 1.20m.
2. No groundwater encountered.

Log last updated 24/01/2018

BOREHOLE RECORD

Borehole BH47

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 36.54 | Scale 1:50

Easting: 433430.80 | Northing: 558934.44

Client: Sunderland City Council | Driller: PK/DC | Logged By: AH | Sheet 1 of 3

Method: Cable Percussive Drilling with Rotary Core Drilling | Checked By: JH | Dates: 07/08/2017 - 18/08/2017

SAMPLE DETAILS Type	Depth From-To (m)	Insitu Testing	(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
D	0.10			MADE GROUND: Brown slightly sandy slightly gravelly clayey topsoil. Gravel is subangular to rounded, fine to coarse of sandstone, mudstone, coal and brick.				
ES	0.10							
	0.30	HVP=25 kPa			(0.60)			
					0.60	35.94		
D	0.70			Firm, dark brown mottled grey, slightly sandy slightly gravelly CLAY of intermediate plasticity. Gravel is subangular to subrounded, fine to coarse of sandstone, mudstone, siltstone and coal.				
ES	0.70							
	0.70	HVP=66 kPa						
B	0.80 - 1.20		1					
BRE	0.80							
U	1.20 - 1.65	29 blows		*1.20m: Stiff*				
D	1.65							
BRE	1.90				(2.50)			
D	2.00		2	(1.60) Dry				
SPT (S)	2.00 - 2.45	N=14 (2,2/3,3,4,4)						
BRE	2.50							
U	3.00 - 3.45	22 blows	3					
					3.10	33.44		
D	3.45			Firm, dark brown mottled grey, silty slightly sandy slightly gravelly CLAY of intermediate plasticity. Gravel is subangular to rounded, fine to coarse of sandstone, mudstone and siltstone.				
BRE	3.70				(1.20)			
B	4.00 - 4.45		4	(1.60) Dry				
D	4.00							
SPT (S)	4.00 - 4.45	N=12 (1,2/2,3,4,3)						
D	4.30				4.30	32.24		
BRE	4.50			Firm thinly laminated greyish brown silty slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded, fine to coarse of sandstone, mudstone and siltstone.				
UT	5.00 - 5.45	12 blows	5	*5.00m: Clay of low plasticity.*				
D	5.45							
BRE	5.70							
B	6.00 - 6.45		6	(1.20) Dry				
D	6.00				(3.70)			
SPT (S)	6.00 - 6.45	N=13 (2,3/3,3,3,4)						
BRE	6.50							
UT	7.00 - 7.45	22 blows	7					
D	7.45							
BRE	7.70							
B	8.00 - 8.45		8	(1.60) Dry	8.00	28.54		
D	8.00			Stiff greyish brown silty slightly sandy CLAY of low plasticity.				
SPT (S)	8.00 - 8.45	N=20 (5,5/6,5,5,4)						
BRE	8.50							
					(1.50)			
UT	9.00 - 9.45	18 blows	9					
D	9.45				9.50	27.04		
BRE	9.70			Firm, slightly sandy slightly gravelly CLAY with frequent cobbles. Gravel is subangular to subrounded, fine to coarse of sandstone, mudstone, limestone and coal. Cobbles are of				
B	10.00 - 10.45		10	(9.90) Dry				

Continued on next sheet

Ground Water (m)

Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)
15.30	14.90	11.8	20	

Chiselling / Hard Strata

From (m)	To (m)	Time (hr)
10.30	10.50	00:30
12.80	13.10	01:00
13.90	14.20	00:45
14.40	14.50	00:20
14.90	15.30	01:00

Casing Depths

Diameter (mm)	Depth (m)
200	1.60
150	15.00
140	18.00

Hole Diameter

Diameter (mm)	Depth (m)
200	1.60
150	15.30
121	20.70

General Remarks

1. Hand dug inspection pit to 1.20m.

Log last updated 24/01/2018

BOREHOLE RECORD

Borehole BH47

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 36.54 Scale 1:50

Easting: 433430.80 Northing: 558934.44

Client: Sunderland City Council

Driller: PK/DC Logged By: AH

Sheet 2 of 3

Method: Cable Percussive Drilling with Rotary Core Drilling

Checked By: JH

Dates: 07/08/2017 - 18/08/2017

SAMPLE DETAILS Type	Depth From-To (m)	Insitu Testing	(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
D	10.00			Firm, slightly sandy slightly gravelly CLAY with frequent cobbles. Gravel is subangular to subrounded, fine to coarse of sandstone, mudstone, limestone and coal. Cobbles are of sandstone.				
SPT (S)	10.00 - 10.37	N=50+ (5,9/12,11,27 for 70mm)						
BRE	10.50			*10.00m: Very stiff.*				
U	11.00 - 11.45	56 blows	11	*11.00m: Clay of low plasticity.*				
D	11.45							
BRE	11.70		07/08/2017 (10.90) Dry					
B	12.00 - 12.45		08/08/2017 0800 12 (10.90) Dry					
D	12.00		(11.90) Dry		(5.30)			
SPT (S)	12.00 - 12.44	N=50+ (7,10/12,14,14,10 for 70mm)						
BRE	12.50							
D	12.70							
B	13.00 - 13.45		13 (12.90) Dry					
D	13.00							
SPT (S)	13.00 - 13.38	N=49 (25/12,11,11,15)						
BRE	13.50							
D	13.80							
B	14.00 - 14.40		14 (13.90) Dry					
D	14.00							
SPT (S)	14.00 - 14.22	N=50+ (21,4 for 10mm/21,29 for 60mm)						
D	14.80			Very dense yellowish brown sandy GRAVEL. Gravel is subangular to angular, fine to coarse of sandstone. (Weathered sandstone, rockhead).	14.80	21.74		
	15.20 - 16.70		15		(0.50)			
D	15.30		08/08/2017 1700 (15.00) Dry		15.30	21.24		
SPT (S)	15.30 - 15.39	N=50+ (25 for 45mm/50 for 45mm)	15.20 - 16.70 55 % Water	Weak, partially weathered, light brown fine to medium SANDSTONE. Fractures are closely to medium spaced, subhorizontal, planar, smooth and clean. Below 16.62m fractures are medium to widely spaced.				
D	15.30		(15.00) Dry					
SPT (S)	15.30 - 15.39	N=50+ (25 for 45mm/50 for 45mm)	08/08/2017 1700 (15.00) Dry (15.00) Dry					
C	15.47 - 15.89	100 72 53 NI 3	16					
C	16.10 - 16.29			*16.25 - 16.70m: Subvertical, planar, smooth, clean fracture.*				
				16.40 - 16.62m: Frequent subvertical fractures with brown clay infill.				
C	16.70 - 16.83		40					
	16.70 - 18.20		16.70 - 18.20 60 % Water		(2.75)			
			17					
		100 100 100 3		*17.50 - 18.00m: Dark red staining.*				
C	17.70 - 17.84							
			18		18.05	18.49		
	18.20 - 19.70		18.20 - 19.70 45 % Water	Weak, partially weathered, orange brown fine, predominantly medium to coarse, micaceous SANDSTONE. Fractures are subhorizontal, planar, smooth with dark red staining.				
			12	*18.05 - 19.05m: Subvertical, undulose fracture with orange staining.*	(1.00)			
		100 80 20	19					
				19.04 - 19.06m: Dark red brown clay.	19.05	17.49		
			30	Extremely weak, partially weathered, thinly to thickly bedded red brown MUDSTONE with occasional thin laminae of siltstone. Fractures are very closely spaced, subhorizontal, planar, smooth and clean.	(0.95)			
	19.70 - 20.70		19.70 - 20.70 90 % Water					
			10	*19.38m: Subvertical, planar, smooth, clean fracture.*				
		TCR% SCR% RQD% FI	20		20.00	16.54		

Continued on next sheet

Ground Water (m)

Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)
15.30	14.90	11.8	20	

Chiselling / Hard Strata

From (m)	To (m)	Time (hr)
10.30	10.50	00:30
12.80	13.10	01:00
13.90	14.20	00:45
14.40	14.50	00:20
14.90	15.30	01:00

Casing Depths

Diameter (mm)	Depth (m)
200	1.60
150	15.00
140	18.00

Hole Diameter

Diameter (mm)	Depth (m)
200	1.60
150	15.30
121	20.70

General Remarks

1. Hand dug inspection pit to 1.20m.

Log last updated 24/01/2018

BOREHOLE RECORD

Borehole BH47

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 36.54 Scale 1:50

Easting: 433430.80 Northing: 558934.44

Client: Sunderland City Council | Driller: PK/DC | Logged By: AH | Sheet 3 of 3

Method: Cable Percussive Drilling with Rotary Core Drilling | Checked By: JH | Dates: 07/08/2017 - 18/08/2017

SAMPLE DETAILS							(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %	FI						
						28		*19.90 - 20.08m: 40 - 60 degree planar, smooth, clean fracture.*				
			100	40	10	NI		Extremely weak to weak, partially weathered, dark grey red brown MUDSTONE. Fractures are subhorizontal, planar, smooth with occasional clay infill.	(0.40)			
									20.40	16.14		
								Red brown gravelly CLAY. Gravel is angular, fine to coarse of mudstone. (Weathered MUDSTONE). Occasional very thin beds of mudstone.	(0.30)			
									20.70	15.84		
								End of Borehole at 20.70 m				

21 22 23 24 25 26 27 28 29 30

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter		General Remarks
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)	1. Hand dug inspection pit to 1.20m.
15.30	14.90				10.30	10.50	00:30	200	1.60	200	1.60	
					12.80	13.10	01:00	150	15.00	150	15.30	
					13.90	14.20	00:45	140	18.00	121	20.70	
					14.40	14.50	00:20					
					14.90	15.30	01:00					

Log last updated 24/01/2018

BOREHOLE RECORD

Borehole BH48

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 35.44 | Scale 1:50

Easting: 433655.60 | Northing: 558895.29

Client: Sunderland City Council | Driller: PK/DC | Logged By: BC | Sheet 1 of 3

Method: Cable Percussive Drilling with Rotary Core Drilling | Checked By: JH | Dates: 08/08/2017 - 18/08/2017

SAMPLE DETAILS Type	Depth From-To (m)	Insitu Testing	(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
D	0.10			Dark brown slightly sandy slightly gravelly clayey TOPSOIL. Gravel is subangular to rounded, fine to coarse of sandstone, limestone, mudstone, siltstone and coal.				
ES	0.10				(0.50)			
	0.40	HVP=26 kPa						
D	0.50			Firm, brown mottled light brown, slightly sandy slightly gravelly CLAY of high plasticity. Gravel is subangular to subrounded, fine to coarse of sandstone, mudstone and coal.	0.50	34.94		
ES	0.50							
B	0.60 - 1.20							
BRE	0.60							
	0.70	HVP=68 kPa	1		(0.80)			
U	1.20 - 1.65	29 blows						
				Firm brown, mottled light grey, slightly sandy slightly gravelly CLAY of intermediate plasticity. Gravel is subangular to rounded, fine to coarse of sandstone, mudstone and coal.	1.30	34.14		
D	1.65							
BRE	1.90							
B	2.00 - 2.45		2 (1.60) Dry	*2.00m: Stiff*				
D	2.00							
SPT (S)	2.00 - 2.45	N=17 (2,3/3,4,5,5)						
					(2.15)			
BRE	2.50							
U	3.00 - 3.45	15 blows	3					
D	3.45				3.45	31.99		
				Firm, thinly laminated, greyish brown, slightly sandy slightly gravelly CLAY. Gravel is subrounded to rounded, fine to coarse of sandstone, mudstone and coal.				
BRE	3.70							
B	4.00 - 4.45		4 (1.60) Dry					
D	4.00							
SPT (S)	4.00 - 4.45	N=9 (1,2/2,2,2,3)						
BRE	4.50							
UT	5.00 - 5.45	9 blows	5	*5.00m: Clay of intermediate plasticity.*				
D	5.45							
BRE	5.70							
B	6.00 - 6.45		6 (1.60) Dry					
D	6.00							
SPT (S)	6.00 - 6.45	N=10 (2,2/2,2,3,3)						
BRE	6.50		08/08/2017 1700 (1.60) Dry 09/08/2017 0800 (1.60) 2.10					
UT	7.00 - 7.45	12 blows	7		(7.35)			
D	7.45							
BRE	7.70							
B	8.00 - 8.45		8 (1.60) Dry	*8.00m: Clay of high plasticity.*				
D	8.00							
SPT (S)	8.00 - 8.45	N=9 (2,2/2,2,2,3)						
BRE	8.50							
UT	9.00 - 9.45	10 blows	9					
D	9.45							
BRE	9.70							
B	10.00 - 10.45		10 (9.90) Dry					

Continued on next sheet

Ground Water (m)

Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)
18.00	12.40	5.3	20	

Chiselling / Hard Strata

From (m)	To (m)	Time (hr)
14.90	15.10	00:20
17.10	17.20	00:20
18.00	18.30	01:00

Casing Depths

Diameter (mm)	Depth (m)
200	1.60
150	11.50
140	22.50

Hole Diameter

Diameter (mm)	Depth (m)
200	10.00
150	18.50
121	23.50

General Remarks

1. Hand dug inspection pit to 1.20m.

Log last updated 24/01/2018

BOREHOLE RECORD

Borehole BH48

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 35.44 | Scale 1:50

Easting: 433655.60 | Northing: 558895.29

Client: Sunderland City Council | Driller: PK/DC | Logged By: BC | Sheet 2 of 3

Method: Cable Percussive Drilling with Rotary Core Drilling | Checked By: JH | Dates: 08/08/2017 - 18/08/2017

SAMPLE DETAILS Type	Depth From-To (m)	Insitu Testing	(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
D	10.00			Firm, thinly laminated, greyish brown, slightly sandy slightly gravelly CLAY. Gravel is subrounded to rounded, fine to coarse of sandstone, mudstone and coal.				
SPT (S)	10.00 - 10.45	N=10 (1,2/2,2,3,3)						
BRE	10.50							
D	10.90				10.80	24.64		
B	11.00 - 11.65		11	Soft, thinly laminated slightly sandy silty CLAY of intermediate plasticity.				
UF	11.00 - 11.65	4 blows			(1.00)			
BRE	11.70							
D	11.80				11.80	23.64		
B	12.00 - 12.45		12 (11.90) Dry	Stiff, brown slightly sandy slightly gravelly CLAY. Gravel is subangular to rounded, fine to coarse of sandstone, mudstone and coal.				
D	12.00							
SPT (S)	12.00 - 12.45	N=22 (3,4/4,5,6,7)						
BRE	12.50							
U	13.00 - 13.45	60 blows	13	*13.00m: Clay of low plasticity.*				
D	13.45							
BRE	13.70							
B	14.00 - 14.45		14 (12.40) Dry					
D	14.00							
SPT (S)	14.00 - 14.45	N=29 (4,5/7,8,8,6)						
BRE	14.50							
					(6.20)			
			15					
B	15.20 - 15.65		(12.40) Dry					
D	15.20							
SPT (S)	15.20 - 15.64	N=50+ (6,8/13,14,11,12 for 70mm)						
BRE	15.70							
U	16.00 - 16.45	72 blows	16					
D	16.45							
BRE	16.70							
B	17.00 - 17.45		17 (12.40) Dry					
D	17.00							
SPT (S)	17.00 - 17.20	N=50+ (9,16 for 55mm/50)						
BRE	17.50							
B	18.00 - 18.30		18 (12.40) Dry		18.00	17.44		
D	18.00			Very dense reddish brown sandy GRAVEL. Gravel is subangular to angular, fine to coarse of sandstone. (Weathered SANDSTONE).				
SPT (S)	18.00 - 18.14	N=50+ (15,10 for 15mm/50 for 55mm)	(12.40) 4.70		(0.50)			
D	18.30		09/08/2017 1700		18.50			
SPT (S)	18.50 - 18.50		(12.40) 4.70	Weak to medium strong, partially weathered, brown fine to coarse grained SANDSTONE. Fractures are very closely to closely spaced, subhorizontal, planar, smooth with localised clay infill.		16.94		
	18.50 - 20.00		18.50 - 20.00 80 % Water		(0.79)			
			10 19	*18.83 - 18.85m: Fractures are subhorizontal, planar, smooth, undulose with light brown clay infill.*				
		100 81 29	NI	*18.90 - 19.01m: Fractures are 60 degrees, steeped, smooth and clean.*	19.29	16.15		
C	19.40 - 19.60				(0.15)			
				Very weak to weak, partially weathered, brown fine to coarse grained SANDSTONE. Frequent randomly orientated interlocking fractures.	19.44	16.00		
			0		(0.33)			
			12		19.77	15.67		
	20.00 - 21.30			Medium strong to strong, partially weathered, light brown fine	(0.16)			
		TCR% SCR% RQD%	FI 20		19.93	15.51		

Continued on next sheet

Ground Water (m)

Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)
18.00	12.40	5.3	20	

Chiselling / Hard Strata

From (m)	To (m)	Time (hr)
14.90	15.10	00:20
17.10	17.20	00:20
18.00	18.30	01:00

Casing Depths

Diameter (mm)	Depth (m)
200	1.60
150	11.50
140	22.50

Hole Diameter

Diameter (mm)	Depth (m)
200	10.00
150	18.50
121	23.50

General Remarks

1. Hand dug inspection pit to 1.20m.

Log last updated 24/01/2018

BOREHOLE RECORD

Borehole BH48

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 35.44 | Scale 1:50

Easting: 433655.60 | Northing: 558895.29

Client: Sunderland City Council | Driller: PK/DC | Logged By: BC | Sheet 3 of 3

Method: Cable Percussive Drilling with Rotary Core Drilling | Checked By: JH | Dates: 08/08/2017 - 18/08/2017

SAMPLE DETAILS							(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %	FI						
						2	20.00 - 21.30 50 % Water	to medium grained SANDSTONE.	(0.49)			
						NI		Weak to medium strong, partially weathered, brown fine to coarse grained SANDSTONE. Fractures are very closely to closely spaced, subhorizontal, planar, smooth with localised clay infill.	20.42	15.02		
			100	85	44	5		*19.82 - 19.93m: Fractures are subvertical, planar, smooth, undulose and clean.*	(0.10) 20.52	14.92		
C	20.95 - 21.10					NA	21	Medium strong to strong, partially weathered, reddish brown fine to medium grained SANDSTONE. Fractures are medium spaced, subhorizontal, planar, smooth and clean.	(0.61) 21.13	14.31		
	21.30 - 22.50						21.30 - 22.50 60 % Water	Weak to medium strong, partially weathered, reddish brown fine to medium grained SANDSTONE. Frequent randomly orientated interlocking fractures.	(0.10) 21.23	14.21		
C	21.50 - 21.60		100	83	56	4		Medium strong to strong, partially weathered, brown fine to coarse grained SANDSTONE.				
							22	*20.76 - 20.88m: Fracture is 35 degrees, planar, smooth and clean.* *21.01m: Fracture is subhorizontal, planar, smooth with light grey clay infill.* *21.06 - 21.11m: Fracture is 25 degrees, planar, smooth and clean with light grey discolouration on surface of fracture.*				
						A...			(2.27)			
	22.50 - 23.50						22.50 - 23.50 90 % Water	Firm brown slightly sandy CLAY.				
			90	90	62	4		Weak to medium strong, partially weathered, greyish brown SILTSTONE. Fractures are closely to medium spaced, subhorizontal, planar, smooth and clean.				
							23	*21.76 -21.79m: Fracture is subhorizontal, planar, smooth with reddish brown clay infill.* *22.50 - 22.60m: AZCL.* *23.16 - 23.17m: Fracture is subhorizontal, planar, smooth with brown clay infill.*				
								End of Borehole at 23.50 m	23.50	11.94		
							24					
							25					
							26					
							27					
							28					
							29					
							30					

Ground Water (m)

Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)
18.00	12.40			

Chiselling / Hard Strata

From (m)	To (m)	Time (hr)
14.90	15.10	00:20
17.10	17.20	00:20
18.00	18.30	01:00

Casing Depths

Diameter (mm)	Depth (m)
200	1.60
150	11.50
140	22.50

Hole Diameter

Diameter (mm)	Depth (m)
200	10.00
150	18.50
121	23.50

General Remarks

1. Hand dug inspection pit to 1.20m.

Log last updated 24/01/2018

BOREHOLE RECORD

Borehole BH49

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 39.21 | Scale 1:50

Easting: 433226.03 | Northing: 558647.01

Client: Sunderland City Council | Driller: RH/DC | Logged By: BC | Sheet 1 of 4

Method: Cable Percussive Drilling with Rotary Core Drilling | Checked By: JH | Dates: 11/08/2017 - 24/08/2017

SAMPLE DETAILS Type	Depth From-To (m)	Insitu Testing	(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
D	0.20			Dark brown slightly sandy, slightly gravelly clayey TOPSOIL. Gravel is subangular to subrounded, fine to coarse of sandstone, mudstone and coal.	(0.30)			
ES	0.20				0.30	38.91		
	0.20	HVP=24 kPa						
B	0.50 - 1.20			Firm brown mottled light grey slightly sandy slightly gravelly CLAY of intermediate plasticity. Gravel is subangular to subrounded, fine to coarse of mudstone, siltstone and coal.				
D	0.50							
ES	0.50							
	0.70	HVP=65 kPa						
BRE	1.00		1		(1.45)			
D	1.00							
B	1.20 - 1.60		Dry					
D	1.20							
SPT (S)	1.20 - 1.65	N=10 (2,2/2,2,3,3)						
BRE	1.75				1.75	37.46		
			2	Firm brown slightly sandy slightly gravelly CLAY of high plasticity. Gravel is subangular to subrounded, fine to coarse of sandstone and mudstone.				
U	2.20 - 2.45	100 blows						
D	2.50				(1.55)			
BRE	2.70							
D	2.90							
B	3.00 - 3.50		3 (2.90) Dry					
D	3.00							
SPT (S)	3.00 - 3.45	N=12 (2,2/3,3,3,3)						
				Stiff dark brown slightly sandy, slightly gravelly CLAY. Gravel is subangular to subrounded, fine to coarse of sandstone, mudstone and coal.	3.30	35.91		
BRE	3.75							
			4					
UF	4.20 - 4.70	100 blows						
B	4.70 - 5.20		(4.60) Dry		(2.70)			
SPT (S)	4.70 - 4.91	N=50+ (3,3/50 for 60mm)						
BRE	4.75							
			5					
BRE	5.20							
B	5.75 - 6.25		(5.70) Dry	*5.75m: Clay of low plasticity.*				
D	5.75							
SPT (S)	5.75 - 6.20	N=42 (5,5/8,10,10,14)						
			6	Very dense grey slightly clayey sandy GRAVEL. Gravel is angular to subangular, fine to coarse of mudstone. (Lightly weathered mudstone, possible rockhead).	6.00	33.21		
BRE	6.20				(0.50)			
				Stiff red brown slightly sandy, slightly gravelly CLAY. Gravel is	6.50	32.71		
D	6.75		(6.70) Dry		(0.20)			
SPT (S)	6.75 - 7.14	N=50+ (10,13/16,21,13,8)	(6.70) Dry	angular to subangular, fine to coarse of mudstone and coal. (drillers description).	6.70	32.51		
SPT (S)	6.75 - 7.14	N=50+ (10,13/16,21,13,8)			(0.08)			
	6.75 - 8.00				6.78	32.46		
			7	Stiff dark grey slightly sandy gravelly CLAY. Gravel is angular to subangular, fine to coarse of mudstone and sandstone. (drillers description).	6.88	32.33		
		100 100 66	40		(0.82)			
				Black COAL.				
			12	Extremely weak very thinly laminated dark grey MUDSTONE. Fractures are extremely closely spaced, subhorizontal, planar, smooth, clean.	7.70	31.51		
	8.00 - 9.50		8					
				Very weak dark grey fine SANDSTONE. Fractures are closely spaced, subhorizontal planar, smooth, clean.	(0.90)			
				8.05 - 8.30m: Subvertical undulating, smooth fracture.				
				8.55 - 8.65m: 40-60 degree, stepped, smooth, clean fracture.	8.60	30.61		
		96 84 0	15	Extremely weak dark grey MUDSTONE with bands. Fractures are very closely spaced, subhorizontal planar, smooth, clean.				
C	9.00 - 9.12		9		(0.70)			
				Weak dark grey SILTSTONE with bands of mudstone. Fractures are very closely to closely spaced, subhorizontal planar, smooth, clean.	9.30	29.91		
	9.50 - 11.00							
		TCR% SCR% RQD% FI	10					

Continued on next sheet

Ground Water (m)

Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)

Chiselling / Hard Strata

From (m)	To (m)	Time (hr)
4.90	5.10	00:30
6.70	7.00	01:00

Casing Depths

Diameter (mm)	Depth (m)
150	6.70
140	11.00

Hole Diameter

Diameter (mm)	Depth (m)
150	6.85
121	30.30

General Remarks

1. Hand dug inspection pit to 1.20m.
2. No groundwater encountered.

Log last updated 24/01/2018

BOREHOLE RECORD

Borehole BH49

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 39.21 | Scale 1:50

Easting: 433226.03 | Northing: 558647.01

Client: Sunderland City Council | Driller: RH/DC | Logged By: BC | Sheet 2 of 4

Method: Cable Percussive Drilling with Rotary Core Drilling | Checked By: JH | Dates: 11/08/2017 - 24/08/2017

SAMPLE DETAILS							(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %	FI						
C	10.30 - 10.45		100	100	53			9.95 - 10.10m: Subvertical planar, smooth, clean fracture. 10.05 - 10.30m: Weak grey mudstone.				
	11.00 - 11.30		100	83	83		11	10.70 - 10.80m: Subvertical planar, smooth, clean fracture.	(3.30)			
	11.30 - 12.80					11		11.12 - 11.15m: Subvertical planar, smooth, clean fracture 11.24 - 11.27m: Subvertical undulating, smooth, clean fracture. 11.40 - 11.45m: Subhorizontal planar, smooth fracture. 11.40 - 11.50m: Subvertical undulating, smooth, clean fracture.				
C	11.83 - 11.93		100	100	80		12					
C	12.50 - 12.90											
C	12.55 - 12.80							12.55m: Medium strong.	12.60	26.61		
	12.80 - 14.30					40		Weak, partially weathered, orange brown medium grained SANDSTONE. Fractures are closely spaced, subhorizontal planar, smooth.				
			100	96	80		13	12.94 - 13.00m: Subvertical planar, smooth, clean fracture.				
C	13.90						14					
	14.30 - 15.80					20			(3.40)			
C	14.80 - 15.00		100	96	93		15					
	15.80 - 17.00							15.55 - 15.60m: Subrounded to rounded, medium to coarse of grout.				
C	15.90 - 16.00						16					
			100	83	28	20		Very weak, partially weathered, thinly bedded, dark grey MUDSTONE. Fractures are extremely closely to very closely spaced, planar with clay infill. 16.00 - 16.10m: Subvertical planar, smooth, clean fracture.	16.00	23.21		
						NI			(1.50)			
						A...						
	17.00 - 17.80		87	66	22	12	17	17.45 - 17.55m: Subvertical planar, smooth, clean, fracture.	17.50	21.71		
	17.80 - 19.00							Very weak, partially weathered black carbonated MUDSTONE. Fractures are very closely spaced, subhorizontal planar, smooth, clean.				
			100	86	13	20	18	18.20 - 18.35m: Subvertical undulating, smooth, fracture.	(1.90)			
	19.00 - 20.80						19	18.75 - 18.95m: Subvertical, stepped, smooth, clean, fracture. 19.15 - 19.30m: Subvertical planar, smooth, clean fracture.				
			100	93	90			Weak, partially weathered dark grey SILTSTONE with bands of fine to medium sandstone. Fractures are closely to medium spaced, subhorizontal planar, smooth, clean.	19.40	19.81		
							20					

Continued on next sheet

Ground Water (m)

Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)

Chiselling / Hard Strata

From (m)	To (m)	Time (hr)
4.90	5.10	00:30
6.70	7.00	01:00

Casing Depths

Diameter (mm)	Depth (m)
150	6.70
140	11.00

Hole Diameter

Diameter (mm)	Depth (m)
150	6.85
121	30.30

General Remarks

1. Hand dug inspection pit to 1.20m.
2. No groundwater encountered.

Log last updated 24/01/2018

BOREHOLE RECORD

Borehole BH49

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 39.21 Scale 1:50

Easting: 433226.03 Northing: 558647.01

Client: Sunderland City Council | Driller: RH/DC | Logged By: BC | Sheet 3 of 4

Method: Cable Percussive Drilling with Rotary Core Drilling | Checked By: JH | Dates: 11/08/2017 - 24/08/2017

SAMPLE DETAILS							(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %	FI						
								20.30 - 20.45: Dark grey fine to medium sandstone.	(2.05)			
	20.80 - 22.30							*20.70 - 20.80m: Dark grey fine to medium sandstone.*				
			100	100	83		21	*21.22 - 21.36m: Subvertical undulating, smooth, clean fracture.*	21.45	17.76		
						6		Weak, partially weathered dark grey fine to medium SANDSTONE. Fractures are closely to medium spaced, subhorizontal planar, smooth, clean.	(1.15)			
	22.30 - 23.80						22		22.60	16.61		
			100	93	73			Weak, partially weathered thinly bedded dark grey SILSTONE. Fractures are closely to medium spaced, subhorizontal planar, smooth, clean.				
							23	*22.90 - 23.00m: Subvertical stepped, smooth, clean fracture.*				
								23.20 - 23.50m: Subvertical undulating, smooth, clean fracture.	(1.35)			
	23.80 - 24.80								23.95	15.26		
			95	75	70		24	Weak, partially weathered dark grey SILSTONE. Fractures are very closely to closely spaced, planar, smooth.				
						15						
						A…		*24.55m: Subvertical planar, smooth, clean fracture.*				
	24.80 - 26.30						25					
			96	96	86							
						12	26	*25.80 - 26.00m: Subvertical planar, smooth, clean fracture.*	(4.30)			
	26.30 - 27.80							*26.30 - 26.45m: Subvertical planar, smooth, clean fracture.*				
								26.58 - 26.62m: Subvertical planar, smooth, clean fracture.				
			100	100	73		27					
						4						
	27.80 - 29.30						28					
			100	100	53			Very weak, partially weathered dark grey MUDSTONE. Fractures are very closely to closely spaced	28.25	10.96		
						15	29	*28.90 - 29.50m: Subvertical planar, smooth, clean fracture.*				
	29.30 - 30.30								(2.05)			
			100	85	30		30					

Continued on next sheet

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter		General Remarks
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)	1. Hand dug inspection pit to 1.20m. 2. No groundwater encountered.
					4.90	5.10	00:30	150	6.70	150	6.85	
					6.70	7.00	01:00	140	11.00	121	30.30	

Log last updated 24/01/2018

BOREHOLE RECORD

Borehole BH49

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 39.21 | Scale 1:50

Easting: 433226.03 | Northing: 558647.01

Client: Sunderland City Council | Driller: RH/DC | Logged By: BC | Sheet 4 of 4

Method: Cable Percussive Drilling with Rotary Core Drilling | Checked By: JH | Dates: 11/08/2017 - 24/08/2017

SAMPLE DETAILS							(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %	FI						
						A...		*30.18 - 30.24m: Subvertical planar, smooth, clean fracture.*	30.30	8.91		
								End of Borehole at 30.30 m				

31 32 33 34 35 36 37 38 39 40

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter	
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)
					4.90	5.10	00:30	150	6.70	150	6.85
					6.70	7.00	01:00	140	11.00	121	30.30

Log last updated 24/01/2018

General Remarks

1. Hand dug inspection pit to 1.20m.
2. No groundwater encountered.

BOREHOLE RECORD

Borehole BH50

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 38.09 | Scale 1:50

Easting: 433419.38 | Northing: 558721.55

Client: Sunderland City Council | Driller: CT/DC | Logged By: BC | Sheet 1 of 4

Method: Cable Percussive Drilling with Rotary Core Drilling | Checked By: JH | Dates: 24/08/2017 - 25/08/2017

SAMPLE DETAILS			(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
Type	Depth From-To (m)	Insitu Testing						
B	0.00 - 0.30			Brown slightly sandy slightly gravelly clayey TOPSOIL. Gravel is subangular to rounded, fine to coarse of sandstone, mudstone, siltstone and coal.	(0.35)			
D	0.10				0.35	37.74		
ES	0.20							
D	0.35							
B	0.40 - 0.90			Firm brown mottled light grey slightly sandy slightly gravelly CLAY. Gravel is subangular to rounded, fine to coarse of sandstone, mudstone and coal.				
ES	0.50							
BRE	0.75				(0.75)			
ES	1.00		1					
B	1.20 - 1.70		Dry	Firm dark brown mottled dark grey slightly sandy, slightly gravelly CLAY of intermediate plasticity. Gravel is subangular to subrounded, fine to coarse of sandstone, siltstone, mudstone and coal.	1.10	36.99		
D	1.20							
SPT (S)	1.20 - 1.65	N=11 (2,2/2,3,3,3)						
BRE	1.75							
			2					
U	2.20 - 2.65	76 blows		*2.20m: Stiff.*	(2.00)			
D	2.70							
BRE	2.75							
			3					
B	3.20		(3.10) Dry	Stiff greyish brown silty slightly sandy CLAY of low plasticity. Sand is fine to medium.	3.10	34.99		
D	3.20			*3.20-4.70m: Silt bands noted.*				
SPT (S)	3.20 - 3.65	N=17 (4,4/4,4,4,5)						
BRE	3.75							
			4					
U	4.20 - 4.65	57 blows		*4.20m: Firm silt of low plasticity.*				
D	4.70				(3.30)			
BRE	4.90							
			5					
B	5.20 - 5.70		(4.50) Dry					
D	5.20							
SPT (S)	5.20 - 5.65	N=11 (1,3/3,2,2,4)						
BRE	5.90							
			6					
U	6.20 - 6.50	100 blows						
D	6.60			Stiff brownish grey slightly sandy, slightly gravelly CLAY. Gravel is subangular to subrounded, fine to coarse of sandstone, mudstone and coal.	6.40	31.69		
BRE	6.90							
			7					
B	7.20 - 7.70		(4.50) Dry					
D	7.20							
SPT (S)	7.20 - 7.46	N=50+ (5,7/26,24 for 40mm)						
BRE	7.90			*7.90m: Very soft band noted.*				
			8					
U	8.20 - 8.70	100 blows						
					(4.20)			
B	8.70 - 9.20		(4.50) Dry					
D	8.70							
SPT (S)	8.70 - 9.14	N=50+ (6,7/8,11,16,15 for 70mm)						
BRE	8.90							
			9					
B	9.70 - 10.20		(4.50) Dry					
D	9.70							
SPT (S)	9.70 - 10.15	N=42 (6,9/9,10,10,13)						
BRE	9.90		10					

Continued on next sheet

Ground Water (m)

Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)

Chiselling / Hard Strata

From (m)	To (m)	Time (hr)
9.00	9.10	00:20
10.70	10.85	01:00

Casing Depths

Diameter (mm)	Depth (m)
200	4.50
140	15.00

Hole Diameter

Diameter (mm)	Depth (m)
200	10.60
116	31.20

General Remarks

1. Hand dug inspection pit to 1.20m.

Log last updated 24/01/2018

BOREHOLE RECORD

Borehole BH50

Contract No: D8044 | **Site:** IAMP - Preliminary Ground Investigation | GL (m AOD) 38.09 | Scale 1:50 | Easting: 433419.38 | Northing: 558721.55

Client: Sunderland City Council | Driller: CT/DC | Logged By: BC | Sheet 2 of 4

Method: Cable Percussive Drilling with Rotary Core Drilling | Checked By: JH | Dates: 24/08/2017 - 25/08/2017

SAMPLE DETAILS Type	Depth From-To (m)	Insitu Testing	TCR%	SCR%	RQD%	FI	(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
								Stiff brownish grey slightly sandy, slightly gravelly CLAY. Gravel is subangular to subrounded, fine to coarse of sandstone, mudstone and coal.				
	10.60 - 14.40								10.60			
D	10.60 - 14.40					NI	10.60 - 15.40 80 % Water (4.50) Dry	Very dense reddish grey sandy GRAVEL. Gravel is angular to subangular, fine to coarse of sandstone. (Weathered SANDSTONE).	10.60 (0.35)	27.49		
SPT (S)	10.70 - 10.91	N=50+ (7,11/9,23,18 for 20mm)				18 6	11	Weak, partially weathered, reddish brown SANDSTONE.	10.95 (0.06)	27.14 27.08		
	11.40 - 12.40		100	40	0	28		Weak, partially weathered, reddish brown fine to medium grained SANDSTONE. Fractures are very closely to closely spaced, subhorizontal planar, smooth, clean.	11.01 (0.39) 11.40	26.69		
C	12.20 - 12.40						12	Very weak, partially weathered, reddish brown thinly interbedded MUDSTONE and SILTSTONE. Fractures are subangular, closely to very closely spaced, subhorizontal planar, smooth, clean.				
	12.40 - 13.90		100	9	0	7						
C	13.20 - 13.40		100	100	95		13					
	13.90 - 15.40											
C	14.00 - 14.15					20	14		(6.00)			
C	14.85 - 15.15		100	93	86	4	15					
C	15.20 - 15.40											
	15.40 - 16.35						15.40 - 19.35 100 % Water					
C	16.00 - 16.10		46	43	43		16					
						AZC L						
	16.35 - 17.85		100	100	70	6	17					
						20		Extremely weak, partially weathered, dark grey MUDSTONE. Fractures are extremely closely spaced, planar, smooth.	17.40	20.69		
	17.85 - 19.35		96	70	6	12 NI 20 NI 6 NI	18	*18.05m: Subvertical, planar, clean fracture.*	(2.35)			
						40	19					
	19.35 - 20.85					A... 40 NI	19.35 - 22.35 95 % Water		19.75	18.34		
							20	Very weak, partially weathered, dark grey MUDSTONE.				

Continued on next sheet

Ground Water (m)

Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)

Chiselling / Hard Strata

From (m)	To (m)	Time (hr)
9.00	9.10	00:20
10.70	10.85	01:00

Casing Depths

Diameter (mm)	Depth (m)
200	4.50
140	15.00

Hole Diameter

Diameter (mm)	Depth (m)
200	10.60
116	31.20

General Remarks

1. Hand dug inspection pit to 1.20m.

Log last updated 24/01/2018

BOREHOLE RECORD

Borehole BH50

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 38.09 | Scale 1:50

Easting: 433419.38 | Northing: 558721.55

Client: Sunderland City Council | Driller: CT/DC | Logged By: BC | Sheet 3 of 4

Method: Cable Percussive Drilling with Rotary Core Drilling | Checked By: JH | Dates: 24/08/2017 - 25/08/2017

SAMPLE DETAILS							(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %	FI						
			90	46	0			Fractures are very closely to subhorizontal, planar, smooth, clean. (drillers description).				
								20.30 - 20.35m: Medium strong dark grey fine to medium sandstone.				
	20.85 - 22.35		100	100	33	40	21	*20.66 - 20.76m: Weak dark grey siltstone.*	(1.95)			
								21.00 - 21.15m: Subvertical planar, smooth fracture.				
								21.50 - 21.70m: Subvertical undulating, smooth, rough, clean fracture.				
								Weak, partially weathered, dark grey MUDSTONE. Fractures are subhorizontal planar, smooth, clean.	21.70	16.39		
							22	*21.75 - 21.90m: Subvertical undulating, smooth, clean fracture.*	(0.30) 22.00	16.09		
	22.35 - 23.85		100	73	73	12	22.35 - 23.85 100 % Water	Weak to medium strong, partially weathered, dark grey SILTSTONE with bands of sandstone. Fractures are very closely to closely subhorizontal planar, clean.				
							23	*22.95 - 23.10m: Subvertical planar, smooth, clean fracture.*				
	23.85 - 25.35		100	95	53	1	23.85 - 25.35 95 % Water		(3.15)			
							24					
							25					
	25.35 - 26.85		100	73	66	12	25.35 - 26.85 100 % Water	Extremely weak, partially weathered, dark grey MUDSTONE. Fractures are very closely subhorizontal, planar, smooth, clean.	25.15 (0.65)	12.94		
							26	Very weak, partially weathered, dark grey SILTSTONE. Fractures are closely subhorizontal, planar, smooth, clean.	25.80	12.29		
								25.85 - 26.00m: Subvertical planar, smooth, clean fracture	(0.90)			
								26.60 - 26.75m: Subvertical planar, smooth, clean fracture.	26.70	11.39		
	26.85 - 28.20		88	88	26	30	26.85 - 31.20 100 % Water	Extremely weak, partially weathered, dark grey MUDSTONE. Fractures are very closely subhorizontal, planar, smooth, clean.				
							27					
							28		(2.90)			
	28.20 - 29.70		100	46	10	NI 15 40 15	29	*28.20 - 28.70m: Subvertical planar, smooth, tight, clean fracture.*				
								29.00 - 29.25m: Subvertical undulating, smooth, clean fracture				
								29.32 - 29.42m: Medium strong dark grey sandstone.				
	29.70 - 31.20							Weak dark grey SILTSTONE with occasional thin beds of mudstone. Fractures are closely subhorizontal planar, smooth, clean.	29.60	8.49		
							30					

Continued on next sheet

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter		General Remarks
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)	1. Hand dug inspection pit to 1.20m.
					9.00	9.10	00:20	200	4.50	200	10.60	
					10.70	10.85	01:00	140	15.00	116	31.20	

Log last updated 24/01/2018

BOREHOLE RECORD

Borehole BH50

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 38.09 Scale 1:50

Easting: 433419.38 Northing: 558721.55

Client: Sunderland City Council

Driller: CT/DC Logged By: BC

Sheet 4 of 4

Method: Cable Percussive Drilling with Rotary Core Drilling

Checked By: JH

Dates: 24/08/2017 - 25/08/2017

SAMPLE DETAILS							(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %	FI						
			100	50	50			*29.70 - 29.85m: Subvertical undulating, smooth, clean fracture.*	(1.60)			
								End of Borehole at 31.20 m	31.20	6.89		

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter		General Remarks
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)	1. Hand dug inspection pit to 1.20m.
					9.00	9.10	00:20	200	4.50	200	10.60	
					10.70	10.85	01:00	140	15.00	116	31.20	

Log last updated 24/01/2018

SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 2016
BRE Digest 365, Figure 2, Page 5

Client:	**Sunderland City Council**				
Site:	**International Advanced Manufacturing Park (IAMP), Sunderland**				
Job No:	**D8044**				
Pit No:	**TPS-01**		**Test No:**	**1**	

CALCULATION OF SOIL INFILTRATION RATE

Time (min)	Depth (m)
0	0.96
0.5	0.965
1	0.97
2	0.97
3	0.97
4	0.975
5	0.975
6	0.975
7	0.975
8	0.975
9	0.975
10	0.975
15	0.975
20	0.975
25	0.975
30	0.975
40	0.975
50	0.975
60	0.975
90	0.975
120	
180	

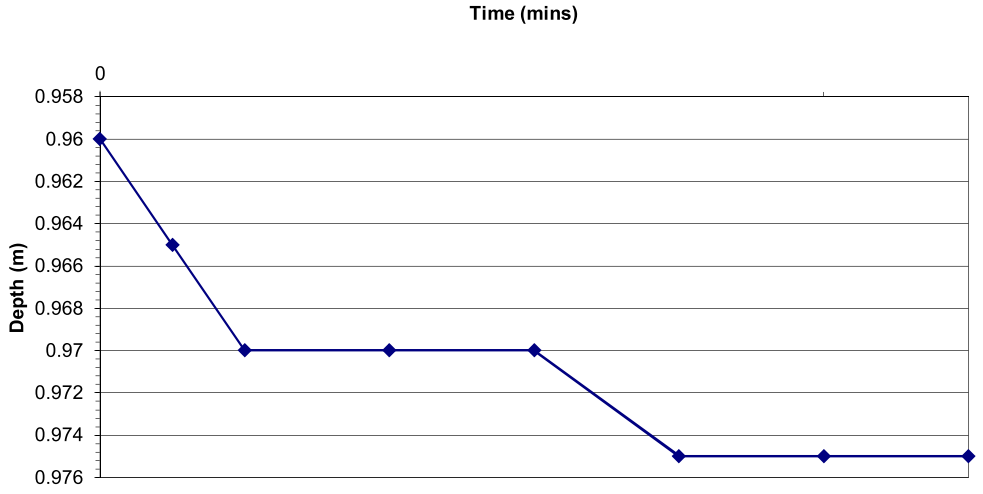
Pit Dimensions		
	Length (m) =	2.00
	Width (m) =	0.65
	Depth (m) =	2.00

Depth at start of test (m) =	0.960
Depth at end of test (m)=	0.975
75% level (m)=	N/A
50% Effective Depth	1.0325
25% level (m)=	N/A
Base area of pit (m^2) =	1.300
Vp_{75-25} (m^3) =	N/A
α_{p50} (m^2) =	6.772

V	0.0195
T	5400

Soil infiltration rate, f, (m/s) =	**5.33E-07**	**Inferred value**

Input by:	**SJS**	**Date:**	**29/08/2017**		
Checked by:		**Date:**			



Notes:

1. Insufficent change in head and lack of infiltration to accurately calculate infiltration rate. Quoted rate should be regarded as indictaive only.

SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 2016
BRE Digest 365, Figure 2, Page 5

Client:	**Sunderland City Council**				
Site:	**International Advanced Manufacturing Park (IAMP), Sunderland**				
Job No:	**D8044**				
Pit No:	**TPS-02**		**Test No:**	**1**	

CALCULATION OF SOIL INFILTRATION RATE

Time (min)	Depth (m)
0	0.98
0.5	0.98
1	0.98
2	0.98
3	0.98
4	0.98
5	0.98
6	0.98
7	0.98
8	0.98
9	0.98
10	0.98
15	0.98
20	0.98
25	0.98
30	0.98
40	0.98
50	0.98
60	0.98
90	0.98
120	
180	

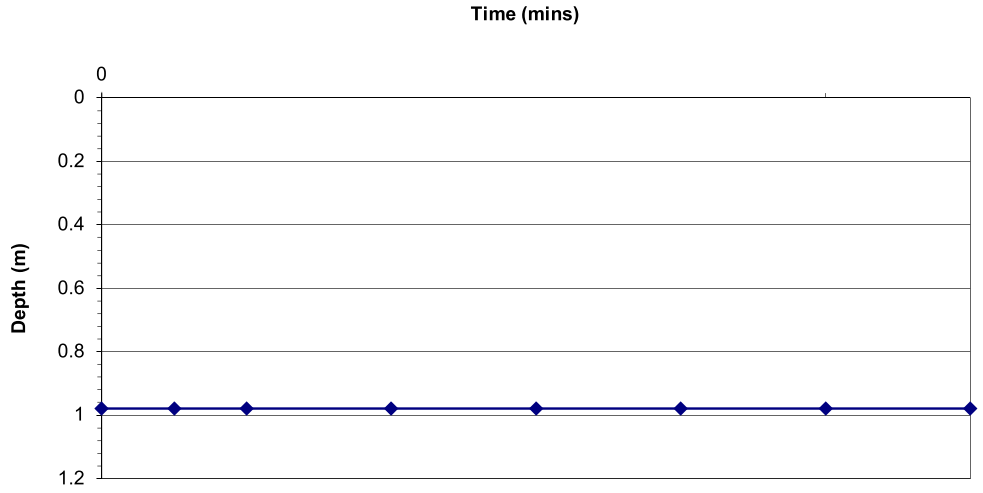
Pit Dimensions		
	Length (m) =	1.90
	Width (m) =	0.65
	Depth (m) =	2.10

Depth at start of test (m) =	0.980
Depth at end of test (m)=	0.980
75% level (m)=	N/A
50% Effective Depth	1.12
25% level (m)=	N/A
Base area of pit (m^2) =	1.235
Vp_{75-25} (m^3) =	N/A
α_{p50} (m^2) =	6.947

V	0
T	5400

Soil infiltration rate, f, (m/s) =	**0.00E+00**	

Input by:	**SJS**	**Date:**	**29/08/2017**
Checked by:		**Date:**	



Notes:

1. Insufficent change in head and lack of infiltration to accurately calculate infiltration rate.

SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 2016
BRE Digest 365, Figure 2, Page 5

Client:	**Sunderland City Council**				
Site:	**International Advanced Manufacturing Park (IAMP), Sunderland**				
Job No:	**D8044**				
Pit No:	**TPS-03**		**Test No:**	**1**	

CALCULATION OF SOIL INFILTRATION RATE

Time (min)	Depth (m)
0	0.88
0.5	0.88
1	0.88
2	0.88
3	0.88
4	0.88
5	0.88
6	0.88
7	0.88
8	0.88
9	0.88
10	0.88
15	0.88
20	0.88
25	0.88
30	0.88
40	0.88
50	0.88
60	0.88
90	0.88
120	
180	

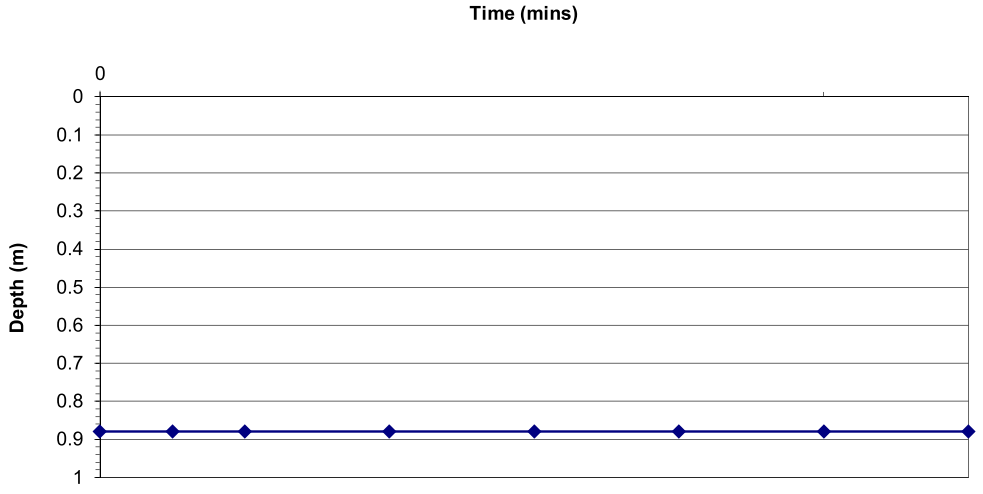
Pit Dimensions		
	Length (m) =	2.10
	Width (m) =	0.65
	Depth (m) =	2.00

Depth at start of test (m) =	0.880
Depth at end of test (m)=	0.880
75% level (m)=	N/A
50% Effective Depth	1.12
25% level (m)=	N/A
Base area of pit (m^2) =	1.365
Vp_{75-25} (m^3) =	N/A
α_{p50} (m^2) =	7.525

V	0
T	5400

Soil infiltration rate, f, (m/s) =	**0.00E+00**	**Inferred value**

Input by:	**SJS**	**Date:**	**29/08/2017**
Checked by:		**Date:**	



Notes:

1. Insufficent change in head and lack of infiltration to accurately calculate infiltration rate.

SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 2016
BRE Digest 365, Figure 2, Page 5

Client:	**Sunderland City Council**				
Site:	**International Advanced Manufacturing Park (IAMP), Sunderland**				
Job No:	**D8044**				
Pit No:	**TPS-04**		**Test No:**	**1**	

CALCULATION OF SOIL INFILTRATION RATE

Time (min)	Depth (m)
0	0.95
0.5	0.95
1	0.955
2	0.955
3	0.955
4	0.955
5	0.96
6	0.96
7	0.96
8	0.96
9	0.96
10	0.96
15	0.96
20	0.96
25	0.96
30	0.96
40	0.96
50	0.96
60	0.96
90	0.96
120	
180	

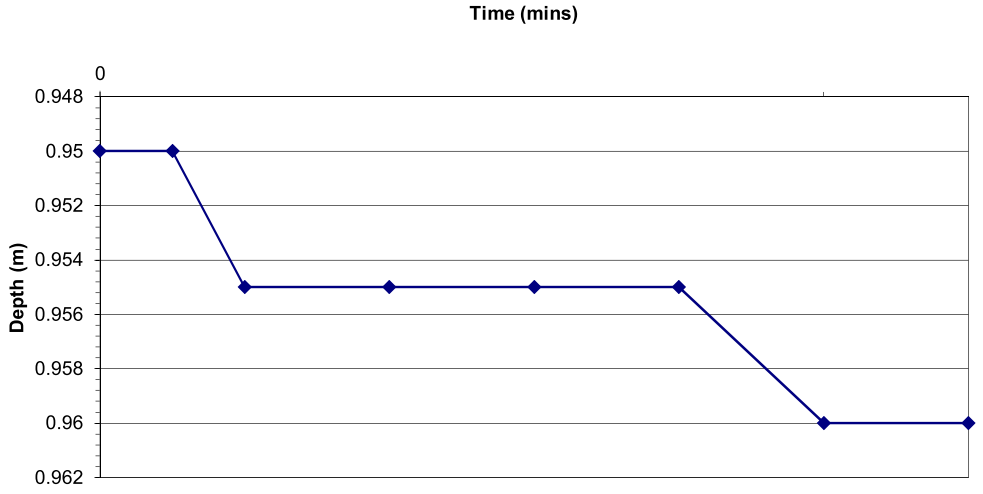
Pit Dimensions		
	Length (m) =	2.00
	Width (m) =	0.65
	Depth (m) =	2.00

Depth at start of test (m) =	0.950
Depth at end of test (m)=	0.960
75% level (m)=	N/A
50% Effective Depth	1.045
25% level (m)=	N/A
Base area of pit (m^2) =	1.300
Vp_{75-25} (m^3) =	N/A
α_{p50} (m^2) =	6.839

V	0.013
T	5400

Soil infiltration rate, f, (m/s) =	**3.52E-07**	**Inferred value**

Input by:	**SJS**	**Date:**	**29/08/2017**		
Checked by:		**Date:**			



Notes:

1. Insufficent change in head and lack of infiltration to accurately calculate infiltration rate. Quoted rate should be regarded as indictaive only.

SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 2016
BRE Digest 365, Figure 2, Page 5

Client:	**Sunderland City Council**				
Site:	**International Advanced Manufacturing Park (IAMP), Sunderland**				
Job No:	**D8044**				
Pit No:	**TPS-05**		**Test No:**	**1**	

CALCULATION OF SOIL INFILTRATION RATE

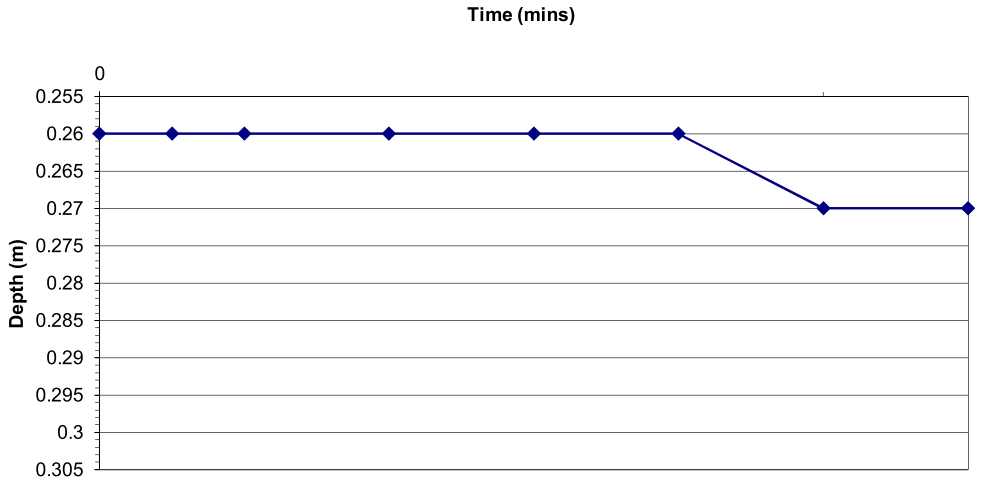
Time (min)	Depth (m)
0	0.26
0.5	0.26
1	0.26
2	0.26
3	0.26
4	0.26
5	0.27
6	0.27
7	0.27
8	0.27
9	0.27
10	0.27
15	0.275
20	0.275
25	0.275
30	0.275
40	0.275
50	0.275
60	0.275
90	0.285
120	0.285
180	0.29
240	0.3
300	0.3

Pit Dimensions		
	Length (m) =	2.00
	Width (m) =	0.65
	Depth (m) =	2.00

Depth at start of test (m) =	0.260
Depth at end of test (m)=	0.290
75% level (m)=	N/A
50% Effective Depth	1.725
25% level (m)=	N/A
Base area of pit (m^2) =	1.300
Vp_{75-25} (m^3) =	N/A
α_{p50} (m^2) =	10.443

V	0.039
T	18000

Soil infiltration rate, f, (m/s) =	**2.07E-07**	**Inferred value**	
Input by:	**SJS**	**Date:**	**29/08/2017**
Checked by:		**Date:**	



Notes:

1. Insufficent change in head and lack of infiltration to accurately calculate infiltration rate. Quoted rate should be regarded as indictaive only.

SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 2016
BRE Digest 365, Figure 2, Page 5

Client:	**Sunderland City Council**				
Site:	**International Advanced Manufacturing Park (IAMP), Sunderland**				
Job No:	**D8044**				
Pit No:	**TPS-08**		**Test No:**	**1**	

CALCULATION OF SOIL INFILTRATION RATE

Time (min)	Depth (m)
0	0.53
0.5	0.53
1	0.53
2	0.53
3	0.53
4	0.53
5	0.53
6	0.53
7	0.53
8	0.53
9	0.53
10	0.53
15	0.53
20	0.53
25	0.53
30	0.53
40	0.53
50	0.53
60	0.53
90	0.53
120	
180	

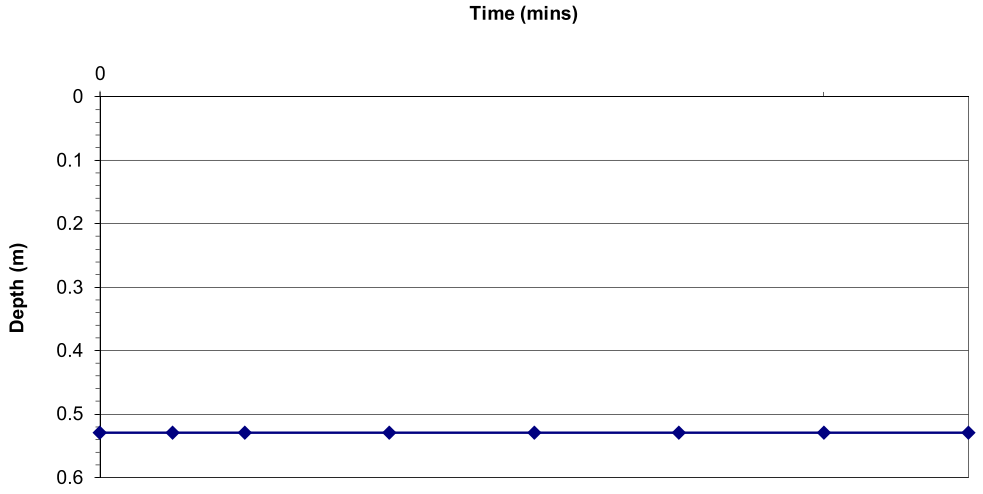
Pit Dimensions		
	Length (m) =	2.00
	Width (m) =	0.70
	Depth (m) =	2.00

Depth at start of test (m) =	0.530
Depth at end of test (m)=	0.530
75% level (m)=	N/A
50% Effective Depth	1.47
25% level (m)=	N/A
Base area of pit (m^2) =	1.400
Vp_{75-25} (m^3) =	N/A
α_{p50} (m^2) =	9.338

V	0
T	5400

Soil infiltration rate, f, (m/s) =	**0.00E+00**	**Inferred value**

Input by:	**SJS**	**Date:**	**29/08/2017**
Checked by:		**Date:**	



Notes:

1. Insufficent change in head and lack of infiltration to accurately calculate infiltration rate.

SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 2016
BRE Digest 365, Figure 2, Page 5

Client:	**Sunderland City Council**				
Site:	**IAMP - Preliminary Ground Investigation**				
Job No:	**D8044**				
Pit No:	**TPS11**		**Test No:**	**1**	

CALCULATION OF SOIL INFILTRATION RATE

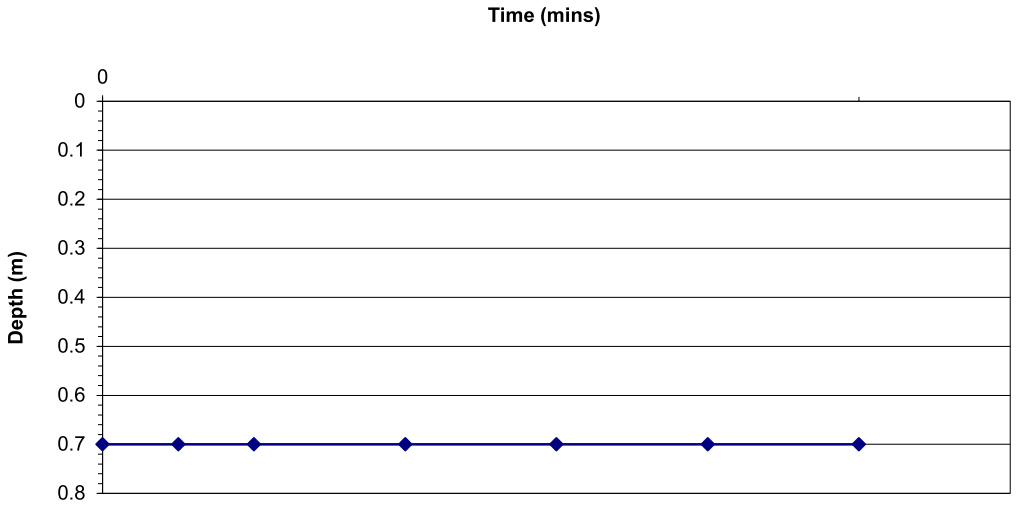
Time (min)	Depth (m)
0	0.7
0.5	0.7
1	0.7
2	0.7
3	0.7
4	0.7
5	0.7
6	0.7
7	0.7
8	0.7
9	0.7
10	0.7
15	0.7
20	0.7
25	0.7
30	0.7
40	0.7
50	0.7
60	0.7
90	0.7
120	
180	

Pit Dimensions	
Length (m) =	3.30
Width (m) =	0.80
Depth (m) =	2.00

Depth at start of test (m) =	0.700
Depth at end of test (m)=	0.700
75% level (m)=	N/A
50% Effective Depth	1.3
25% level (m)=	N/A
Base area of pit (m^2) =	2.640
Vp_{75-25} (m^3) =	N/A
α_{p50} (m^2) =	13.300

V	0
T	5400

Soil infiltration rate, f, (m/s) =	**0.00E+00**	**Inferred value**	
Input by:	**CA**	**Date:**	**25/09/2017**
Checked by:		**Date:**	



Appendix C: Regulatory Information

Appendix C: Contents

- Sunderland City Council policies WWE2 – WWE5
- NE_LLFA_SuDS_Local_Standards_July_2020

11.6 Significant weight is given to the wider environmental, social and economic benefits of renewable and low carbon energy generation and particularly, decentralised energy generation schemes. The impact on neighbouring residents and other sensitive receptors is also a significant consideration, but will vary, depending on the size, scale, location and type of technology proposed. Any potential cumulative impact of schemes within the area, including within and outside the city, will also be considered.

11.7 The A&D Plan will identify locations suitable for wind energy development if appropriate.

11.8 Applications for wind turbine installations will need to include details of associated infrastructure and connectivity, such as new access roads and overhead power lines, so that the council can fully assess the proposal.

Policy

WWE2 Flood risk and coastal management

1. To reduce flood risk and ensure appropriate coastal management, development:
   - i. should follow the sequential approach to determining the suitability of land for development, directing new development to areas at the lowest risk of flooding and where necessary applying the exception test, as outlined in national planning policy;
   - ii. will be required to demonstrate, where necessary, through an appropriate Flood Risk Assessment (FRA) that development will not increase flood risk on site or elsewhere, and if possible reduce the risk of flooding;
   - iii. will be required to include or contribute to flood mitigation, compensation and/or protection measures, where necessary, to manage flood risk associated with or caused by the development;
   - iv. should comply with the Water Framework Directive by contributing to the Northumbria River Basin Management Plan;
   - v. will maintain linear coastal flood defences north from Hendon Sea Wall to Seaburn, and managed coastal retreat on the Heritage Coast and north of Seaburn;
   - vi. which would adversely affect the quantity of surface or groundwater flow or ability to abstract water must demonstrate that no significant adverse impact would occur, or mitigation can be put in place to minimise this impact; and
   - vii. of additional river flood defences must demonstrate that the proposal represents the most sustainable response to a particular threat.

11.9 Flooding is a key factor in determining the scale and location of development in Sunderland. It is important that inappropriate development is avoided in areas currently at risk from flooding, or likely to be at risk as a result of climate change, or in areas where development is likely to increase flooding elsewhere. Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where it is necessary, without increasing flood risk elsewhere. The National Planning Practice Guidance (NPPG), together with the council's latest Strategic Flood Risk Assessment (SFRA), Preliminary Flood Risk Assessment (PFRA) and latest Local Flood Risk Management Strategy (LFRMS) provides guidance in this respect. The SFRA provides a framework for the overall appraisal and management of risk. It allows the identification of land with the lowest probability of flooding that would be appropriate to the type of development or land use proposed.

11.10 Development should be directed towards locations which are at lowest risk from flooding. Where necessary, the applicant will be required to demonstrate that they have followed the sequential test.

11.11 Developers must consider flood risk from all sources as part of a SFRA and ensure they are utilising the most appropriate and up-to-date information in assessing the risk of flooding from all sources to the development site. Discussions should be held with the Lead Local Flood Authority when considering measures to mitigate flooding from different flood sources within development proposals. Conditions or planning obligations will be used as appropriate to secure flood risk mitigation measures.

11.12 Sunderland falls within the Northumbria River Basin Management Plan (RBMP) which provides cross-boundary guidance on good

practice and measures for improvement. Drawn up by the Environment Agency, RBMPs aim to provide integrated management of surface and groundwater bodies across individual regions.

11.13 Built development can lead to increased surface water run-off; therefore new development is encouraged to incorporate mitigation techniques in its design, such as source control (interception) Sustainable Drainage Systems (SuDS) and attenuation SuDS. Where appropriate, SuDS should be used as part of the linked Green Infrastructure Network to provide multiple functions and benefits to landscape quality, recreation and biodiversity. This can be achieved through habitat creation, new open spaces and good design. SuDS should be designed to help cope with intense rainfall events as well as day-to-day rainfall events and to overcome any deterioration in water quality status. In determining the suitability of SuDS for individual development sites, developers should seek advice from the Lead Local Flood Authority.

11.14 In line with the Sunderland Corporation Act 1972 and Shoreline Management Plan, coastal flood defences will be maintained (termed "holding the line") at Hendon Beach, the Port of Sunderland, Sunderland Harbour, Roker and Seaburn Beaches. 'Managed retreat' (which monitors the coastline's natural processes but with no active intervention) will be undertaken along the Heritage Coast to the south of Hendon as well as at South Bents and Whitburn Cliffs.

11.15 This policy should be read alongside the Marine Management Organisation's North East Inshore and Offshore Plans.

Policy

WWE3 Water management

Development must consider the effect on flood risk, on-site and off-site, commensurate with the scale and impact. Development must:

1. be accompanied by a Flood Risk Assessment (where appropriate), to demonstrate that the development, including the access, will be safe, without increasing or exacerbating flood risk elsewhere and where possible will reduce flood risk overall;
2. demonstrate that they pass the Sequential Test and if necessary the Exceptions Test in flood Zones 2 and 3;
3. discharge at greenfield runoff rates for the 1 in 1 and 1 in 100 flood events plus the relevant climate change allowance for greenfield and brownfield sites in accordance with the latest Local Flood Risk Management Strategy;
4. incorporate a Sustainable Drainage System (SuDS) to manage surface water drainage. Where SuDS are provided, arrangements must be put in place for their whole life management and maintenance;
5. separate, minimise and control surface water runoff by discharging in the following order:
   i. to an infiltration or soak away system;
   ii. to a watercourse (open or closed);
   iii. to a surface water sewer; then
   iv. to a combined sewer.

   However, if sites are within 250m of a tidal estuary or the sea, surface water can be discharged directly);
6. ensure adequate protection where sites may be susceptible to over land flood flows (as shown in the Strategic Flood Risk Assessment) or lie within a Surface Water Risk Area (as shown on the Environment Agency flood maps);
7. incorporate allowance for climate change in accordance with the latest Environment Agency Guidance;
8. make developer contributions, where needed, to ensure that the drainage infrastructure can cope with the capacity needed to support proposed new development;
9. demonstrate control of the quality of surface water runoff during construction and for the lifetime of the development. For all developments the management of water should be an intrinsic part of the overall development; and
10. not have a detrimental impact on the city's water resources, including the Magnesian Limestone Aquifer and its ground source protection zones. Development along the River Wear and coast should take account of the Northumbria River Basin Management Plan, to deliver continuing improvements in water quality.

11.16 Flooding from sewers is increasingly recognised as an issue in areas that are not necessarily at risk from fluvial flooding – whereby rainfall events, sometimes away from the area concerned, cause major surface water run-off to enter the sewerage system.

11.17 This policy seeks to minimise the risk that future development locations could be flooded from sewers or add to an existing risk by ensuring that surface water run-off entering the sewer system is kept to an absolute minimum. Other benefits of such an approach will include a much reduced risk to water quality.

11.18 To help adapt to expected climate change, the policy provides the broad framework for addressing the increased risk of flooding including a requirement for sustainable drainage systems.

11.19 Where appropriate, SuDS should contribute to the provision of green infrastructure whilst retaining acceptable levels of useable amenity space.

11.20 In order to protect the Magnesian Limestone Aquifer and its ground source protection zones, the use of deep infiltration SUDS and other infiltration SuDS will not be supported where they are likely to have an adverse impact on drinking water supply. Ground investigations would need to be considered on a case by case basis and should be guided by the Environment Agency's approach to groundwater protection.

Policy

WWE4 Water quality

The quantity and quality of surface and groundwater bodies and quality of bathing water shall be protected and where possible enhanced in accordance with the Northumbria River Basin Management Plan.

1. Water quality assessments will be required for:
   i. any physical modifications to a watercourse; and
   ii. any development which could indirectly, adversely affect water bodies.
2. Development that discharges water into a watercourse will be required to incorporate appropriate water pollution control measures.
3. Development that incorporates infiltration based SuDS will be required to incorporate appropriate water pollution control measures.
4. Development adjacent to, over or in, a main river or ordinary watercourse should consider opportunities to improve the river environment and water quality by:
   i. naturalising watercourse channels;
   ii. improving the biodiversity and ecological connectivity of watercourses;
   iii. safeguarding and enlarging river buffers with appropriate habitat; and
   iv. mitigating diffuse agricultural and urban pollution.

11.21 This policy seeks to minimise the impact of development on the quality of surface water and the Magnesian Limestone Aquifer and its ground source protection zones.

11.22 The potential to pollute our groundwater aquifers is significant. Intense rainfall can cause localised flooding and erosion, and storm sewage overflows are known to affect water quality, environmental quality and affect important wildlife sites. Furthermore, old mine workings within the city have the potential to release heavy metals into the groundwater aquifers, and in areas along the coast, over-pumping of the aquifer has resulted in saline intrusions. Increased use of fertilizers in the catchment by the agricultural industry is also resulting in increasing nitrite concentrations, and landfill sites also present a high risk to groundwater.

11.23 The Environment Agency and the Coal Authority recommend a hydrogeological risk assessment is provided on the impact of development on the existing minewater 'blocks' (in terms of flood risk and water quality) as identified by the Coal Authority. Further advice should be sought with the local planning authority.

11.24 The council, in conjunction with the Environment Agency and the sewerage undertaker, will seek to resist development that threatens water quality and quantity, and will generally encourage initiatives that result in an improvement of water quality and the capacity of surface waters to support wildlife. The WFD became part of UK law in 2003 with the primary objectives of achieving good

ecological status in water bodies, and providing protection for drinking water sources and protected sites (Habitats Directive Sites and Sites of Special Scientific Interest). These requirements are reflected in the Environment Agency's Northumbria River Basin Management Plan, which covers the city area.

11.25 Early engagement with the local planning authority, the LLFA, Environment Agency and relevant water and sewerage companies can help to establish if water quality is likely to be a significant planning concern and, if it is, to clarify what assessment will be needed to support the application. Applicants should provide sufficient information for the council to be able to identify the likely impacts on water quality. The information supplied should be proportionate to the nature and scale of the development proposed and the level of concern about water quality.

11.26 Water quality at the designated bathing water sites at Roker and Seaburn is assessed by the Environment Agency. From May to September, weekly assessments measure current water quality, and at a number of sites daily pollution risk forecasts are issued. Both beaches have been rated as excellent for 2015, 2016 and 2017.

Policy

WWE5 Disposal of foul water

1. Development should utilise the following drainage hierarchy:
   i. connection to a public sewer;
   ii. package sewage treatment plant (which can be offered to the Sewerage Undertaker for adoption); then
   iii. septic tank.
2. Development involving the use of non-main methods of drainage in areas where public sewerage exists or the use of Cess Pits will not be permitted.
3. Development of new or extensions/ improvements to existing waste water, sludge or sewage treatment works, will normally be supported unless the adverse impact of the development significantly outweighs the need for greater capacity.

11.27 For further information regarding the drainage hierarchy and use of non-main methods of drainage advice should be sought from Northumbria Water.

Policy

WWE6 Waste management

Development that encourages and supports the minimisation of waste production, and the re-use and recovery of waste materials including, for example, re-cycling, composting and Energy from Waste will normally be supported. Proposals for waste management facilities to deal with waste arisings will be encouraged based upon the following principles:

1. managing waste through the waste hierarchy in sequential order. Sites for the disposal of waste will only be permitted where it meets a need which cannot be met by treatment higher in the waste hierarchy;
2. promoting the opportunities for on-site management of waste where it arises and encouraging co-location of waste developments that can use each other's waste materials;
3. ensuring that sufficient capacity is located within the city to accommodate forecast waste arisings of all types during the Plan period, reducing the reliance on other authority areas;
4. supporting delivery of the South Tyne and Wear Joint Municipal Waste Management Strategy;
5. facilitating the development of recycling facilities across the city including civic amenity sites and small recycling 'bring' banks to ensure there is sufficient capacity and access for the deposit of municipal waste for re-use, recycling and disposal;
6. facilitating the development of a network of small scale local waste management facilities in accessible locations, and effective methods of waste management such as suitable facilities to separate or store different types of waste, including materials that are required to be separated for kerbside collection schemes;
7. ensuring new waste developments are located and designed to avoid unacceptable adverse impacts on landscape, wildlife, heritage assets and amenity;
8. working collaboratively with neighbouring local authorities with responsibilities for waste and other local authorities where waste import/export relationships exist. This will ensure a co-operative cross boundary approach to waste management is established and maintained; and

North-East Lead Local Flood Authorities Sustainable Drainage Local Standards

Durham County Council
Gateshead City Council
Newcastle City Council
North Tyneside Council
Northumberland County Council
South Tyneside Council
Sunderland City Council

Version	Date	Author(s)	Comment
Draft	October 2019	Ian Dalgleish (SCC)	For LLFA review
For comment	November 2019	Brian Weatherall (DCC) Peter Burrows (GC) Jimmy Young (GC) Darren Varley (NeCC) Venus Sanchez (NeCC) James Hitching (NoCC) Helen Parkin (NoCC) Andy Burnett (NTC) Michelle Hogg (STC) Amy Ridgeon(STC) Paul Armin (SCC) Ian Dalgleish (SCC)	
Post comment	May 2020	Helen Parkin (NoCC)	Updated post comment period Feb 2020
Final Issue	July 2020	Helen Parkin (NoCC)	Final editing and formatting

The North-East Lead Local Flood Authorities (NE LLFA) consist of Durham, Gateshead, Newcastle, Northumberland, North Tyneside, South Tyneside and Sunderland. Contact details for each Lead Local Flood Authority are as below. Please contact the Local Authority directly if you cannot contact the persons named below.

Local Authority	Email
Durham	ns_drainage@durham.gov.uk
Gateshead	suds@gateshead.gov.uk
Newcastle	flood.management@newcastle.gov.uk
Northumberland	llfa@northumberland.gov.uk
North Tyneside	Andrew.Burnett@northtyneside.gov.uk
South Tyneside	developmentservices@southtyneside.gov.uk
Sunderland	LLFA@sunderland.gov.uk

Glossary

LLFA	Lead Local Flood Authority
NE LLFA	North-East Lead Local Flood Authorities
FWMA	Flood and Water Management Act 2010
SuDS	Sustainable Drainage Systems
NPPF	National Planning Policy Framework
CIRIA	Construction Industry Research and Information Association
LASOO	Local Authority SuDS Officer Organisation
FEH	Flood Estimation Handbook
IOH	Institute of Hydrology

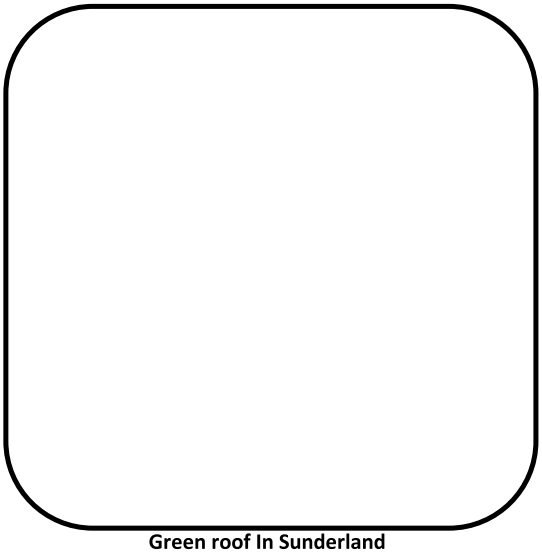
Introduction

Lead Local Flood Authorities were created by the Flood and Water Management Act with responsibility to manage flooding from surface water, groundwater and ordinary watercourses. The accepted NE LLFA definition of SuDS is:

The means of managing rainwater (including snow and other precipitation) by mimicking natural drainage with the aim of reducing damage from flooding, improving water quality, protecting and improving the environment, providing amenity and ensuring the stability and durability of drainage systems.

The NPPF (163-165) states that SuDS are required on major developments and LLFAs are statutory consultees for surface water management under the Town and Country Planning Act (TCPA) 2015. Typically, the approach of the NE LLFA toward drainage design will follow the NPPF, Planning Practice Guidance - Flood Risk and Coastal Change, Non-Statutory Technical Standards for Sustainable Drainage and the FWMA. Best practice guidance will be used to supplement the above documents such as the CIRIA SuDS Manual (C753 at time of writing, LASOO guidance, BS8582:2013, and C532, C648 and C768). All NE LLFAs will have a Local Flood Risk Management Strategy, Strategic Flood Risk Assessment and requirements in relation to flood risk, water quality, biodiversity and amenity within a Local Plan or Core Strategy. Some NE LLFAs have other drainage or SuDS guidance and adoption documents. There may also be specific drainage requirements in planning validation checklists required before an application will be validated.

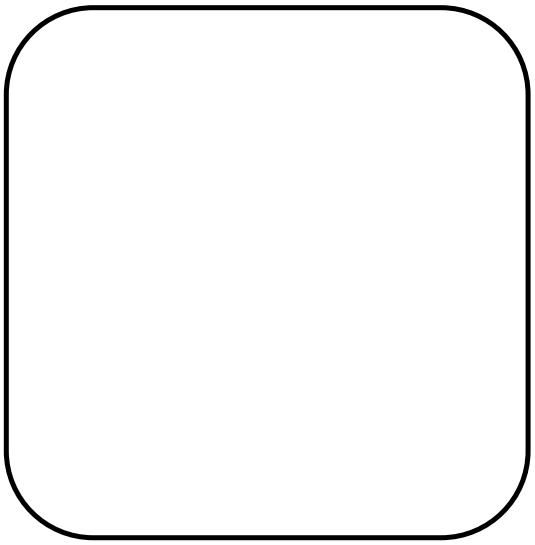
This guidance provides the approach the NE LLFA will take on some key questions often asked through the planning process by developers with the aim to improve the submission of flood risk assessments, drainage strategies and SuDS design and promote consistency and best practice within the NE LLFA area. It does not attempt to answer all questions on drainage design and pre-application consultation with a NE LLFA is always recommended. This guidance has been developed considering feedback from developers and their consultants, the Tees Valley Combined Authority (TVCA) local standards for sustainable drainage and in consultation with Northumbrian Water and the Environment Agency.



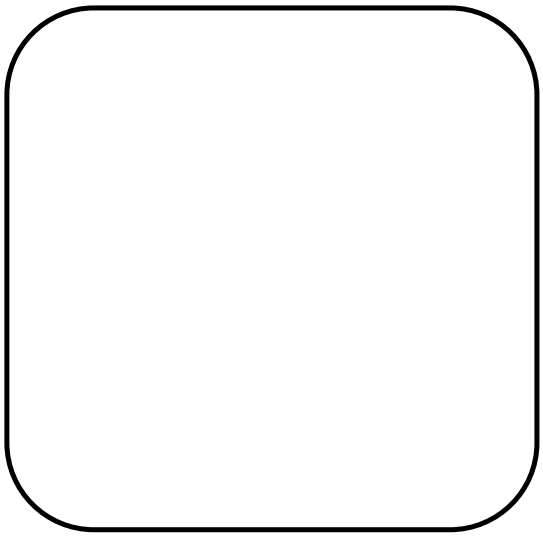
Green roof In Sunderland

Planning pre-application consultations, NE LLFA SuDS adoption and Highway Authority SuDS adoption

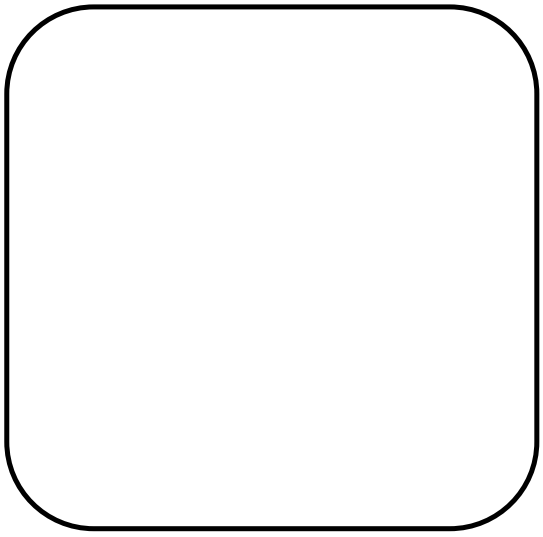
All the NE LLFAs are agreed that consultation with the LLFA during the pre-application stage is the only way of ensuring SuDS are best incorporated into development. In addition, some authorities offer a separate pre-application priority charged service relating to SuDS and some NE LLFAs adopt SuDS either via an estate rent charge or Community Infrastructure Levy (CIL). It is important to note that the adoption of development SuDS by the NE LLFA which this guidance refers to is separate to requirements of the Highway Authorities relating to highway drainage. Some Highway Authorities adopt SuDS too. To ensure the best design and any chance of adoption pre-application consultation must be undertaken. From 1st April 2020 Northumbrian Water may adopt forms of SuDS considered sewers in line with Design and Construction Guidance March 2020.



Lemington SuDS Basin



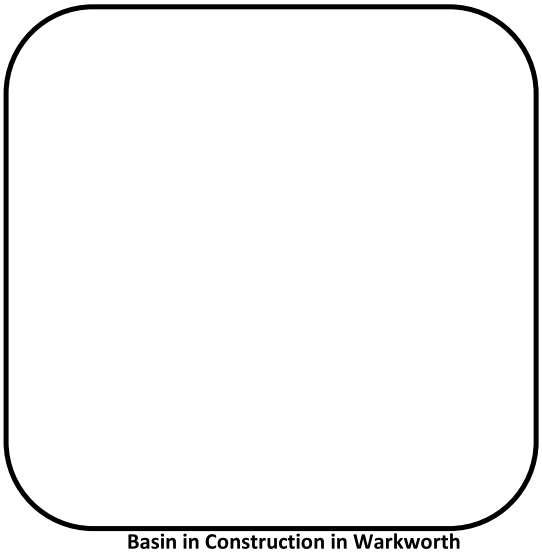
M&S Living wall Newcastle
Source : Chronicle Live



Dry Basin In Stobhill Morpeth

The North- East LLFA Local Standards

The NE LLFA Local Standards are set out below with reference to the Non-Statutory Technical Standards for Sustainable Drainage in brackets.



Basin in Construction in Warkworth Northumberland

Peak Flow Control (S2 & S3)

Local Standard 1 – Equivalent Greenfield Run-Off (GFRO) discharge rates should be provided for new development at all sites (Greenfield and Brownfield).

The only limitation on the lowest restricted run-off rate for smaller sites may be the smallest orifice sized flow control as accepted by Northumbrian Water (i.e. 100mm unprotected and 50mm protected – See Design and Construction Guidance).

Local Standard 2 – The NNE LLFA accept either FEH or IOH124 methods for calculating GFRO rates.

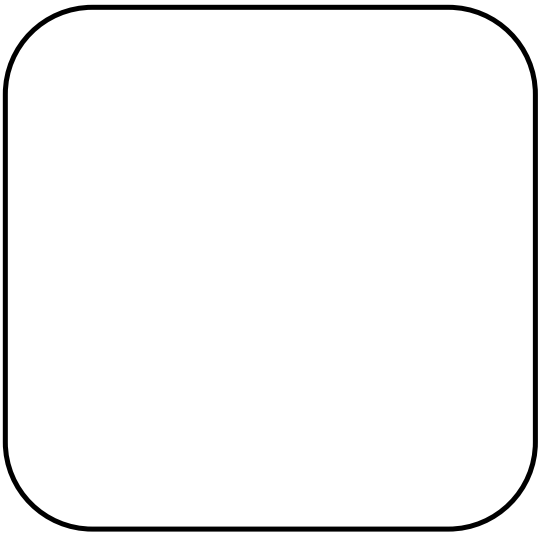
Use of FEH (particularly FEH2013 data) is preferred. See https://fehweb.ceh.ac.uk/. However the LLFAs will accept the FSR method. For some sites the LLFA may ask for the 2013 FEH method to be used.

Local Standard 3 – For calculating GFRO rate the whole site area minus significant areas of public open space should be used.

Enclosed areas such as gardens may be included in the GFRO rate for the site. You can use tools such as at the UK SuDS website to determine GFRO rates. https://www.uksuds.com/

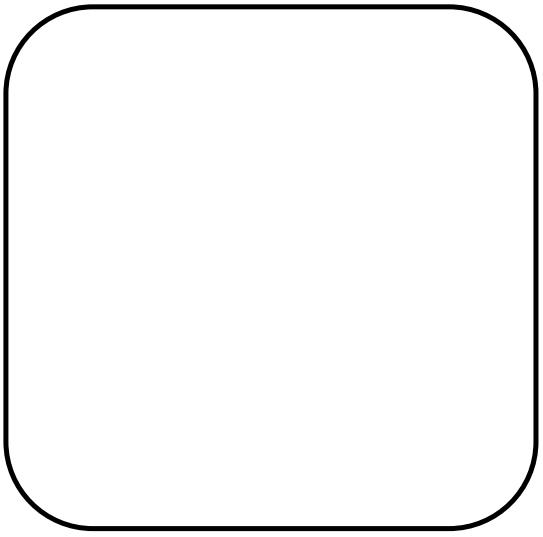
Volume Control (S4-S6)

Local Standard 4 – The NNE LLFA will set allowable discharge rates following Local Standards 1-3, unless the permissible discharge rate Northumbrian Water will allow to sewer is below GFRO rates.



Elba Park SuDS Sunderland

Whenever there is a proposed discharge to sewer it will be expected that formal agreement for a discharge rate to sewer will be provided by Northumbrian Water. You should contact Northumbrian Water Developer Services via their website to make a pre planning enquiry or email developmentenquiries@nwl.co.uk. It is expected any pre planning enquiry response will be included in submitted documents to LLFAs. Outline planning



The Sill Green Roof Hexham

applications will need to provide a Pre Development Enquiry.

Local Standard 5 – Urban creep allowances to be applied up to 10% for residential developments and 0% for commercial developments.

Unless a site has a design life of less than 100 years or the current site is 100% impermeable an allowance of 10% for urban creep should be supplied to calculations. PIMP factors (impermeable area as a % of total area) can be set up to 110% to model this. See LASOO guidance for further details.

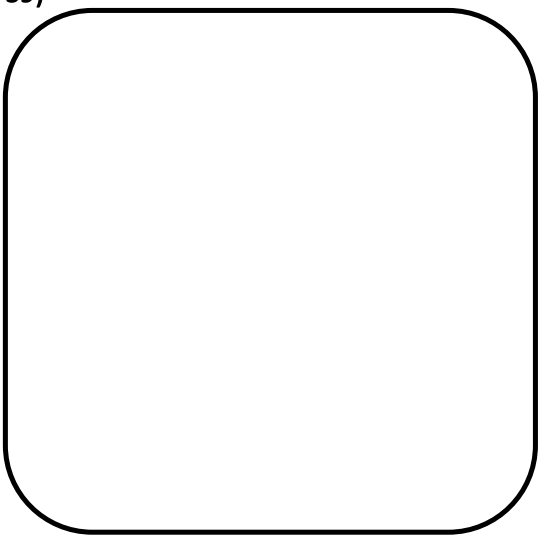
https://www.susdrain.org/files/resources/other-guidance/lasoo_non_statutory_suds_technical_standards_guidance_2016_.pdf

Local Standard 6 – The NE LLFA will accept a single Qbar discharge rate from site or rates no more than the 1 in 1 and 1 in 100-year GFRO in accordance with Defra Standards.

For both greenfield and brownfield sites, the LLFA will accept equivalent greenfield runoff rates. At some sites use of a complex control with managed flooding on site may be the most appropriate way to deliver development. In other areas of known flood risk developers will only be allowed to discharge at Qbar. Please contact your LLFA during pre-application to confirm requirements.

If discharge is through existing sewerage networks connected to other offsite drainage GFRO restrictions (or Northumbrian Water restrictions) will apply.

Flood risk within the development (S7 – S9)

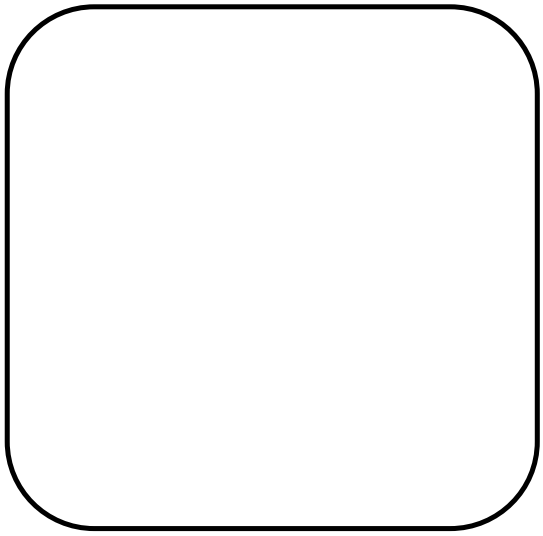


Storm Cells In Sunderland

Local Standard 7 – The NNE LLFA accepts direct free (unrestricted) discharge to estuarine waters or the sea.

Discharges will still need to be treated for water quality and source control provided. Any designed network will be required to show that it can convey water freely and safely to the estuarine waters. A section of any new outfall will be required to show details including high water levels. The developer may also require consultation with the Environment Agency.

Local Standard 8 – Storm events should be checked as a minimum between 15 minutes and 360 minutes.



Swales in Witton Gilber Durham

It is expected that as a minimum all events from a 15-minute storm to the 360-minute (6 hour) storm will be assessed to ensure the volume of water leaving the developed site is not greater than the existing GFRO. This would apply to the 1 year and 100-year + 40% climate change storm event. Attenuation drain down times will be checked for half empty in 24 hours for larger catchments and modelling times extended where required.

Local Standard 9 - Climate change allowances to be applied are 40% on the extreme event modelling (100 year return period)

This is equal to the current upper end requirement as noted by the Environment Agency.

https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances.

Structural Integrity (S10-S11)

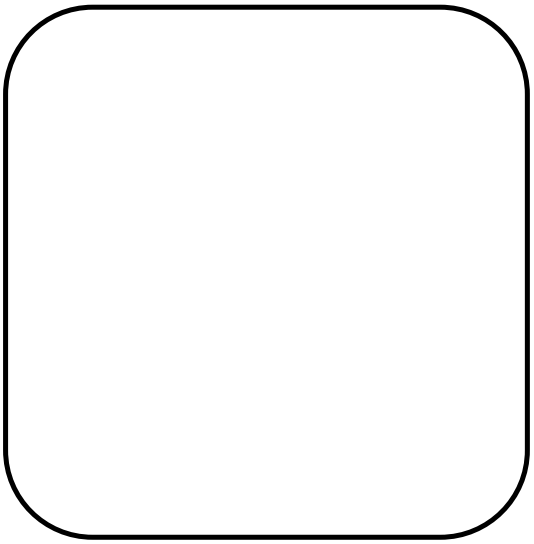
Local Standard 10 - 300mm free board is required in SuDS design

300mm freeboard should be provided or 300mm between top level of water during the 1 in 100 year +40% climate change storm event and finished floor level must be shown and exceedance routes should be checked.

Local Standard 11 – 1D or 2D modelling may be required for ordinary watercourses within or adjacent to new developments.

The developer should contact the LLFA to ensure the approach and modelling package they use is appropriate

Designing for Maintenance Considerations (S12)



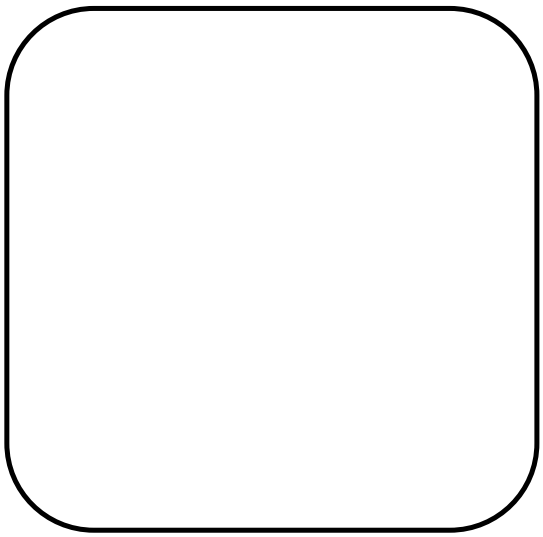
Permeable paving in Gateshead

Local Standard 12 – Overland flow modelling for surface water flood routes or other reasons may be required as part of formal submissions.

Sites where surface water overland flow routes are present, are located on sloping sites or are in are location of known surface water flood risk will be required to submit

detail on overland flow management. The LLFA may request overland flow modelling. This is required to show surface water flow routes will be managed. The type of modelling package required should be confirmed with the LLFA. Indicative overland flow routes can viewed online https://flood-warning-information.service.gov.uk/long-term-flood-risk/map

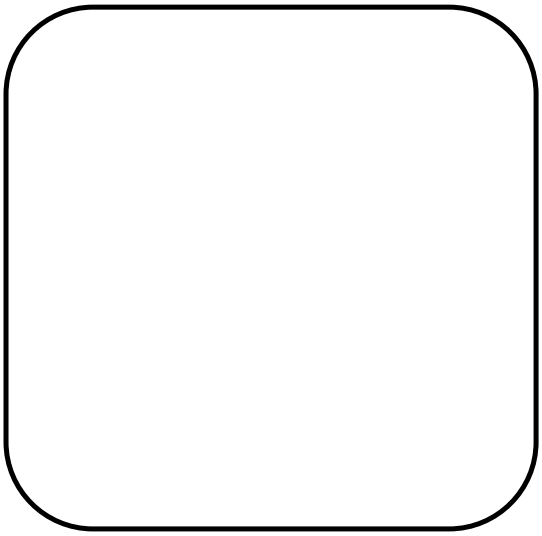
Construction (S13-S14)



Swales under construction Gateshead

Local Standard 13 – To assess the risk of tide locking a combined tidal and surface water event must be assessed where the development is in or directly adjacent to flood zone 2 or 3.

The key risk to be assessed is whether the outfall is surcharged affecting site drainage. For example, a 1 in 100-year tidal level and a 1 in 10-year surface water flow or a 1 in 200-year tidal level and a 1 in 5-year surface water flow could be assessed. The drainage network of the development should still be assessed to show that it can convey flow up to the 1 in 100 year plus 40% rainfall event. A similar requirement may apply to discharges to watercourses where outfalls may be surcharged. Coastal design sea level data can be found as Environment Agency Open Data.



Silksworth Basin Sunderland

Local Standard 14 – SuDS design should meet the latest CIRIA SuDS Manual, Sewers for Adoption, British Standards and other best practice guidance.

A formal pre-application check should be made with local authorities to determine where there may be any change allowed from this standard based on site specific requirements. See also:

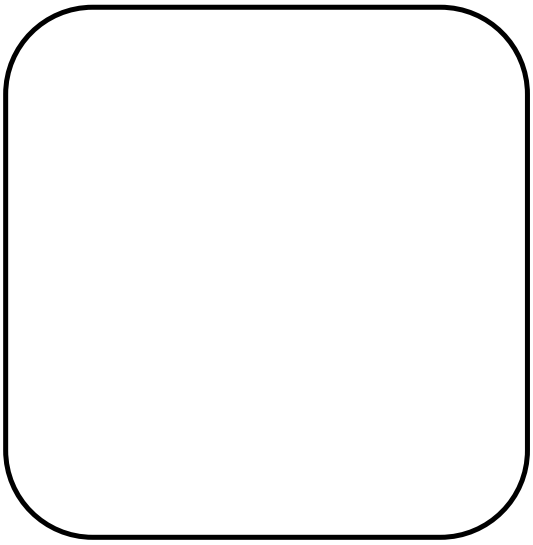
https://www.susdrain.org/resources/ , http://sfa.wrcplc.co.uk/home.aspx & https://www.bsigroup.com/en-GB/

Other Local Standards (S15-S22)

Local Standard 15 – A site specific maintenance plan will be required to detail how SuDS will be maintained and who will maintain them.

This plan should include consideration of practicalities such as access routes. Some LLFAs may allow this to be conditioned or a final plan to be conditioned. Check with the LLFA during formal pre-application discussions. Management and maintenance company details will need to be supplied prior to occupation.

Local Standard 16 - A construction plan is required to show surface run off, any water receptors and an outline of mitigation measures.

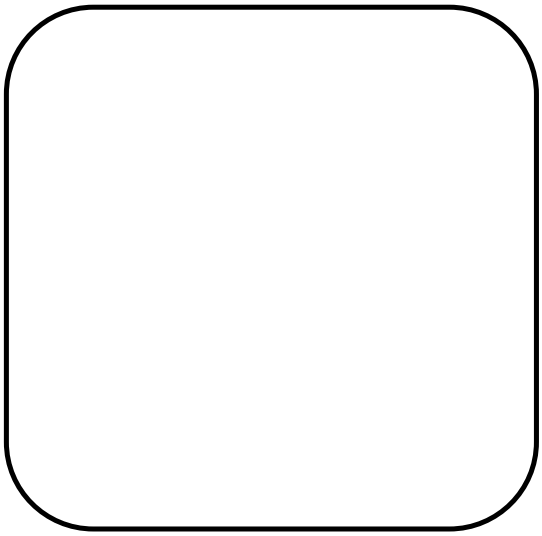


Swales in Hexham Northumberland

This is to manage risk to development sites when the surface of the site is stripped or on larger sites as the wider site is developed. Some LLFAs may allow this to be conditioned or a final plan to be conditioned. Check with the LLFA during formal pre-application discussions. These standards add further detail to the approach provided in the Non-Statutory Technical Standards for Sustainable Drainage and are intended to clarify the local approach.

Local Standard 17- The NNE LLFA consider SuDS to be on the surface "green SuDS" that show multifunctional benefit (including quantity control, water quality, biodiversity and amenity) and mimic natural drainage in line with the NPPF and FWMA definitions

Consideration of landscaping and ecology should be an integral part of the selection and design process for SuDS. Local Planning Authorities will ensure that liaison between drainage, landscape and ecology teams will occur through pre planning enquiry to support these applications. It will be expected that landscaping and ecology details will be referred to and described on drainage layouts and where required supported by additional plans before planning approval. Other drainage solutions such as tanked storage will be considered only on a site by site basis. A viability assessment will be required if multifunctional benefit vegetated SuDS are not proposed

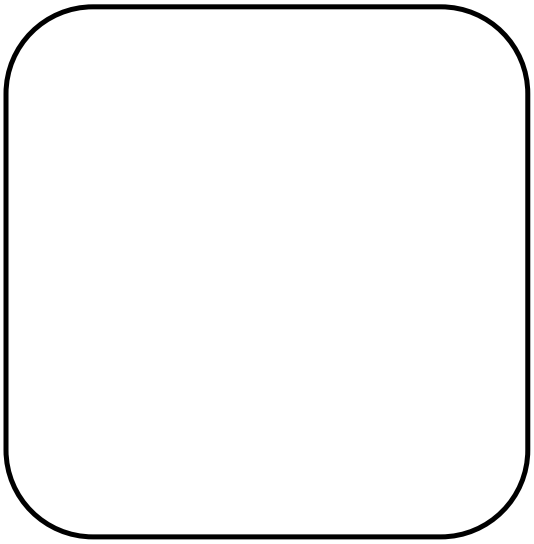


Monkseaton Flood Alleviation scheme

Local Standard 18 – The NNE LLFA typically follow LASOO guidance for FRA and Drainage Strategy requirements at Outline and Full planning permission

Some LLFAs have further defined requirements. Please contact them during formal pre-application to obtain further information. The LASOO guidance can be found at:

https://www.susdrain.org/files/resources/other-guidance/lasoo_non_statutory_suds_technical_standards_guidance_2016_.pdf



Permeable Paving Newcastle Airport

Local Standard 19 – Infiltration testing is required at all sites before planning approval.

While it is accepted at most sites full infiltration will not be possible partial infiltration (10^{-6} ms^{-1} to 10^{-8} ms^{-1}) may be achievable. Infiltration tests should be undertaken as part of site investigations including falling head tests (in line with DG365) at all sites. A minimum of 2 representative tests of 6 hours at likely discharge locations should be provided and the results submitted. Should tests be favourable for full infiltration further testing in specific locations for infiltration should be undertaken. The only exceptions are sites where ground contamination is present, there are proven concerns over ground stability (i.e. coal mining reports), or groundwater levels are measured within 1m of the surface. Copies of DG365 may be obtained at

https://www.brebookshop.com/details.jsp?id=327631

Local Standard 20 - Source control interception (retaining 5mm rainfall on site) should be applied for the impermeable area of all sites using the CIRIA SuDS manual method.

Where source control interception is not possible for all impermeable areas as evidenced through site investigation and infiltration testing every reasonable effort should be made to provide as much source control across the site as possible using features like permeable paving. See the SuDS Manual section 24. The developer may use site infiltration results and SuDS design evidencing infiltration and/or evaporation to demonstrate provision of source control by volume. Infiltration tests results, risk of subsidence, ground contamination and measured high ground water levels can all be used to determine whether full interception can be provided at a site.

Local Standard 21- SuDS can be used as open space outside of the area wetted by a 1-year return storm.

SuDS should be designed to be accessible and useable spaces outside of frequent storm extents both for amenity and wildlife with appropriate health and safety assessments considered. Gradients of 1 in 5 are preferred for useable amenity space.

Local Standard 22 - Water quality information should be assessed using criteria in the current CIRIA SuDS manual.

The approach of the developer should be explained within submitted documents in terms of pollutant loading and removal. Where required consideration should be given to treatment volumes, velocities, depths and retention times of water being treated. Each design should be assessed against treatment stages and the simple indices method of the SuDS Manual. See the SuDS Manual section 26.

Appendix D: Drainage model details – trunk sewer system

Appendix D: Contents

- MicroDrainage model network details
- MicroDrainage model results for 1, 30 and 100-year conditions
- SYSTRA dwg 21B34-SYS-HDG-Z0-CH-01 *Proposed Drainage Layout*

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for 01 Site Entrance

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	1	PIMP (%)	100
M5-60 (mm)	18.300	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	100	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for 01 Site Entrance

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.266	4-8	0.200

Total Area Contributing (ha) = 0.465

Total Pipe Volume (m^3) = 17.272

Network Design Table for 01 Site Entrance

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	27.893	0.300	93.0	0.058	5.00	0.0	0.600	o	300	Pipe/Conduit	
S1.001	30.942	0.300	103.1	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.002	30.936	0.200	154.7	0.076	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.000	37.219	0.220	169.2	0.034	5.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	23.700	0.140	169.3	0.108	0.00	0.0	0.600	o	300	Pipe/Conduit	
S3.000	17.978	0.090	200.0	0.105	5.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	45.82	5.29	36.000	0.058	0.0	0.0	0.0	1.63	115.3	7.2
S1.001	44.62	5.62	35.700	0.058	0.0	0.0	0.0	1.55	109.4	7.2
S1.002	43.26	6.03	35.400	0.134	0.0	0.0	0.0	1.26	89.2	15.7
S2.000	44.62	5.62	36.000	0.034	0.0	0.0	0.0	1.00	39.9	4.2
S1.003	42.23	6.35	35.200	0.277	0.0	0.0	0.0	1.21	85.2	31.6
S3.000	45.87	5.27	34.200	0.105	0.0	0.0	0.0	1.11	78.3	13.1

Network Design Table for 01 Site Entrance

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
S3.001	25.028	0.119	210.0	0.043	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.004	5.653	0.044	129.5	0.040	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.005	30.216	0.044	686.7	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.006	9.009	0.055	163.1	0.000	0.00	0.0	0.600	o	375	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)
S3.001	44.49	5.66	34.110	0.148	0.0	0.0	0.0	1.08	76.4	17.9
S1.004	42.02	6.42	33.991	0.465	0.0	0.0	0.0	1.38	97.5	53.0
S1.005	39.94	7.16	33.872	0.465	0.0	0.0	0.0	0.68	75.5	53.0
S1.006	39.66	7.27	33.828	0.465	0.0	0.0	0.0	1.42	156.4	53.0

Manhole Schedules for 01 Site Entrance

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	38.300	2.300	Open Manhole	1200	S1.000	36.000	300				
S2	38.000	2.300	Open Manhole	1200	S1.001	35.700	300	S1.000	35.700	300	
S3	37.700	2.300	Open Manhole	1200	S1.002	35.400	300	S1.001	35.400	300	
S4	37.500	1.500	Open Manhole	1200	S2.000	36.000	225				
S5	37.500	2.300	Open Manhole	1200	S1.003	35.200	300	S1.002	35.200	300	
								S2.000	35.780	225	505
S6	35.800	1.600	Open Manhole	1200	S3.000	34.200	300				
S7	35.800	1.690	Open Manhole	1200	S3.001	34.110	300	S3.000	34.110	300	
S8	37.500	3.509	Open Manhole	1200	S1.004	33.991	300	S1.003	35.060	300	1069
								S3.001	33.991	300	
S9	36.750	2.878	Open Manhole	1350	S1.005	33.872	375	S1.004	33.947	300	
S10	36.000	2.172	Open Manhole	1350	S1.006	33.828	375	S1.005	33.828	375	
S	36.000	2.227	Open Manhole	0		OUTFALL		S1.006	33.773	375	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S1	433384.111	558941.192	433384.111	558941.192	Required	
S2	433372.767	558966.674	433372.767	558966.674	Required	
S3	433360.003	558994.861	433360.003	558994.861	Required	
S4	433313.095	559007.905	433313.095	559007.905	Required	
S5	433347.121	559022.988	433347.121	559022.988	Required	
S6	433410.016	559041.610	433410.016	559041.610	Required	
S7	433392.039	559041.875	433392.039	559041.875	Required	
S8	433368.978	559032.149	433368.978	559032.149	Required	
S9	433371.333	559027.010	433371.333	559027.010	Required	

Manhole Schedules for 01 Site Entrance

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S10	433383.499	558999.352	433383.499	558999.352	Required	
S	433382.272	558990.427			No Entry	

Area Summary for 01 Site Entrance

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	100	0.058	0.058	0.058
1.001	-	-	100	0.000	0.000	0.000
1.002	User	-	100	0.076	0.076	0.076
2.000	User	-	100	0.034	0.034	0.034
1.003	User	-	100	0.073	0.073	0.073
	User	-	100	0.035	0.035	0.108
3.000	User	-	100	0.105	0.105	0.105
3.001	User	-	100	0.043	0.043	0.043
1.004	User	-	100	0.030	0.030	0.030
	User	-	100	0.010	0.010	0.040
1.005	-	-	100	0.000	0.000	0.000
1.006	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.465	0.465	0.465

Free Flowing Outfall Details for 01 Site Entrance

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.006	S	36.000	33.773	0.000	0	0

Simulation Criteria for 01 Site Entrance

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
Hot Start (mins)	0	Inlet Coeffiecient	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	FSR	Profile Type	Summer
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.300	Storm Duration (mins)	30
Ratio R	0.350		

Online Controls for 01 Site Entrance

Pump Manhole: S10, DS/PN: S1.006, Volume (m³): 6.3

Invert Level (m) 33.828

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.5000	0.700	1.5000	1.300	1.5000	1.900	1.5000	2.500	1.5000
0.200	1.5000	0.800	1.5000	1.400	1.5000	2.000	1.5000	2.600	1.5000
0.300	1.5000	0.900	1.5000	1.500	1.5000	2.100	1.5000	2.700	1.5000
0.400	1.5000	1.000	1.5000	1.600	1.5000	2.200	1.5000	2.800	1.5000
0.500	1.5000	1.100	1.5000	1.700	1.5000	2.300	1.5000	2.900	1.5000
0.600	1.5000	1.200	1.5000	1.800	1.5000	2.400	1.5000	3.000	1.5000

Storage Structures for 01 Site Entrance

Tank or Pond Manhole: S10, DS/PN: S1.006

Invert Level (m) 33.828

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	300.0	2.400	0.0	4.800	0.0	7.200	0.0	9.600	0.0
0.400	300.0	2.800	0.0	5.200	0.0	7.600	0.0	10.000	0.0
0.800	300.0	3.200	0.0	5.600	0.0	8.000	0.0		
1.200	300.0	3.600	0.0	6.000	0.0	8.400	0.0		
1.201	0.0	4.000	0.0	6.400	0.0	8.800	0.0		
2.000	0.0	4.400	0.0	6.800	0.0	9.200	0.0		

Volume Summary (Static)

Length Calculations based on Centre-Centre

Pipe Number	USMH Name	Total Volume (m³)
S1.000	S1	0.000
S1.001	S2	0.000
S1.002	S3	0.000
S2.000	S4	0.000
S1.003	S5	0.000
S3.000	S6	0.000
S3.001	S7	0.000
S1.004	S8	0.000
S1.005	S9	0.000
S1.006	S10	0.000
Total		0.000

Volume Summary (Static)

Length Calculations based on True Length

Pipe Number	USMH Name	Total Volume (m³)
S1.000	S1	0.000
S1.001	S2	0.000
S1.002	S3	0.000
S2.000	S4	0.000
S1.003	S5	0.000
S3.000	S6	0.000
S3.001	S7	0.000
S1.004	S8	0.000
S1.005	S9	0.000
S1.006	S10	0.000
Total		0.000

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 01 Site Entrance

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of 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 FSR M5-60 (mm) 18.300 Cv (Summer) 0.750
Region England and Wales Ratio R 0.350 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 10.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
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
Climate Change (%)	0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S1.000	S1	15 Winter	1	+0%					36.051	-0.249	0.000
S1.001	S2	15 Winter	1	+0%					35.752	-0.248	0.000
S1.002	S3	15 Winter	1	+0%					35.486	-0.214	0.000
S2.000	S4	15 Winter	1	+0%					36.050	-0.175	0.000
S1.003	S5	15 Winter	1	+0%					35.330	-0.170	0.000
S3.000	S6	15 Winter	1	+0%					34.289	-0.211	0.000
S3.001	S7	15 Winter	1	+0%					34.230	-0.180	0.000
S1.004	S8	15 Winter	1	+0%					34.198	-0.093	0.000
S1.005	S9	15 Winter	1	+0%					34.126	-0.121	0.000
S1.006	S10	720 Winter	1	+0%					34.033	-0.171	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.07			7.0	OK	
S1.001	S2	0.07			7.0	OK	
S1.002	S3	0.18			14.7	OK	
S2.000	S4	0.11			4.2	OK	
S1.003	S5	0.39			29.5	OK	
S3.000	S6	0.19			12.6	OK	
S3.001	S7	0.24			16.5	OK	
S1.004	S8	0.81			49.9	OK	
S1.005	S9	0.79			49.4	OK	
S1.006	S10	0.01			1.5	OK	

Summary of Critical Results by Maximum Level (Rank 1) for 01 Site Entrance

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of 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	FSR	M5-60 (mm) 18.300	Cv (Summer) 0.750
Region	England and Wales	Ratio R 0.350	Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 10.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
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)	30
Climate Change (%)	0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S1.000	S1	15 Winter	30	+0%					36.082	-0.218	0.000
S1.001	S2	15 Winter	30	+0%					35.784	-0.216	0.000
S1.002	S3	15 Winter	30	+0%					35.553	-0.147	0.000
S2.000	S4	15 Winter	30	+0%					36.080	-0.145	0.000
S1.003	S5	15 Winter	30	+0%					35.500	0.000	0.000
S3.000	S6	15 Winter	30	+0%	30/15 Summer				34.814	0.314	0.000
S3.001	S7	15 Winter	30	+0%	30/15 Summer				34.722	0.312	0.000
S1.004	S8	15 Winter	30	+0%	30/15 Summer				34.624	0.333	0.000
S1.005	S9	720 Winter	30	+0%	30/15 Summer				34.361	0.114	0.000
S1.006	S10	720 Winter	30	+0%	30/120 Winter				34.360	0.157	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.16			17.1	OK	
S1.001	S2	0.17			17.1	OK	
S1.002	S3	0.48			39.2	OK	
S2.000	S4	0.27			10.2	OK	
S1.003	S5	1.02			77.5	OK	
S3.000	S6	0.44			29.7	SURCHARGED	
S3.001	S7	0.60			41.2	SURCHARGED	
S1.004	S8	2.10			128.9	SURCHARGED	
S1.005	S9	0.20			12.4	SURCHARGED	
S1.006	S10	0.01			1.5	SURCHARGED	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 01 Site Entrance

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of 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	FSR	M5-60 (mm)	18.300
Region	England and Wales	Ratio R	0.350
Cv (Summer)	0.750		
Cv (Winter)	0.840		

Margin for Flood Risk Warning (mm) 10.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
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)	100
Climate Change (%)	40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S1.000	S1	15 Winter	100	+40%					36.113	-0.187	0.000
S1.001	S2	15 Winter	100	+40%	100/15 Winter				36.005	0.005	0.000
S1.002	S3	15 Winter	100	+40%	100/15 Summer				35.946	0.246	0.000
S2.000	S4	15 Winter	100	+40%					36.112	-0.113	0.000
S1.003	S5	15 Winter	100	+40%	100/15 Summer				35.834	0.334	0.000
S3.000	S6	15 Winter	100	+40%	100/15 Summer				35.645	1.145	0.000
S3.001	S7	15 Winter	100	+40%	100/15 Summer				35.560	1.149	0.000
S1.004	S8	15 Winter	100	+40%	100/15 Summer				35.428	1.137	0.000
S1.005	S9	1440 Winter	100	+40%	100/15 Summer				34.954	0.707	0.000
S1.006	S10	1440 Winter	100	+40%	100/30 Summer				34.953	0.750	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.30			31.0	OK	
S1.001	S2	0.36			36.1	SURCHARGED	
S1.002	S3	0.82			66.7	SURCHARGED	
S2.000	S4	0.49			18.4	OK	
S1.003	S5	1.76			133.5	SURCHARGED	
S3.000	S6	0.77			51.9	SURCHARGED	
S3.001	S7	1.05			71.6	SURCHARGED	
S1.004	S8	3.53			216.6	SURCHARGED	
S1.005	S9	0.21			13.2	SURCHARGED	
S1.006	S10	0.01			1.5	SURCHARGED	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for 02 HW & CarPark

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	1	PIMP (%)	100
M5-60 (mm)	18.300	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	100	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for 02 HW & CarPark

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	2.067	4-8	1.496	8-12	0.644	12-16	0.325	16-20	0.240	20-24	0.017

Total Area Contributing (ha) = 4.789

Total Pipe Volume (m^3) = 327.689

Network Design Table for 02 HW & CarPark

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
4.000	64.400	0.157	410.2	0.050	5.00	0.0	0.600	o	450	Pipe/Conduit	
4.001	39.380	0.096	411.2	0.077	0.00	0.0	0.600	o	450	Pipe/Conduit	
4.002	45.516	0.111	409.6	0.050	0.00	0.0	0.600	o	450	Pipe/Conduit	
4.003	48.072	0.111	433.8	0.053	0.00	0.0	0.600	o	450	Pipe/Conduit	
4.004	48.079	0.124	388.6	0.055	0.00	0.0	0.600	o	450	Pipe/Conduit	
4.005	23.578	0.058	410.0	0.180	0.00	0.0	0.600	o	450	Pipe/Conduit	
4.006	46.503	0.113	410.0	0.030	0.00	0.0	0.600	o	450	Pipe/Conduit	
4.007	43.491	0.106	410.0	0.057	0.00	0.0	0.600	o	450	Pipe/Conduit	
4.008	58.136	0.142	410.0	0.039	0.00	0.0	0.600	o	450	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)
4.000	43.10	6.08	34.805	0.050	0.0	0.0	0.0	1.00	158.7	5.9
4.001	41.11	6.73	34.648	0.128	0.0	0.0	0.0	1.00	158.5	14.2
4.002	39.06	7.49	34.552	0.178	0.0	0.0	0.0	1.00	158.8	18.8
4.003	37.09	8.32	34.441	0.231	0.0	0.0	0.0	0.97	154.2	23.2
4.004	35.43	9.10	34.330	0.285	0.0	0.0	0.0	1.03	163.0	27.4
4.005	34.65	9.50	34.207	0.465	0.0	0.0	0.0	1.00	158.7	43.6
4.006	33.24	10.27	34.149	0.495	0.0	0.0	0.0	1.00	158.7	44.6
4.007	32.03	11.00	34.036	0.552	0.0	0.0	0.0	1.00	158.7	47.9
4.008	30.56	11.97	33.930	0.591	0.0	0.0	0.0	1.00	158.7	48.9

Network Design Table for 02 HW & CarPark

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
4.009	24.475	0.049	499.0	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit	
5.000	29.482	0.087	338.9	0.016	5.00	0.0	0.600	o	450	Pipe/Conduit	
5.001	37.556	0.091	412.5	0.109	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.002	49.713	0.122	407.6	0.037	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.003	50.054	0.122	410.4	0.057	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.004	50.256	0.123	409.9	0.059	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.005	49.795	0.121	410.6	0.059	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.006	50.654	0.123	411.2	0.053	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.007	49.440	0.121	409.6	0.056	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.008	27.953	0.066	424.2	0.050	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.009	11.106	0.032	342.5	0.047	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.010	43.366	0.106	410.0	0.060	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.011	45.037	0.110	410.0	0.031	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.012	44.973	0.110	410.0	0.052	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.013	44.958	0.110	410.0	0.054	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.014	42.323	0.103	410.0	0.056	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.015	42.323	0.103	410.0	0.133	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.016	49.956	0.122	409.6	0.091	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.017	35.685	0.087	410.4	0.061	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.018	50.024	0.122	410.2	0.067	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.019	49.991	0.122	409.9	0.094	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.020	28.007	0.068	410.0	0.051	0.00	0.0	0.600	o	450	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)
4.009	30.18	12.26	33.343	0.591	0.0	0.0	0.0	1.40	888.0	48.9
5.000	45.23	5.45	35.928	0.016	0.0	0.0	0.0	1.10	174.7	2.0
5.001	43.10	6.08	35.841	0.126	0.0	0.0	0.0	0.99	158.2	14.7
5.002	40.63	6.90	35.750	0.162	0.0	0.0	0.0	1.00	159.2	17.9
5.003	38.45	7.74	35.628	0.219	0.0	0.0	0.0	1.00	158.6	22.8
5.004	36.52	8.58	35.506	0.278	0.0	0.0	0.0	1.00	158.7	27.5
5.005	34.81	9.41	35.383	0.337	0.0	0.0	0.0	1.00	158.6	31.8
5.006	33.26	10.26	35.262	0.390	0.0	0.0	0.0	1.00	158.5	35.1
5.007	31.89	11.09	35.139	0.446	0.0	0.0	0.0	1.00	158.8	38.5
5.008	31.16	11.56	35.018	0.495	0.0	0.0	0.0	0.98	156.0	41.8
5.009	30.91	11.73	34.952	0.542	0.0	0.0	0.0	1.09	173.8	45.4
5.010	29.93	12.45	34.920	0.602	0.0	0.0	0.0	1.00	158.7	48.8
5.011	29.00	13.21	34.814	0.632	0.0	0.0	0.0	1.00	158.7	49.7
5.012	28.14	13.96	34.704	0.684	0.0	0.0	0.0	1.00	158.7	52.1
5.013	27.33	14.71	34.595	0.738	0.0	0.0	0.0	1.00	158.7	54.6
5.014	26.63	15.42	34.485	0.794	0.0	0.0	0.0	1.00	158.7	57.2
5.015	25.96	16.12	34.382	0.927	0.0	0.0	0.0	1.00	158.7	65.2
5.016	25.23	16.96	34.278	1.017	0.0	0.0	0.0	1.00	158.8	69.5
5.017	24.73	17.55	34.157	1.078	0.0	0.0	0.0	1.00	158.6	72.2
5.018	24.08	18.39	34.070	1.145	0.0	0.0	0.0	1.00	158.7	74.7
5.019	23.46	19.22	33.948	1.239	0.0	0.0	0.0	1.00	158.7	78.8
5.020	23.14	19.69	33.826	1.290	0.0	0.0	0.0	1.00	158.7	80.8

Network Design Table for 02 HW & CarPark

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
4.010	18.173	0.036	504.8	0.553	0.00	0.0	0.600	o	900	Pipe/Conduit	
4.011	29.195	0.059	498.9	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit	
4.012	12.654	0.025	499.0	0.255	0.00	0.0	0.600	o	900	Pipe/Conduit	
4.013	8.780	0.018	499.0	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit	
4.014	60.345	0.080	754.3	1.127	0.00	0.0	0.600	o	900	Pipe/Conduit	
4.015	36.520	0.073	499.0	0.972	0.00	0.0	0.600	o	900	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)
4.010	22.99	19.91	33.294	2.435	0.0	0.0	0.0	1.39	882.8	151.6
4.011	22.75	20.26	33.258	2.435	0.0	0.0	0.0	1.40	888.1	151.6
4.012	22.65	20.41	33.199	2.690	0.0	0.0	0.0	1.40	888.0	165.0
4.013	22.58	20.51	33.174	2.690	0.0	0.0	0.0	1.40	888.0	165.0
4.014	22.02	21.40	33.157	3.817	0.0	0.0	0.0	1.13	720.8	227.7
4.015	21.76	21.84	33.077	4.789	0.0	0.0	0.0	1.40	888.0	282.2

Manhole Schedules for 02 HW & CarPark

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S11	38.005	3.200	Open Manhole	1350	4.000	34.805	450				
S12	37.900	3.252	Open Manhole	1350	4.001	34.648	450	4.000	34.648	450	
S13	37.900	3.348	Open Manhole	1350	4.002	34.552	450	4.001	34.552	450	
S14	38.005	3.564	Open Manhole	1350	4.003	34.441	450	4.002	34.441	450	
S15	38.005	3.675	Open Manhole	1350	4.004	34.330	450	4.003	34.330	450	
S16	38.005	3.798	Open Manhole	1350	4.005	34.207	450	4.004	34.207	450	
S17	37.700	3.551	Open Manhole	1350	4.006	34.149	450	4.005	34.149	450	
S18	38.090	4.054	Open Manhole	1350	4.007	34.036	450	4.006	34.036	450	
S19	38.000	4.070	Open Manhole	1350	4.008	33.930	450	4.007	33.930	450	
S20	38.150	4.807	Open Manhole	1800	4.009	33.343	900	4.008	33.788	450	
S21	38.005	2.077	Open Manhole	1350	5.000	35.928	450				
S22	38.005	2.164	Open Manhole	1350	5.001	35.841	450	5.000	35.841	450	
S23	38.435	2.685	Open Manhole	1350	5.002	35.750	450	5.001	35.750	450	
S24	38.430	2.802	Open Manhole	1350	5.003	35.628	450	5.002	35.628	450	
S25	38.430	2.924	Open Manhole	1350	5.004	35.506	450	5.003	35.506	450	
S26	38.500	3.117	Open Manhole	1350	5.005	35.383	450	5.004	35.383	450	
S27	38.000	2.738	Open Manhole	1350	5.006	35.262	450	5.005	35.262	450	
S28	37.700	2.561	Open Manhole	1350	5.007	35.139	450	5.006	35.139	450	
S29	37.500	2.482	Open Manhole	1350	5.008	35.018	450	5.007	35.018	450	
S30	37.300	2.348	Open Manhole	1350	5.009	34.952	450	5.008	34.952	450	
S31	37.300	2.380	Open Manhole	1350	5.010	34.920	450	5.009	34.920	450	
S32	37.300	2.486	Open Manhole	1350	5.011	34.814	450	5.010	34.814	450	
S33	37.200	2.496	Open Manhole	1350	5.012	34.704	450	5.011	34.704	450	
S34	37.200	2.605	Open Manhole	1350	5.013	34.595	450	5.012	34.595	450	
S35	37.200	2.715	Open Manhole	1350	5.014	34.485	450	5.013	34.485	450	
S36	37.600	3.218	Open Manhole	1350	5.015	34.382	450	5.014	34.382	450	
S37	38.150	3.872	Open Manhole	1350	5.016	34.278	450	5.015	34.278	450	
S38	38.150	3.993	Open Manhole	1350	5.017	34.157	450	5.016	34.157	450	
S39	38.150	4.080	Open Manhole	1350	5.018	34.070	450	5.017	34.070	450	
S40	37.925	3.977	Open Manhole	1350	5.019	33.948	450	5.018	33.948	450	
S41	38.150	4.324	Open Manhole	1350	5.020	33.826	450	5.019	33.826	450	
S42	38.300	5.006	Open Manhole	1800	4.010	33.294	900	4.009	33.294	900	
								5.020	33.757	450	13
S43	38.275	5.017	Open Manhole	1800	4.011	33.258	900	4.010	33.258	900	
S44	38.250	5.051	Open Manhole	1800	4.012	33.199	900	4.011	33.199	900	
S45	37.935	4.761	Open Manhole	1800	4.013	33.174	900	4.012	33.174	900	
S46	37.620	4.463	Open Manhole	1800	4.014	33.157	900	4.013	33.157	900	
S47	37.420	4.343	Open Manhole	1800	4.015	33.077	900	4.014	33.077	900	
S49	37.500	4.497	Open Manhole	1800		OUTFALL		4.015	33.003	900	

Manhole Schedules for 02 HW & CarPark

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S11	433133.993	558513.525	433133.993	558513.525	Required	
S12	433107.016	558572.002	433107.016	558572.002	Required	
S13	433090.870	558607.919	433090.870	558607.919	Required	
S14	433072.243	558649.450	433072.243	558649.450	Required	
S15	433052.274	558693.178	433052.274	558693.178	Required	
S16	433032.302	558736.912	433032.302	558736.912	Required	
S17	433041.403	558758.664	433041.403	558758.664	Required	
S18	433083.761	558777.856	433083.761	558777.856	Required	
S19	433123.388	558795.776	433123.388	558795.776	Required	
S20	433176.359	558819.731	433176.359	558819.731	Required	
S21	433140.187	558504.622	433140.187	558504.622	Required	
S22	433167.102	558516.656	433167.102	558516.656	Required	
S23	433201.434	558531.881	433201.434	558531.881	Required	
S24	433246.747	558552.329	433246.747	558552.329	Required	
S25	433292.356	558572.948	433292.356	558572.948	Required	
S26	433338.146	558593.658	433338.146	558593.658	Required	
S27	433383.543	558614.119	433383.543	558614.119	Required	

Manhole Schedules for 02 HW & CarPark

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S28	433429.657	558635.081	433429.657	558635.081	Required	
S29	433474.717	558655.425	433474.717	558655.425	Required	
S30	433500.246	558666.811	433500.246	558666.811	Required	
S31	433500.939	558677.896	433500.939	558677.896	Required	
S32	433483.054	558717.402	433483.054	558717.402	Required	
S33	433464.589	558758.480	433464.589	558758.480	Required	
S34	433446.035	558799.447	433446.035	558799.447	Required	
S35	433427.535	558840.423	433427.535	558840.423	Required	
S36	433410.438	558879.138	433410.438	558879.138	Required	
S37	433393.340	558917.854	433393.340	558917.854	Required	
S38	433347.678	558897.589	433347.678	558897.589	Required	
S39	433315.122	558882.976	433315.122	558882.976	Required	
S40	433269.593	558862.251	433269.593	558862.251	Required	
S41	433224.040	558841.659	433224.040	558841.659	Required	
S42	433198.657	558829.821	433198.657	558829.821	Required	
S43	433191.180	558846.385	433191.180	558846.385	Required	
S44	433217.790	558858.397	433217.790	558858.397	Required	

Manhole Schedules for 02 HW & CarPark

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S45	433212.583	558869.931	433212.583	558869.931	Required	
S46	433208.971	558877.933	433208.971	558877.933	Required	
S47	433263.740	558903.268	433263.740	558903.268	Required	
S49	433298.223	558891.241			No Entry	

Area Summary for 02 HW & CarPark

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
4.000	User	-	100	0.050	0.050	0.050
4.001	User	-	100	0.077	0.077	0.077
4.002	User	-	100	0.050	0.050	0.050
4.003	User	-	100	0.053	0.053	0.053
4.004	User	-	100	0.055	0.055	0.055
4.005	User	-	100	0.180	0.180	0.180
4.006	User	-	100	0.030	0.030	0.030
4.007	User	-	100	0.057	0.057	0.057
4.008	User	-	100	0.039	0.039	0.039
4.009	-	-	100	0.000	0.000	0.000
5.000	User	-	100	0.016	0.016	0.016
5.001	User	-	100	0.109	0.109	0.109
5.002	User	-	100	0.037	0.037	0.037
5.003	User	-	100	0.057	0.057	0.057
5.004	User	-	100	0.059	0.059	0.059
5.005	User	-	100	0.059	0.059	0.059
5.006	User	-	100	0.053	0.053	0.053
5.007	User	-	100	0.056	0.056	0.056
5.008	User	-	100	0.050	0.050	0.050
5.009	User	-	100	0.047	0.047	0.047
5.010	User	-	100	0.060	0.060	0.060
5.011	User	-	100	0.031	0.031	0.031
5.012	User	-	100	0.052	0.052	0.052
5.013	User	-	100	0.054	0.054	0.054
5.014	User	-	100	0.056	0.056	0.056
5.015	User	-	100	0.133	0.133	0.133
5.016	User	-	100	0.091	0.091	0.091
5.017	User	-	100	0.061	0.061	0.061
5.018	User	-	100	0.067	0.067	0.067
5.019	User	-	100	0.094	0.094	0.094
5.020	User	-	100	0.051	0.051	0.051
4.010	User	-	100	0.381	0.381	0.381
	User	-	100	0.172	0.172	0.553
4.011	-	-	100	0.000	0.000	0.000
4.012	User	-	100	0.255	0.255	0.255
4.013	-	-	100	0.000	0.000	0.000
4.014	User	-	100	1.127	1.127	1.127
4.015	User	-	100	0.828	0.828	0.828
	User	-	100	0.105	0.105	0.933
	User	-	100	0.039	0.039	0.972
				Total	Total	Total
				4.789	4.789	4.789

Free Flowing Outfall Details for 02 HW & CarPark

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
4.015	S49	37.500	33.003	0.000	1800	0

Simulation Criteria for 02 HW & CarPark

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
Hot Start (mins)	0	Inlet Coeffiecient	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 2	Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.300	Storm Duration (mins)	30
Ratio R	0.350		

Online Controls for 02 HW & CarPark

Pump Manhole: S47, DS/PN: 4.015, Volume (m³): 48.3

Invert Level (m) 33.077

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	15.3000	0.700	15.3000	1.300	15.3000	1.900	15.3000	2.500	15.3000
0.200	15.3000	0.800	15.3000	1.400	15.3000	2.000	15.3000	2.600	15.3000
0.300	15.3000	0.900	15.3000	1.500	15.3000	2.100	15.3000	2.700	15.3000
0.400	15.3000	1.000	15.3000	1.600	15.3000	2.200	15.3000	2.800	15.3000
0.500	15.3000	1.100	15.3000	1.700	15.3000	2.300	15.3000	2.900	15.3000
0.600	15.3000	1.200	15.3000	1.800	15.3000	2.400	15.3000	3.000	15.3000

Storage Structures for 02 HW & CarPark

Porous Car Park Manhole: S46, DS/PN: 4.014

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	62.0
Membrane Percolation (mm/hr)	1000	Length (m)	210.0
Max Percolation (l/s)	3616.7	Slope (1:X)	1000.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	34.270	Membrane Depth (mm)	0

Tank or Pond Manhole: S47, DS/PN: 4.015

Invert Level (m) 33.077

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	3500.0	2.400	0.0	4.800	0.0	7.200	0.0	9.600	0.0
0.400	3500.0	2.800	0.0	5.200	0.0	7.600	0.0	10.000	0.0
0.800	3500.0	3.200	0.0	5.600	0.0	8.000	0.0		
1.200	3500.0	3.600	0.0	6.000	0.0	8.400	0.0		
1.201	0.0	4.000	0.0	6.400	0.0	8.800	0.0		
2.000	0.0	4.400	0.0	6.800	0.0	9.200	0.0		

Volume Summary (Static)

Length Calculations based on Centre-Centre

Pipe Number	USMH Name	Total Volume (m^3)
4.000	S11	0.000
4.001	S12	0.000
4.002	S13	0.000
4.003	S14	0.000
4.004	S15	0.000
4.005	S16	0.000
4.006	S17	0.000
4.007	S18	0.000
4.008	S19	0.000
4.009	S20	0.000
5.000	S21	0.000
5.001	S22	0.000
5.002	S23	0.000
5.003	S24	0.000
5.004	S25	0.000
5.005	S26	0.000
5.006	S27	0.000
5.007	S28	0.000
5.008	S29	0.000
5.009	S30	0.000
5.010	S31	0.000
5.011	S32	0.000
5.012	S33	0.000
5.013	S34	0.000
5.014	S35	0.000
5.015	S36	0.000
5.016	S37	0.000
5.017	S38	0.000
5.018	S39	0.000
5.019	S40	0.000
5.020	S41	0.000
4.010	S42	0.000
4.011	S43	0.000
4.012	S44	0.000
4.013	S45	0.000
4.014	S46	0.000
4.015	S47	0.000
Total		0.000

Volume Summary (Static)

Length Calculations based on True Length

Pipe Number	USMH Name	Total Volume (m^3)
4.000	S11	0.000
4.001	S12	0.000
4.002	S13	0.000
4.003	S14	0.000
4.004	S15	0.000
4.005	S16	0.000
4.006	S17	0.000
4.007	S18	0.000
4.008	S19	0.000
4.009	S20	0.000
5.000	S21	0.000
5.001	S22	0.000
5.002	S23	0.000
5.003	S24	0.000
5.004	S25	0.000
5.005	S26	0.000
5.006	S27	0.000
5.007	S28	0.000
5.008	S29	0.000
5.009	S30	0.000
5.010	S31	0.000
5.011	S32	0.000
5.012	S33	0.000
5.013	S34	0.000
5.014	S35	0.000
5.015	S36	0.000
5.016	S37	0.000
5.017	S38	0.000
5.018	S39	0.000
5.019	S40	0.000
5.020	S41	0.000
4.010	S42	0.000
4.011	S43	0.000
4.012	S44	0.000
4.013	S45	0.000
4.014	S46	0.000
4.015	S47	0.000
Total		0.000

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 02 HW & CarPark

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	18.300
Region	England and Wales	Ratio R	0.350
Cv (Summer)	0.750		
Cv (Winter)	0.840		

Margin for Flood Risk Warning (mm) 10.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
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
Climate Change (%)	0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
4.000	S11	15 Winter	1	+0%					34.864	-0.391	0.000	0.04
4.001	S12	15 Winter	1	+0%					34.744	-0.354	0.000	0.09
4.002	S13	15 Winter	1	+0%					34.657	-0.345	0.000	0.12
4.003	S14	15 Winter	1	+0%					34.559	-0.332	0.000	0.15
4.004	S15	15 Winter	1	+0%					34.460	-0.320	0.000	0.17
4.005	S16	15 Winter	1	+0%					34.375	-0.282	0.000	0.28
4.006	S17	15 Winter	1	+0%					34.307	-0.292	0.000	0.27
4.007	S18	15 Winter	1	+0%					34.201	-0.285	0.000	0.29
4.008	S19	30 Winter	1	+0%					34.095	-0.285	0.000	0.29
4.009	S20	30 Winter	1	+0%					33.656	-0.587	0.000	0.07
5.000	S21	15 Winter	1	+0%					35.973	-0.405	0.000	0.01
5.001	S22	15 Winter	1	+0%					35.936	-0.355	0.000	0.09
5.002	S23	15 Winter	1	+0%					35.851	-0.349	0.000	0.11
5.003	S24	15 Winter	1	+0%					35.741	-0.337	0.000	0.14
5.004	S25	15 Winter	1	+0%					35.630	-0.326	0.000	0.17
5.005	S26	15 Winter	1	+0%					35.517	-0.316	0.000	0.19
5.006	S27	15 Winter	1	+0%					35.401	-0.311	0.000	0.20
5.007	S28	30 Winter	1	+0%					35.283	-0.306	0.000	0.22
5.008	S29	30 Winter	1	+0%					35.186	-0.282	0.000	0.25
5.009	S30	30 Winter	1	+0%					35.120	-0.282	0.000	0.30
5.010	S31	30 Winter	1	+0%					35.076	-0.294	0.000	0.26
5.011	S32	30 Winter	1	+0%					34.972	-0.292	0.000	0.27
5.012	S33	30 Winter	1	+0%					34.865	-0.289	0.000	0.28
5.013	S34	30 Winter	1	+0%					34.759	-0.286	0.000	0.29
5.014	S35	30 Winter	1	+0%					34.653	-0.282	0.000	0.30
5.015	S36	30 Winter	1	+0%					34.556	-0.275	0.000	0.32
5.016	S37	60 Winter	1	+0%					34.458	-0.271	0.000	0.33

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 02 HW & CarPark

PN	US/MH Name	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
4.000	S11			5.8	OK	
4.001	S12			13.1	OK	
4.002	S13			17.3	OK	
4.003	S14			21.1	OK	
4.004	S15			24.5	OK	
4.005	S16			36.6	OK	
4.006	S17			38.2	OK	
4.007	S18			40.9	OK	
4.008	S19			42.5	OK	
4.009	S20			42.6	OK	
5.000	S21			1.9	OK	
5.001	S22			12.7	OK	
5.002	S23			15.8	OK	
5.003	S24			20.3	OK	
5.004	S25			24.1	OK	
5.005	S26			27.2	OK	
5.006	S27			29.4	OK	
5.007	S28			31.3	OK	
5.008	S29			33.2	OK	
5.009	S30			34.9	OK	
5.010	S31			37.1	OK	
5.011	S32			38.1	OK	
5.012	S33			39.6	OK	
5.013	S34			41.0	OK	
5.014	S35			42.3	OK	
5.015	S36			45.5	OK	
5.016	S37			48.1	OK	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 02 HW & CarPark

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
5.017	S38	60 Winter	1	+0%					34.347	-0.260	0.000	0.36
5.018	S39	60 Winter	1	+0%					34.257	-0.263	0.000	0.36
5.019	S40	60 Winter	1	+0%					34.141	-0.257	0.000	0.38
5.020	S41	60 Winter	1	+0%					34.028	-0.247	0.000	0.42
4.010	S42	30 Winter	1	+0%					33.643	-0.551	0.000	0.25
4.011	S43	30 Winter	1	+0%					33.605	-0.553	0.000	0.19
4.012	S44	30 Winter	1	+0%					33.570	-0.529	0.000	0.33
4.013	S45	30 Winter	1	+0%					33.533	-0.541	0.000	0.34
4.014	S46	30 Winter	1	+0%					33.504	-0.552	0.000	0.32
4.015	S47	720 Winter	1	+0%					33.253	-0.724	0.000	0.02

PN	US/MH Name	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Level Status	Level Exceeded
5.017	S38			50.2	OK	
5.018	S39			52.3	OK	
5.019	S40			55.2	OK	
5.020	S41			56.7	OK	
4.010	S42			123.4	OK	
4.011	S43			122.9	OK	
4.012	S44			133.2	OK	
4.013	S45			133.3	OK	
4.014	S46		13	191.6	OK	
4.015	S47			15.3	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 02 HW & CarPark

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	18.300
Region	England and Wales	Ratio R	0.350
Cv (Summer)	0.750		
Cv (Winter)	0.840		

Margin for Flood Risk Warning (mm) 10.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
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)	30
Climate Change (%)	0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
4.000	S11	15 Winter	30	+0%					34.904	-0.351	0.000	0.10
4.001	S12	15 Winter	30	+0%					34.810	-0.288	0.000	0.24
4.002	S13	15 Winter	30	+0%					34.736	-0.266	0.000	0.31
4.003	S14	15 Winter	30	+0%					34.649	-0.242	0.000	0.39
4.004	S15	15 Winter	30	+0%					34.565	-0.215	0.000	0.42
4.005	S16	15 Winter	30	+0%					34.502	-0.155	0.000	0.72
4.006	S17	15 Winter	30	+0%					34.428	-0.172	0.000	0.69
4.007	S18	15 Winter	30	+0%					34.326	-0.159	0.000	0.73
4.008	S19	15 Winter	30	+0%					34.218	-0.161	0.000	0.72
4.009	S20	30 Winter	30	+0%					33.953	-0.290	0.000	0.17
5.000	S21	15 Winter	30	+0%					36.020	-0.358	0.000	0.03
5.001	S22	15 Winter	30	+0%					36.009	-0.282	0.000	0.26
5.002	S23	15 Winter	30	+0%					35.926	-0.274	0.000	0.31
5.003	S24	15 Winter	30	+0%					35.827	-0.251	0.000	0.38
5.004	S25	15 Winter	30	+0%					35.720	-0.236	0.000	0.45
5.005	S26	15 Winter	30	+0%					35.609	-0.224	0.000	0.49
5.006	S27	15 Winter	30	+0%					35.494	-0.218	0.000	0.52
5.007	S28	30 Winter	30	+0%					35.391	-0.198	0.000	0.54
5.008	S29	30 Winter	30	+0%					35.308	-0.160	0.000	0.62
5.009	S30	30 Winter	30	+0%					35.243	-0.160	0.000	0.74
5.010	S31	30 Winter	30	+0%					35.184	-0.186	0.000	0.64
5.011	S32	30 Winter	30	+0%					35.082	-0.183	0.000	0.66
5.012	S33	30 Winter	30	+0%					34.978	-0.176	0.000	0.68
5.013	S34	30 Winter	30	+0%					34.878	-0.167	0.000	0.71
5.014	S35	30 Winter	30	+0%					34.781	-0.154	0.000	0.73
5.015	S36	30 Winter	30	+0%					34.690	-0.142	0.000	0.79
5.016	S37	30 Winter	30	+0%					34.594	-0.135	0.000	0.82

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 02 HW & CarPark

PN	US/MH Name	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
4.000	S11			14.1	OK	
4.001	S12			34.1	OK	
4.002	S13			45.1	OK	
4.003	S14			54.0	OK	
4.004	S15			62.1	OK	
4.005	S16			94.5	OK	
4.006	S17			98.2	OK	
4.007	S18			104.5	OK	
4.008	S19			105.6	OK	
4.009	S20			107.7	OK	
5.000	S21			4.8	OK	
5.001	S22			36.9	OK	
5.002	S23			44.8	OK	
5.003	S24			55.3	OK	
5.004	S25			64.4	OK	
5.005	S26			71.0	OK	
5.006	S27			75.1	OK	
5.007	S28			78.0	OK	
5.008	S29			82.2	OK	
5.009	S30			86.3	OK	
5.010	S31			91.5	OK	
5.011	S32			93.9	OK	
5.012	S33			97.6	OK	
5.013	S34			100.8	OK	
5.014	S35			104.2	OK	
5.015	S36			112.3	OK	
5.016	S37			118.9	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 02 HW & CarPark

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
5.017	S38	30 Winter	30	+0%					34.493	-0.114	0.000	0.89
5.018	S39	30 Winter	30	+0%					34.401	-0.118	0.000	0.89
5.019	S40	60 Winter	30	+0%					34.302	-0.096	0.000	0.92
5.020	S41	60 Winter	30	+0%					34.199	-0.076	0.000	1.00
4.010	S42	30 Winter	30	+0%					33.929	-0.265	0.000	0.66
4.011	S43	30 Winter	30	+0%					33.894	-0.264	0.000	0.49
4.012	S44	30 Winter	30	+0%					33.862	-0.238	0.000	0.88
4.013	S45	30 Winter	30	+0%					33.833	-0.242	0.000	0.89
4.014	S46	30 Winter	30	+0%					33.815	-0.242	0.000	0.88
4.015	S47	720 Winter	30	+0%					33.553	-0.423	0.000	0.02

PN	US/MH Name	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
5.017	S38			123.5	OK	
5.018	S39			128.3	OK	
5.019	S40			132.7	OK	
5.020	S41			135.2	OK	
4.010	S42			319.0	OK	
4.011	S43			321.9	OK	
4.012	S44			350.4	OK	
4.013	S45			354.8	OK	
4.014	S46		14	530.4	OK	
4.015	S47			15.3	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 02 HW & CarPark

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.300 Cv (Summer) 0.750
Region England and Wales Ratio R 0.350 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 10.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
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) 100
Climate Change (%) 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
4.000	S11	30 Winter	100	+40%					35.030	-0.225	0.000
4.001	S12	30 Winter	100	+40%					35.022	-0.076	0.000
4.002	S13	30 Winter	100	+40%					34.969	-0.033	0.000
4.003	S14	15 Winter	100	+40%	100/15 Winter				34.895	0.004	0.000
4.004	S15	15 Winter	100	+40%	100/15 Winter				34.853	0.073	0.000
4.005	S16	15 Winter	100	+40%	100/15 Summer				34.808	0.151	0.000
4.006	S17	15 Winter	100	+40%	100/15 Summer				34.751	0.152	0.000
4.007	S18	30 Winter	100	+40%	100/15 Summer				34.635	0.150	0.000
4.008	S19	30 Winter	100	+40%	100/15 Summer				34.510	0.130	0.000
4.009	S20	30 Winter	100	+40%	100/15 Summer				34.330	0.087	0.000
5.000	S21	30 Winter	100	+40%					36.296	-0.082	0.000
5.001	S22	30 Winter	100	+40%	100/30 Winter				36.294	0.003	0.000
5.002	S23	30 Winter	100	+40%	100/30 Winter				36.284	0.084	0.000
5.003	S24	30 Winter	100	+40%	100/15 Winter				36.235	0.157	0.000
5.004	S25	15 Winter	100	+40%	100/15 Winter				36.416	0.460	0.000
5.005	S26	30 Summer	100	+40%	100/15 Winter				36.194	0.361	0.000
5.006	S27	30 Winter	100	+40%	100/15 Winter				36.131	0.419	0.000
5.007	S28	30 Winter	100	+40%	100/15 Winter				36.095	0.506	0.000
5.008	S29	30 Winter	100	+40%	100/15 Summer				36.053	0.584	0.000
5.009	S30	30 Winter	100	+40%	100/15 Winter				36.055	0.653	0.000
5.010	S31	30 Winter	100	+40%	100/15 Winter				35.987	0.617	0.000
5.011	S32	30 Winter	100	+40%	100/15 Winter				35.923	0.659	0.000
5.012	S33	30 Winter	100	+40%	100/15 Summer				35.850	0.695	0.000
5.013	S34	30 Winter	100	+40%	100/15 Summer				35.764	0.720	0.000
5.014	S35	30 Winter	100	+40%	100/15 Summer				35.666	0.731	0.000
5.015	S36	30 Winter	100	+40%	100/15 Summer				35.564	0.732	0.000
5.016	S37	30 Winter	100	+40%	100/15 Summer				35.421	0.692	0.000

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 02 HW & CarPark

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
4.000	S11	0.14			21.0	OK	
4.001	S12	0.35			49.2	OK	
4.002	S13	0.44			62.5	OK	
4.003	S14	0.51			70.8	SURCHARGED	
4.004	S15	0.56			82.6	SURCHARGED	
4.005	S16	1.11			146.8	SURCHARGED	
4.006	S17	1.03			148.1	SURCHARGED	
4.007	S18	1.08			153.1	SURCHARGED	
4.008	S19	1.10			161.3	SURCHARGED	
4.009	S20	0.27			167.6	SURCHARGED	
5.000	S21	0.05			7.0	OK	
5.001	S22	0.38			53.5	SURCHARGED	
5.002	S23	0.45			64.5	SURCHARGED	
5.003	S24	0.54			78.0	SURCHARGED	
5.004	S25	0.67			96.2	SURCHARGED	
5.005	S26	0.64			91.5	SURCHARGED	
5.006	S27	0.68			98.1	SURCHARGED	
5.007	S28	0.74			106.5	SURCHARGED	
5.008	S29	0.85			112.4	SURCHARGED	
5.009	S30	0.98			113.5	SURCHARGED	
5.010	S31	0.86			121.9	SURCHARGED	
5.011	S32	0.83			118.9	SURCHARGED	
5.012	S33	0.90			128.1	SURCHARGED	
5.013	S34	0.96			136.8	SURCHARGED	
5.014	S35	1.03			145.8	SURCHARGED	
5.015	S36	1.17			166.3	SURCHARGED	
5.016	S37	1.26			182.1	SURCHARGED	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 02 HW & CarPark

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
5.017	S38	30 Winter	100	+40%	100/15 Summer				35.223	0.616	0.000
5.018	S39	30 Winter	100	+40%	100/15 Summer				35.057	0.537	0.000
5.019	S40	30 Winter	100	+40%	100/15 Summer				34.809	0.411	0.000
5.020	S41	30 Winter	100	+40%	100/15 Summer				34.513	0.237	0.000
4.010	S42	30 Winter	100	+40%	100/15 Summer				34.318	0.124	0.000
4.011	S43	30 Winter	100	+40%	100/15 Summer				34.276	0.118	0.000
4.012	S44	30 Winter	100	+40%	100/15 Summer				34.230	0.131	0.000
4.013	S45	30 Winter	100	+40%	100/15 Summer				34.191	0.117	0.000
4.014	S46	30 Winter	100	+40%	100/15 Summer				34.157	0.101	0.000
4.015	S47	1440 Winter	100	+40%	100/600 Winter				34.067	0.091	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
5.017	S38	1.39			193.4	SURCHARGED	
5.018	S39	1.43			205.5	SURCHARGED	
5.019	S40	1.54			222.5	SURCHARGED	
5.020	S41	1.72			232.0	SURCHARGED	
4.010	S42	1.16			561.4	SURCHARGED	
4.011	S43	0.86			561.4	SURCHARGED	
4.012	S44	1.56			622.4	SURCHARGED	
4.013	S45	1.57			623.8	SURCHARGED	
4.014	S46	1.62		16	980.0	SURCHARGED	
4.015	S47	0.02			15.3	SURCHARGED	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for 03 Building

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	1	PIMP (%)	100
M5-60 (mm)	18.300	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	100	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for 03 Building

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.953	4-8	4.066	8-12	3.590	12-16	0.377

Total Area Contributing (ha) = 8.986

Total Pipe Volume (m^3) = 1141.630

Network Design Table for 03 Building

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
S6.000	52.798	0.106	498.1	0.185	5.00	0.0	0.600	o	900	Pipe/Conduit	
S6.001	59.874	0.120	500.1	0.567	0.00	0.0	0.600	o	900	Pipe/Conduit	
S6.002	45.966	0.092	498.1	0.479	0.00	0.0	0.600	o	900	Pipe/Conduit	
S6.003	43.916	0.088	499.5	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit	
S6.004	35.898	0.072	499.0	0.296	0.00	0.0	0.600	o	900	Pipe/Conduit	
S6.005	23.044	0.046	499.0	0.251	0.00	0.0	0.600	o	900	Pipe/Conduit	
S6.006	41.465	0.083	499.0	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit	
S6.007	45.614	0.087	521.8	0.096	0.00	0.0	0.600	o	900	Pipe/Conduit	
S6.008	54.934	0.110	499.0	0.000	0.00	0.0	0.600	o	900	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)
S6.000	44.58	5.63	36.063	0.185	0.0	0.0	0.0	1.40	888.8	22.4
S6.001	42.26	6.35	35.957	0.752	0.0	0.0	0.0	1.39	887.0	86.1
S6.002	40.66	6.89	35.837	1.231	0.0	0.0	0.0	1.40	888.8	135.5
S6.003	39.26	7.42	35.745	1.231	0.0	0.0	0.0	1.40	887.5	135.5
S6.004	38.19	7.85	35.657	1.527	0.0	0.0	0.0	1.40	888.0	157.9
S6.005	37.54	8.12	35.585	1.778	0.0	0.0	0.0	1.40	888.0	180.8
S6.006	36.44	8.62	35.539	1.778	0.0	0.0	0.0	1.40	888.0	180.8
S6.007	35.28	9.17	35.456	1.874	0.0	0.0	0.0	1.36	868.2	180.8
S6.008	34.03	9.83	35.368	1.874	0.0	0.0	0.0	1.40	888.0	180.8

Network Design Table for 03 Building

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
S6.009	41.593	0.083	499.0	0.759	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S6.010	59.179	0.119	499.0	0.942	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S6.011	62.133	0.128	483.8	0.417	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S7.000	45.013	0.090	499.0	0.168	5.00	0.0	0.600	o	900	Pipe/Conduit	
S7.001	45.000	0.090	499.0	0.404	0.00	0.0	0.600	o	900	Pipe/Conduit	
S7.002	45.000	0.090	499.0	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit	
S7.003	48.599	0.097	499.0	0.481	0.00	0.0	0.600	o	900	Pipe/Conduit	
S7.004	48.599	0.097	499.0	0.520	0.00	0.0	0.600	o	900	Pipe/Conduit	
S7.005	45.058	0.090	499.0	0.751	0.00	0.0	0.600	o	900	Pipe/Conduit	
S7.006	44.943	0.090	499.0	0.189	0.00	0.0	0.600	o	900	Pipe/Conduit	
S7.007	21.304	0.043	499.0	0.220	0.00	0.0	0.600	o	900	Pipe/Conduit	
S7.008	18.541	0.037	499.0	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit	
S7.009	26.445	0.053	499.0	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit	
S7.010	45.000	0.090	500.0	0.177	0.00	0.0	0.600	o	900	Pipe/Conduit	
S7.011	45.000	0.090	499.0	0.440	0.00	0.0	0.600	o	900	Pipe/Conduit	
S7.012	39.749	0.080	499.0	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit	
S7.013	50.286	0.101	499.3	0.211	0.00	0.0	0.600	o	900	Pipe/Conduit	
S7.014	51.655	0.107	483.2	0.615	0.00	0.0	0.600	o	900	Pipe/Conduit	
S7.015	76.381	0.153	499.2	0.000	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S6.012	39.112	0.078	499.0	0.817	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S6.013	62.002	0.124	499.0	0.000	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S6.014	47.187	0.095	499.0	0.000	0.00	0.0	0.600	o	1200	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)
S6.009	33.28	10.25	34.958	2.633	0.0	0.0	0.0	1.67	1886.4	237.3
S6.010	32.29	10.84	34.875	3.575	0.0	0.0	0.0	1.67	1886.4	312.6
S6.011	31.33	11.45	34.756	3.992	0.0	0.0	0.0	1.69	1915.9	338.7
S7.000	44.91	5.54	36.327	0.168	0.0	0.0	0.0	1.40	888.0	20.5
S7.001	43.10	6.07	36.237	0.572	0.0	0.0	0.0	1.40	888.0	66.8
S7.002	41.46	6.61	36.147	0.572	0.0	0.0	0.0	1.40	888.0	66.8
S7.003	39.85	7.19	36.056	1.053	0.0	0.0	0.0	1.40	888.0	113.6
S7.004	38.37	7.77	35.959	1.573	0.0	0.0	0.0	1.40	888.0	163.4
S7.005	37.11	8.31	35.862	2.324	0.0	0.0	0.0	1.40	888.0	233.6
S7.006	35.95	8.85	35.771	2.513	0.0	0.0	0.0	1.40	888.0	244.7
S7.007	35.43	9.10	35.681	2.733	0.0	0.0	0.0	1.40	888.0	262.3
S7.008	34.99	9.32	35.639	2.733	0.0	0.0	0.0	1.40	888.0	262.3
S7.009	34.38	9.64	35.601	2.733	0.0	0.0	0.0	1.40	888.0	262.3
S7.010	33.40	10.18	35.548	2.911	0.0	0.0	0.0	1.39	887.1	263.3
S7.011	32.49	10.71	35.458	3.350	0.0	0.0	0.0	1.40	888.0	294.8
S7.012	31.73	11.19	35.368	3.350	0.0	0.0	0.0	1.40	888.0	294.8
S7.013	30.83	11.79	35.289	3.561	0.0	0.0	0.0	1.40	887.7	297.3
S7.014	30.00	12.40	35.188	4.177	0.0	0.0	0.0	1.42	902.4	339.4
S7.015	29.05	13.16	34.781	4.177	0.0	0.0	0.0	1.67	1886.0	339.4
S6.012	28.60	13.55	34.628	8.986	0.0	0.0	0.0	1.67	1886.4	695.9
S6.013	27.90	14.17	34.550	8.986	0.0	0.0	0.0	1.67	1886.4	695.9
S6.014	27.40	14.64	34.425	8.986	0.0	0.0	0.0	1.67	1886.4	695.9

Network Design Table for 03 Building

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
S6.015	46.004	0.086	532.1	0.000	0.00	0.0	0.600	o	1200	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)
S6.015	26.92	15.12	34.331	8.986	0.0	0.0	0.0	1.61	1826.3	695.9

Manhole Schedules for 03 Building

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)
S48	38.163	2.100	Open Manhole	1800	S6.000	36.063	900				
S49	38.163	2.206	Open Manhole	1800	S6.001	35.957	900	S6.000	35.957	900	
S50	38.163	2.326	Open Manhole	1800	S6.002	35.837	900	S6.001	35.837	900	
S51	38.163	2.418	Open Manhole	1800	S6.003	35.745	900	S6.002	35.745	900	
S52	38.300	2.643	Open Manhole	1800	S6.004	35.657	900	S6.003	35.657	900	
S53	37.900	2.315	Open Manhole	1800	S6.005	35.585	900	S6.004	35.585	900	
S54	37.900	2.361	Open Manhole	1800	S6.006	35.539	900	S6.005	35.539	900	
S55	38.290	2.834	Open Manhole	1800	S6.007	35.456	900	S6.006	35.456	900	
S56	38.150	2.782	Open Manhole	1800	S6.008	35.368	900	S6.007	35.368	900	
S57	38.300	3.342	Open Manhole	2100	S6.009	34.958	1200	S6.008	35.258	900	
S58	38.250	3.375	Open Manhole	2100	S6.010	34.875	1200	S6.009	34.875	1200	
S59	38.150	3.394	Open Manhole	2100	S6.011	34.756	1200	S6.010	34.756	1200	
S60	38.550	2.223	Open Manhole	1800	S7.000	36.327	900				
S61	38.558	2.321	Open Manhole	1800	S7.001	36.237	900	S7.000	36.237	900	
S62	38.562	2.415	Open Manhole	1800	S7.002	36.147	900	S7.001	36.147	900	
S63	38.566	2.510	Open Manhole	1800	S7.003	36.056	900	S7.002	36.056	900	
S64	38.575	2.616	Open Manhole	1800	S7.004	35.959	900	S7.003	35.959	900	
S65	38.112	2.250	Open Manhole	1800	S7.005	35.862	900	S7.004	35.862	900	
S66	37.895	2.124	Open Manhole	1800	S7.006	35.771	900	S7.005	35.771	900	
S67	37.672	1.991	Open Manhole	1800	S7.007	35.681	900	S7.006	35.681	900	
S68	37.483	1.844	Open Manhole	1800	S7.008	35.639	900	S7.007	35.639	900	
S69	37.481	1.880	Open Manhole	1800	S7.009	35.601	900	S7.008	35.601	900	
S70	37.400	1.852	Open Manhole	1800	S7.010	35.548	900	S7.009	35.548	900	
S71	37.372	1.914	Open Manhole	1800	S7.011	35.458	900	S7.010	35.458	900	
S72	37.358	1.990	Open Manhole	1800	S7.012	35.368	900	S7.011	35.368	900	
S73	37.344	2.055	Open Manhole	1800	S7.013	35.289	900	S7.012	35.289	900	
S74	37.800	2.612	Open Manhole	1800	S7.014	35.188	900	S7.013	35.188	900	
S75	38.050	3.269	Open Manhole	2100	S7.015	34.781	1200	S7.014	35.081	900	
S76	38.150	3.522	Open Manhole	2100	S6.012	34.628	1200	S6.011	34.628	1200	
								S7.015	34.628	1200	
S77	37.825	3.275	Open Manhole	2100	S6.013	34.550	1200	S6.012	34.550	1200	
S78	37.623	3.198	Open Manhole	2100	S6.014	34.425	1200	S6.013	34.425	1200	
S79	37.420	3.089	Open Manhole	2100	S6.015	34.331	1200	S6.014	34.331	1200	
S80	37.500	3.256	Open Manhole	2100		OUTFALL		S6.015	34.244	1200	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S48	433133.288	558519.379	433133.288	558519.379	Required	

Manhole Schedules for 03 Building

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S49	433111.226	558567.347	433111.226	558567.347	Required	
S50	433086.306	558621.789	433086.306	558621.789	Required	
S51	433067.436	558663.703	433067.436	558663.703	Required	
S52	433049.503	558703.790	433049.503	558703.790	Required	
S53	433034.364	558736.340	433034.364	558736.340	Required	
S54	433043.178	558757.632	433043.178	558757.632	Required	
S55	433080.913	558774.816	433080.913	558774.816	Required	
S56	433122.585	558793.367	433122.585	558793.367	Required	
S57	433172.672	558815.927	433172.672	558815.927	Required	
S58	433210.358	558833.527	433210.358	558833.527	Required	
S59	433264.278	558857.914	433264.278	558857.914	Required	
S60	433171.865	558523.831	433171.865	558523.831	Required	
S61	433212.983	558542.148	433212.983	558542.148	Required	
S62	433253.985	558560.690	433253.985	558560.690	Required	
S63	433294.987	558579.232	433294.987	558579.232	Required	
S64	433339.269	558599.257	433339.269	558599.257	Required	
S65	433383.551	558619.282	433383.551	558619.282	Required	

Manhole Schedules for 03 Building

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S66	433424.524	558638.028	433424.524	558638.028	Required	
S67	433465.556	558656.366	433465.556	558656.366	Required	
S68	433485.040	558664.981	433485.040	558664.981	Required	
S69	433496.440	558679.603	433496.440	558679.603	Required	
S70	433485.954	558703.880	433485.954	558703.880	Required	
S71	433467.412	558744.882	433467.412	558744.882	Required	
S72	433448.870	558785.885	433448.870	558785.885	Required	
S73	433432.121	558821.933	433432.121	558821.933	Required	
S74	433411.778	558867.921	433411.778	558867.921	Required	
S75	433390.488	558914.985	433390.488	558914.985	Required	
S76	433320.876	558883.551	433320.876	558883.551	Required	
S77	433304.428	558919.036	433304.428	558919.036	Required	
S78	433278.853	558975.518	433278.853	558975.518	Required	
S79	433321.961	558994.711	433321.961	558994.711	Required	
S80	433303.412	559036.809			No Entry	

Area Summary for 03 Building

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
6.000	User	-	100	0.185	0.185	0.185
6.001	User	-	100	0.567	0.567	0.567
6.002	User	-	100	0.479	0.479	0.479
6.003	-	-	100	0.000	0.000	0.000
6.004	User	-	100	0.296	0.296	0.296
6.005	User	-	100	0.251	0.251	0.251
6.006	-	-	100	0.000	0.000	0.000
6.007	User	-	100	0.096	0.096	0.096
6.008	-	-	100	0.000	0.000	0.000
6.009	User	-	100	0.759	0.759	0.759
6.010	User	-	100	0.543	0.543	0.543
	User	-	100	0.399	0.399	0.942
6.011	User	-	100	0.417	0.417	0.417
7.000	User	-	100	0.168	0.168	0.168
7.001	User	-	100	0.404	0.404	0.404
7.002	-	-	100	0.000	0.000	0.000
7.003	User	-	100	0.481	0.481	0.481
7.004	User	-	100	0.520	0.520	0.520
7.005	User	-	100	0.395	0.395	0.395
	User	-	100	0.356	0.356	0.751
7.006	User	-	100	0.189	0.189	0.189
7.007	User	-	100	0.220	0.220	0.220
7.008	-	-	100	0.000	0.000	0.000
7.009	-	-	100	0.000	0.000	0.000
7.010	User	-	100	0.177	0.177	0.177
7.011	User	-	100	0.229	0.229	0.229
	User	-	100	0.211	0.211	0.440
7.012	-	-	100	0.000	0.000	0.000
7.013	User	-	100	0.211	0.211	0.211
7.014	User	-	100	0.615	0.615	0.615
7.015	-	-	100	0.000	0.000	0.000
6.012	User	-	100	0.368	0.368	0.368
	User	-	100	0.450	0.450	0.817
6.013	-	-	100	0.000	0.000	0.000
6.014	-	-	100	0.000	0.000	0.000
6.015	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				8.986	8.986	8.986

Free Flowing Outfall Details for 03 Building

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S6.015	S80	37.500	34.244	0.000	2100	0

Simulation Criteria for 03 Building

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
Hot Start (mins)	0	Inlet Coeffiecient	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	FSR	Profile Type	Summer
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.300	Storm Duration (mins)	30
Ratio R	0.350		

Online Controls for 03 Building

Pump Manhole: S79, DS/PN: S6.015, Volume (m³): 61.7

Invert Level (m) 34.331

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	29.7000	0.680	60.3000	1.300	72.0000	1.900	72.0000	2.500	72.0000
0.200	29.7000	0.720	72.0000	1.400	72.0000	2.000	72.0000	2.600	72.0000
0.290	60.3000	0.800	72.0000	1.500	72.0000	2.100	72.0000	2.700	72.0000
0.400	60.3000	1.000	72.0000	1.600	72.0000	2.200	72.0000	2.800	72.0000
0.410	60.3000	1.100	72.0000	1.700	72.0000	2.300	72.0000	2.900	72.0000
0.600	60.3000	1.200	72.0000	1.800	72.0000	2.400	72.0000	3.000	72.0000

Storage Structures for 03 Building

Tank or Pond Manhole: S79, DS/PN: S6.015

Invert Level (m) 34.331

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	3500.0	2.400	0.0	4.800	0.0	7.200	0.0	9.600	0.0
0.400	3500.0	2.800	0.0	5.200	0.0	7.600	0.0	10.000	0.0
0.800	3500.0	3.200	0.0	5.600	0.0	8.000	0.0		
1.200	3500.0	3.600	0.0	6.000	0.0	8.400	0.0		
1.600	3500.0	4.000	0.0	6.400	0.0	8.800	0.0		
1.601	0.0	4.400	0.0	6.800	0.0	9.200	0.0		

Volume Summary (Static)

Length Calculations based on Centre-Centre

Pipe Number	USMH Name	Total Volume (m³)
S6.000	S48	0.000
S6.001	S49	0.000
S6.002	S50	0.000
S6.003	S51	0.000
S6.004	S52	0.000
S6.005	S53	0.000
S6.006	S54	0.000
S6.007	S55	0.000
S6.008	S56	0.000
S6.009	S57	0.000
S6.010	S58	0.000
S6.011	S59	0.000
S7.000	S60	0.000
S7.001	S61	0.000
S7.002	S62	0.000
S7.003	S63	0.000
S7.004	S64	0.000
S7.005	S65	0.000
S7.006	S66	0.000
S7.007	S67	0.000
S7.008	S68	0.000
S7.009	S69	0.000
S7.010	S70	0.000
S7.011	S71	0.000
S7.012	S72	0.000
S7.013	S73	0.000
S7.014	S74	0.000
S7.015	S75	0.000
S6.012	S76	0.000
S6.013	S77	0.000
S6.014	S78	0.000
S6.015	S79	0.000
Total		0.000

Volume Summary (Static)

Length Calculations based on True Length

Pipe Number	USMH Name	Total Volume (m^3)
S6.000	S48	0.000
S6.001	S49	0.000
S6.002	S50	0.000
S6.003	S51	0.000
S6.004	S52	0.000
S6.005	S53	0.000
S6.006	S54	0.000
S6.007	S55	0.000
S6.008	S56	0.000
S6.009	S57	0.000
S6.010	S58	0.000
S6.011	S59	0.000
S7.000	S60	0.000
S7.001	S61	0.000
S7.002	S62	0.000
S7.003	S63	0.000
S7.004	S64	0.000
S7.005	S65	0.000
S7.006	S66	0.000
S7.007	S67	0.000
S7.008	S68	0.000
S7.009	S69	0.000
S7.010	S70	0.000
S7.011	S71	0.000
S7.012	S72	0.000
S7.013	S73	0.000
S7.014	S74	0.000
S7.015	S75	0.000
S6.012	S76	0.000
S6.013	S77	0.000
S6.014	S78	0.000
S6.015	S79	0.000
Total		0.000

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 03 Building

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of 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	FSR	M5-60 (mm)	18.300
Region	England and Wales	Ratio R	0.350
Cv (Summer)	0.750		
Cv (Winter)	0.840		

Margin for Flood Risk Warning (mm) 10.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
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
Climate Change (%)	0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
S6.000	S48	15 Winter	1	+0%					36.215	-0.748	0.000	0.03
S6.001	S49	15 Winter	1	+0%					36.187	-0.670	0.000	0.09
S6.002	S50	15 Winter	1	+0%					36.107	-0.630	0.000	0.15
S6.003	S51	15 Winter	1	+0%					36.023	-0.622	0.000	0.14
S6.004	S52	15 Winter	1	+0%					35.952	-0.605	0.000	0.17
S6.005	S53	15 Winter	1	+0%					35.888	-0.597	0.000	0.22
S6.006	S54	15 Winter	1	+0%					35.827	-0.612	0.000	0.18
S6.007	S55	30 Winter	1	+0%					35.737	-0.619	0.000	0.19
S6.008	S56	30 Winter	1	+0%					35.621	-0.647	0.000	0.18
S6.009	S57	30 Winter	1	+0%					35.317	-0.842	0.000	0.12
S6.010	S58	30 Winter	1	+0%					35.264	-0.811	0.000	0.15
S6.011	S59	30 Winter	1	+0%					35.189	-0.767	0.000	0.15
S7.000	S60	15 Winter	1	+0%					36.470	-0.757	0.000	0.03
S7.001	S61	15 Winter	1	+0%					36.440	-0.697	0.000	0.08
S7.002	S62	15 Winter	1	+0%					36.374	-0.672	0.000	0.07
S7.003	S63	15 Winter	1	+0%					36.338	-0.618	0.000	0.12
S7.004	S64	15 Winter	1	+0%					36.289	-0.570	0.000	0.18
S7.005	S65	15 Winter	1	+0%					36.230	-0.532	0.000	0.26
S7.006	S66	15 Winter	1	+0%					36.152	-0.519	0.000	0.26
S7.007	S67	15 Winter	1	+0%					36.080	-0.501	0.000	0.35
S7.008	S68	30 Winter	1	+0%					36.031	-0.508	0.000	0.38
S7.009	S69	30 Winter	1	+0%					35.975	-0.526	0.000	0.29
S7.010	S70	30 Winter	1	+0%					35.919	-0.530	0.000	0.27
S7.011	S71	30 Winter	1	+0%					35.832	-0.526	0.000	0.29
S7.012	S72	30 Winter	1	+0%					35.738	-0.531	0.000	0.29
S7.013	S73	30 Winter	1	+0%					35.648	-0.541	0.000	0.29
S7.014	S74	30 Winter	1	+0%					35.526	-0.562	0.000	0.30
S7.015	S75	30 Winter	1	+0%					35.198	-0.783	0.000	0.14

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 03 Building

PN	US/MH Name	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S6.000	S48			21.6	OK	
S6.001	S49			70.6	OK	
S6.002	S50			106.0	OK	
S6.003	S51			102.7	OK	
S6.004	S52			118.9	OK	
S6.005	S53			131.1	OK	
S6.006	S54			129.3	OK	
S6.007	S55			130.0	OK	
S6.008	S56			129.6	OK	
S6.009	S57			163.4	OK	
S6.010	S58			221.3	OK	
S6.011	S59			234.7	OK	
S7.000	S60			19.7	OK	
S7.001	S61			57.0	OK	
S7.002	S62			52.6	OK	
S7.003	S63			87.8	OK	
S7.004	S64			127.8	OK	
S7.005	S65			182.9	OK	
S7.006	S66			187.7	OK	
S7.007	S67			194.4	OK	
S7.008	S68			188.2	OK	
S7.009	S69			187.2	OK	
S7.010	S70			192.1	OK	
S7.011	S71			205.5	OK	
S7.012	S72			203.7	OK	
S7.013	S73			208.1	OK	
S7.014	S74			223.4	OK	
S7.015	S75			223.0	OK	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 03 Building

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S6.012	S76	30 Winter	1	+0%					35.139	-0.689	0.000
S6.013	S77	30 Winter	1	+0%					35.038	-0.711	0.000
S6.014	S78	30 Winter	1	+0%					34.889	-0.736	0.000
S6.015	S79	360 Winter	1	+0%					34.618	-0.913	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S6.012	S76	0.34			457.3	OK	
S6.013	S77	0.30			454.9	OK	
S6.014	S78	0.32			454.0	OK	
S6.015	S79	0.04			59.4	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 03 Building

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of 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	FSR	M5-60 (mm)	18.300
Region	England and Wales	Ratio R	0.350
Cv (Summer)	0.750		
Cv (Winter)	0.840		

Margin for Flood Risk Warning (mm) 10.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
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)	30
Climate Change (%)	0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
S6.000	S48	15 Winter	30	+0%					36.393	-0.570	0.000	0.07
S6.001	S49	15 Winter	30	+0%					36.361	-0.496	0.000	0.24
S6.002	S50	15 Winter	30	+0%					36.296	-0.441	0.000	0.38
S6.003	S51	15 Winter	30	+0%					36.216	-0.429	0.000	0.37
S6.004	S52	15 Winter	30	+0%					36.147	-0.410	0.000	0.44
S6.005	S53	15 Winter	30	+0%					36.077	-0.408	0.000	0.56
S6.006	S54	15 Winter	30	+0%					36.009	-0.430	0.000	0.46
S6.007	S55	30 Winter	30	+0%					35.911	-0.445	0.000	0.46
S6.008	S56	30 Winter	30	+0%					35.789	-0.479	0.000	0.43
S6.009	S57	30 Winter	30	+0%					35.628	-0.531	0.000	0.30
S6.010	S58	30 Winter	30	+0%					35.599	-0.476	0.000	0.36
S6.011	S59	30 Winter	30	+0%					35.551	-0.405	0.000	0.37
S7.000	S60	15 Winter	30	+0%					36.679	-0.548	0.000	0.07
S7.001	S61	15 Winter	30	+0%					36.660	-0.476	0.000	0.21
S7.002	S62	15 Winter	30	+0%					36.631	-0.416	0.000	0.17
S7.003	S63	15 Winter	30	+0%					36.596	-0.361	0.000	0.30
S7.004	S64	15 Winter	30	+0%					36.556	-0.303	0.000	0.43
S7.005	S65	15 Winter	30	+0%					36.508	-0.254	0.000	0.62
S7.006	S66	15 Winter	30	+0%					36.437	-0.234	0.000	0.63
S7.007	S67	15 Winter	30	+0%					36.370	-0.211	0.000	0.83
S7.008	S68	15 Winter	30	+0%					36.316	-0.223	0.000	0.92
S7.009	S69	30 Winter	30	+0%					36.241	-0.261	0.000	0.71
S7.010	S70	30 Winter	30	+0%					36.180	-0.268	0.000	0.65
S7.011	S71	30 Winter	30	+0%					36.092	-0.266	0.000	0.69
S7.012	S72	30 Winter	30	+0%					35.991	-0.277	0.000	0.70
S7.013	S73	30 Winter	30	+0%					35.896	-0.293	0.000	0.69
S7.014	S74	30 Winter	30	+0%					35.769	-0.319	0.000	0.74
S7.015	S75	30 Winter	30	+0%					35.550	-0.431	0.000	0.35

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 03 Building

PN	US/MH Name	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S6.000	S48			52.1	OK	
S6.001	S49			176.4	OK	
S6.002	S50			273.8	OK	
S6.003	S51			262.8	OK	
S6.004	S52			301.1	OK	
S6.005	S53			332.1	OK	
S6.006	S54			324.5	OK	
S6.007	S55			321.0	OK	
S6.008	S56			316.1	OK	
S6.009	S57			409.4	OK	
S6.010	S58			542.8	OK	
S6.011	S59			565.7	OK	
S7.000	S60			47.3	OK	
S7.001	S61			149.1	OK	
S7.002	S62			122.3	OK	
S7.003	S63			214.6	OK	
S7.004	S64			307.0	OK	
S7.005	S65			444.4	OK	
S7.006	S66			447.6	OK	
S7.007	S67			458.6	OK	
S7.008	S68			457.5	OK	
S7.009	S69			448.3	OK	
S7.010	S70			460.6	OK	
S7.011	S71			491.1	OK	
S7.012	S72			487.4	OK	
S7.013	S73			498.2	OK	
S7.014	S74			549.5	OK	
S7.015	S75			546.7	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 03 Building

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S6.012	S76	30 Winter	30	+0%					35.495	-0.333	0.000
S6.013	S77	30 Winter	30	+0%					35.383	-0.367	0.000
S6.014	S78	30 Winter	30	+0%					35.224	-0.402	0.000
S6.015	S79	360 Winter	30	+0%					35.040	-0.490	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S6.012	S76	0.82			1116.5	OK	
S6.013	S77	0.74			1107.1	OK	
S6.014	S78	0.78			1103.8	OK	
S6.015	S79	0.05			69.0	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 03 Building

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of 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	FSR	M5-60 (mm) 18.300	Cv (Summer) 0.750
Region	England and Wales	Ratio R 0.350	Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 10.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
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)	100
Climate Change (%)	40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S6.000	S48	30 Winter	100	+40%	100/30 Winter				38.055	1.092	0.000
S6.001	S49	30 Winter	100	+40%	100/30 Winter				37.877	1.020	0.000
S6.002	S50	30 Winter	100	+40%	100/15 Winter				37.656	0.919	0.000
S6.003	S51	30 Winter	100	+40%	100/30 Summer				37.360	0.715	0.000
S6.004	S52	30 Winter	100	+40%	100/30 Winter				36.915	0.358	0.000
S6.005	S53	30 Winter	100	+40%	100/15 Summer				36.638	0.153	0.000
S6.006	S54	30 Winter	100	+40%	100/15 Summer				36.518	0.079	0.000
S6.007	S55	30 Winter	100	+40%	100/30 Winter				36.388	0.032	0.000
S6.008	S56	30 Winter	100	+40%	100/15 Summer				36.324	0.056	0.000
S6.009	S57	30 Winter	100	+40%	100/15 Winter				36.287	0.129	0.000
S6.010	S58	30 Winter	100	+40%	100/15 Winter				36.263	0.188	0.000
S6.011	S59	30 Winter	100	+40%	100/30 Summer				36.226	0.269	0.000
S7.000	S60	30 Winter	100	+40%	100/30 Winter				37.528	0.301	0.000
S7.001	S61	30 Winter	100	+40%	100/15 Winter				37.451	0.314	0.000
S7.002	S62	30 Winter	100	+40%	100/15 Winter				37.356	0.309	0.000
S7.003	S63	30 Winter	100	+40%	100/15 Winter				37.317	0.361	0.000
S7.004	S64	30 Winter	100	+40%	100/15 Winter				37.314	0.455	0.000
S7.005	S65	30 Winter	100	+40%	100/15 Summer				37.299	0.538	0.000
S7.006	S66	30 Winter	100	+40%	100/15 Summer				37.255	0.584	0.000
S7.007	S67	30 Winter	100	+40%	100/15 Summer				37.186	0.605	0.000
S7.008	S68	30 Winter	100	+40%	100/15 Summer				37.123	0.584	0.000
S7.009	S69	30 Winter	100	+40%	100/15 Summer				37.060	0.558	0.000
S7.010	S70	30 Winter	100	+40%	100/15 Summer				36.981	0.532	0.000
S7.011	S71	30 Winter	100	+40%	100/15 Summer				36.861	0.502	0.000
S7.012	S72	30 Winter	100	+40%	100/15 Summer				36.721	0.453	0.000
S7.013	S73	30 Winter	100	+40%	100/15 Summer				36.603	0.415	0.000
S7.014	S74	30 Winter	100	+40%	100/15 Summer				36.453	0.365	0.000
S7.015	S75	30 Winter	100	+40%	100/30 Summer				36.248	0.267	0.000

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 03 Building

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S6.000	S48	0.11			77.0	SURCHARGED	
S6.001	S49	0.37			274.0	SURCHARGED	
S6.002	S50	0.61			435.2	SURCHARGED	
S6.003	S51	0.56			394.4	SURCHARGED	
S6.004	S52	0.69			471.9	SURCHARGED	
S6.005	S53	0.91			538.3	SURCHARGED	
S6.006	S54	0.70			488.9	SURCHARGED	
S6.007	S55	0.64			449.3	SURCHARGED	
S6.008	S56	0.57			416.8	SURCHARGED	
S6.009	S57	0.46			635.0	SURCHARGED	
S6.010	S58	0.60			895.4	SURCHARGED	
S6.011	S59	0.61			935.9	SURCHARGED	
S7.000	S60	0.09			64.8	SURCHARGED	
S7.001	S61	0.29			203.0	SURCHARGED	
S7.002	S62	0.24			169.0	SURCHARGED	
S7.003	S63	0.41			298.9	SURCHARGED	
S7.004	S64	0.64			458.6	SURCHARGED	
S7.005	S65	0.98			699.1	SURCHARGED	
S7.006	S66	1.04			739.0	SURCHARGED	
S7.007	S67	1.42			789.5	SURCHARGED	
S7.008	S68	1.58			785.7	SURCHARGED	
S7.009	S69	1.22			776.3	SURCHARGED	
S7.010	S70	1.13			800.9	SURCHARGED	
S7.011	S71	1.24			878.8	SURCHARGED	
S7.012	S72	1.25			869.1	SURCHARGED	
S7.013	S73	1.23			895.4	SURCHARGED	
S7.014	S74	1.38			1019.6	SURCHARGED	
S7.015	S75	0.65			1007.4	SURCHARGED	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 03 Building

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S6.012	S76	30 Winter	100	+40%	100/15 Winter				36.183	0.355	0.000
S6.013	S77	30 Winter	100	+40%	100/15 Winter				35.961	0.211	0.000
S6.014	S78	30 Winter	100	+40%	100/30 Winter				35.718	0.093	0.000
S6.015	S79	600 Winter	100	+40%	100/360 Winter				35.585	0.055	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S6.012	S76	1.48			2023.9	SURCHARGED	
S6.013	S77	1.33			1995.2	SURCHARGED	
S6.014	S78	1.39			1982.2	SURCHARGED	
S6.015	S79	0.05			72.0	SURCHARGED	

FOUL SEWERAGE DESIGN

Network Design Table for Foul South

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F1.000	43.456	0.435	99.9	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F1.001	43.456	0.435	99.9	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F1.002	44.973	0.450	99.9	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F1.003	44.973	0.450	100.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F1.004	45.013	0.450	100.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F1.005	45.013	0.450	100.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F1.006	64.436	0.644	100.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F1.007	13.853	0.139	100.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F1.008	45.000	0.450	100.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F1.009	45.000	0.450	100.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F1.010	30.147	0.301	100.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F1.011	30.194	0.302	100.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.000	36.885	0.000	0.0	0	0.0	0	0.00	0.88	15.5	0.0
F1.001	36.451	0.000	0.0	0	0.0	0	0.00	0.88	15.5	0.0
F1.002	36.016	0.000	0.0	0	0.0	0	0.00	0.88	15.5	0.0
F1.003	35.566	0.000	0.0	0	0.0	0	0.00	0.88	15.5	0.0
F1.004	35.116	0.000	0.0	0	0.0	0	0.00	0.88	15.5	0.0
F1.005	34.666	0.000	0.0	0	0.0	0	0.00	0.88	15.5	0.0
F1.006	34.216	0.000	0.0	0	0.0	0	0.00	0.88	15.5	0.0
F1.007	33.572	0.000	0.0	0	0.0	0	0.00	0.88	15.5	0.0
F1.008	33.433	0.000	0.0	0	0.0	0	0.00	0.88	15.5	0.0
F1.009	32.983	0.000	0.0	0	0.0	0	0.00	0.88	15.5	0.0
F1.010	32.533	0.000	0.0	0	0.0	0	0.00	0.88	15.5	0.0
F1.011	32.232	0.000	0.0	0	0.0	0	0.00	0.88	15.5	0.0

FOUL SEWERAGE DESIGN

Network Design Table for Foul - north

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F2.000	37.242	0.372	100.1	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F3.000	27.159	0.272	100.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F2.001	44.999	0.450	100.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F2.002	44.999	0.450	100.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F2.003	43.913	0.439	100.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F2.004	43.913	0.439	100.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F2.005	45.156	0.452	100.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F2.006	45.156	0.452	100.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F2.007	33.355	0.334	100.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F4.000	61.257	0.613	100.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F2.008	27.360	0.274	100.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F2.009	9.887	0.099	100.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F2.000	36.640	0.000	0.0	0	0.0	0	0.00	0.88	15.5	0.0
F3.000	36.640	0.000	0.0	0	0.0	0	0.00	0.88	15.5	0.0
F2.001	36.268	0.000	0.0	0	0.0	0	0.00	0.88	15.5	0.0
F2.002	35.818	0.000	0.0	0	0.0	0	0.00	0.88	15.5	0.0
F2.003	35.368	0.000	0.0	0	0.0	0	0.00	0.88	15.5	0.0
F2.004	34.929	0.000	0.0	0	0.0	0	0.00	0.88	15.5	0.0
F2.005	34.490	0.000	0.0	0	0.0	0	0.00	0.88	15.5	0.0
F2.006	34.038	0.000	0.0	0	0.0	0	0.00	0.88	15.5	0.0
F2.007	33.587	0.000	0.0	0	0.0	0	0.00	0.88	15.5	0.0
F4.000	36.640	0.000	0.0	0	0.0	0	0.00	0.88	15.5	0.0
F2.008	33.253	0.000	0.0	0	0.0	0	0.00	0.88	15.5	0.0
F2.009	32.979	0.000	0.0	0	0.0	0	0.00	0.88	15.5	0.0