

Project Title: ECMWF - New Headquarters - CBRs							Status: FINAL		Location ID: SW105		 Card Geotechnics Limited, 12 Melcombe Place, London, NW1 6JJ www.cgl-uk.com		
Client: Mace Construct Limited							Location Type: Trial pit/trench						
Method and Plant Used				Groundwater									
From (m)	To (m)	Type	Plant Used	Strike (m)	Time (min)	Rose To							
0.00	0.90	TP	Mini Digger	0.90	-	-							
							Coords: 474135.617E/171745.579N		Level: 66.505m				
									Final Depth: 0.90 m				
							Orientation: 0°		Inclination: 90°				
							Date Start: 20/02/2024		Date End: 20/02/2024		Sheet 1 of 1		
Samples & Tests				Water Level (m)	Legend	Strata Depth (m)	Level (m)	Strata Description			Inst/Backfill (m)	Depth (m)	
Sample Depth (m)	Type/Ref	Tests/Results											
0.46 - 0.90	B 1					0.46	66.04	Grass over dark grey slightly gravelly slightly sandy clay/silt. Gravel is subangular to subrounded fine to coarse of flint. Rare subangular to subrounded fine to medium gravel of charcoal and red brick fragments. [MADE GROUND]					
						0.90	65.60	Greyish yellow to yellow slightly gravelly silty SAND. Sand is fine to medium. Gravel is subangular to subrounded fine to coarse of flint. [BYON HILL MEMBER]					
EOH at 0.90m - Terminated as target depth reached													

[illegible]

APPENDIX C

Infiltration testing results

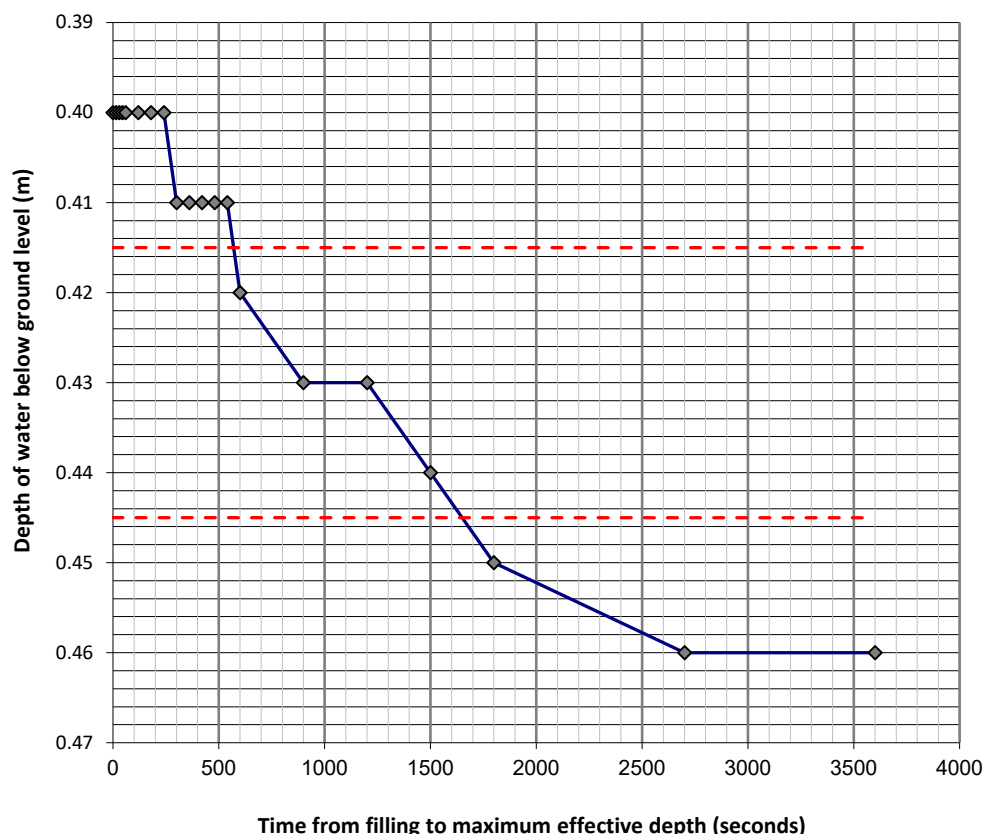
[illegible]

[illegible]

DATE:	20/02/2024	Card Geotechnics Limited, 4 Godalming Business Centre, Woolsack Way, Godalming, Surrey, GU7 1XW Tel: 01483 310600	
PROJECT No:	CGL/10078A		
PROJECT NAME:	Reading - ECMWF Headquarters		
CLIENT:	Mace Construct Ltd		
TRIAL PIT ID:	SW101		
TEST NUMBER:	3		

SOAKAWAY TEST - SOIL INFILTRATION RATE/PERMEABILITY

Time Elapsed (s)	Time Elapsed (mins)	Distance to water surface from ground level (m)	Pit Construction Remarks	PIT LENGTH (L):		1.00 m
				PIT WIDTH (W):		0.50 m
				PIT DEPTH (D):		0.62 m
				EFFECTIVE DEPTH (ED) * :		0.06 m
0	0.00	0.400	INPUT PARAMETERS:	Maximum potential volume of water (V)	(m ³)	0.03
15	0.25	0.400		Pit volume between 75% & 25% depths (PV _{25/75}) = L x W x ½ ED	(m ³)	0.02
30	0.50	0.400		Maximum head of water lost during test = D - Water depth @ time 0	(m)	0.06
45	0.75	0.400		Surface area of pit up to 50% effective depth (AP ₅₀)	(m ²)	1.07
60	1.00	0.400		Level of water in pit at 75% effective depth (P ₇₅)	(m)	0.42
120	2.00	0.400		Level of water in pit at 25% effective depth (P ₂₅)	(m)	0.45
180	3.00	0.400		Time at 75% effective depth (T ₇₅)	(s)	570
240	4.00	0.400		Time at 25% effective depth (T ₂₅)	(s)	1650
300	5.00	0.410		Time for outflow for 75% and 25% effective depth (T ₇₅ -T ₂₅)	(s)	1080
360	6.00	0.410		SOIL INFILTRATION RATE (f) = PV ₇₅₋₂₅ / (AP ₅₀ x T ₇₅₋₂₅)	(m/s)	1.30E-05
420	7.00	0.410		WATER INPUT:	110L	in
480	8.00	0.410				2 minutes
540	9.00	0.410		Geology of test section/Test remarks		
600	10.00	0.420		Infiltration rate is indicative and is calculated only from readings recorded during testing. Not all of the water fully drained from the initial head of water to the full pit depth during the period readings were recorded.		
900	15.00	0.430				
1200	20.00	0.430		Compiled by:	SJP	Checked by: JSB
1500	25.00	0.440		After BRE Digest 365, Soakaway Design, 2016		Page 1 of 1
1800	30.00	0.450		* Effective Depth (ED) = Total drop in water level over test period		
2700	45.00	0.460				
3600	60.00	0.460				





Time Elapsed (s)	Time Elapsed (mins)	Distance to water surface from ground level (m)	Pit Construction Remarks		PIT LENGTH (L):		1.00 m																																																																	
					PIT WIDTH (W):		0.50 m																																																																	
					PIT DEPTH (D):		0.84 m																																																																	
			INPUT PARAMETERS:		EFFECTIVE DEPTH (ED) * :		0.17 m																																																																	
0	0.00	0.400	Maximum potential volume of water (V)				(m ³)	0.09																																																																
15	0.25	0.400	Pit volume between 75% & 25% depths (PV _{25/75}) = L x W x ½ ED				(m ³)	0.04																																																																
30	0.50	0.400	Maximum head of water lost during test = D - Water depth @ time 0				(m)	0.17																																																																
45	0.75	0.400	Surface area of pit up to 50% effective depth (AP ₅₀)				(m ²)	1.57																																																																
60	1.00	0.410	Level of water in pit at 75% effective depth (P ₇₅)				(m)	0.44																																																																
90	1.50	0.410	Level of water in pit at 25% effective depth (P ₂₅)				(m)	0.53																																																																
120	2.00	0.420	Time at 75% effective depth (T ₇₅)				(s)	495																																																																
180	3.00	0.420	Time at 25% effective depth (T ₂₅)				(s)	9675																																																																
240	4.00	0.420	Time for outflow for 75% and 25% effective depth (T ₇₅ -T ₂₅)				(s)	9180																																																																
300	5.00	0.430	SOIL INFILTRATION RATE (f) =		PV ₇₅₋₂₅ /(AP ₅₀ x T ₇₅₋₂₅)		(m/s)	2.96E-06																																																																
360	6.00	0.430	WATER INPUT:		220L		in	2 minutes																																																																
420	7.00	0.440	Geology of test section/Test remarks																																																																					
480	8.00	0.440	Infiltration rate is indicative and is calculated only from readings recorded during testing. Not all of the water fully drained from the initial head of water to the full pit depth during the period readings were recorded.																																																																					
540	9.00	0.450	Compiled by:		SJP		Checked by:	JSB																																																																
600	10.00	0.450	After BRE Digest 365, Soakaway Design, 2016																																																																					
900	15.00	0.450	Page 1 of 1																																																																					
1200	20.00	0.450	* Effective Depth (ED) = Total drop in water level over test period																																																																					
1500	25.00	0.460	<table><caption>Data points estimated from the graph</caption><tr><th>Time (seconds)</th><th>Depth (m)</th></tr><tr><td>0</td><td>0.40</td></tr><tr><td>100</td><td>0.41</td></tr><tr><td>200</td><td>0.42</td></tr><tr><td>300</td><td>0.43</td></tr><tr><td>400</td><td>0.44</td></tr><tr><td>500</td><td>0.45</td></tr><tr><td>600</td><td>0.46</td></tr><tr><td>700</td><td>0.47</td></tr><tr><td>800</td><td>0.48</td></tr><tr><td>900</td><td>0.49</td></tr><tr><td>1000</td><td>0.50</td></tr><tr><td>1500</td><td>0.51</td></tr><tr><td>2000</td><td>0.52</td></tr><tr><td>3000</td><td>0.53</td></tr><tr><td>4000</td><td>0.54</td></tr><tr><td>5000</td><td>0.55</td></tr><tr><td>6000</td><td>0.56</td></tr><tr><td>7000</td><td>0.57</td></tr><tr><td>8000</td><td>0.58</td></tr><tr><td>9000</td><td>0.59</td></tr><tr><td>10000</td><td>0.60</td></tr><tr><td>11000</td><td>0.61</td></tr><tr><td>12000</td><td>0.62</td></tr><tr><td>13000</td><td>0.63</td></tr><tr><td>14000</td><td>0.64</td></tr><tr><td>15000</td><td>0.65</td></tr><tr><td>16000</td><td>0.66</td></tr><tr><td>17000</td><td>0.67</td></tr><tr><td>18000</td><td>0.68</td></tr><tr><td>19000</td><td>0.69</td></tr><tr><td>20000</td><td>0.70</td></tr></table>						Time (seconds)	Depth (m)	0	0.40	100	0.41	200	0.42	300	0.43	400	0.44	500	0.45	600	0.46	700	0.47	800	0.48	900	0.49	1000	0.50	1500	0.51	2000	0.52	3000	0.53	4000	0.54	5000	0.55	6000	0.56	7000	0.57	8000	0.58	9000	0.59	10000	0.60	11000	0.61	12000	0.62	13000	0.63	14000	0.64	15000	0.65	16000	0.66	17000	0.67	18000	0.68	19000	0.69	20000	0.70
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1800	30.00	0.460																																																																						
2700	45.00	0.470																																																																						
3600	60.00	0.490																																																																						
5400	90.00	0.490																																																																						
7200	120.00	0.510																																																																						
9000	150.00	0.520																																																																						
10800	180.00	0.540																																																																						
14400	240.00	0.540																																																																						
18000	300.00	0.570																																																																						
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DATE:	21/02/2024	Card Geotechnics Limited, 4 Godalming Business Centre, Woolsack Way, Godalming, Surrey, GU7 1XW Tel: 01483 310600 
PROJECT No:	CG/10078A	
PROJECT NAME:	Reading - ECMWF Headquarters	
CLIENT:	Mace Construct Ltd	
TRIAL PIT ID:	SW104	
TEST NUMBER:	1	

SOAKAWAY TEST - SOIL INFILTRATION RATE/PERMEABILITY

Time Elapsed (s)	Time Elapsed (mins)	Distance to water surface from ground level (m)
0	0.00	0.400
15	0.25	0.600
30	0.50	0.600
45	0.75	0.610
60	1.00	0.610
90	1.50	0.610
120	2.00	0.610
180	3.00	0.610
240	4.00	0.610
300	5.00	0.610
600	10.00	0.620
900	15.00	0.630
1200	20.00	0.630
1800	30.00	0.640
2700	45.00	0.650
3600	60.00	0.650
5400	90.00	0.670
7200	120.00	0.680
10800	180.00	0.700
14400	240.00	0.720
18000	300.00	0.740

Pit Construction Remarks		PIT LENGTH (L):	1.00 m
		PIT WIDTH (W):	0.50 m
		PIT DEPTH (D):	1.10 m
INPUT PARAMETERS:			
Total volume of pit/Maximum potential volume of water (V)	(m ³)	0.35	
Pit volume between 75% & 25% depths (PV _{25/75}) = L x W x ½D	(m ³)	0.18	
Maximum depth of water (MDW) = D - Water depth @ time 0	(m)	0.70	
Surface area of pit up to 50% effective depth (AP ₅₀)	(m ²)	1.55	
Level of water in pit at 75% effective depth (P ₇₅)	(m)	0.18	
Level of water in pit at 25% effective depth (P ₂₅)	(m)	0.53	
Time at 75% effective depth (T ₇₅)	(s)	13	
Time at 25% effective depth (T ₂₅)	(s)	#N/A	
Time for outflow for 75% and 25% effective depth (T ₇₅ -T ₂₅)	(s)	#N/A	
SOIL INFILTRATION RATE (f) =	PV ₇₅₋₂₅ /(AP ₅₀ x T ₇₅₋₂₅)	(m/s)	#N/A
WATER INPUT:	110L	in	2 minutes
Geology of test section/Test remarks			
MADE GROUND from 0.00m to 0.40m, silty GRAVEL from 0.40m to 0.62m.			
Compiled by: SJP		Checked by: JSB	
After BRE Digest 365, Soakaway Design, 2016			Page 1 of 1

The graph plots the depth of water below ground level in meters against the time taken for water to reach its maximum effective depth in seconds. The y-axis ranges from 0.00 to 1.00 m, and the x-axis ranges from 0 to 20000 seconds. Data points are plotted as diamonds connected by a solid blue line. A horizontal dashed red line is positioned at approximately 0.57 m. The data shows a steady decrease in water depth over time, starting at 0.40 m at 0 seconds and reaching approximately 0.74 m after 18000 seconds.

Time (seconds)	Depth (m)
0	0.40
15	0.60
30	0.60
45	0.61
60	0.61
90	0.61
120	0.61
180	0.61
240	0.61
300	0.61
600	0.62
900	0.63
1200	0.63
1800	0.64
2700	0.65
3600	0.65
5400	0.67
7200	0.68
10800	0.70
14400	0.72
18000	0.74



Time Elapsed (s)	Time Elapsed (mins)	Distance to water surface from ground level (m)	Pit Construction Remarks		PIT LENGTH (L):		1.00 m																							
					PIT WIDTH (W):		0.50 m																							
					PIT DEPTH (D):		1.00 m																							
0	0.00	0.400	INPUT PARAMETERS:																											
15	0.25	0.460	Total volume of pit/Maximum potential volume of water (V)				(m ³)	0.30																						
30	0.50	0.470	Pit volume between 75% & 25% depths (PV _{25/75}) = L x W x ½D				(m ³)	0.15																						
45	0.75	0.480	Maximum depth of water (MDW) = D - Water depth @ time 0				(m)	0.60																						
60	1.00	0.480	Surface area of pit up to 50% effective depth (AP ₅₀)				(m ²)	1.40																						
120	2.00	0.480	Level of water in pit at 75% effective depth (P ₇₅)				(m)	0.15																						
180	3.00	0.490	Level of water in pit at 25% effective depth (P ₂₅)				(m)	0.45																						
240	4.00	0.490	Time at 75% effective depth (T ₇₅)				(s)	2252																						
300	5.00	0.490	Time at 25% effective depth (T ₂₅)				(s)	#N/A																						
600	10.00	0.500	Time for outflow for 75% and 25% effective depth (T ₇₅ -T ₂₅)				(s)	#N/A																						
900	15.00	0.510	SOIL INFILTRATION RATE (f) =		PV ₇₅₋₂₅ /(AP ₅₀ x T ₇₅₋₂₅)		(m/s)	#N/A																						
1200	20.00	0.520	WATER INPUT:		110L		in	2 minutes																						
1800	30.00	0.540	Geology of test section/Test remarks																											
2700	45.00	0.560	MADE GROUND from 0.00m to 0.40m, silty GRAVEL from 0.40m to 0.62m.																											
3600	60.00	0.570	Compiled by:		SJP		Checked by: JSB																							
5400	90.00	0.590	After BRE Digest 365, Soakaway Design, 2016					Page 1 of 1																						
7200	120.00	0.610	The graph displays the relationship between the depth of water below ground level and the time taken for it to reach its maximum effective depth. The y-axis ranges from 0.00 to 0.90 meters, and the x-axis ranges from 0 to 18000 seconds. Data points are plotted as diamonds along a blue curve that starts near 0.40m and gradually descends towards 0.68m over 16000 seconds. A horizontal reference line is shown at 0.55m. <table><caption>Data points estimated from the graph</caption><tr><th>Time (seconds)</th><th>Depth (m)</th></tr><tr><td>0</td><td>~0.40</td></tr><tr><td>1000</td><td>~0.48</td></tr><tr><td>2000</td><td>~0.52</td></tr><tr><td>3000</td><td>~0.55</td></tr><tr><td>4000</td><td>~0.57</td></tr><tr><td>5500</td><td>~0.59</td></tr><tr><td>7000</td><td>~0.61</td></tr><tr><td>11000</td><td>~0.64</td></tr><tr><td>14500</td><td>~0.66</td></tr><tr><td>16000</td><td>~0.68</td></tr></table>						Time (seconds)	Depth (m)	0	~0.40	1000	~0.48	2000	~0.52	3000	~0.55	4000	~0.57	5500	~0.59	7000	~0.61	11000	~0.64	14500	~0.66	16000	~0.68
Time (seconds)	Depth (m)																													
0	~0.40																													
1000	~0.48																													
2000	~0.52																													
3000	~0.55																													
4000	~0.57																													
5500	~0.59																													
7000	~0.61																													
11000	~0.64																													
14500	~0.66																													
16000	~0.68																													
10800	180.00	0.640																												
14400	240.00	0.660																												
16200	270.00	0.670																												

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APPENDIX D

CBR testing results



OAKLAND
site investigation

Job Reference:

Site Address: Reading University

Client: CGL

Date: 20.02.2024

In-Situ CBR No. CBR101

Depth (m): 1.00

Ring Number: 15060

Ring Factor: 9.2064

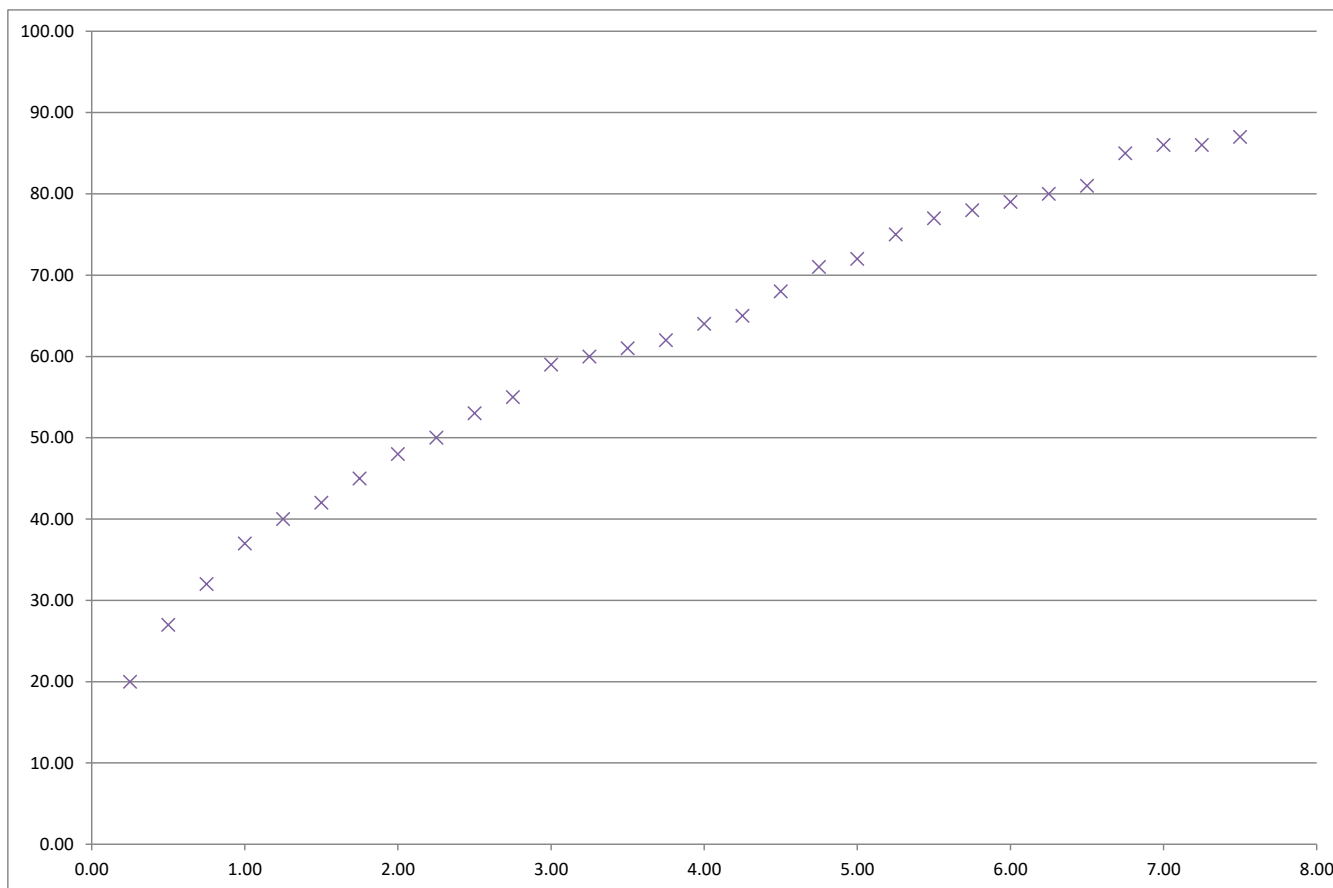
Natural Moisture Content (%): 13.3

CBR Value at 2.5mm Penetration (%) 3.7

CBR Value at 5.0mm Penetration (%) 3.3

Accepted CBR Value (%) 3.7

Penetration (mm)	Dial Gauge Reading
0.25	20
0.50	27
0.75	32
1.00	37
1.25	40
1.50	42
1.75	45
2.00	48
2.25	50
2.50	53
2.75	55
3.00	59
3.25	60
3.50	61
3.75	62
4.00	64
4.25	65
4.50	68
4.75	71
5.00	72
5.25	75
5.50	77
5.75	78
6.00	79
6.25	80
6.50	81
6.75	85
7.00	86
7.25	86
7.50	87





OAKLAND
site investigation

Job Reference:

Site Address: Reading University

Client: CGL

Date: 20.02.2024

In-Situ CBR No. CBR113

Depth (m): 0.85

Ring Number: 15060

Ring Factor: 9.2064

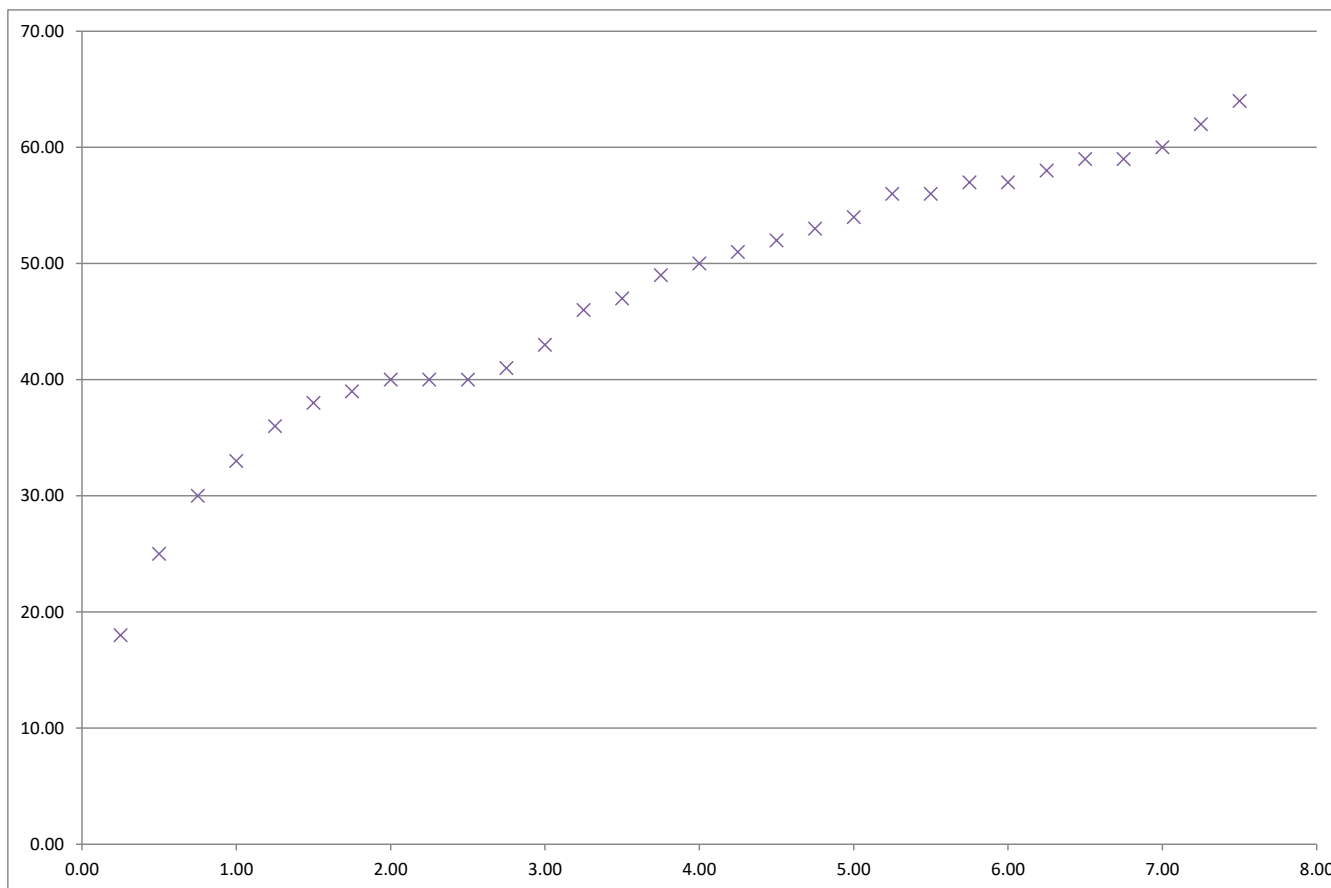
Natural Moisture Content (%): 12.1

CBR Value at 2.5mm Penetration (%) 2.8

CBR Value at 5.0mm Penetration (%) 2.5

Accepted CBR Value (%) 2.8

Penetration (mm)	Dial Gauge Reading
0.25	18
0.50	25
0.75	30
1.00	33
1.25	36
1.50	38
1.75	39
2.00	40
2.25	40
2.50	40
2.75	41
3.00	43
3.25	46
3.50	47
3.75	49
4.00	50
4.25	51
4.50	52
4.75	53
5.00	54
5.25	56
5.50	56
5.75	57
6.00	57
6.25	58
6.50	59
6.75	59
7.00	60
7.25	62
7.50	64



Oakland Site Investigation www.oaklandsi.co.uk T:01444 871 464

Registered Office Address: Unit 13, Firslan Park Estate, Henfield Road, Albourne, BN6 9JJ



OAKLAND
site investigation

Job Reference:

Site Address: Reading University

Client: CGL

Date: 20.02.2024

In-Situ CBR No. CBR112

Depth (m): 1.01

Ring Number: 15060

Ring Factor: 9.2064

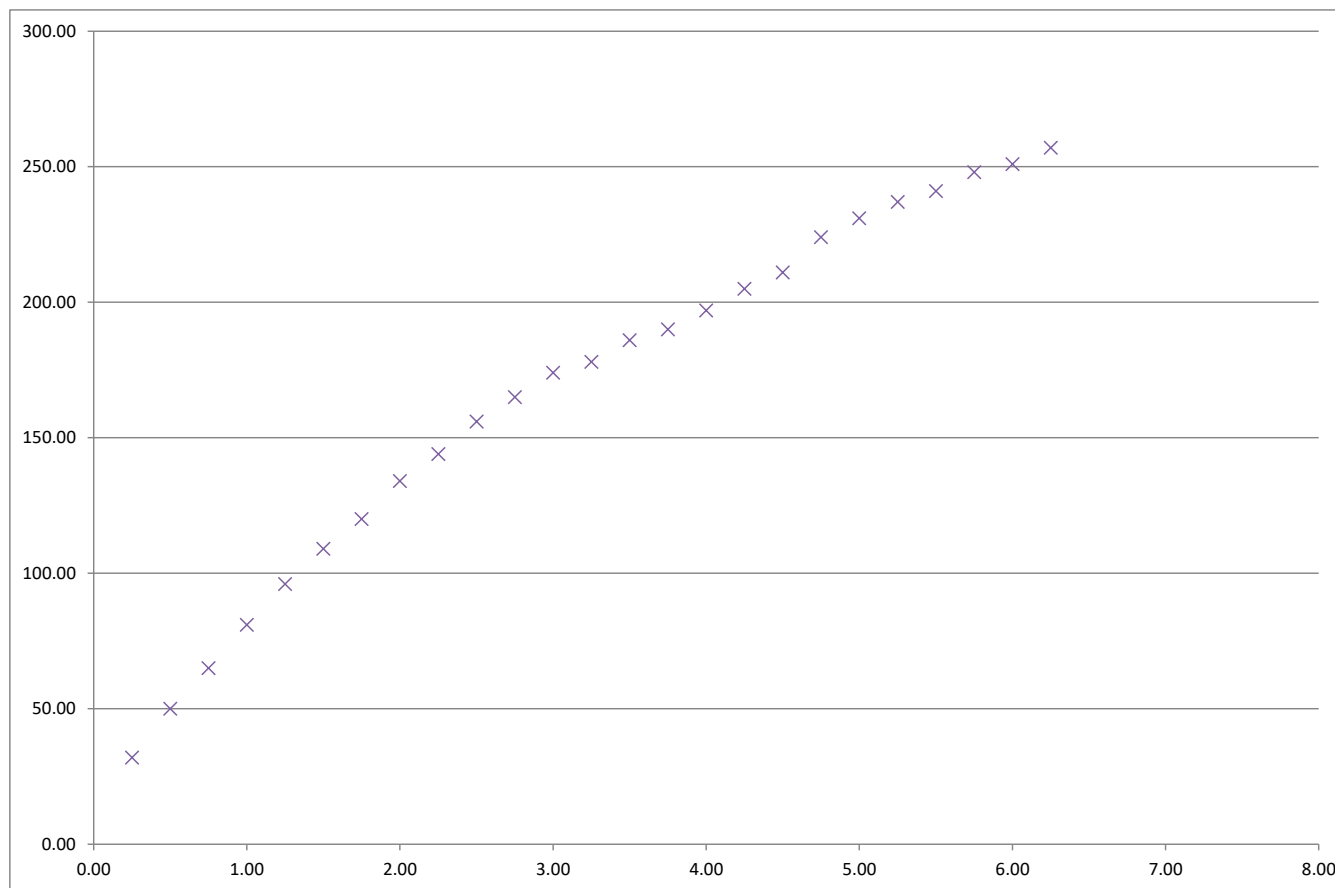
Natural Moisture Content (%): 14.5

CBR Value at 2.5mm Penetration (%) 10.9

CBR Value at 5.0mm Penetration (%) 10.6

Accepted CBR Value (%) 10.9

Penetration (mm)	Dial Gauge Reading
0.25	32
0.50	50
0.75	65
1.00	81
1.25	96
1.50	109
1.75	120
2.00	134
2.25	144
2.50	156
2.75	165
3.00	174
3.25	178
3.50	186
3.75	190
4.00	197
4.25	205
4.50	211
4.75	224
5.00	231
5.25	237
5.50	241
5.75	248
6.00	251
6.25	257
6.50	
6.75	
7.00	
7.25	
7.50	





OAKLAND
site investigation

Job Reference:
Site Address: Reading University
Client: CGL
Date: 21.02.2024

In-Situ CBR No. CBR106
Depth (m): 0.89

Ring Number: 15060

Ring Factor: 9.2064

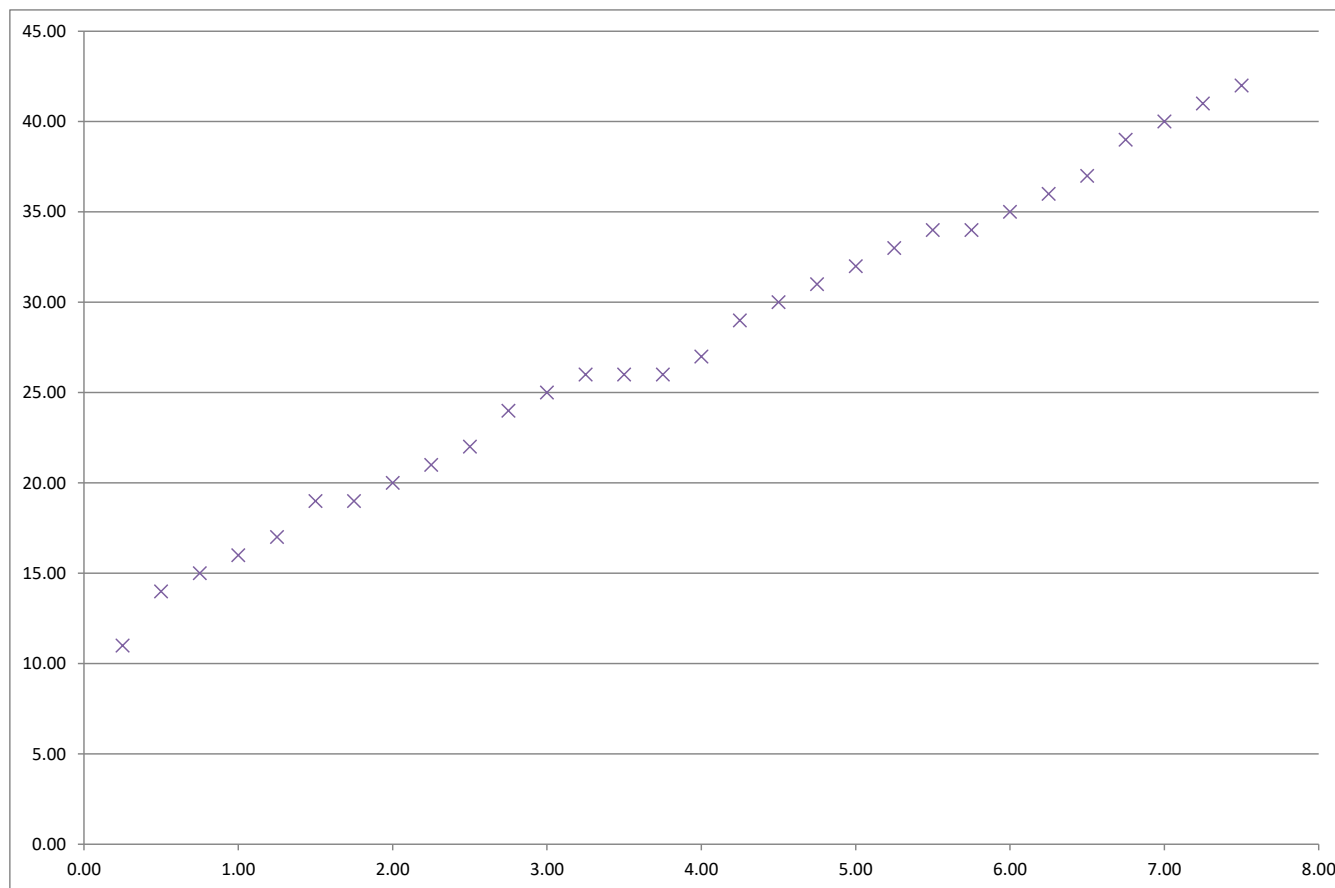
Natural Moisture Content (%): 29.7

CBR Value at 2.5mm Penetration (%) 1.5

CBR Value at 5.0mm Penetration (%) 1.5

Accepted CBR Value (%) 1.5

Penetration (mm)	Dial Gauge Reading
0.25	11
0.50	14
0.75	15
1.00	16
1.25	17
1.50	19
1.75	19
2.00	20
2.25	21
2.50	22
2.75	24
3.00	25
3.25	26
3.50	26
3.75	26
4.00	27
4.25	29
4.50	30
4.75	31
5.00	32
5.25	33
5.50	34
5.75	34
6.00	35
6.25	36
6.50	37
6.75	39
7.00	40
7.25	41
7.50	42





OAKLAND
site investigation

Job Reference:
Site Address: Reading University
Client: CGL
Date: 21.02.2024

In-Situ CBR No. CBR104
Depth (m): 0.86

Ring Number: 15060

Ring Factor: 9.2064

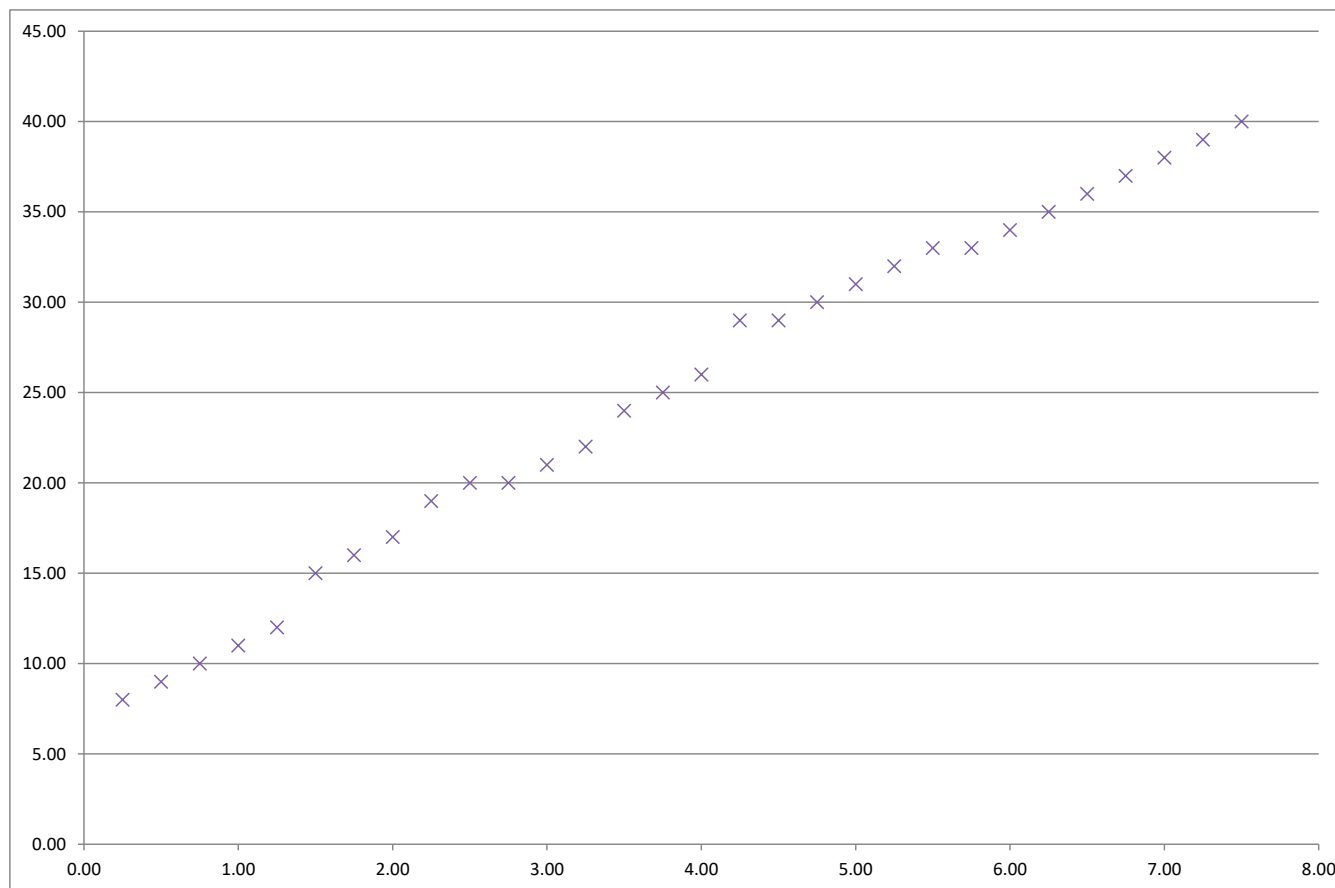
Natural Moisture Content (%): 15.7

CBR Value at 2.5mm Penetration (%) 1.4

CBR Value at 5.0mm Penetration (%) 1.4

Accepted CBR Value (%) 1.4

Penetration (mm)	Dial Gauge Reading
0.25	8
0.50	9
0.75	10
1.00	11
1.25	12
1.50	15
1.75	16
2.00	17
2.25	19
2.50	20
2.75	20
3.00	21
3.25	22
3.50	24
3.75	25
4.00	26
4.25	29
4.50	29
4.75	30
5.00	31
5.25	32
5.50	33
5.75	33
6.00	34
6.25	35
6.50	36
6.75	37
7.00	38
7.25	39
7.50	40





OAKLAND
site investigation

Job Reference:

Site Address: Reading University

Client: CGL

Date: 21.02.2024

In-Situ CBR No. CBR102

Depth (m): 1.07

Ring Number: 15060

Ring Factor: 9.2064

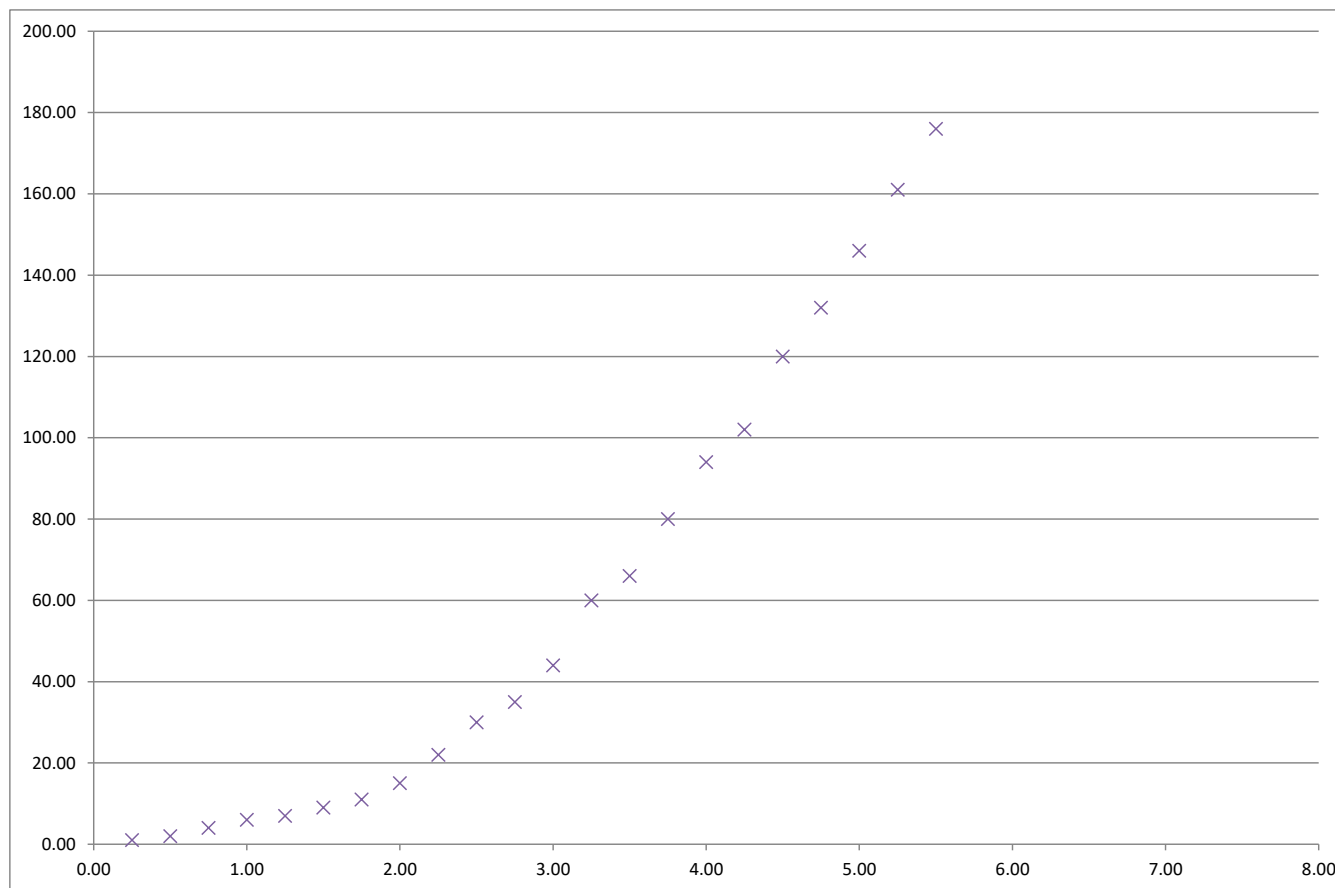
Natural Moisture Content (%): 13.3

CBR Value at 2.5mm Penetration (%) 2.1

CBR Value at 5.0mm Penetration (%) 6.7

Accepted CBR Value (%) 6.7

Penetration (mm)	Dial Gauge Reading
0.25	1
0.50	2
0.75	4
1.00	6
1.25	7
1.50	9
1.75	11
2.00	15
2.25	22
2.50	30
2.75	35
3.00	44
3.25	60
3.50	66
3.75	80
4.00	94
4.25	102
4.50	120
4.75	132
5.00	146
5.25	161
5.50	176
5.75	
6.00	
6.25	
6.50	
6.75	
7.00	
7.25	
7.50	





OAKLAND
site investigation

Job Reference:

Site Address: Reading University

Client: CGL

Date: 22.02.2024

In-Situ CBR No. CBR111

Depth (m): 1.15

Ring Number: 15060

Ring Factor: 9.2064

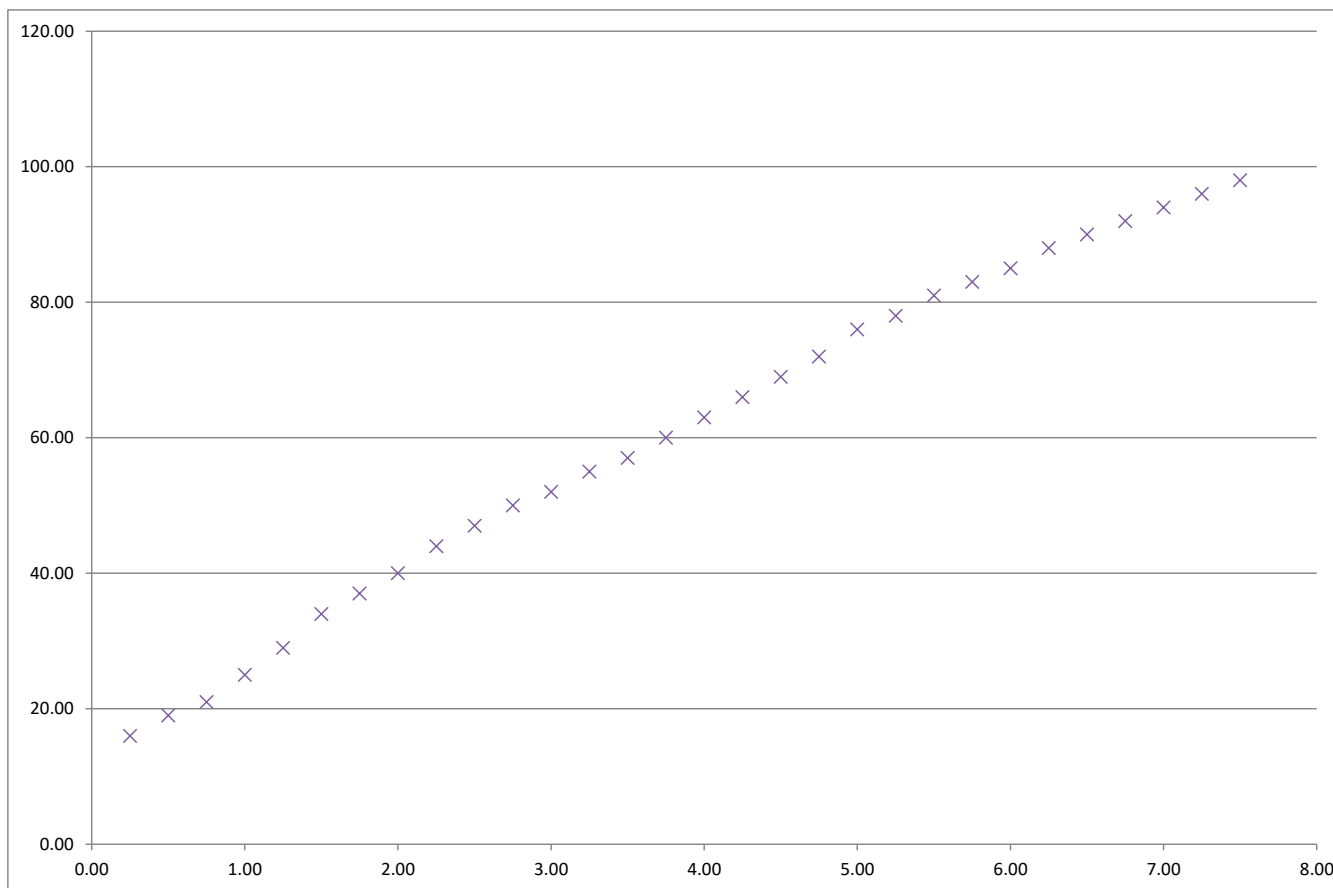
Natural Moisture Content (%): 9.9

CBR Value at 2.5mm Penetration (%) 3.3

CBR Value at 5.0mm Penetration (%) 3.5

Accepted CBR Value (%) 3.5

Penetration (mm)	Dial Gauge Reading
0.25	16
0.50	19
0.75	21
1.00	25
1.25	29
1.50	34
1.75	37
2.00	40
2.25	44
2.50	47
2.75	50
3.00	52
3.25	55
3.50	57
3.75	60
4.00	63
4.25	66
4.50	69
4.75	72
5.00	76
5.25	78
5.50	81
5.75	83
6.00	85
6.25	88
6.50	90
6.75	92
7.00	94
7.25	96
7.50	98



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Job Reference:

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Client: CGL

Date: 22.02.2024

In-Situ CBR No. CBR105

Depth (m): 1.15

Ring Number: 15060

Ring Factor: 9.2064

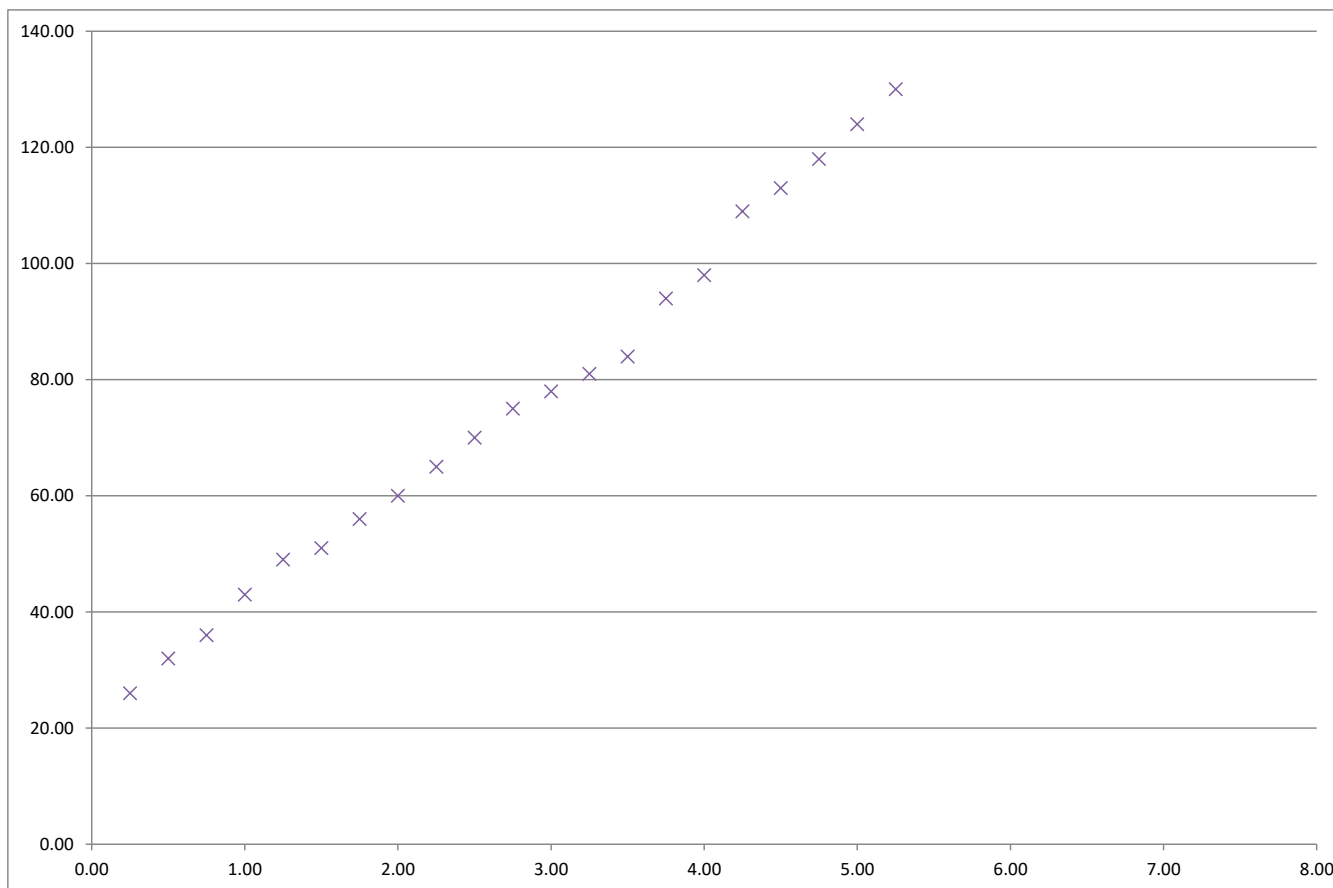
Natural Moisture Content (%): 27.9

CBR Value at 2.5mm Penetration (%) 4.9

CBR Value at 5.0mm Penetration (%) 5.7

Accepted CBR Value (%) 5.7

Penetration (mm)	Dial Gauge Reading
0.25	26
0.50	32
0.75	36
1.00	43
1.25	49
1.50	51
1.75	56
2.00	60
2.25	65
2.50	70
2.75	75
3.00	78
3.25	81
3.50	84
3.75	94
4.00	98
4.25	109
4.50	113
4.75	118
5.00	124
5.25	130
5.50	
5.75	
6.00	
6.25	
6.50	
6.75	
7.00	
7.25	
7.50	



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Registered Office Address: Unit 13, Firslan Park Estate, Henfield Road, Albourne, BN6 9JJ



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site investigation

Job Reference:
Site Address: Reading University
Client: CGL
Date: 22.02.2024

In-Situ CBR No. CBR103
Depth (m): 1.15

Ring Number: 15060

Ring Factor: 9.2064

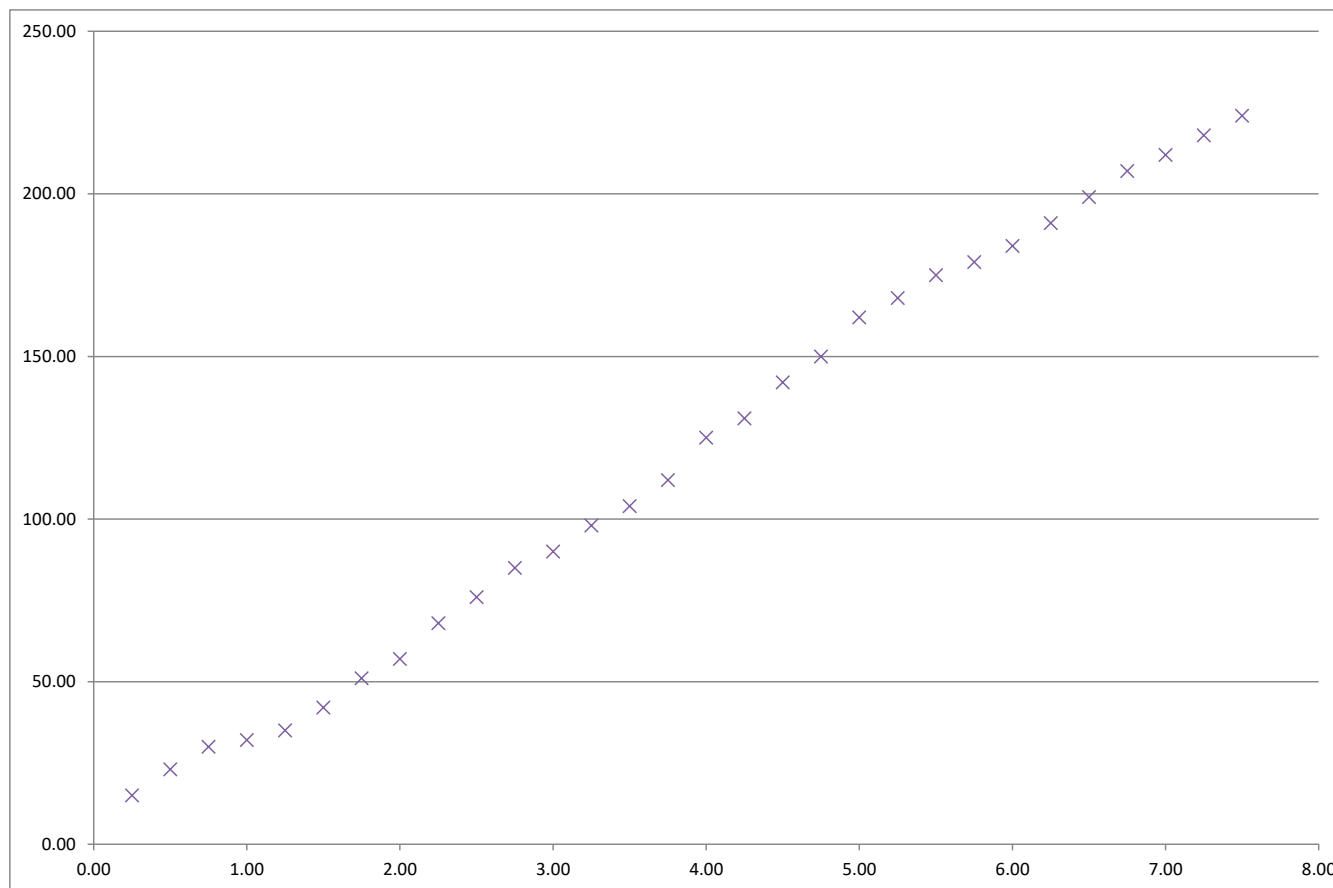
Natural Moisture Content (%): 11.3

CBR Value at 2.5mm Penetration (%) 5.3

CBR Value at 5.0mm Penetration (%) 7.5

Accepted CBR Value (%) 7.5

Penetration (mm)	Dial Gauge Reading
0.25	15
0.50	23
0.75	30
1.00	32
1.25	35
1.50	42
1.75	51
2.00	57
2.25	68
2.50	76
2.75	85
3.00	90
3.25	98
3.50	104
3.75	112
4.00	125
4.25	131
4.50	142
4.75	150
5.00	162
5.25	168
5.50	175
5.75	179
6.00	184
6.25	191
6.50	199
6.75	207
7.00	212
7.25	218
7.50	224



Appendix C – Surface Water Modelling Results

Building Design Partnership Ltd		Page 1
11 Ducie Street Piccadilly Basin Manchester M1 2JB	ECMWF Proposed Eastern Road Network	
Date 16/09/2024	Designed by LJ	
File ECMWF_BDP_SW_MD - Stage 4.8.MDX	Checked by JT	
Innovyze	Network 2020.1.3	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Eastern Access Road SW Network

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales			
Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	18.800	Add Flow / Climate Change (%)	0
Ratio R	0.400	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	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

Network Design Table for Eastern Access Road SW Network

- Indicates pipe length does not match coordinates

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	21.070	0.105	200.7	0.016	5.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	40.507	0.203	199.5	0.019	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	36.364	0.182	199.8	0.018	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	10.756	0.053	202.9	0.020	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.004	43.210	0.217	199.1	0.011	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.005	13.763	0.068	202.4	0.052	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.006	30.767	0.154	199.8	0.019	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	15.969	0.079	202.1	0.018	5.00	0.0	0.600	o	225	Pipe/Conduit	
S1.007	12.263#	0.062	197.8	0.031	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.008	2.330#	0.012	194.2	0.017	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	5.38	65.524	0.016	0.0	0.0	0.0	0.92	36.6	2.1
S1.001	50.00	6.11	65.419	0.035	0.0	0.0	0.0	0.92	36.7	4.7
S1.002	50.00	6.77	65.216	0.053	0.0	0.0	0.0	0.92	36.6	7.2
S1.003	50.00	6.97	65.034	0.073	0.0	0.0	0.0	0.91	36.3	9.9
S1.004	50.00	7.75	64.981	0.084	0.0	0.0	0.0	0.92	36.7	11.4
S1.005	50.00	8.00	64.764	0.136	0.0	0.0	0.0	0.92	36.4	18.5
S1.006	50.00	8.56	64.696	0.155	0.0	0.0	0.0	0.92	36.6	21.0
S2.000	50.00	5.29	64.621	0.018	0.0	0.0	0.0	0.92	36.4	2.4
S1.007	50.00	8.78	64.542	0.203	0.0	0.0	0.0	0.93	36.8	27.5
S1.008	50.00	8.82	64.480	0.221	0.0	0.0	0.0	0.93	37.2	29.9

Area Summary for Eastern Access Road SW Network

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	100	0.016	0.016	0.016
1.001	User	-	100	0.019	0.019	0.019
1.002	User	-	100	0.018	0.018	0.018
1.003	User	-	100	0.020	0.020	0.020
1.004	User	-	100	0.011	0.011	0.011
1.005	User	-	100	0.052	0.052	0.052
1.006	User	-	100	0.019	0.019	0.019
2.000	User	-	100	0.018	0.018	0.018
1.007	User	-	100	0.031	0.031	0.031
1.008	User	-	100	0.017	0.017	0.017
				Total	Total	Total
				0.221	0.221	0.221

Network Classifications for Eastern Access Road SW Network

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
S1.000	SSA.01	225	0.824	1.183	Unclassified	1200	0	0.824	Unclassified
S1.001	SSA.02	225	1.020	1.241	Unclassified	1200	0	1.088	Unclassified
S1.002	SSA.03	225	0.756	1.249	Unclassified	1200	0	1.241	Unclassified
S1.003	SSA.04	225	0.999	1.305	Unclassified	1200	0	1.249	Unclassified
S1.004	SSA.05	225	1.305	1.497	Unclassified	1200	0	1.305	Unclassified
S1.005	SSA.06	225	1.363	1.471	Unclassified	1200	0	1.471	Unclassified
S1.006	SSA.07	225	1.214	1.432	Unclassified	1200	0	1.432	Unclassified
S2.000	SSA.09	225	1.265	1.422	Unclassified	1200	0	1.422	Unclassified
S1.007	SSA.08	225	1.144	1.322	Unclassified	1200	0	1.322	Unclassified
S1.008	SSA.10	225	1.114	1.295	Unclassified	1200	0	1.295	Unclassified

Free Flowing Outfall Details for Eastern Access Road SW Network

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.008	SSA.10	65.826	64.468	0.000	300	0

Simulation Criteria for Eastern Access Road SW Network

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.800	Storm Duration (mins)	30
Ratio R	0.400		

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Eastern Access Road SW Network

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 Coefficient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

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

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.800 Cv (Summer) 0.750
Region England and Wales Ratio R 0.400 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 40

										Water	Surcharged	Flooded
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.		Level (m)	Depth (m)	Volume (m³)
S1.000	SSA.01	15 Winter	30	+0%	100/15	Summer				65.582	-0.167	0.000
S1.001	SSA.02	15 Winter	30	+0%	100/15	Summer				65.508	-0.136	0.000
S1.002	SSA.03	15 Winter	30	+0%	100/15	Summer				65.327	-0.114	0.000
S1.003	SSA.04	15 Winter	30	+0%	30/15	Winter				65.270	0.011	0.000
S1.004	SSA.05	15 Winter	30	+0%	30/15	Winter				65.229	0.023	0.000
S1.005	SSA.06	15 Winter	30	+0%	30/15	Summer				65.166	0.177	0.000
S1.006	SSA.07	15 Winter	30	+0%	30/15	Summer				65.098	0.177	0.000
S2.000	SSA.09	15 Winter	30	+0%	30/15	Summer				64.946	0.100	0.000
S1.007	SSA.08	15 Winter	30	+0%	30/15	Summer				64.937	0.170	0.000
S1.008	SSA.10	15 Winter	30	+0%	30/15	Summer				64.806	0.101	0.000

										Half Drain	Pipe
PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)	Status	Level Exceeded				
S1.000	SSA.01	0.15			4.9	OK					
S1.001	SSA.02	0.31			10.9	OK					
S1.002	SSA.03	0.47			16.3	OK					
S1.003	SSA.04	0.67			20.4	SURCHARGED					
S1.004	SSA.05	0.61			21.5	SURCHARGED					
S1.005	SSA.06	0.94			29.6	SURCHARGED					
S1.006	SSA.07	0.98			33.6	SURCHARGED					
S2.000	SSA.09	0.15			4.9	SURCHARGED					
S1.007	SSA.08	1.43			45.2	SURCHARGED					
S1.008	SSA.10	1.74			49.0	SURCHARGED					

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Eastern Access Road SW Network

<u>Simulation Criteria</u>											
Areal Reduction Factor			1.000			Additional Flow - % of Total Flow			0.000		
Hot Start (mins)			0			MADD Factor * 10m³/ha Storage			0.000		
Hot Start Level (mm)			0			Inlet Coefficient			0.800		
Manhole Headloss Coeff (Global)			0.500			Flow per Person per Day (l/per/day)			0.000		
Foul Sewage per hectare (l/s)			0.000								
Number of Input Hydrographs			0			Number of Offline Controls			0		
Number of Online Controls			0			Number of Storage Structures			0		
Number of Time/Area Diagrams			0			Number of Real Time Controls			0		
<u>Synthetic Rainfall Details</u>											
Rainfall Model			FSR M5-60 (mm)			18.800 Cv (Summer)			0.750		
Region England and Wales			Ratio R			0.400 Cv (Winter)			0.840		
Margin for Flood Risk Warning (mm)						300.0					
Analysis Timestep			2.5 Second Increment (Extended)								
DTS Status						OFF					
DVD Status						ON					
Inertia Status						ON					
Profile(s)						Summer and Winter					
Duration(s) (mins)			15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080								
Return Period(s) (years)						2, 30, 100					
Climate Change (%)						0, 0, 40					

										Water	Surcharged	Flooded
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.		Level (m)	Depth (m)	Volume (m³)
S1.000	SSA.01	15 Winter	100	+40%	100/15 Summer					66.146	0.397	0.000
S1.001	SSA.02	15 Winter	100	+40%	100/15 Summer					66.132	0.488	0.000
S1.002	SSA.03	15 Winter	100	+40%	100/15 Summer					66.092	0.651	0.000
S1.003	SSA.04	15 Winter	100	+40%	30/15 Winter					66.037	0.778	0.000
S1.004	SSA.05	15 Winter	100	+40%	30/15 Winter					65.972	0.766	0.000
S1.005	SSA.06	15 Winter	100	+40%	30/15 Summer					65.868	0.879	0.000
S1.006	SSA.07	15 Winter	100	+40%	30/15 Summer					65.724	0.803	0.000
S2.000	SSA.09	15 Winter	100	+40%	30/15 Summer					65.384	0.538	0.000
S1.007	SSA.08	15 Winter	100	+40%	30/15 Summer					65.368	0.601	0.000
S1.008	SSA.10	15 Winter	100	+40%	30/15 Summer					65.025	0.320	0.000

				Half Drain	Pipe		
	US/MH	Flow /	Overflow	Time	Flow		Level
PN	Name	Cap.	(l/s)	(mins)	(l/s)	Status	Exceeded
S1.000	SSA.01	0.24			7.9	SURCHARGED	
S1.001	SSA.02	0.44			15.5	SURCHARGED	
S1.002	SSA.03	0.64			22.3	SURCHARGED	
S1.003	SSA.04	0.87			26.5	SURCHARGED	
S1.004	SSA.05	0.88			30.7	SURCHARGED	
S1.005	SSA.06	1.40			44.3	SURCHARGED	
S1.006	SSA.07	1.51			51.9	SURCHARGED	
S2.000	SSA.09	0.28			9.0	SURCHARGED	
S1.007	SSA.08	2.32			73.2	SURCHARGED	
S1.008	SSA.10	2.86			80.8	SURCHARGED	

Building Design Partnership Ltd		Page 1
11 Ducie Street Piccadilly Basin Manchester M1 2JB	ECMWF Proposed Building Network	
Date 16/09/2024	Designed by LJ	
File ECMWF_BDP_SW_MD - Stage 4.8.MDX	Checked by JT	
Innovyze	Network 2020.1.3	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Building SW Network

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	18.800	Add Flow / Climate Change (%)	0
Ratio R	0.400	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	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

Network Design Table for Building SW Network

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	32.279	0.440	73.4	0.018	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	6.948	0.135	51.5	0.055	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	18.777	0.125	150.0	0.010	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.003	12.672	0.275	46.1	0.005	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.004	10.609	0.071	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.005	11.292	0.075	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.000	15.086	0.831	18.2	0.106	5.00	0.0	0.600	o	300	Pipe/Conduit	
1.006	6.646	0.044	150.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
3.000	18.645	0.093	200.0	0.074	5.00	0.0	0.600	o	225	Pipe/Conduit	
3.001	8.631	0.122	70.7	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
3.002	11.827	0.059	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
3.003	15.027	0.075	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
3.004	22.415	0.063	357.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
3.005	15.351	0.077	199.4	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.46	66.376	0.018	0.0	0.0	0.0	1.18	20.8	2.4
1.001	50.00	5.54	65.935	0.073	0.0	0.0	0.0	1.41	24.8	9.9
1.002	50.00	5.92	65.800	0.083	0.0	0.0	0.0	0.82	14.5	11.2
1.003	50.00	6.06	65.675	0.088	0.0	0.0	0.0	1.49	26.3	11.9
1.004	50.00	6.28	65.400	0.088	0.0	0.0	0.0	0.82	14.5	11.9
1.005	50.00	6.51	65.329	0.088	0.0	0.0	0.0	0.82	14.5	11.9
2.000	50.00	5.07	65.935	0.106	0.0	0.0	0.0	3.71	262.1	14.4
1.006	50.00	6.60	65.104	0.194	0.0	0.0	0.0	1.28	90.6	26.3
3.000	50.00	5.34	66.315	0.074	0.0	0.0	0.0	0.92	36.6	10.0
3.001	50.00	5.43	66.222	0.074	0.0	0.0	0.0	1.56	61.9	10.0
3.002	50.00	5.64	66.100	0.074	0.0	0.0	0.0	0.92	36.6	10.0
3.003	50.00	5.92	66.041	0.074	0.0	0.0	0.0	0.92	36.6	10.0
3.004	50.00	6.46	65.966	0.074	0.0	0.0	0.0	0.69	27.3	10.0
3.005	50.00	6.74	65.872	0.074	0.0	0.0	0.0	0.92	36.7	10.0

Network Design Table for Building SW Network

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	13.207	0.223	59.2	0.032	5.00	0.0	0.600	o	375	Pipe/Conduit	
5.000	2.384	0.164	14.5	0.055	5.00	0.0	0.600	o	375	Pipe/Conduit	
3.006	18.045	0.255	70.8	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.007	15.967	0.052	310.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.008	3.274	-3.502	-0.9	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)
4.000	50.00	5.09	65.868	0.032	0.0	0.0	0.0	2.36	260.5	4.3
5.000	50.00	5.01	65.809	0.055	0.0	0.0	0.0	4.77	527.2	7.4
3.006	50.00	6.88	65.645	0.161	0.0	0.0	0.0	2.16	238.2	21.8
1.007	50.00	7.14	62.550	0.355	0.0	0.0	0.0	1.02	113.1	48.1
1.008	50.00	7.45	62.498	0.355	0.0	0.0	0.0	0.17	19.1«	48.1

Area Summary for Building SW Network

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.018	0.018	0.018
1.001	-	-	100	0.055	0.055	0.055
1.002	-	-	100	0.010	0.010	0.010
1.003	-	-	100	0.005	0.005	0.005
1.004	-	-	100	0.000	0.000	0.000
1.005	-	-	100	0.000	0.000	0.000
2.000	-	-	100	0.106	0.106	0.106
1.006	-	-	100	0.000	0.000	0.000
3.000	-	-	100	0.074	0.074	0.074
3.001	-	-	100	0.000	0.000	0.000
3.002	-	-	100	0.000	0.000	0.000
3.003	-	-	100	0.000	0.000	0.000
3.004	-	-	100	0.000	0.000	0.000
3.005	-	-	100	0.000	0.000	0.000
4.000	-	-	100	0.032	0.032	0.032
5.000	-	-	100	0.055	0.055	0.055
3.006	-	-	100	0.000	0.000	0.000
1.007	-	-	100	0.000	0.000	0.000
1.008	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.355	0.355	0.355

Network Classifications for Building SW Network

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
1.000	SW.08	150	0.449	0.889	Unclassified	600	0	0.449	Unclassified
1.001	SW.09	150	0.890	0.921	Unclassified	600	0	0.890	Unclassified
1.002	Wetland 1	150	0.910	1.084	Unclassified	1200	0	0.910	Unclassified
1.003	SW.10	150	1.013	1.265	Unclassified	600	0	1.013	Unclassified
1.004	Swale + Tank	150	1.170	1.490	Unclassified	1200	0	1.170	Unclassified
1.005	SW.12	150	1.490	1.574	Unclassified	600	0	1.490	Unclassified
2.000	SW.14	300	0.765	1.574	Unclassified	1200	0	0.765	Unclassified
1.006	SW.13	300	1.540	1.588	Unclassified	1200	0	1.574	Unclassified
3.000	SW.22	225	0.452	0.501	Unclassified	1200	0	0.460	Unclassified
3.001	SW.21	225	0.455	0.501	Unclassified	1200	0	0.501	Unclassified
3.002	Wetland 2	225	0.455	0.726	Unclassified	1200	0	0.455	Unclassified
3.003	SW.20	225	0.719	0.744	Unclassified	1200	0	0.726	Unclassified
3.004	SW19	225	0.701	0.761	Unclassified	1200	0	0.742	Unclassified
3.005	SW.18	225	0.747	0.923	Unclassified	1200	0	0.747	Unclassified
4.000	SW.15	375	0.732	0.879	Unclassified	1350	0	0.732	Unclassified
5.000	SW.16	375	0.725	0.895	Unclassified	1350	0	0.725	Unclassified
3.006	SW.17	375	0.839	1.135	Unclassified	1350	0	0.839	Unclassified
1.007	RWH+Storage	375	3.975	4.082	Unclassified	1350	0	3.975	Unclassified
1.008	SWPC	375	0.332	4.082	Unclassified	2100	0	4.082	Unclassified

Free Flowing Outfall Details for Building SW Network

Outfall Pipe Number	Outfall C. Level Name (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.008	66.707	66.000	0.000	150	0

Simulation Criteria for Building SW Network

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 Online Controls	1	Number of Storage Structures	4
		Number of Time/Area Diagrams	0
		Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.800	Storm Duration (mins)	30
Ratio R	0.400		

Online Controls for Building SW Network

Pump Manhole: SWPC, DS/PN: 1.008, Volume (m³): 17.0

Invert Level (m) 62.498

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	1.0000	0.800	1.0000	2.000	1.0000	4.000	1.0000	7.000	0.0000
0.200	1.0000	1.000	1.0000	2.200	1.0000	4.500	1.0000	7.500	0.0000
0.300	1.0000	1.200	1.0000	2.400	1.0000	5.000	1.0000	8.000	0.0000
0.400	1.0000	1.400	1.0000	2.600	1.0000	5.500	0.0000	8.500	0.0000
0.500	1.0000	1.600	1.0000	3.000	1.0000	6.000	0.0000	9.000	0.0000
0.600	1.0000	1.800	1.0000	3.500	1.0000	6.500	0.0000	9.500	0.0000

Storage Structures for Building SW Network

Infiltration Basin Manhole: Wetland 1, DS/PN: 1.002

Invert Level (m) 65.800 Safety Factor 1.5
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	5.4	1.000	90.0

Complex Manhole: Swale + Tank, DS/PN: 1.004

Cellular Storage

Invert Level (m) 65.400 Safety Factor 1.5
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	64.0	64.0	0.800	64.0	96.0	0.801	0.0	96.0

Swale

Warning:- Volume should always be included unless the upstream pipe is being used for storage and/or as a carrier

Infiltration Coefficient Base (m/hr) 0.00000 Length (m) 14.0
Infiltration Coefficient Side (m/hr) 0.00000 Side Slope (1:X) 3.0
Safety Factor 1.5 Slope (1:X) 500.0
Porosity 1.00 Cap Volume Depth (m) 0.000
Invert Level (m) 66.400 Cap Infiltration Depth (m) 0.000
Base Width (m) 0.8 Include Swale Volume Yes

Infiltration Basin Manhole: Wetland 2, DS/PN: 3.002

Invert Level (m) 66.100 Safety Factor 1.5
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	47.0	0.680	134.7

Cellular Storage Manhole: RWH+Storage, DS/PN: 1.007

Invert Level (m) 62.550 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	46.5	0.0	1.800	46.5	0.0	1.801	0.0	0.0

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

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 Coefficient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		
Number of Input Hydrographs	0	Number of Offline Controls	0
Number of Online Controls	1	Number of Storage Structures	4
Number of Time/Area Diagrams	0	Number of Real Time Controls	0
Synthetic Rainfall Details			
Rainfall Model	FSR M5-60 (mm)	18.800 Cv (Summer)	0.750
Region	England and Wales	Ratio R	0.400 Cv (Winter)
Margin for Flood Risk Warning (mm)			300.0
Analysis Timestep	2.5 Second Increment (Extended)		
DTS Status			OFF
DVD Status			ON
Inertia Status			ON
Profile(s)			Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080		
Return Period(s) (years)			2, 30, 100
Climate Change (%)			0, 0, 40

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

									Water	Surcharged
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Level (m)	Depth (m)
1.000	SW.08	15 Winter	2	+0%	100/15 Summer				66.415	-0.111
1.001	SW.09	15 Winter	2	+0%	30/15 Summer				66.012	-0.073
1.002	Wetland 1	15 Winter	2	+0%	30/15 Summer				65.908	-0.042
1.003	SW.10	15 Winter	2	+0%	100/15 Summer				65.751	-0.074
1.004	Swale + Tank	30 Winter	2	+0%	30/240 Winter				65.474	-0.076
1.005	SW.12	30 Winter	2	+0%	30/180 Winter				65.402	-0.077
2.000	SW.14	15 Winter	2	+0%	100/120 Winter				65.992	-0.243
1.006	SW.13	15 Winter	2	+0%	30/180 Winter				65.217	-0.187
3.000	SW.22	15 Winter	2	+0%	100/15 Summer				66.411	-0.129
3.001	SW.21	15 Winter	2	+0%	100/240 Winter				66.299	-0.148
3.002	Wetland 2	30 Winter	2	+0%	100/180 Winter				66.168	-0.157
3.003	SW.20	30 Winter	2	+0%	100/120 Winter				66.108	-0.158
3.004	SW19	30 Winter	2	+0%	100/120 Winter				66.042	-0.149
3.005	SW.18	30 Winter	2	+0%	100/60 Winter				65.939	-0.158
4.000	SW.15	15 Winter	2	+0%	100/120 Winter				65.910	-0.333
5.000	SW.16	15 Winter	2	+0%	100/120 Winter				65.868	-0.316
3.006	SW.17	15 Winter	2	+0%	100/60 Winter				65.714	-0.306
1.007	RWH+Storage	360 Winter	2	+0%	2/15 Summer				63.623	0.698
1.008	SWPC	360 Winter	2	+0%	2/15 Summer				63.644	0.771
		US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded	
1.000	SW.08		0.000	0.15			3.0	OK		
1.001	SW.09		0.000	0.51			10.8	OK		
1.002	Wetland 1		0.000	0.86		7	11.6	OK		

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

PN	US/MH Name	Flooded		Half Drain		Pipe	Status	Level Exceeded
		Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)		
1.003	SW.10	0.000	0.51			12.3	OK	
1.004	Swale + Tank	0.000	0.48		19	6.3	OK	
1.005	SW.12	0.000	0.48			6.3	OK	
2.000	SW.14	0.000	0.08			17.9	OK	
1.006	SW.13	0.000	0.30			18.4	OK	
3.000	SW.22	0.000	0.37			12.3	OK	
3.001	SW.21	0.000	0.25			12.4	OK	
3.002	Wetland 2	0.000	0.20		16	6.3	OK	
3.003	SW.20	0.000	0.20			6.3	OK	
3.004	SW19	0.000	0.25			6.3	OK	
3.005	SW.18	0.000	0.19			6.2	OK	
4.000	SW.15	0.000	0.03			5.4	OK	
5.000	SW.16	0.000	0.06			9.3	OK	
3.006	SW.17	0.000	0.08			14.8	OK	
1.007	RWH+Storage	0.000	0.03			2.8	SURCHARGED	
1.008	SWPC	0.000	0.01			1.0	SURCHARGED	

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

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 Coefficient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		
Number of Input Hydrographs	0	Number of Offline Controls	0
Number of Online Controls	1	Number of Storage Structures	4
Number of Time/Area Diagrams	0	Number of Real Time Controls	0
Synthetic Rainfall Details			
Rainfall Model	FSR M5-60 (mm)	18.800 Cv (Summer)	0.750
Region	England and Wales	Ratio R	0.400 Cv (Winter)
Margin for Flood Risk Warning (mm)			300.0
Analysis Timestep	2.5 Second Increment (Extended)		
DTS Status			OFF
DVD Status			ON
Inertia Status			ON
Profile(s)			Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080		
Return Period(s) (years)			2, 30, 100
Climate Change (%)			0, 0, 40

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

									Water	Surcharged
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Level (m)	Depth (m)
1.000	SW.08	15 Winter	30	+0%	100/15 Summer				66.431	-0.095
1.001	SW.09	15 Winter	30	+0%	30/15 Summer				66.195	0.110
1.002	Wetland 1	15 Winter	30	+0%	30/15 Summer				66.060	0.110
1.003	SW.10	15 Winter	30	+0%	100/15 Summer				65.780	-0.045
1.004	Swale + Tank	600 Winter	30	+0%	30/240 Winter				65.705	0.155
1.005	SW.12	600 Winter	30	+0%	30/180 Winter				65.704	0.225
2.000	SW.14	15 Winter	30	+0%	100/120 Winter				66.014	-0.221
1.006	SW.13	600 Winter	30	+0%	30/180 Winter				65.704	0.300
3.000	SW.22	15 Winter	30	+0%	100/15 Summer				66.458	-0.082
3.001	SW.21	15 Winter	30	+0%	100/240 Winter				66.332	-0.115
3.002	Wetland 2	15 Winter	30	+0%	100/180 Winter				66.207	-0.118
3.003	SW.20	15 Winter	30	+0%	100/120 Winter				66.146	-0.120
3.004	SW19	15 Winter	30	+0%	100/120 Winter				66.088	-0.103
3.005	SW.18	15 Winter	30	+0%	100/60 Winter				65.976	-0.121
4.000	SW.15	15 Winter	30	+0%	100/120 Winter				65.925	-0.318
5.000	SW.16	15 Winter	30	+0%	100/120 Winter				65.892	-0.292
3.006	SW.17	15 Winter	30	+0%	100/60 Winter				65.746	-0.274
1.007	RWH+Storage	600 Winter	30	+0%	2/15 Summer				65.704	2.779
1.008	SWPC	600 Winter	30	+0%	2/15 Summer				65.703	2.830
			Flooded		Half Drain		Pipe			
	US/MH		Volume	Flow /	Overflow	Time	Flow		Level	
PN	Name		(m³)	Cap.	(l/s)	(mins)	(l/s)	Status	Exceeded	
	1.000	SW.08	0.000	0.28			5.6	OK		
	1.001	SW.09	0.000	1.09			23.1	SURCHARGED		
	1.002	Wetland 1	0.000	1.39		5	18.8	SURCHARGED		

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

PN	US/MH Name	Flooded		Half Drain		Pipe	Status	Level Exceeded
		Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)		
1.003	SW.10	0.000	0.82			19.6	OK	
1.004	Swale + Tank	0.000	0.20		209	2.6	SURCHARGED	
1.005	SW.12	0.000	0.20			2.6	SURCHARGED	
2.000	SW.14	0.000	0.15			34.0	OK	
1.006	SW.13	0.000	0.09			5.8	SURCHARGED	
3.000	SW.22	0.000	0.71			23.3	OK	
3.001	SW.21	0.000	0.48			23.5	OK	
3.002	Wetland 2	0.000	0.46		10	14.3	OK	
3.003	SW.20	0.000	0.44			14.2	OK	
3.004	SW19	0.000	0.57			14.1	OK	
3.005	SW.18	0.000	0.44			14.1	OK	
4.000	SW.15	0.000	0.06			10.2	OK	
5.000	SW.16	0.000	0.11			17.6	OK	
3.006	SW.17	0.000	0.16			30.7	OK	
1.007	RWH+Storage	0.000	0.06			5.5	SURCHARGED	
1.008	SWPC	0.000	0.01			1.0	SURCHARGED	

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

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 Coefficient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 4 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.800 Cv (Summer) 0.750
Region England and Wales Ratio R 0.400 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 40

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Surcharged	
									Level (m)	Depth (m)
1.000	SW.08	15 Winter	100	+40%	100/15 Summer				66.855	0.329
1.001	SW.09	15 Winter	100	+40%	30/15 Summer				66.745	0.660
1.002	Wetland 1	960 Winter	100	+40%	30/15 Summer				66.652	0.702
1.003	SW.10	960 Winter	100	+40%	100/15 Summer				66.651	0.826
1.004	Swale + Tank	960 Winter	100	+40%	30/240 Winter				66.650	1.100
1.005	SW.12	960 Winter	100	+40%	30/180 Winter				66.649	1.170
2.000	SW.14	960 Winter	100	+40%	100/120 Winter				66.649	0.414
1.006	SW.13	960 Winter	100	+40%	30/180 Winter				66.648	1.244
3.000	SW.22	960 Winter	100	+40%	100/15 Summer				66.649	0.109
3.001	SW.21	960 Winter	100	+40%	100/240 Winter				66.649	0.202
3.002	Wetland 2	960 Winter	100	+40%	100/180 Winter				66.649	0.324
3.003	SW.20	960 Winter	100	+40%	100/120 Winter				66.648	0.382
3.004	SW19	960 Winter	100	+40%	100/120 Winter				66.648	0.457
3.005	SW.18	960 Winter	100	+40%	100/60 Winter				66.648	0.551
4.000	SW.15	960 Winter	100	+40%	100/120 Winter				66.648	0.405
5.000	SW.16	960 Winter	100	+40%	100/120 Winter				66.648	0.464
3.006	SW.17	960 Winter	100	+40%	100/60 Winter				66.648	0.628
1.007	RWH+Storage	960 Winter	100	+40%	2/15 Summer				66.648	3.723
1.008	SWPC	960 Winter	100	+40%	2/15 Summer				66.648	3.775

PN	US/MH Name	Flooded		Half Drain	Pipe	Status	Level Exceeded
		Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)		
1.000	SW.08	0.000	0.52			10.3	FLOOD RISK
1.001	SW.09	0.000	1.99			42.1	FLOOD RISK
1.002	Wetland 1	0.000	0.23		814	3.1	FLOOD RISK