

Appendix F – Drainage Strategy

Appendix G – Greenfield Rates Calculations, Proposed Drainage Model Details and Results.

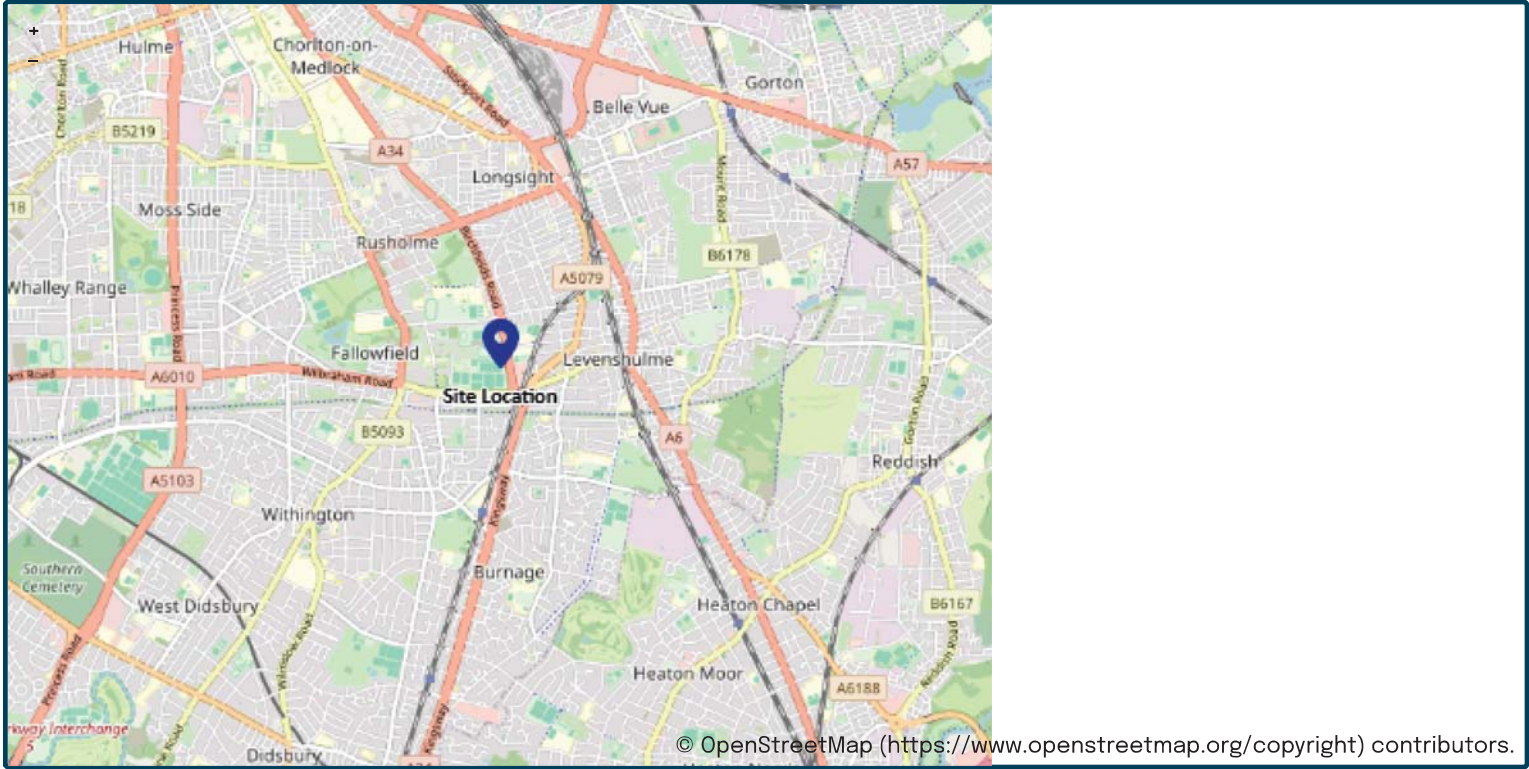
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Project details

Date	14/04/2025
Calculated by	Marta Wolska
Reference	087546
Model version	0.6.5

Location

Site name	Hawthorn
Site location	



Site easting	386347
Site northing	393958

Site details

Total site area (ha)	0.27	ha
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Greenfield runoff

Method

Method	IH124
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IH124

	<u>My value</u>	☐	<u>Map value</u>
SAAR (mm)	865 mm	☐	865
How should SPR be derived?	WRAP soil type		
WRAP soil type	4	☐	4
SPR	0.47	☐	0.47
QBar (IH124) (l/s)	1.7 l/s		

Growth curve factors

	<u>My value</u>	☐	<u>Map value</u>
Hydrological region	10	☐	10
1 year growth factor	0.87		
2 year growth factor	0.93		
10 year growth factor	1.38		
30 year growth factor	1.7		
100 year growth factor	2.08		
200 year growth factor	2.37		

Results

Method	IH124	
Flow rate 1 year (l/s)	1.5 l/s	
Flow rate 2 year (l/s)	1.6 l/s	
Flow rate 10 years (l/s)	2.3 l/s	
Flow rate 30 years (l/s)	2.8 l/s	
Flow rate 100 years (l/s)	3.5 l/s	
Flow rate 200 years (l/s)	4 l/s	

Disclaimer

This report was produced using the Greenfield runoff rate estimation tool (0.6.5) developed by HR Wallingford and available at uksuds.com (<https://www.uksubs.com/>).

The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at [uksuds.com/terms-conditions](https://www.uksubs.com/terms-conditions) (<https://www.uksubs.com/terms-conditions>). The outputs from this tool have been used to estimate Greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, Centre for Ecology and Hydrology, Wallingford Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	19.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.420	Preferred Cover Depth (m)	0.900
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
Rainfall Events	Singular	Skip Steady State	x
FSR Region	England and Wales	Drain Down Time (mins)	240
M5-60 (mm)	19.000	Additional Storage (m³/ha)	20.0
Ratio-R	0.420	Starting Level (m)	
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

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

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	45	0	0

Node EX MH1B Surcharged Outfall

Overrides Design Area	x	Depression Storage Area (m²)	0	Evapo-transpiration (mm/day)	0
Overrides Design Additional Inflow	x	Depression Storage Depth (mm)	0		

Applies to 30yr 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440 minute storms

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
0	1.300	300	1.300	600	1.300	900	1.300	1200	1.300
60	1.300	360	1.300	660	1.300	960	1.300	1260	1.300
120	1.300	420	1.300	720	1.300	1020	1.300	1320	1.300
180	1.300	480	1.300	780	1.300	1080	1.300	1380	1.300
240	1.300	540	1.300	840	1.300	1140	1.300	1440	1.300

Node S05 Online Hydro-Brake® Control

Flap Valve	✓	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	42.064	Product Number	CTL-SHE-0100-5000-1400-5000
Design Depth (m)	1.400	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	5.0	Min Node Diameter (mm)	1200

Node TANK Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	42.245
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	155.0	155.0	0.400	155.0	172.7	0.800	155.0	190.3
0.200	155.0	163.8	0.600	155.0	181.5	0.801	0.0	190.3

Node S08A Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	43.030	Slope (1:X)	21.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	4	Depth (m)	0.300
Safety Factor	2.0	Width (m)	4.800	Inf Depth (m)	
Porosity	0.30	Length (m)	23.000		

Node S04 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	43.400	Slope (1:X)	21.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.300
Safety Factor	2.0	Width (m)	5.000	Inf Depth (m)	
Porosity	0.30	Length (m)	16.000		

Node S09 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	43.250	Slope (1:X)	21.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.300
Safety Factor	2.0	Width (m)	4.800	Inf Depth (m)	
Porosity	0.30	Length (m)	7.000		

Node S10 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	43.420	Slope (1:X)	21.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.300
Safety Factor	2.0	Width (m)	4.800	Inf Depth (m)	
Porosity	0.30	Length (m)	7.000		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 15 minute summer	105.525	29.860	1 year 720 minute winter	5.033	2.007
1 year 15 minute winter	74.052	29.860	1 year 960 minute summer	6.151	1.620
1 year 30 minute summer	68.120	19.275	1 year 960 minute winter	4.074	1.620
1 year 30 minute winter	47.803	19.275	1 year 1440 minute summer	4.467	1.197
1 year 60 minute summer	45.726	12.084	1 year 1440 minute winter	3.002	1.197
1 year 60 minute winter	30.379	12.084	30 year 15 minute summer	258.728	73.211
1 year 120 minute summer	28.067	7.417	30 year 15 minute winter	181.564	73.211
1 year 120 minute winter	18.647	7.417	30 year 30 minute summer	167.191	47.309
1 year 180 minute summer	21.555	5.547	30 year 30 minute winter	117.327	47.309
1 year 180 minute winter	14.011	5.547	30 year 60 minute summer	110.635	29.238
1 year 240 minute summer	17.057	4.508	30 year 60 minute winter	73.503	29.238
1 year 240 minute winter	11.333	4.508	30 year 120 minute summer	66.436	17.557
1 year 360 minute summer	13.066	3.362	30 year 120 minute winter	44.138	17.557
1 year 360 minute winter	8.493	3.362	30 year 180 minute summer	50.139	12.902
1 year 480 minute summer	10.277	2.716	30 year 180 minute winter	32.591	12.902
1 year 480 minute winter	6.828	2.716	30 year 240 minute summer	39.089	10.330
1 year 600 minute summer	8.407	2.300	30 year 240 minute winter	25.970	10.330
1 year 600 minute winter	5.744	2.300	30 year 360 minute summer	29.190	7.512
1 year 720 minute summer	7.489	2.007	30 year 360 minute winter	18.974	7.512

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year 480 minute summer	22.671	5.991	100 year +45% CC 120 minute winter	84.170	33.481
30 year 480 minute winter	15.062	5.991	100 year +45% CC 180 minute summer	95.444	24.561
30 year 600 minute summer	18.372	5.025	100 year +45% CC 180 minute winter	62.041	24.561
30 year 600 minute winter	12.553	5.025	100 year +45% CC 240 minute summer	74.220	19.614
30 year 720 minute summer	16.235	4.351	100 year +45% CC 240 minute winter	49.310	19.614
30 year 720 minute winter	10.911	4.351	100 year +45% CC 360 minute summer	55.101	14.179
30 year 960 minute summer	13.158	3.465	100 year +45% CC 360 minute winter	35.817	14.179
30 year 960 minute winter	8.716	3.465	100 year +45% CC 480 minute summer	42.640	11.268
30 year 1440 minute summer	9.368	2.511	100 year +45% CC 480 minute winter	28.329	11.268
30 year 1440 minute winter	6.296	2.511	100 year +45% CC 600 minute summer	34.454	9.424
100 year +45% CC 15 minute summer	486.243	137.590	100 year +45% CC 600 minute winter	23.541	9.424
100 year +45% CC 15 minute winter	341.223	137.590	100 year +45% CC 720 minute summer	30.372	8.140
100 year +45% CC 30 minute summer	316.903	89.673	100 year +45% CC 720 minute winter	20.412	8.140
100 year +45% CC 30 minute winter	222.388	89.673	100 year +45% CC 960 minute summer	24.517	6.456
100 year +45% CC 60 minute summer	210.766	55.699	100 year +45% CC 960 minute winter	16.241	6.456
100 year +45% CC 60 minute winter	140.028	55.699	100 year +45% CC 1440 minute summer	17.352	4.650
100 year +45% CC 120 minute summer	126.691	33.481	100 year +45% CC 1440 minute winter	11.661	4.650

Results for 1 year Critical Storm Duration. Lowest mass balance: 97.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	RE7A	11	43.096	0.016	0.4	0.0015	0.0000	OK
15 minute winter	S07	10	43.079	0.030	2.2	0.0148	0.0000	OK
15 minute winter	S08A	11	42.709	0.059	3.8	0.0266	0.0000	OK
15 minute winter	S08	11	42.690	0.058	4.0	0.0119	0.0000	OK
15 minute winter	S09	11	42.653	0.067	6.0	0.0300	0.0000	OK
15 minute winter	RE16A	10	43.219	0.039	2.2	0.0173	0.0000	OK
15 minute winter	S16	10	43.083	0.019	2.1	0.0031	0.0000	OK
15 minute winter	S10	11	42.548	0.102	10.1	0.0390	0.0000	OK
15 minute winter	S01	10	43.519	0.039	2.6	0.0203	0.0000	OK
15 minute winter	S02	11	43.277	0.039	2.5	0.0447	0.0000	OK
15 minute winter	S14	10	43.343	0.033	1.9	0.0140	0.0000	OK
15 minute winter	S15	11	43.154	0.043	2.9	0.0068	0.0000	OK
15 minute winter	RE3A	10	43.882	0.032	1.6	0.0107	0.0000	OK
15 minute winter	S03	11	42.344	0.064	7.0	0.0728	0.0000	OK
30 minute winter	TANK	27	42.291	0.046	12.7	6.7271	0.0000	OK
15 minute winter	RE4A	10	43.184	0.034	1.8	0.0123	0.0000	OK
15 minute winter	S04	13	42.322	0.088	11.9	0.1559	0.0000	OK
15 minute winter	S11	10	44.062	0.042	2.6	0.0219	0.0000	OK
15 minute winter	S12	10	43.876	0.023	2.5	0.0037	0.0000	OK
15 minute winter	S18	11	43.167	0.017	0.5	0.0041	0.0000	OK
15 minute winter	S13	11	43.159	0.051	4.2	0.0155	0.0000	OK
15 minute winter	S05	12	42.326	0.262	11.3	0.2967	0.0000	OK
15 minute winter	S06	13	42.057	0.045	4.6	0.0505	0.0000	OK
15 minute winter	EX MH1B	13	41.901	0.044	4.6	0.0000	0.0000	OK
Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	RE7A	1.000	S07	0.4	0.240	0.023	0.0054	
15 minute winter	S07	1.001	S08A	2.2	0.497	0.088	0.0927	
15 minute winter	S08A	1.002	S08	3.7	0.582	0.254	0.0174	
15 minute winter	S08	1.003	S09	4.0	0.576	0.276	0.0475	
15 minute winter	S09	1.004	S10	6.0	0.597	0.417	0.2103	
15 minute winter	RE16A	2.000	S16	2.1	0.899	0.121	0.0287	
15 minute winter	S16	2.001	S10	2.1	0.346	0.035	0.0371	
15 minute winter	S10	1.005	S04	10.2	0.844	0.703	0.0850	
15 minute winter	S01	3.000	S02	2.5	0.705	0.143	0.0873	
15 minute winter	S02	3.001	S03	2.5	0.698	0.142	0.0351	
15 minute winter	S14	4.000	S15	1.9	0.551	0.105	0.0692	
15 minute winter	S15	4.001	S03	2.9	0.723	0.164	0.0304	
15 minute winter	RE3A	6.000	S03	1.6	0.605	0.089	0.0134	
15 minute winter	S03	3.002	TANK	7.0	1.341	0.110	0.0649	
15 minute winter	TANK	3.003	S04	-10.1	-1.100	-0.159	0.0324	
15 minute winter	RE4A	7.000	S04	1.8	0.622	0.100	0.0131	
15 minute winter	S04	1.006	S05	7.1	0.355	0.111	2.0472	
15 minute winter	S11	8.000	S12	2.5	0.907	0.143	0.0480	
15 minute winter	S12	8.001	S13	2.5	0.747	0.051	0.0344	
15 minute summer	S18	9.000	S13	0.5	0.177	0.028	0.0134	
15 minute winter	S13	8.002	S05	4.2	0.810	0.238	0.0708	
15 minute winter	S05	1.007	S06	4.6	0.714	0.042	0.0341	
15 minute winter	S06	1.008	EX MH1B	4.6	0.724	0.046	0.1216	9.8

Results for 1 year Critical Storm Duration. Lowest mass balance: 97.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
15 minute winter	RE17A	10	44.028	0.028	1.1	0.0064	0.0000	OK
15 minute winter	S17	10	43.903	0.013	1.1	0.0021	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
15 minute winter	RE17A	5.000	S17	1.1	0.741	0.060	0.0164	
15 minute winter	S17	5.001	S15	1.0	0.471	0.016	0.0144	

Results for 30 year Critical Storm Duration. Lowest mass balance: 97.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	RE7A	10	43.104	0.024	1.0	0.0023	0.0000	OK
15 minute winter	S07	10	43.096	0.047	5.3	0.0230	0.0000	OK
15 minute winter	S08A	12	42.852	0.202	9.2	0.0905	0.0000	SURCHARGED
15 minute winter	S08	12	42.841	0.209	8.5	0.0431	0.0000	SURCHARGED
15 minute winter	S09	12	42.818	0.232	12.9	0.1033	0.0000	SURCHARGED
15 minute winter	RE16A	10	43.242	0.062	5.3	0.0275	0.0000	OK
15 minute winter	S16	10	43.094	0.030	5.2	0.0047	0.0000	OK
960 minute winter	S10	960	42.711	0.265	1.5	0.1017	0.0000	SURCHARGED
15 minute winter	S01	10	43.543	0.063	6.3	0.0327	0.0000	OK
15 minute winter	S02	11	43.303	0.065	6.2	0.0730	0.0000	OK
15 minute winter	S14	10	43.362	0.052	4.7	0.0222	0.0000	OK
15 minute winter	S15	11	43.182	0.071	7.3	0.0113	0.0000	OK
15 minute winter	RE3A	10	43.902	0.052	4.0	0.0175	0.0000	OK
960 minute winter	S03	1095	42.711	0.431	1.1	0.4874	0.0000	SURCHARGED
960 minute winter	TANK	1125	42.711	0.466	3.3	68.6039	0.0000	SURCHARGED
15 minute winter	RE4A	10	43.204	0.054	4.3	0.0198	0.0000	OK
960 minute winter	S04	1110	42.711	0.477	2.4	0.8427	0.0000	SURCHARGED
15 minute winter	S11	10	44.087	0.067	6.3	0.0351	0.0000	OK
15 minute winter	S12	10	43.889	0.036	6.2	0.0057	0.0000	OK
15 minute winter	S18	11	43.195	0.045	1.3	0.0107	0.0000	OK
15 minute winter	S13	11	43.195	0.087	10.3	0.0261	0.0000	OK
960 minute winter	S05	945	42.711	0.647	0.7	0.7320	0.0000	SURCHARGED
960 minute winter	S06	1200	42.712	0.700	0.1	0.7913	0.0000	SURCHARGED
15 minute summer	EX MH1B	1	43.157	1.300	0.0	0.0000	0.0000	OK
Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	RE7A	1.000	S07	1.0	0.309	0.055	0.0101	
15 minute winter	S07	1.001	S08A	5.2	0.581	0.211	0.2303	
15 minute winter	S08A	1.002	S08	7.9	0.665	0.547	0.0484	
15 minute winter	S08	1.003	S09	8.7	0.625	0.605	0.1205	
15 minute winter	S09	1.004	S10	13.0	0.738	0.899	0.3665	
15 minute winter	RE16A	2.000	S16	5.2	1.154	0.295	0.0541	
15 minute winter	S16	2.001	S10	5.2	0.431	0.085	0.0532	
15 minute winter	S10	1.005	S04	22.1	1.259	1.532	0.1208	
15 minute winter	S01	3.000	S02	6.2	0.882	0.351	0.1715	
15 minute winter	S02	3.001	S03	6.2	0.885	0.348	0.0680	
15 minute winter	S14	4.000	S15	4.6	0.683	0.261	0.1351	
15 minute winter	S15	4.001	S03	7.2	0.914	0.405	0.0595	
15 minute winter	RE3A	6.000	S03	4.0	0.775	0.223	0.0264	
15 minute winter	S03	3.002	TANK	17.8	1.594	0.278	0.2969	
15 minute winter	TANK	3.003	S04	-33.2	-1.861	-0.520	0.1130	
15 minute winter	RE4A	7.000	S04	4.3	0.784	0.240	0.0250	
15 minute summer	S04	1.006	S05	11.5	0.390	0.181	2.5957	
15 minute winter	S11	8.000	S12	6.2	1.161	0.351	0.0912	
15 minute winter	S12	8.001	S13	6.2	0.917	0.125	0.0673	
15 minute summer	S18	9.000	S13	1.5	0.214	0.083	0.0300	
15 minute winter	S13	8.002	S05	10.3	1.014	0.583	0.1385	
15 minute summer	S05	1.007	S06	5.3	0.645	0.047	0.3688	
15 minute summer	S06	1.008	EX MH1B	0.0	0.000	0.000	1.3348	0.0

Results for 30 year Critical Storm Duration. Lowest mass balance: 97.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
15 minute winter	RE17A	10	44.043	0.043	2.7	0.0100	0.0000	OK
15 minute winter	S17	10	43.911	0.021	2.7	0.0033	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
15 minute winter	RE17A	5.000	S17	2.7	0.966	0.149	0.0313	
15 minute winter	S17	5.001	S15	2.6	0.582	0.040	0.0284	

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 97.98%

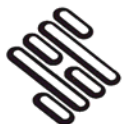
Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	RE7A	12	43.369	0.289	3.0	0.0284	0.0000	SURCHARGED
15 minute winter	S07	12	43.369	0.320	9.4	0.1574	0.0000	SURCHARGED
15 minute winter	S08A	12	43.331	0.681	16.1	0.7069	0.0000	FLOOD RISK
15 minute winter	S08	12	43.308	0.676	13.8	0.1393	0.0000	FLOOD RISK
15 minute winter	S09	12	43.262	0.676	19.7	0.3045	0.0000	SURCHARGED
15 minute winter	RE16A	10	43.269	0.089	10.0	0.0395	0.0000	OK
15 minute winter	S16	10	43.105	0.041	9.9	0.0065	0.0000	OK
15 minute winter	S10	11	42.963	0.517	37.0	0.1986	0.0000	SURCHARGED
15 minute winter	S01	10	43.572	0.092	11.9	0.0482	0.0000	OK
15 minute winter	S02	11	43.334	0.096	11.7	0.1082	0.0000	OK
15 minute winter	S14	10	43.384	0.074	8.8	0.0314	0.0000	OK
15 minute winter	S15	11	43.218	0.107	13.6	0.0171	0.0000	OK
15 minute winter	RE3A	10	43.924	0.074	7.5	0.0252	0.0000	OK
120 minute winter	S03	118	42.664	0.384	10.3	0.4344	0.0000	SURCHARGED
120 minute winter	TANK	118	42.664	0.419	26.9	61.7155	0.0000	SURCHARGED
15 minute winter	RE4A	10	43.229	0.079	8.1	0.0287	0.0000	OK
120 minute winter	S04	118	42.664	0.430	18.4	0.7599	0.0000	SURCHARGED
15 minute winter	S11	10	44.119	0.099	11.9	0.0513	0.0000	OK
15 minute winter	S12	10	43.903	0.050	11.8	0.0079	0.0000	OK
15 minute winter	S18	11	43.281	0.131	2.5	0.0307	0.0000	OK
15 minute winter	S13	11	43.280	0.172	19.1	0.0517	0.0000	SURCHARGED
120 minute winter	S05	116	42.663	0.599	6.4	0.6777	0.0000	SURCHARGED
30 minute winter	S06	67	42.058	0.046	5.0	0.0524	0.0000	OK
30 minute winter	EX MH1B	67	41.902	0.045	5.0	0.0000	0.0000	OK
Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	RE7A	1.000	S07	2.7	0.403	0.153	0.0546	
15 minute winter	S07	1.001	S08A	9.0	0.626	0.364	0.3653	
15 minute winter	S08A	1.002	S08	13.3	0.754	0.919	0.0484	
15 minute winter	S08	1.003	S09	15.2	0.862	1.049	0.1205	
15 minute winter	S09	1.004	S10	20.6	1.172	1.427	0.3665	
15 minute winter	RE16A	2.000	S16	9.9	1.359	0.558	0.0856	
15 minute winter	S16	2.001	S10	9.9	0.765	0.161	0.0569	
15 minute winter	S10	1.005	S04	36.5	2.075	2.527	0.1231	
15 minute winter	S01	3.000	S02	11.7	1.013	0.661	0.2809	
15 minute winter	S02	3.001	S03	11.6	1.026	0.654	0.1103	
15 minute winter	S14	4.000	S15	8.7	0.783	0.489	0.2194	
15 minute winter	S15	4.001	S03	13.4	1.049	0.754	0.0965	
15 minute winter	RE3A	6.000	S03	7.4	0.907	0.418	0.0423	
15 minute winter	S03	3.002	TANK	32.5	1.703	0.509	0.6611	
15 minute winter	TANK	3.003	S04	-55.7	-1.945	-0.874	0.2181	
15 minute winter	RE4A	7.000	S04	8.0	0.918	0.452	0.0402	
15 minute winter	S04	1.006	S05	-13.8	0.418	-0.217	3.5456	
15 minute winter	S11	8.000	S12	11.8	1.356	0.662	0.1452	
15 minute winter	S12	8.001	S13	11.7	1.008	0.237	0.1109	
15 minute winter	S18	9.000	S13	2.7	0.213	0.150	0.0717	
15 minute winter	S13	8.002	S05	18.9	1.106	1.067	0.2269	
30 minute summer	S05	1.007	S06	5.0	0.727	0.045	0.0361	
30 minute winter	S06	1.008	EX MH1B	5.0	0.740	0.050	0.1282	63.5

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 97.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
15 minute winter	RE17A	10	44.060	0.060	5.0	0.0139	0.0000	OK
15 minute winter	S17	10	43.918	0.028	4.9	0.0044	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
15 minute winter	RE17A	5.000	S17	4.9	1.149	0.278	0.0488	
15 minute winter	S17	5.001	S15	4.9	0.650	0.075	0.0460	

Appendix H – CBR and Soakaway Test Results.



STRUCTURAL SOILS LTD
INSITU TESTING REPORT



1774

Report No. 785764R.01(00)

Office Location: Castleford

Date	01-September-2025	Contract:	Hawthorn Medical Centre, Manchester
Client	Curtins Consulting Limited		
Address	51-55 Tithebarn Street, Liverpool, L2 2SB		

For the Attention of: Rebecca Baksh-Jones

Order received	24-April-2025	Client Reference	None
Testing Started	27-August-2025	Client Order No.	None
Testing Completed	28-August-2025	Instruction Type	Written

Tests marked 'Not UKAS Accredited' in this report are not included in the UKAS Accreditation Schedule for our Laboratory.

UKAS Accredited Tests

- * 5 no. Insitu CBR Test in accordance with BS1377:Part 9:1990, Clause 4.3

Not UKAS Accredited Tests

- * 2 no. Soakaway Testing to BRE Digest 365
- Please note that 3 fills in each pit was not achievable due to time constraints/ground conditions

The results represent the ground conditions at the specified locations and depths at the time of testing.

Please Note: Remaining samples will be retained for a period of one month from today and will then be disposed of .

Test were undertaken on samples 'as received' unless otherwise stated.

Opinions and interpretations expressed in this report are outside the scope of accreditation for this laboratory.

Results relate only to items tested

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Structural Soils Ltd, The Potteries, Pottery Street, Castleford, WF10 1NJ Tel.01977552255, email Matthew Doran, matthew.doran@soils.co.uk

TESTING VERIFICATION CERTIFICATE



1774

The test results included in this report are certified as:-

ISSUE STATUS: **FINAL**

In accordance with the Structural Soils Ltd Laboratory Quality Management System, results sheets and summaries of results issued by the laboratory are checked by an approved signatory. The integrity of the test data and results are ensured by control of the computer system employed by the laboratory as part of the Software Verification Program as detailed in the Laboratory Quality Manual.

This testing verification certificate covers all testing compiled on or before the following datetime: **01/09/2025 09:36:40**.

Testing reported after this date is not covered by this Verification Certificate.



Approved Signatory
Matthew Doran (Site Testing Manager)

(Head Office)
Bristol Laboratory
Unit 1A, Princess Street
Bedminster
Bristol
BS3 4AG

Castleford Laboratory
The Potteries, Pottery Street
Castleford
West Yorkshire
WF10 1NJ

Hemel Laboratory
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT



**STRUCTURAL
SOILS LTD**

Contract:

**Hawthorn Medical Centre,
Manchester**

Job No:

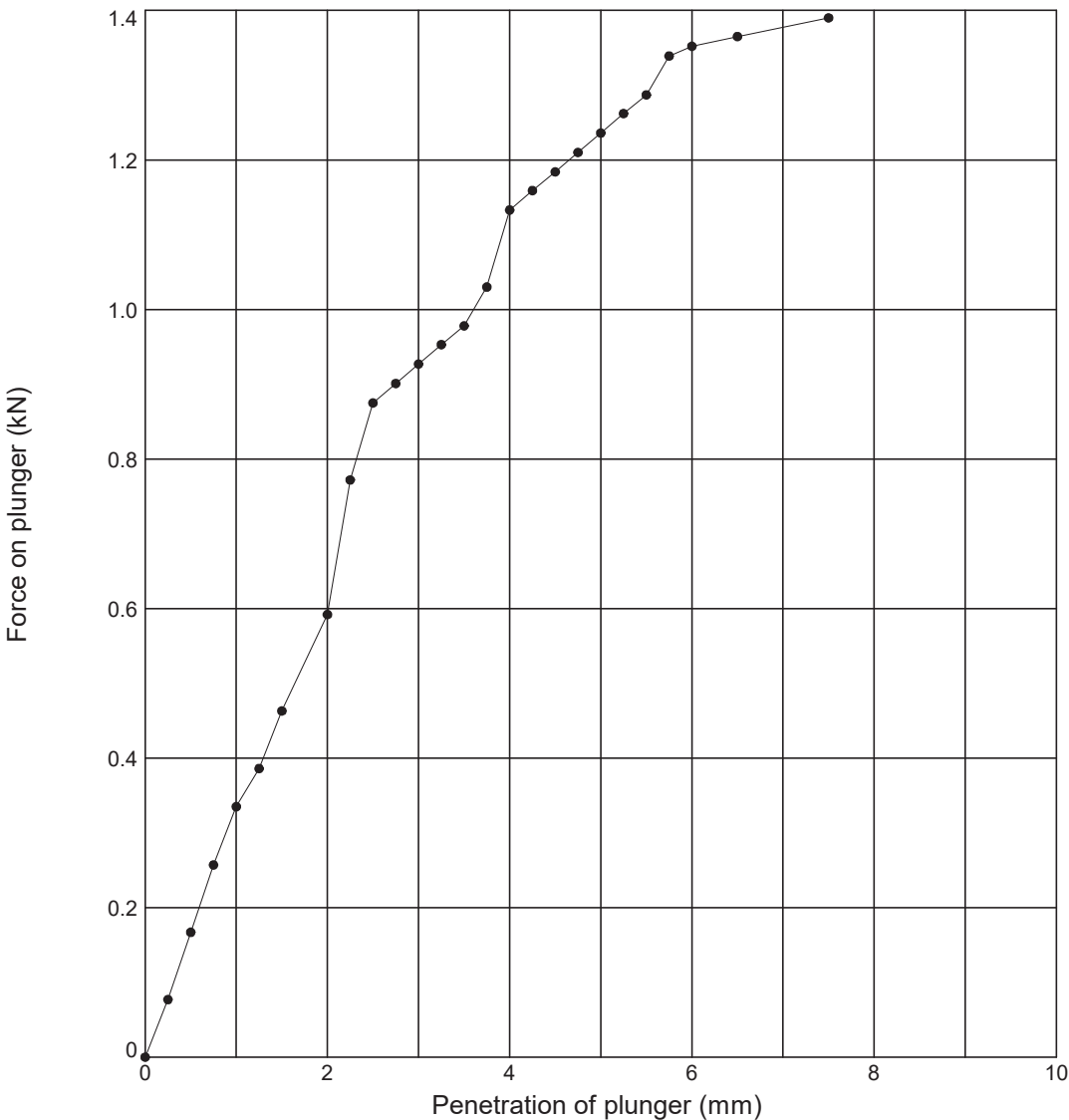
785764



IN SITU CALIFORNIA BEARING RATIO TEST

In accordance with BS1377:Part 9:1990

Position Ref: CBR01 Depth (m): 0.20 Date: 28/08/25



Test Details	Test Conditions	Test Results
Kentledge : Toyota Hilux Surcharge (kg) : 4.52 Surcharge Pressure (kPa) : 1	Weather : Fine Temperature (°C) : 16	CBR Value (%) : 6.6 Moisture Content (%) : 5.4
Sample Description	Test Notes	
Dark reddish brown gravelly SAND	Estimated particles >20 mm (%) : 5 Size and position of particles >20mm in relation to the plunger : Unknown	

 STRUCTURAL SOILS The Potteries Pottery Street Castleford W. Yorkshire WF10 1NJ	Compiled By	Date
		MATTHEW DORAN 01/09/25
	Contract Hawthorn Medical Centre, Manchester	Contract Ref: 785764 

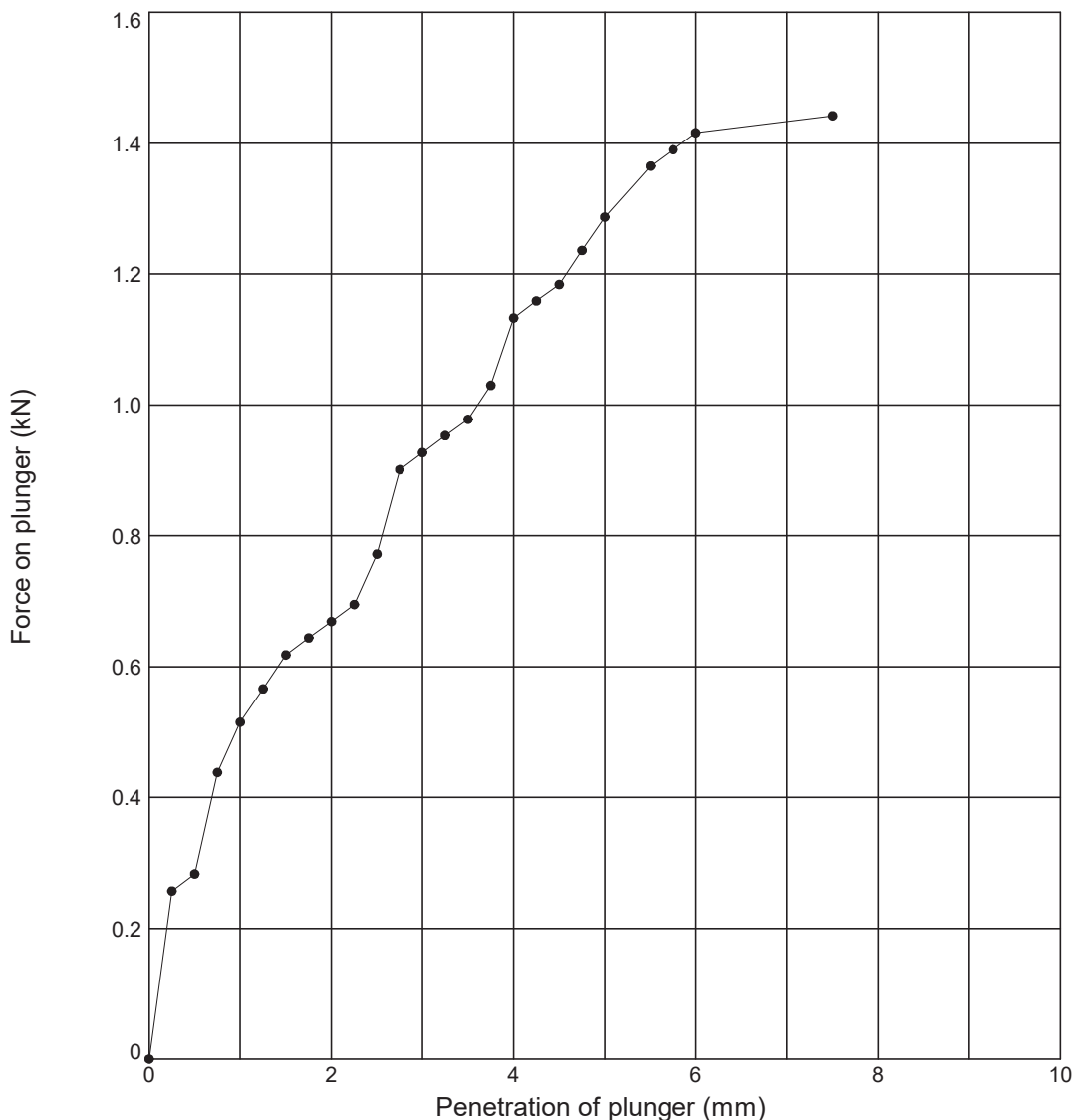
IN SITU CALIFORNIA BEARING RATIO TEST

In accordance with BS1377:Part 9:1990

Position Ref: **CBR02**

Depth (m): **0.19**

Date: **28/08/25**



Test Details	Test Conditions	Test Results
Kentledge : Toyota Hilux Surcharge (kg) : 4.52 Surcharge Pressure (kPa) : 1	Weather : Temperature (°C) : 10	CBR Value (%) : 6.4 Moisture Content (%) : 11
Sample Description	Test Notes	
Dark brown slightly clayey SAND with rootlets	Estimated particles >20 mm (%) : 0 Size and position of particles >20mm in relation to the plunger : Unknown	



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Compiled By		Date
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Contract	Contract Ref:	
Hawthorn Medical Centre, Manchester	785764	



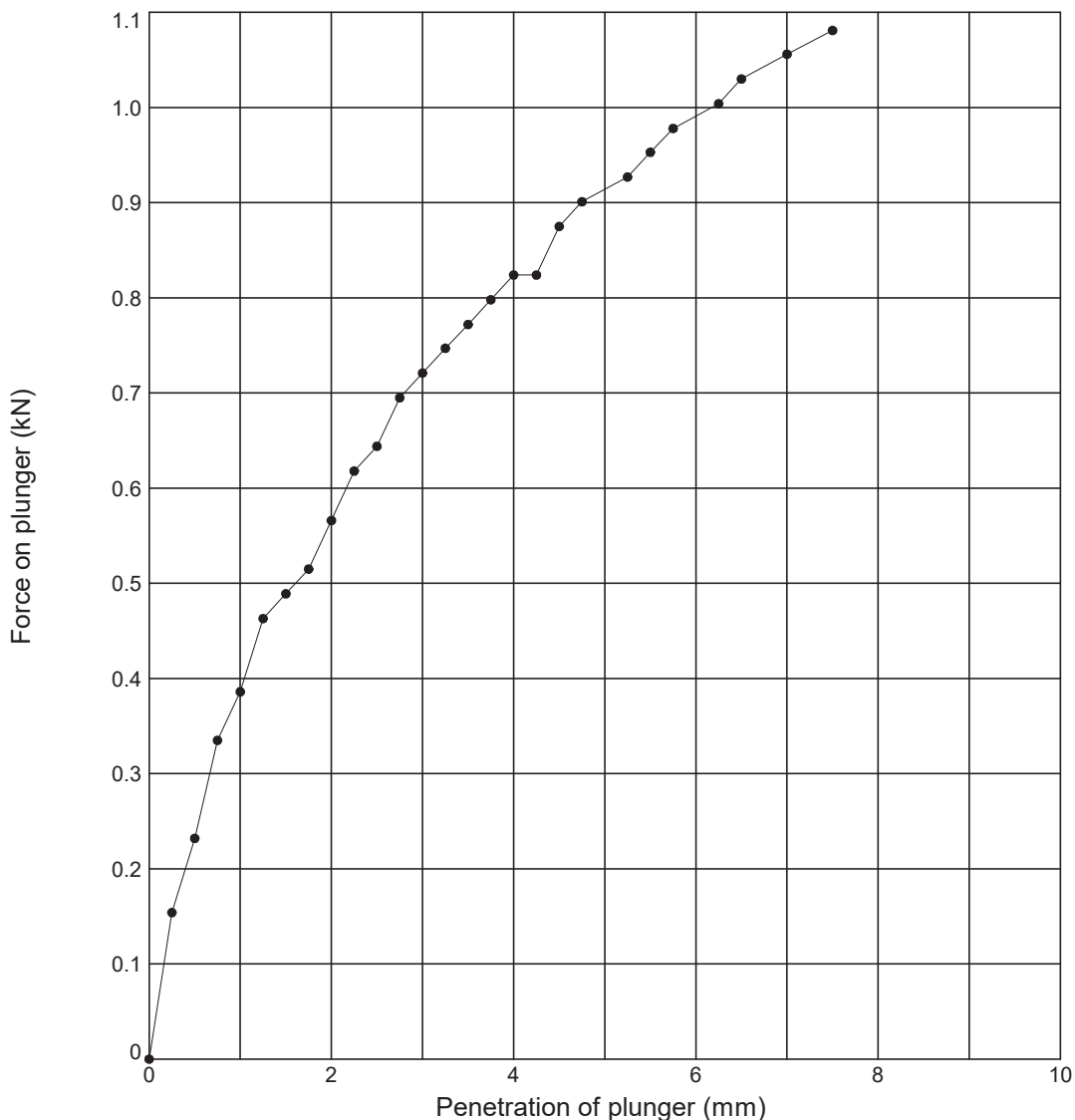
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In accordance with BS1377:Part 9:1990

Position Ref: **CBR03**

Depth (m): **0.19**

Date: **28/08/25**



Test Details	Test Conditions	Test Results
Kentledge : Toyota Hilux Surcharge (kg) : 4.52 Surcharge Pressure (kPa) : 1	Weather : Fine Temperature (°C) : 18	CBR Value (%) : 4.9 Moisture Content (%) : 11
Sample Description	Test Notes	
Dark grey brown very gravelly SAND	Estimated particles >20 mm (%) : 0 Size and position of particles >20mm in relation to the plunger : Unknown	



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Compiled By		Date
	MATTHEW DORAN	01/09/25
Contract		Contract Ref:
Hawthorn Medical Centre, Manchester		785764
		

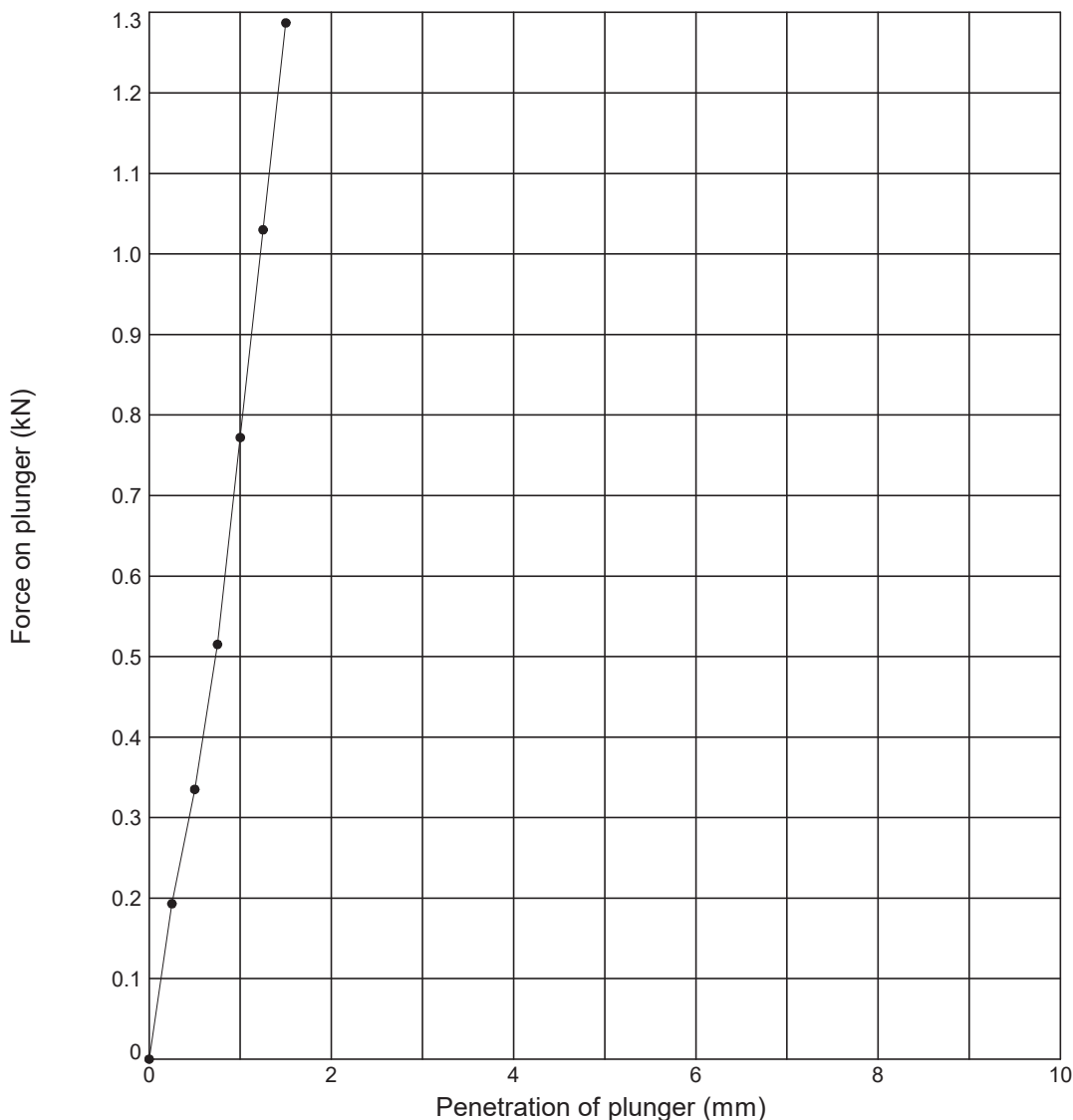
IN SITU CALIFORNIA BEARING RATIO TEST

In accordance with BS1377:Part 9:1990

Position Ref: **CBR04**

Depth (m): **0.19**

Date: **28/08/25**



Test Details	Test Conditions	Test Results
Kentledge : Toyota Hilux Surcharge (kg) : 4.52 Surcharge Pressure (kPa) : 1	Weather : Fine Temperature (°C) : 18	CBR Value (%) : 11 Moisture Content (%) : 8.2
Sample Description	Test Notes	
Dark red gravelly SAND	Estimated particles >20 mm (%) : 5 Size and position of particles >20mm in relation to the plunger : Unknown Remarks : Test stopped prematurely due to limits of equipment being reached.	



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Compiled By		Date
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Contract	MATTHEW DORAN Hawthorn Medical Centre, Manchester	
Contract Ref:		785764 

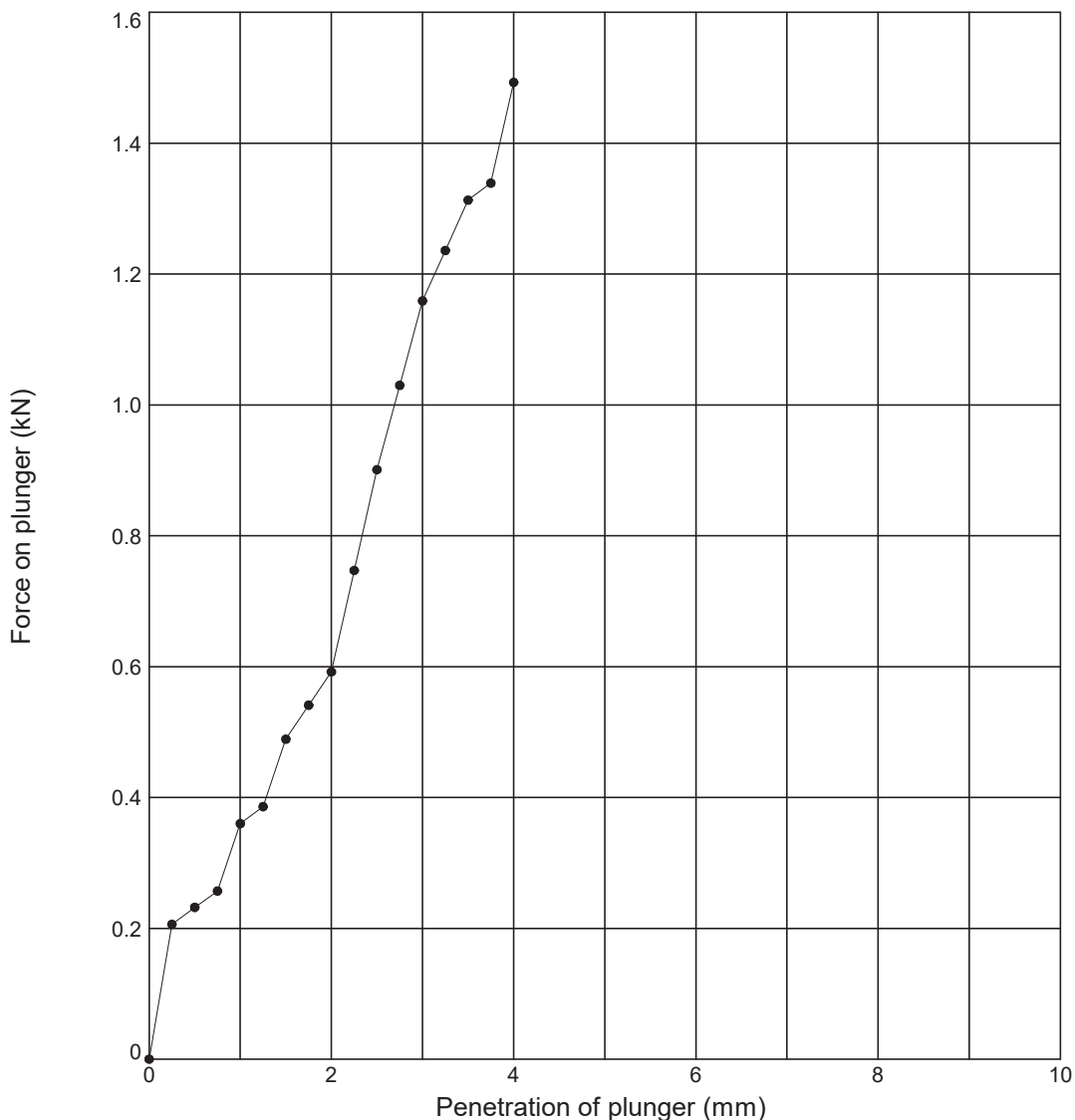
IN SITU CALIFORNIA BEARING RATIO TEST

In accordance with BS1377:Part 9:1990

Position Ref: **CBR05**

Depth (m): **0.19**

Date: **28/08/25**



Test Details	Test Conditions	Test Results
Kentledge : Toyota Hilux Surcharge (kg) : 4.52 Surcharge Pressure (kPa) : 1	Weather : Fine Temperature (°C) : 18	CBR Value (%) : 8.5 Moisture Content (%) : 11
Sample Description	Test Notes	
Dark reddish grey sandy GRAVEL	Estimated particles >20 mm (%) : 0 Size and position of particles >20mm in relation to the plunger : Unknown Remarks : Test stopped prematurely due to limits of equipment being reached.	



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Compiled By		Date
[Redacted]		01/09/25
Contract	MATTHEW DORAN Hawthorn Medical Centre, Manchester	
Contract Ref:		785764

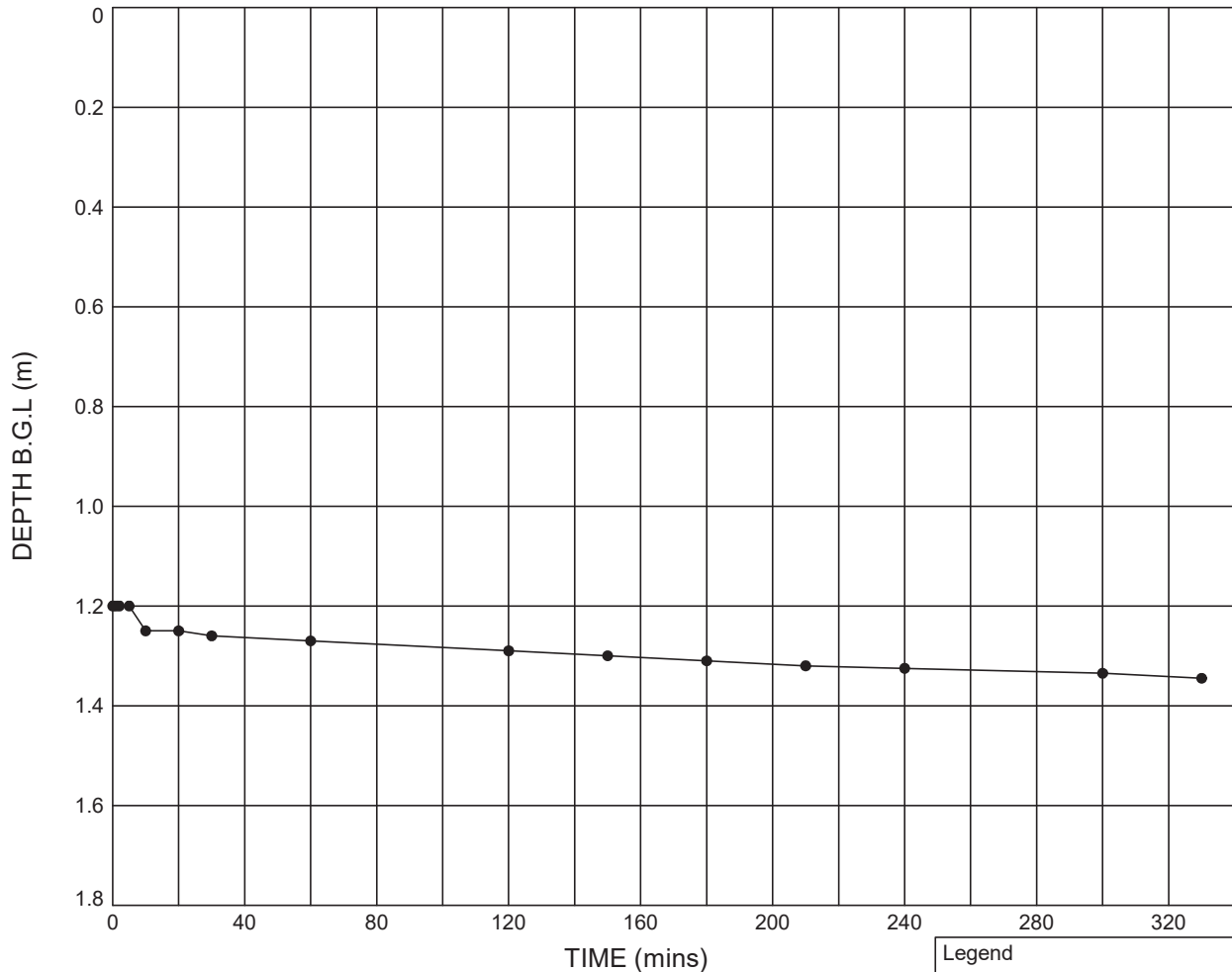


FULL SCALE SOAKAWAY TEST

Non-standard test

Soakaway Test - Position ID : **SA01**

PLOT OF DEPTH OF WATER BELOW GROUND LEVEL AGAINST TIME



Test 1

Pit start depth: = **1.70** m

Pit final depth: = **1.70** m

Effective depth, D_e = **0.50** m

Effective storage volume, V_{p75-25} = **0.2975** m³

Surface area, a_{s50} = **2.3900** m²

Time, t_{p75-25} = **N/A** secs

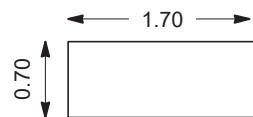
Infiltration rate, f = **N/A** m/s

Notes: Test 1 - Unable to calculate infiltration rate due to insufficient drop in water level.

Legend

● Test 1 (27.08.25)

Plan (Not to scale)



No Bearing Taken



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Pottery Street
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Compiled By

Date

Checked By

Date

27/08/25

27/08/25

Contract

**Hawthorn Medical Centre,
Manchester**

Contract Ref:

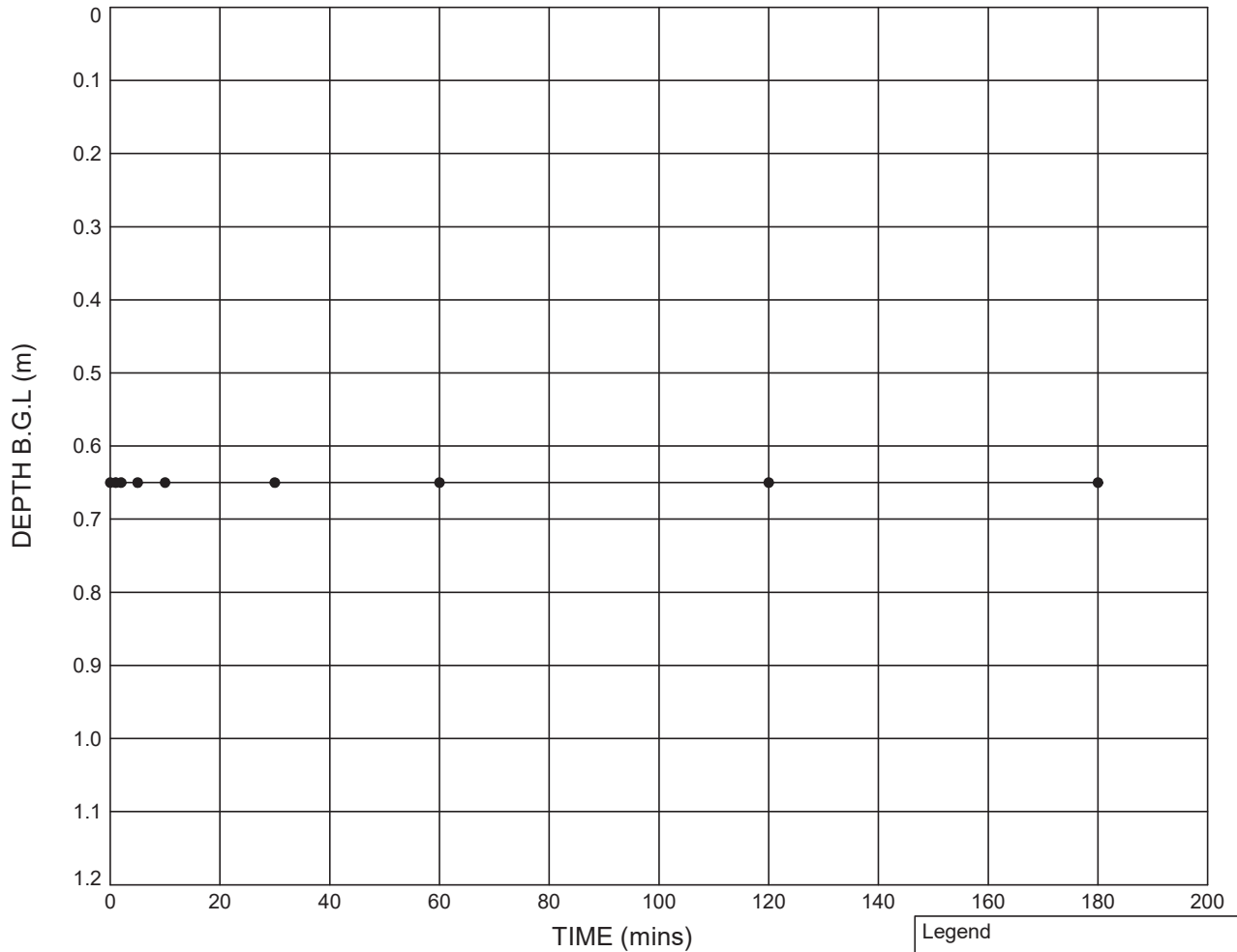
785764

FULL SCALE SOAKAWAY TEST

Non-standard test

Soakaway Test - Position ID : **SA02**

PLOT OF DEPTH OF WATER BELOW GROUND LEVEL AGAINST TIME



Test 1

Pit start depth: = **1.10** m

Pit final depth: = **1.10** m

Effective depth, D_e = **0.45** m

Effective storage volume, V_{p75-25} = **2.8800** m³

Surface area, a_{s50} = **2.3600** m²

Time, t_{p75-25} = **N/A** secs

Infiltration rate, f = **N/A** m/s

Notes: Test 1 - Unable to calculate infiltration rate due to insufficient drop in water level.

Legend

● Test 1 (27.08.25)

Plan (Not to scale)

1.60

0.80

No Bearing Taken



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Compiled By	Date	Checked By	Date
[REDACTED]	27/08/25	[REDACTED]	27/08/25
Contract Hawthorn Medical Centre, Manchester		Contract Ref: 785764	