

BROWN STREET, LITTLEBOROUGH GREATER MANCHESTER

SOAKAWAY TEST REPORT

Job Number: FRA 21 1052

Date: May 2021

Client: Fred Veers



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Document Verification

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Report Title	Soakaway Test Report		
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Date Issued	May 2021	Report Version	R0
Prepared By	Matthew Craig – Environmental Scientist	Signature	
Reviewed By	Mark Jones – Associate	Signature	

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Figure 2: Trial Pit Location Plan

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1 INTRODUCTION

LK Consult Ltd (LKC) has been commissioned by Fred Veers to carry out Infiltration Testing on land at Brown Street, Littleborough. The investigation was undertaken to provide factual information on the infiltration characteristics of the shallow sub-surface soil.

A summary of the site details is presented in Table 1-1 below. Figures 1 and 2 indicate the study area location and boundary.

Site Details	
Location	West of Brown Street, Littleborough, Greater Manchester, OL15 8BW. Centred at approximate National Grid Reference 393522E 416427N.
Area	Approximately 0.42ha.
Topography	Approximately 150m in the north, falling to approximately 148m in the southwest. Site is sloping down gently to the southwest.
Current Land Use	<u>Site</u> Hardstood concrete and gravel yard with industrial buildings. <u>Surrounding Area/ Boundary Treatment</u> North: Parkland. East: Residential area. South: Residential area. West: Industrial area.
Proposed Development	Residential development with provision for soft landscaping and car parking.

Table 1-1. Summary of the study area details.

The following work has previously been undertaken at the site:

- » Flood Risk Assessment (FRA) report, undertaken by LKC (Ref: FRA 20 1133, dated April 2020).

This report should be read in conjunction with the previous reports.

2 GROUND INVESTIGATION

The ground investigation works were carried out on 9th April 2021 and comprised the following:

- Two machine-excavated trial pits (ref. TP1, TP2) to depths of 2 metres below ground level (mbgl).
- Logging of arisings in line accordance with BS5930¹.
- Infiltration tests carried out in both trial pits, in accordance with the guidance given in BRE 365².

All logs are provided in Appendix A and testing locations are shown on Figure 2.

¹BS 5930:2015. "Code of Practice for Ground Investigations".

² BRE Digest 365 1991. "Soakaway Design".

3 GROUND CONDITIONS

The ground at TP1 (north of site) was excavated as Made Ground comprised of medium-dense dark brown clayey Sand with frequent rootlets, brick and ash to 0.5m, loose brown gravelly sandy clayey Silt with low cobble content to 1.30m, very soft light brown sandy silty Clay in gravel matrix with bands of light brown firm Clay to 1.40m, and firm light brown Clay in gravel and cobble matrix to 2.00m.

The ground at TP2 (south of site) was excavated as Made Ground comprised of loose black clayey Sand with rootlets, frequent brick, occasional plastic and metal fragments, ash and large concrete blocks to 1.10m, and soft mid-brown slightly gravelly sandy silty Clay with bands of light brown firm Clay to 2.00m.

4 RESULTS AND ANALYSIS

The results of the infiltration tests are presented in Appendix B and summarised in Table 4-1.

BRE 365 indicates that the calculation of the soil infiltration rate is made from the time taken for the water level to fall from 75% to 25% effective storage depth in each pit.

$$\text{Soil infiltration rate, } f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

Where:

V_{p75-25} = the effective storage volume of water in the trial pit between 75% and 25% effective depth.

a_{p50} = the internal surface area of the trial pit up to 50% effective depth including the base area.

t_{p75-25} = the time for the water level to fall from 75% to 25% effective depth.

TP	Strata at Test Level	Test No.	Time for outflow between 75% and 25% (mins/secs)	Soil infiltration rate (m/s)
TP1	Sandy Silty Clay	1	10:59	8.04×10^{-5}
		2	13:25	6.57×10^{-5}
		3	15:37	5.69×10^{-5}
TP2	Sandy Silty Clay	1	20:13	4.38×10^{-5}
		2	34:13	2.59×10^{-5}
		3	33:20	2.66×10^{-5}

Table 4-1: Summary of soakaway tests and permeability.

Both trial pits were gravel-filled, and the tests were undertaken at a depth of 1mbgl.

In TP1 (northern site), the water soaked away between 25% and 75% of the depth within 10 minutes 59 seconds in the first test; 13 minutes 25 seconds in the second test; and 15 minutes 37 seconds in the third test. Taking the third test as the final reading, this gives an infiltration rate of **5.69×10^{-5} m/s.**

In TP2 (southern site), the water soaked away between 25% and 75% of the depth within 20 minutes 13 seconds in the first test; 34 minutes 13 seconds in the second test; and 33 minutes 20 seconds in the third test. Taking the third test as the final reading, this gives an infiltration rate of **2.66×10^{-5} m/s.**

Both locations are deemed to have passed, and therefore infiltration storage is appropriate.

5 INFILTRATION STORAGE ESTIMATE

The infiltration storage estimate has been calculated for both locations, as determined by the recorded infiltration rates, and are calculated in accordance with the 1 in 100 year + 40% Climate Change event. These storage volumes were undertaken for an infiltration tank.

The storage estimates are provided in Appendix C.

The storage depths are informed by the presence of made ground in the site, which is recorded to a depth of 0.5m in TP1, and 1m in TP2. A soakaway should not be positioned within the made ground, and so is required to be beneath this level. In a trial pit of 2m depth, this would require a maximum soakaway depth of 1.50m in TP1, and a maximum soakaway depth of 1.00m in TP2.

At TP1, a length of 15.00m, a width of 12.00m, and a depth of 1.50m would give a total storage volume of **283.55m³**.

At TP2, a length of 30.00m, a width of 10.50m, and a depth of 1.00m would give a total storage volume of **313.60m³**.

Either volume can be contained within the site boundary.

6 SUMMARY CONCLUSIONS

Two trial pits were undertaken at the north of the site (TP1) and south of the site (TP2). Both trial pits were found to be comprised of made ground to between 0.5 and 1.1m, underlain by sandy silty gravelly Clay to 2.00m.

LKC carried out infiltration tests at both locations to identify feasibility of utilising soakaways or other infiltration SuDS on the site. Both trial pits are deemed to have passed. The infiltration rates of the third and final test are recorded as **5.69 x 10⁻⁵ m/s** in TP1, and **2.66 x 10⁻⁵ m/s** in TP2.

Infiltration storage is therefore determined to be feasible. The estimated volumes and dimensions for the required infiltration tank are between **288.02m³** and **250.64m³** depending upon the location chosen. The required dimensions are considered to be feasible within the site boundary.

FIGURES

APPENDIX A

PROFILE LOGS

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Excavation Method

Trial Pit

Dimensions

2 x 2 x 0.75

Ground Level (mOD)
Client

Fred Veers

**Job
Number**
fra 21 1052

Location

North

Dates

09/04/2021

Engineer

MC

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					0.50	MADE GROUND: Medium dense dark brown to black clayey SAND with frequent rootlets, brick and ash. Clay is very soft. Sand is fine.		
					0.50			
					0.80	Loose mid-brown slightly gravelly sandy clayey SILT with low cobble content. Clay is very soft. Sand is loose. Silt is loose. Gravel is sub-rounded.		
					1.30			
					1.40	Very soft light brown sandy silty CLAY in gravel matrix with bands of light brown firm CLAY. Sand and silt are medium dense.		
					0.60			
					2.00	Firm light brown CLAY in gravel and cobble matrix. Gravel is sub-rounded.		
						Complete at 2.00m		


Remarks

Trial pit stable
No groundwater encountered

Scale (approx)

1:50

Logged By

MC

Figure No.

FRA 21 1052.1

Excavation Method

Trial Pit

Dimensions

2 x 2 x 0.75

Ground Level (mOD)
Client

Fred Veers

**Job
Number**
fra 21 1052

Location

South

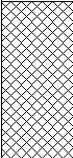
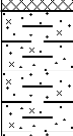
Dates

01/04/2021

Engineer

MC

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(1.10)	MADE GROUND: Loose black clayey SAND with rootlets, frequent brick, occasional plastic fragments, metal fragments, ash and large concrete blocks		
					1.10 (0.90)	Soft Mid-brown slightly gravelly sandy silty CLAY with bands of light brown firm CLAY. Sand and silt are medium dense. Gravel is sub-rounded.		
					2.00	Complete at 2.00m		


Remarks

Trial pit stable
No groundwater encountered

Scale (approx)

1:50

Logged By

MC

Figure No.

FRA 21 1052.2

APPENDIX B

INFILTRATION TESTING RESULTS

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Site : Brown Street, Littleborough

Client : Fred Veers

Engineer: MC

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Sheet

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Location	Date	Level	Location
1	09/04/2021		North

Pit Width (m)	0.75
Pit Depth (m)	2.00
Pit Length (m)	2.00

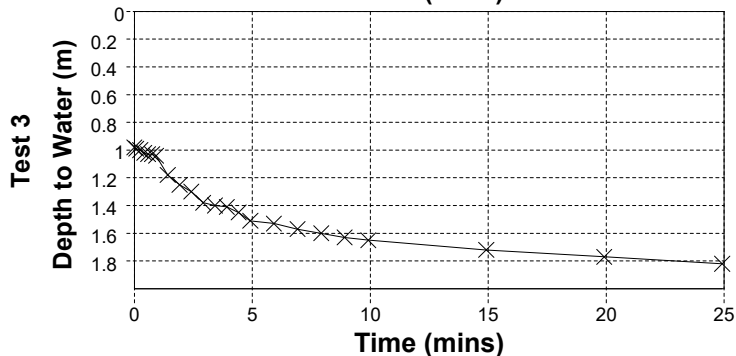
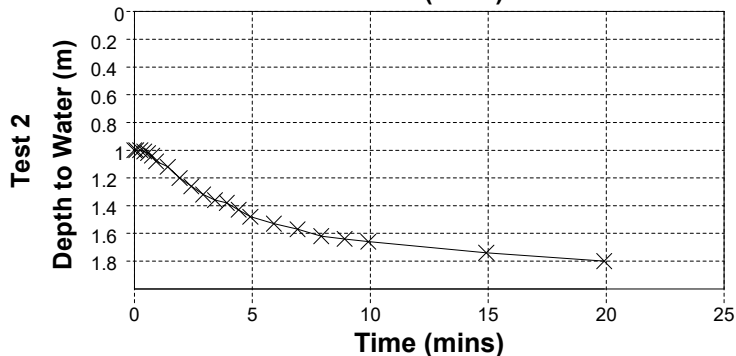
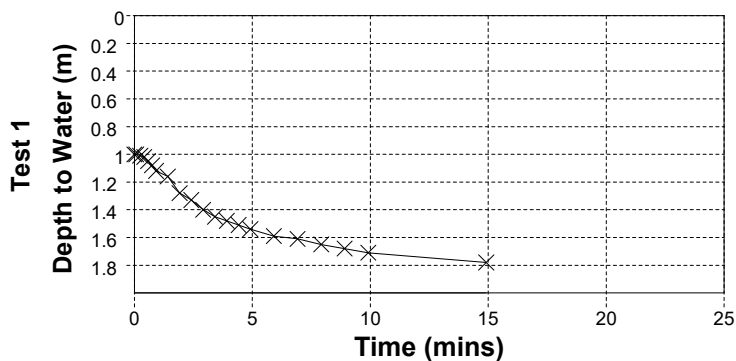
Soil type at test level	Sandy silty Clay
Groundwater	None recorded
Drain discharge depth	1
Sidewall stability	Stable
Stone filled or open pit	Stone Filled

	1	2	3
Effective depth (m)	1.00	1.00	1.02
Volume outflowing between 75% & 25% (m3)*	0.23	0.23	0.23
Mean surface area through which outflow occurs (m2)	4.25	4.25	4.31
Time for outflow between 75% & 25% (min)	10.98	13.42	15.61
SOIL INFILTRATION RATE (ms-1), f	8.04E-5	6.57E-5	5.69E-5

Remarks

* Volume outflowing reduced to account for granular backfill used during testing (30 % of free volume assumed).

Elapsed time (mins)	Depth to Water Test 1	Depth to Water Test 2	Depth to Water Test 3
0	1.00	1.00	0.98
0.083	1.00	1.00	0.99
0.25	1.01	1.00	1.00
0.417	1.02	1.01	1.02
0.583	1.05	1.02	1.03
0.75	1.08	1.04	1.03
0.917	1.12	1.08	1.04
1.417	1.16	1.12	1.18
1.917	1.28	1.20	1.25
2.417	1.33	1.26	1.30
2.917	1.40	1.32	1.38
3.417	1.45	1.36	1.40
3.917	1.48	1.38	1.41
4.417	1.51	1.43	1.45
4.917	1.54	1.48	1.51
5.917	1.59	1.53	1.53
6.917	1.61	1.57	1.57
7.917	1.65	1.62	1.60
8.917	1.68	1.64	1.63
9.917	1.71	1.66	1.65
14.917	1.78	1.74	1.72
19.917		1.80	1.77
24.917			1.82



Site : Brown Street, Littleborough

Client : Fred Veers

Engineer: MC

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Sheet

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Location	Date	Level	Location
2	09/04/2021		South

Pit Width (m)	0.75
Pit Depth (m)	2.00
Pit Length (m)	2.00

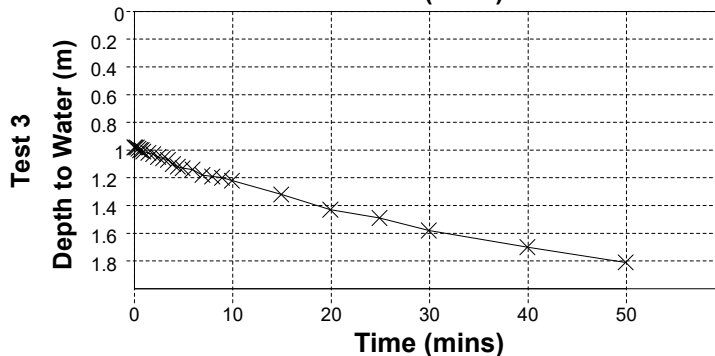
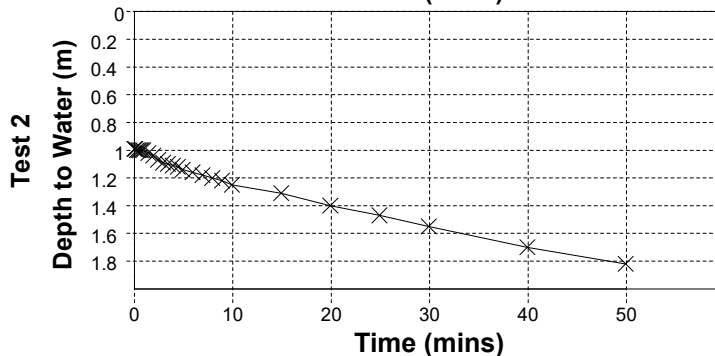
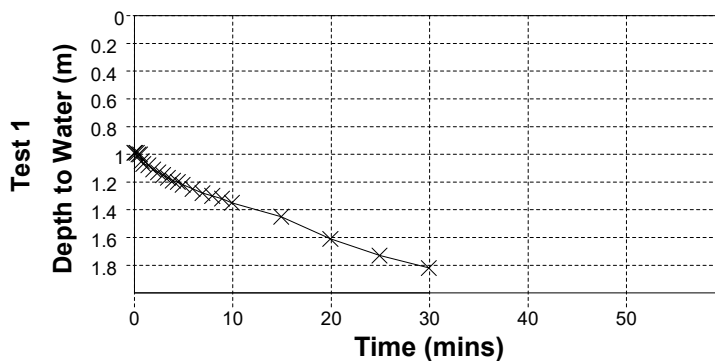
Soil type at test level	Silty Sandy Clay
Groundwater	None
Drain discharge depth	1
Sidewall stability	Slightly unstable
Stone filled or open pit	Stone Filled

	1	2	3
Effective depth (m)	1.01	1.01	1.02
Volume outflowing between 75% & 25% (m3)*	0.23	0.23	0.23
Mean surface area through which outflow occurs (m2)	4.28	4.28	4.31
Time for outflow between 75% & 25% (min)	20.22	34.21	33.34
SOIL INFILTRATION RATE (ms-1), f	4.38E-5	2.59E-5	2.66E-5

Remarks

* Volume outflowing reduced to account for granular backfill used during testing (30 % of free volume assumed).

Elapsed time (mins)	Depth to Water Test 1	Depth to Water Test 2	Depth to Water Test 3
0	0.99	0.99	0.98
0.083	0.99	0.99	0.98
0.25	0.99	1.00	0.98
0.417	1.00	1.00	0.99
0.583	1.00	1.00	1.00
0.75	1.05	1.00	1.00
0.917	1.07	1.00	1.01
1.417	1.08	1.02	1.02
1.917	1.11	1.04	1.03
2.417	1.13	1.07	1.05
2.917	1.15	1.09	1.06
3.417	1.17	1.10	1.07
3.917	1.19	1.11	1.10
4.417	1.20	1.12	1.12
4.917	1.22	1.14	1.13
5.917	1.25	1.16	1.14
6.917	1.28	1.18	1.18
7.917	1.30	1.20	1.19
8.917	1.32	1.22	1.20
9.917	1.35	1.25	1.22
14.917	1.45	1.31	1.32
19.917	1.61	1.40	1.43
24.917	1.73	1.47	1.49
29.917	1.82	1.55	1.58
39.917		1.70	1.70
49.917		1.82	1.81



APPENDIX C

INFILTRATION STORAGE CALCULATIONS

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Radclyffe M26 2ZS
Tel: 0161 763 7200
email: m.jones@thelkgroup.com

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Project **Brown Street Littleborough**

Title **TP1 - infiltration**

Data:-

Hydrology:-

Location	= Littleborough	Grid reference	= SD8913
M5-60 (mm)	= 19	r	= 0.28
WRAP	= 2	Soil index	= 0.30
SAAR (mm/yr)	= 1150	Area	= England and Wales

Soil classification for WRAP type 2

- i) Very permeable soils with shallow ground water;
- ii) Permeable soils over rock or fragipan, commonly on slopes in western Britain associated with smaller areas of less permeable wet soils;
- iii) Moderately permeable soils, some with slowly permeable subsoils.

Design data:-

Pit length	= 15.00 m	Pit width	= 12.00 m
Pit depth	= 1.58 m	Available volume	= 269.37 m ³
Voids %	= 95	Pit volume	= 283.55 m ³
Max inf area	= 265.06 m ²	Inf coeff.	= 0.2040 m/hr
Season	= Winter	Climate change	= 40.0 %
Return period	= 100 yrs		

Results:-

Duration hours	Peak rain mm/hr	Max volume m ³	Max. Outflow l/s	Peak time hours	Max depth mm	% full
0.25	23.05	113.94	12.24	0.25	666.32	42.30
0.50	16.10	152.38	12.93	0.50	891.12	56.57
1.00	11.83	188.65	13.58	0.96	1103.22	70.03
2.00	12.45	214.47	14.06	1.72	1254.21	79.62
3.00	12.84	220.35	14.17	2.40	1288.57	81.80
4.00	12.18	219.15	14.16	3.12	1281.56	81.36
6.00	12.35	210.99	14.03	4.44	1233.83	78.33
8.00	11.88	198.28	13.82	5.76	1159.51	73.61
10.00	11.67	184.04	13.58	7.00	1076.25	68.32
12.00	12.18	169.33	13.33	8.16	990.23	62.86
16.00	11.29	140.10	12.84	10.56	819.27	52.01
24.00	10.72	87.59	11.95	14.88	512.21	32.52
36.00	9.49	27.81	10.95	20.88	162.61	10.32
48.00	0.00	0.00	0.00	0.00	0.00	0.00
96.00	0.00	0.00	0.00	0.00	0.00	0.00
192.00	0.00	0.00	0.00	0.00	0.00	0.00

Results display

This display shows data associated with the maximum state:-

Duration - length of storm in hours
Peak rain mm/hr - rainfall intensity at peak of storage
Max volume m³ - water volume at peak of storage
Max. Outflow l/s - infiltration rate at peak of storage
Peak time hrs - time at peak of storage
% full - % of available volume used at peak of storage



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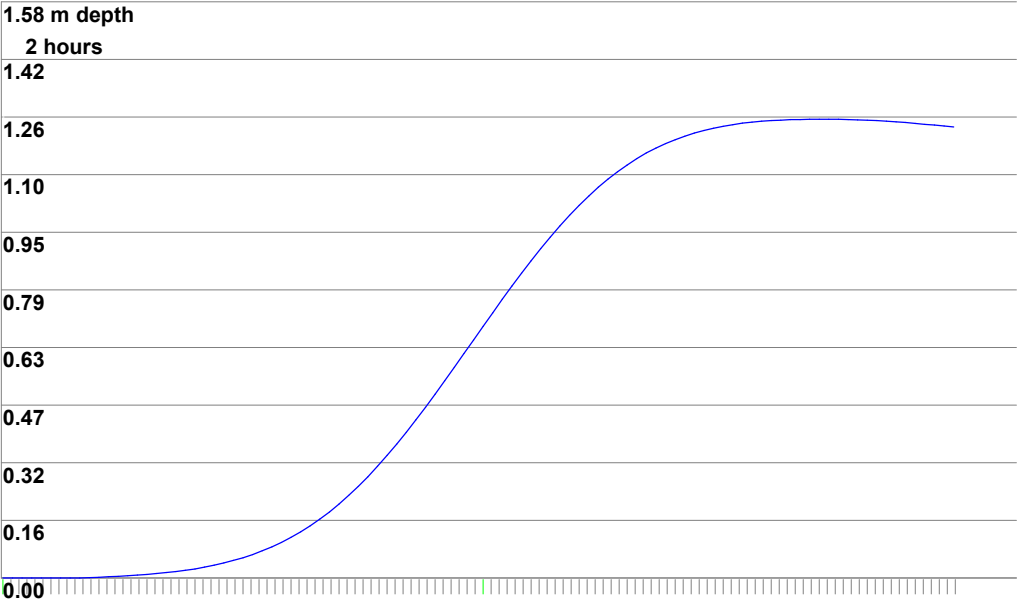
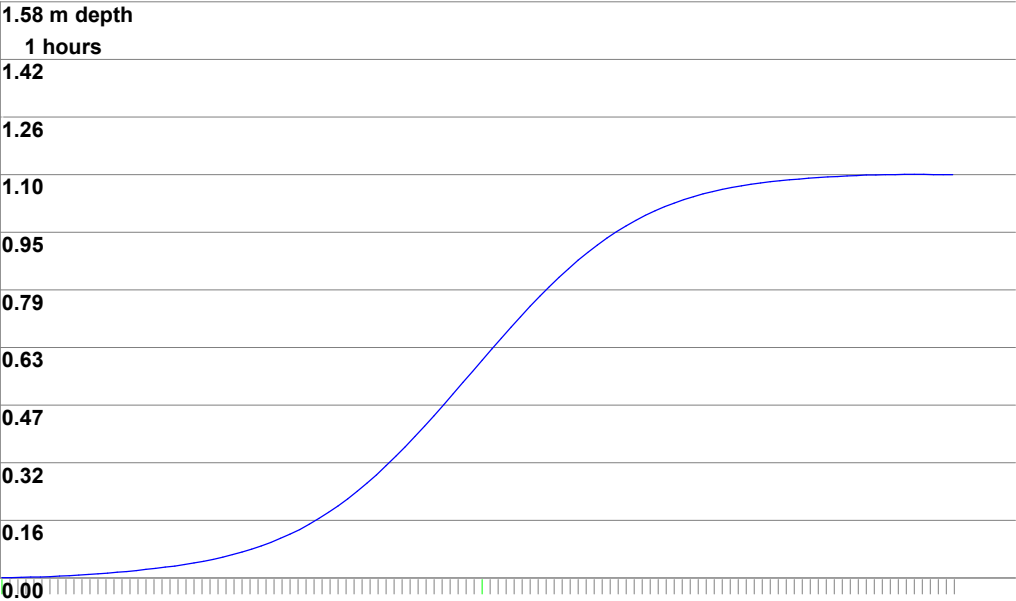
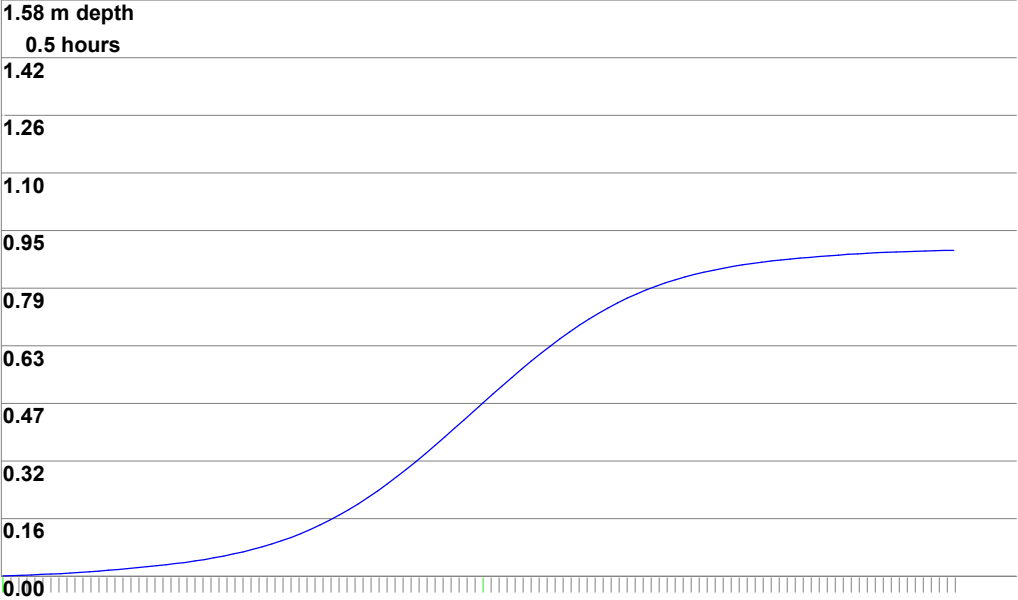
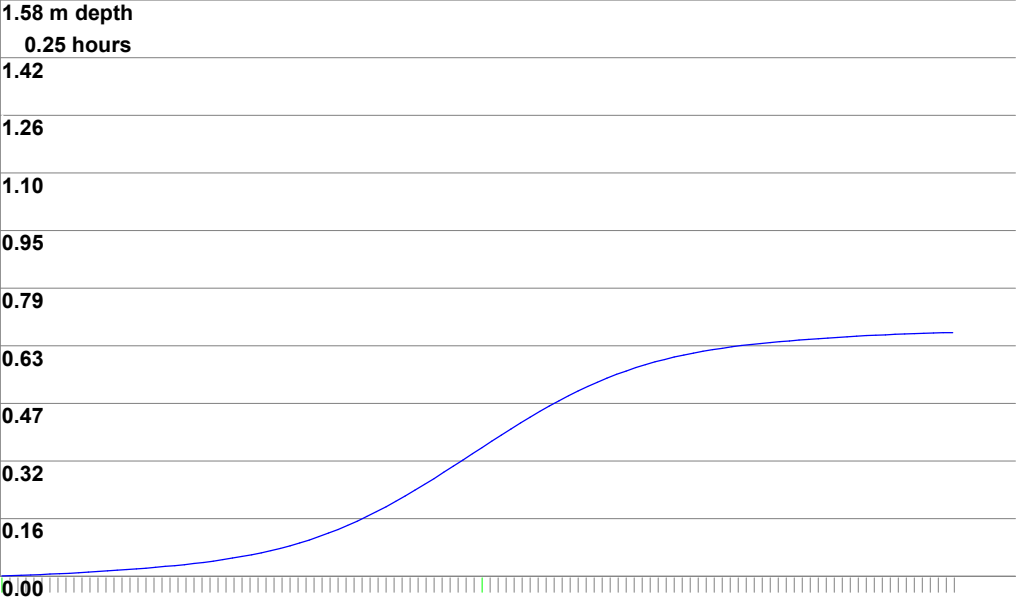
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Radcliffe M26 2ZS
Tel: 0161 763 7200
email: m.jones@thelkgroup.com

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Title	TP1 - infiltration	





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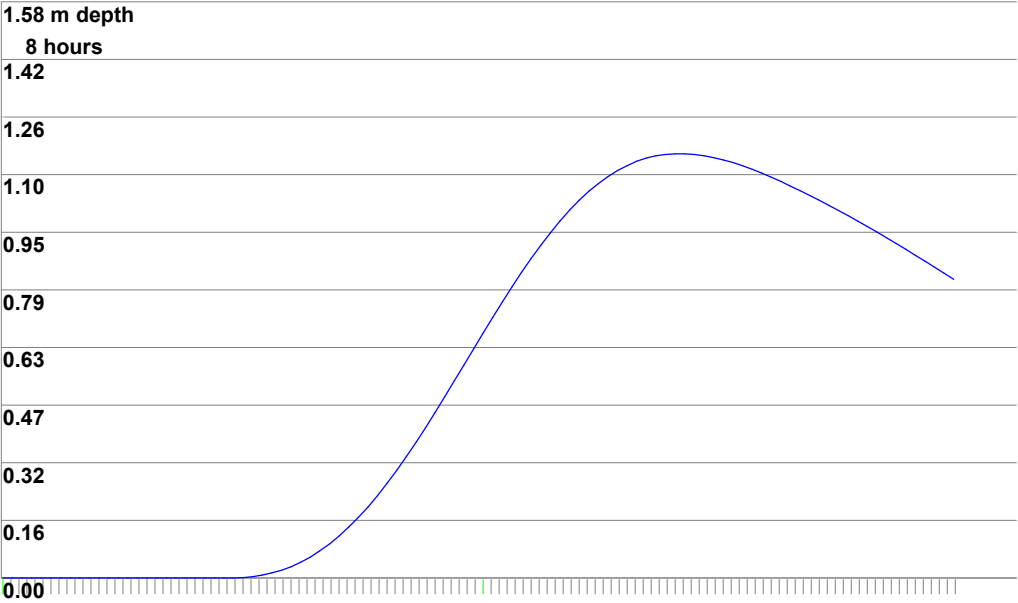
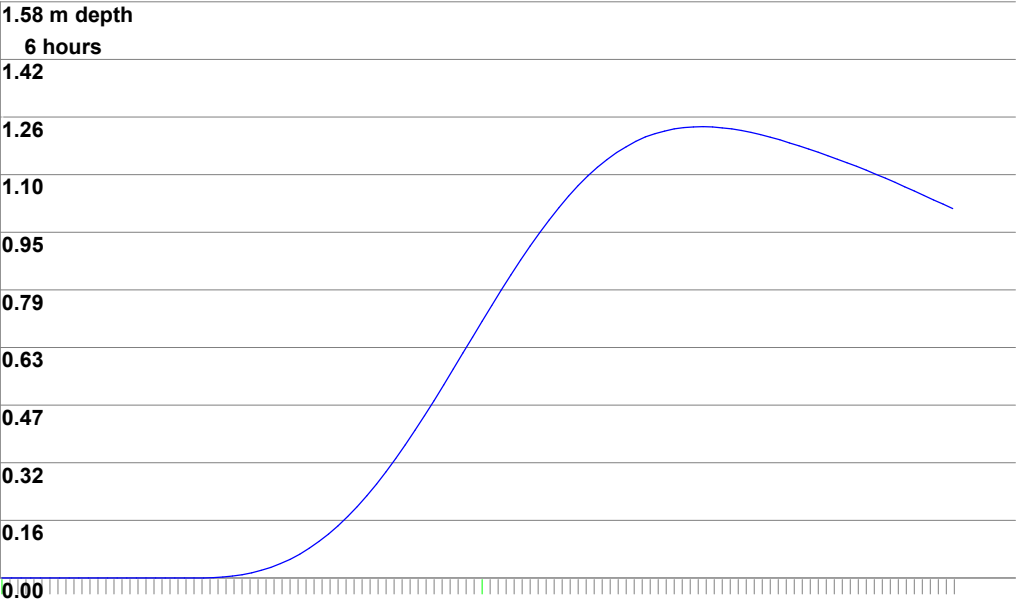
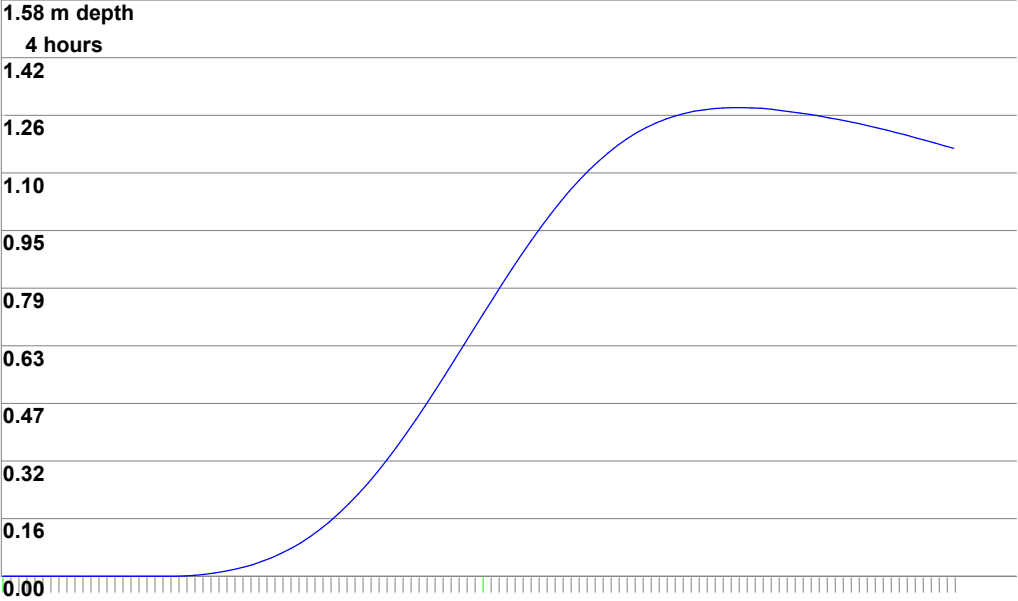
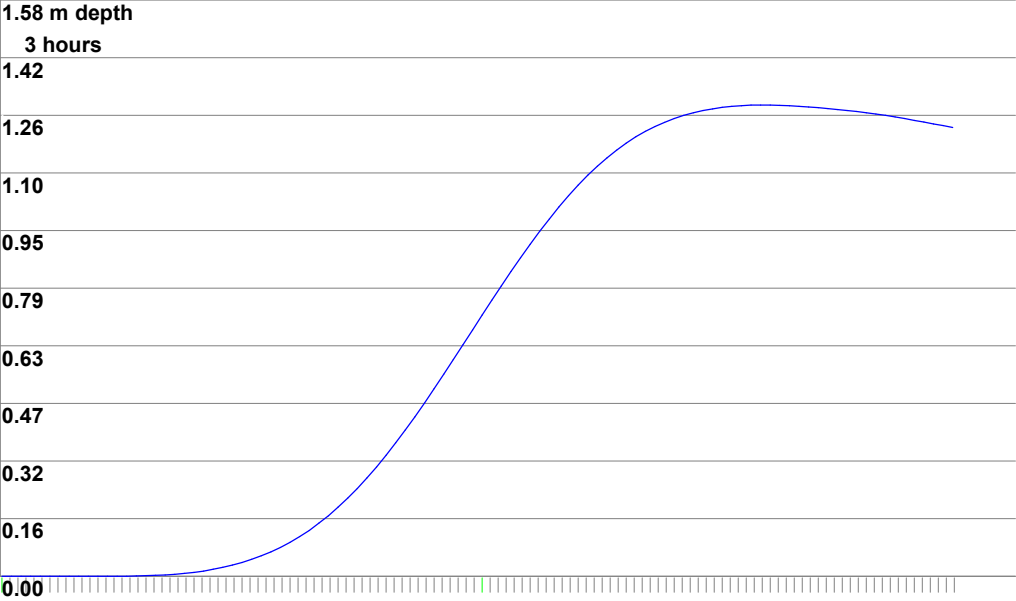
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Title	TP1 - infiltration	





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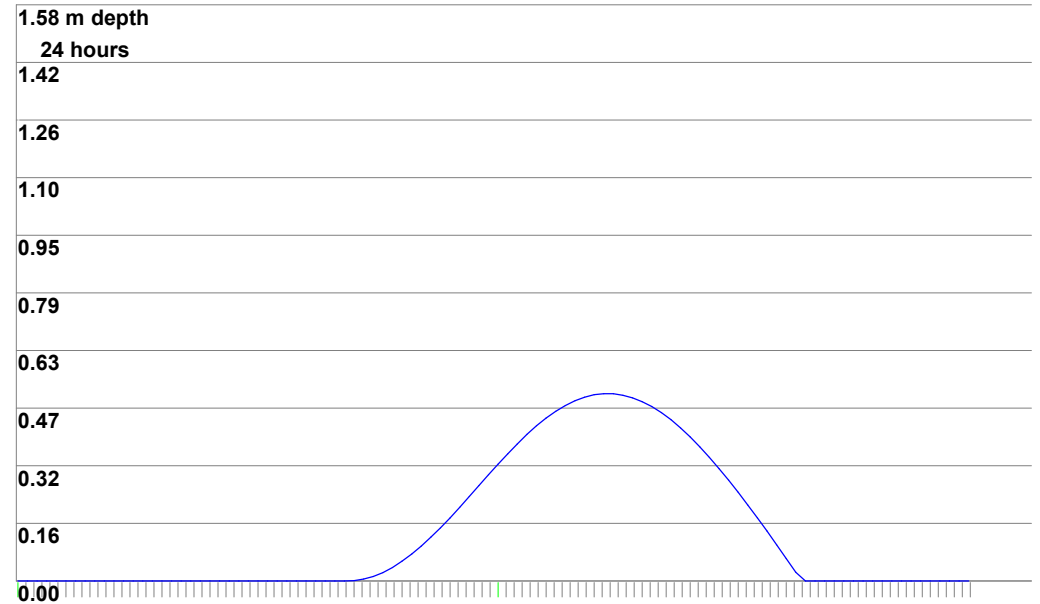
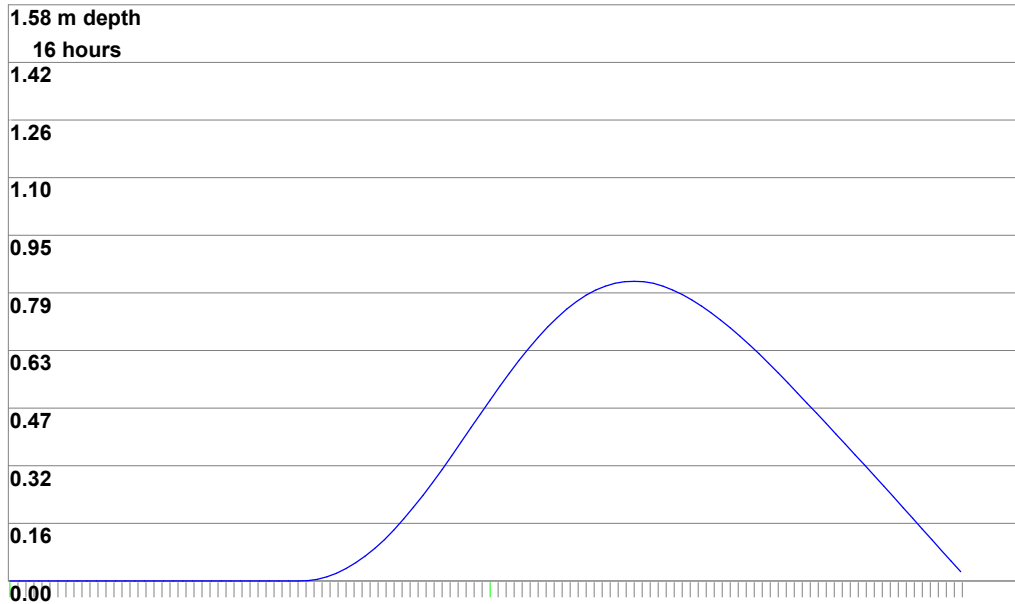
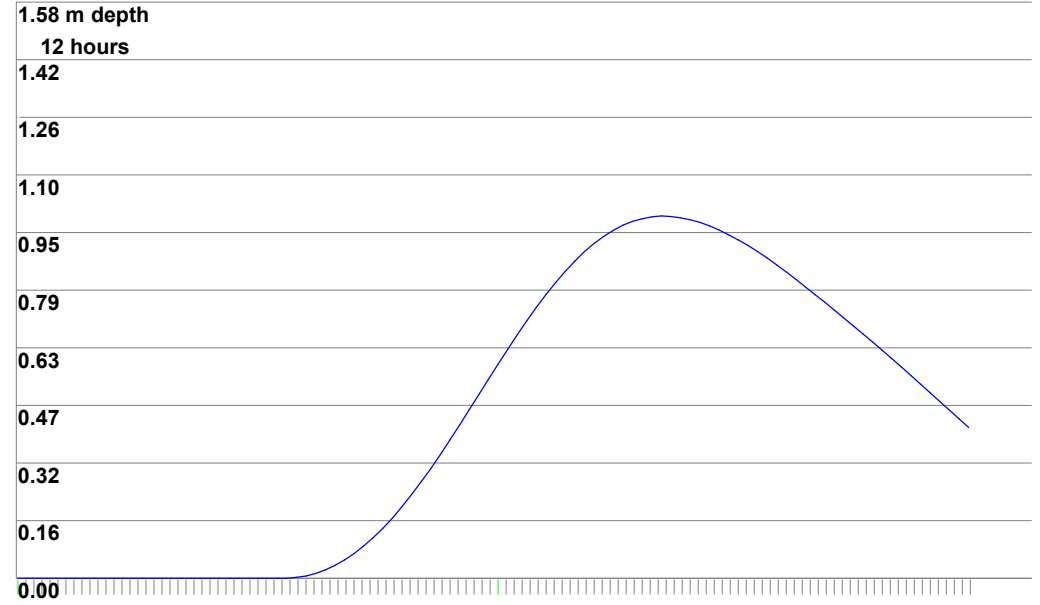
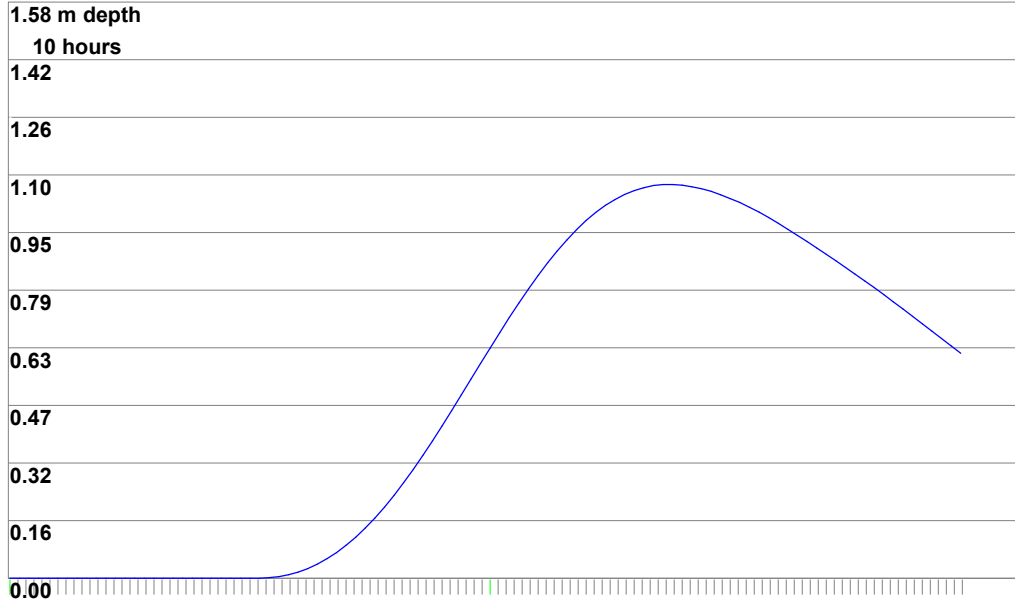
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Radcliffe M26 2ZS
Tel: 0161 763 7200
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Project **Brown Street Littleborough**

Title **TP1 - infiltration**





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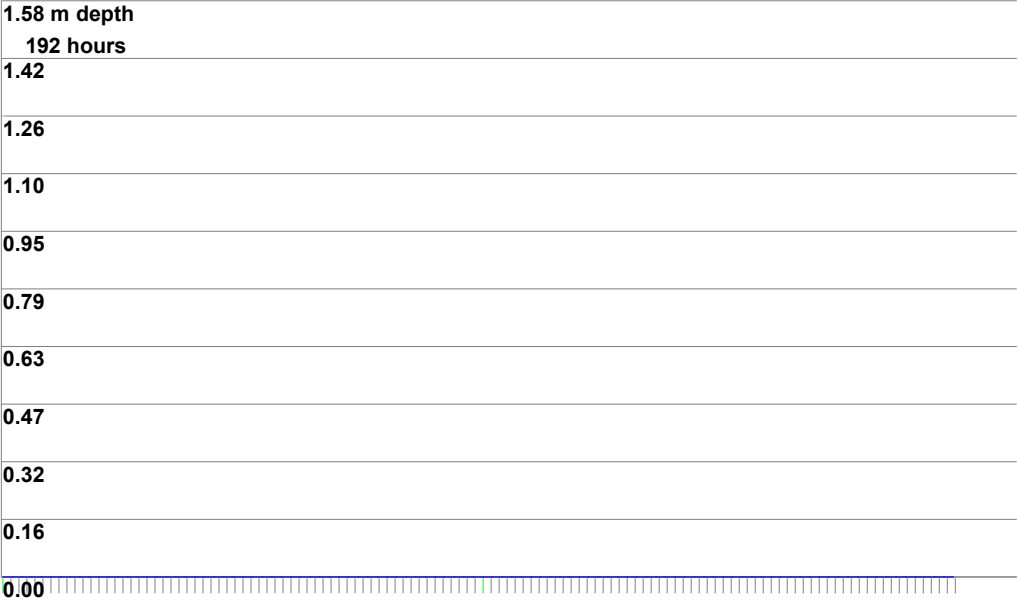
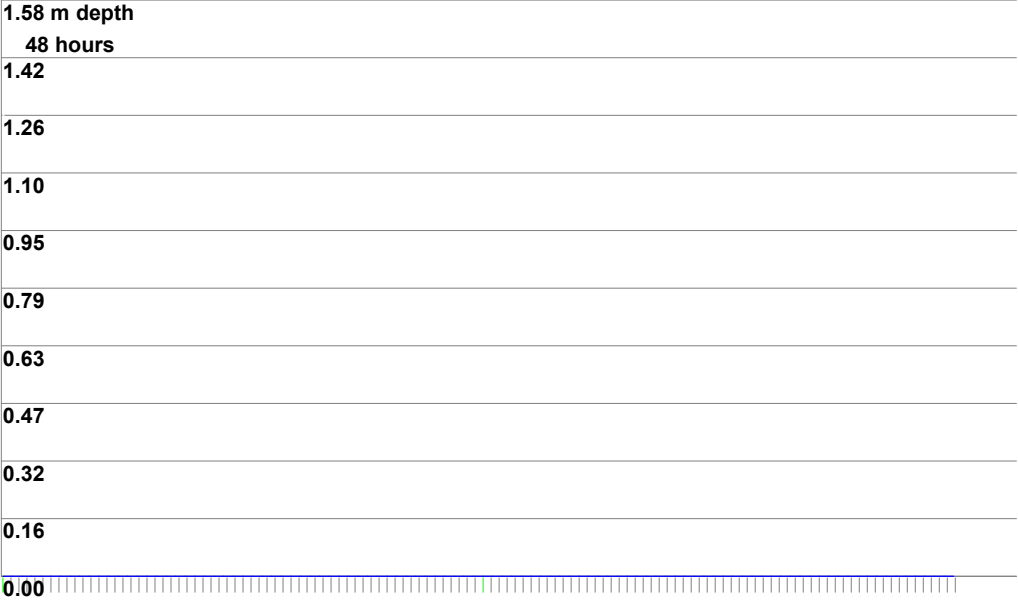
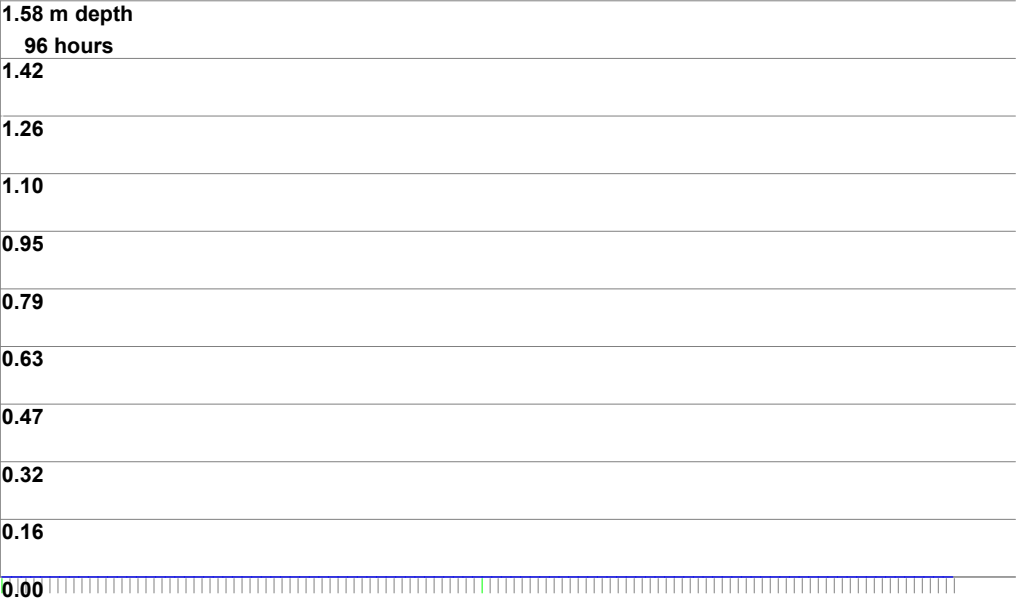
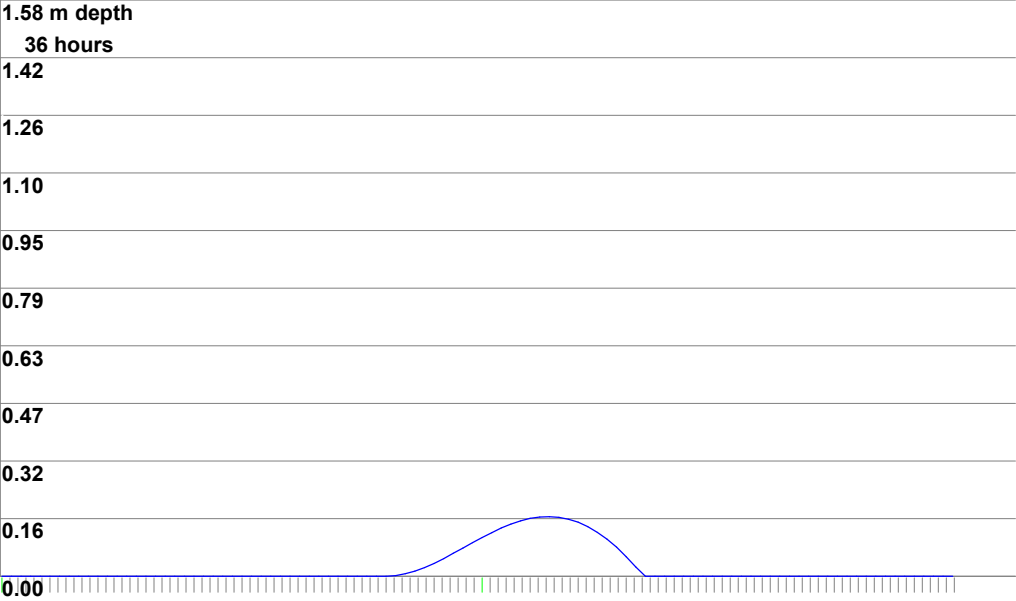
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Project	Brown Street Littleborough	
Title	TP1 - infiltration	





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Project **Brown Street Littleborough**

Title **TP2 - infiltration**

Data:-

Hydrology:-

Location	= Littleborough	Grid reference	= SD8913
M5-60 (mm)	= 19	r	= 0.28
WRAP	= 2	Soil index	= 0.30
SAAR (mm/yr)	= 1150	Area	= England and Wales

Soil classification for WRAP type 2

- i) Very permeable soils with shallow ground water;
- ii) Permeable soils over rock or fragipan, commonly on slopes in western Britain associated with smaller areas of less permeable wet soils;
- iii) Moderately permeable soils, some with slowly permeable subsoils.

Design data:-

Pit length	= 30.00 m	Pit width	= 10.50 m
Pit depth	= 1.00 m	Available volume	= 297.92 m ³
Voids %	= 95	Pit volume	= 313.60 m ³
Max inf area	= 395.64 m ²	Inf coeff.	= 0.1000 m/hr
Season	= Winter	Climate change	= 40.0 %
Return period	= 100 yrs		

Results:-

Duration hours	Peak rain mm/hr	Max volume m ³	Max. Outflow l/s	Peak time hours	Max depth mm	% full
0.25	23.05	115.78	9.62	0.25	386.90	38.86
0.50	16.10	156.42	9.93	0.50	522.70	52.50
1.00	10.76	197.29	10.24	1.00	659.30	66.22
2.00	8.99	229.51	10.48	1.86	766.96	77.04
3.00	9.43	239.72	10.56	2.58	801.06	80.46
4.00	9.62	242.04	10.58	3.24	808.82	81.24
6.00	9.14	240.25	10.57	4.68	802.85	80.64
8.00	9.27	232.65	10.52	6.00	777.43	78.09
10.00	9.34	222.35	10.45	7.30	743.03	74.63
12.00	9.55	210.60	10.37	8.52	703.75	70.69
16.00	9.00	185.64	10.19	11.04	620.35	62.31
24.00	9.02	135.59	9.83	15.60	453.11	45.51
36.00	8.41	70.26	9.37	21.96	234.78	23.58
48.00	7.89	21.27	9.03	27.36	71.07	7.14
96.00	0.00	0.00	0.00	0.00	0.00	0.00
192.00	0.00	0.00	0.00	0.00	0.00	0.00

Results display

This display shows data associated with the maximum state:-

Duration - length of storm in hours
Peak rain mm/hr - rainfall intensity at peak of storage
Max volume m³ - water volume at peak of storage
Max. Outflow l/s - infiltration rate at peak of storage
Peak time hrs - time at peak of storage
% full - % of available volume used at peak of storage



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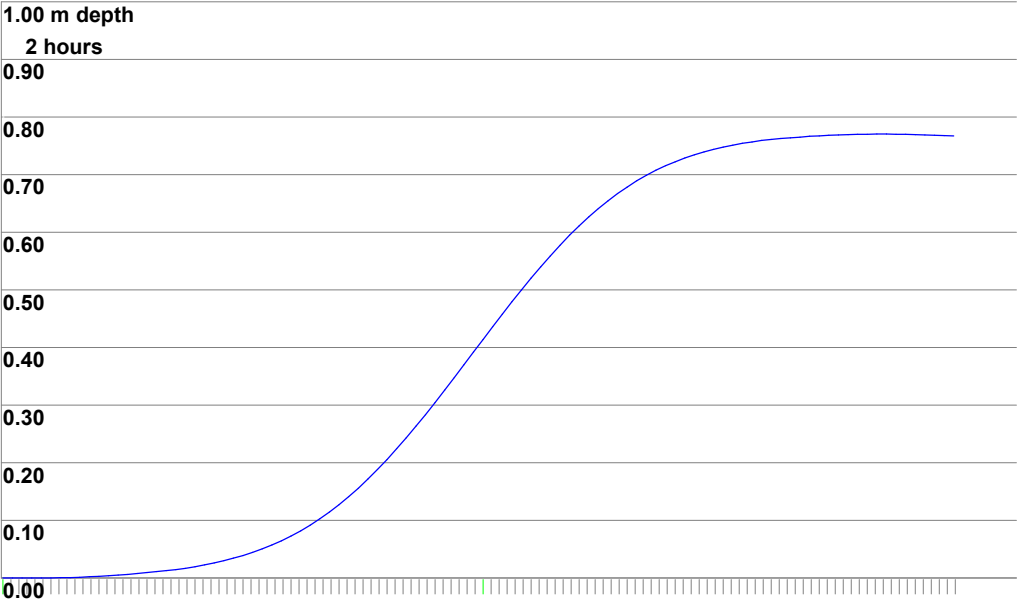
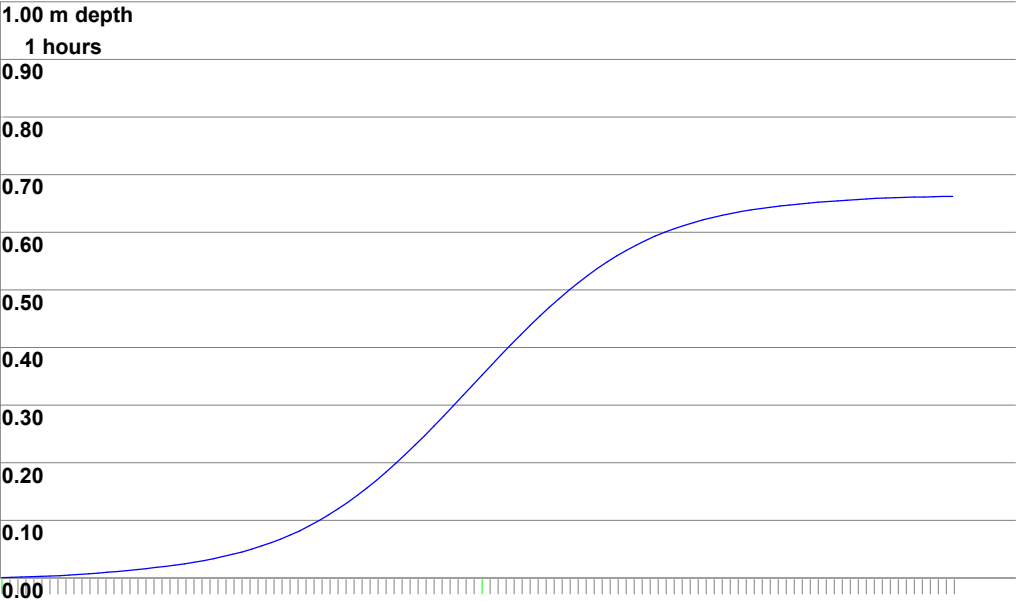
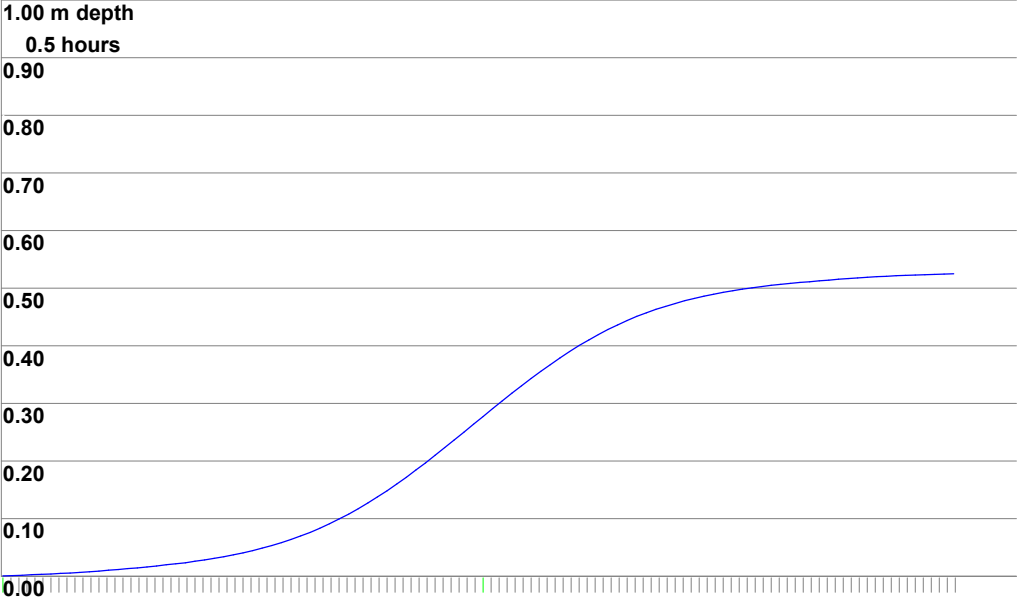
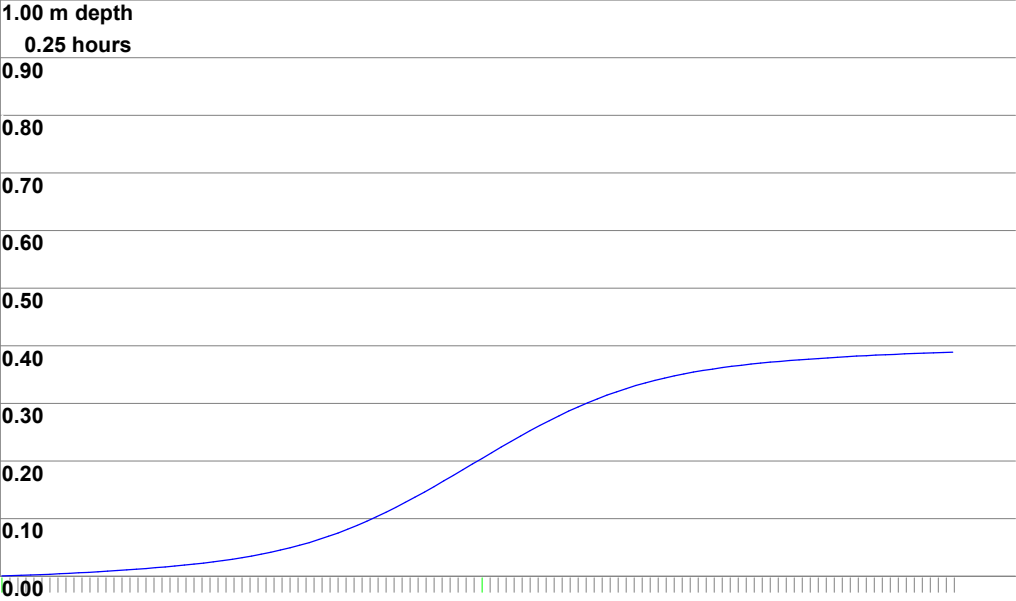
The LK Group

www.thelkgroup.com

Eton Business Park,
Eton Hill Road,
Radcliffe M26 2ZS
Tel: 0161 763 7200
email: m.jones@thelkgroup.com

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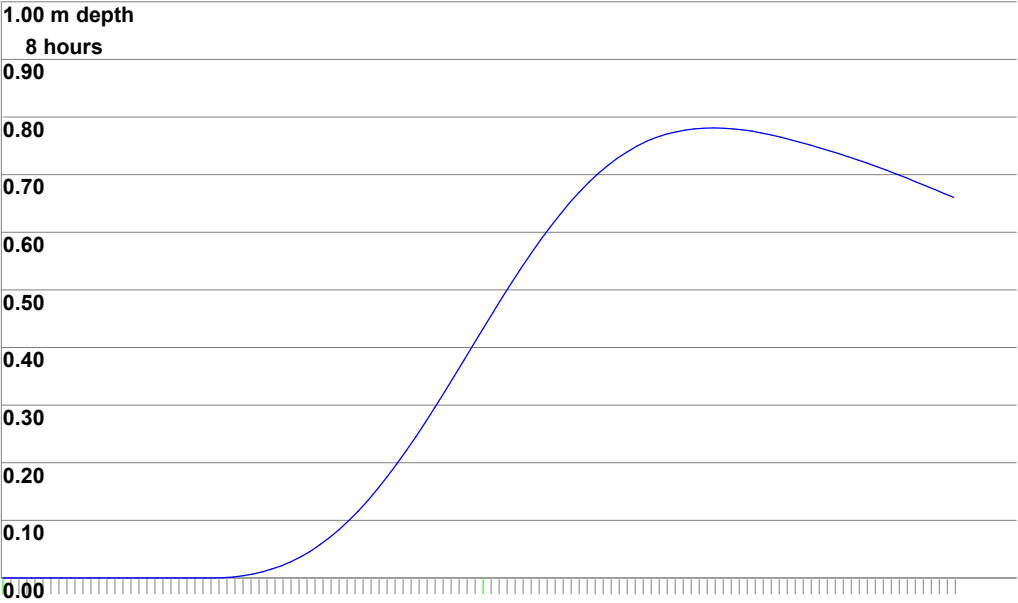
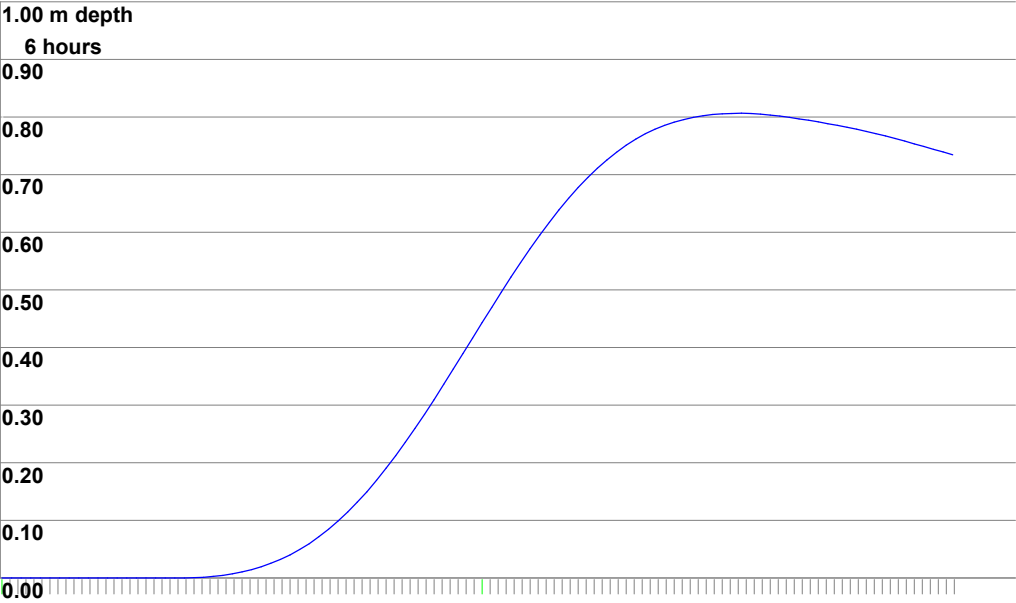
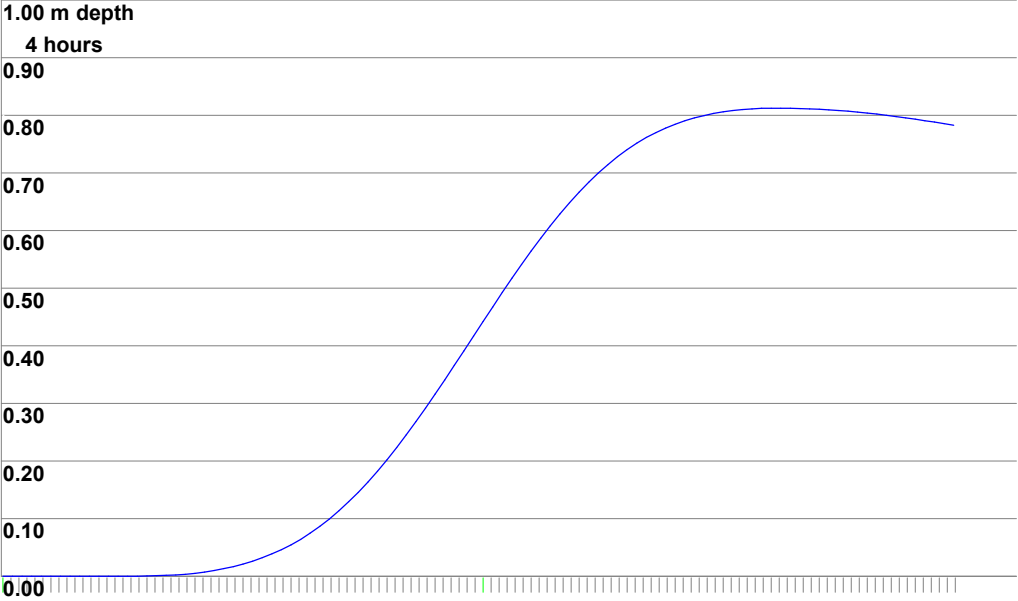
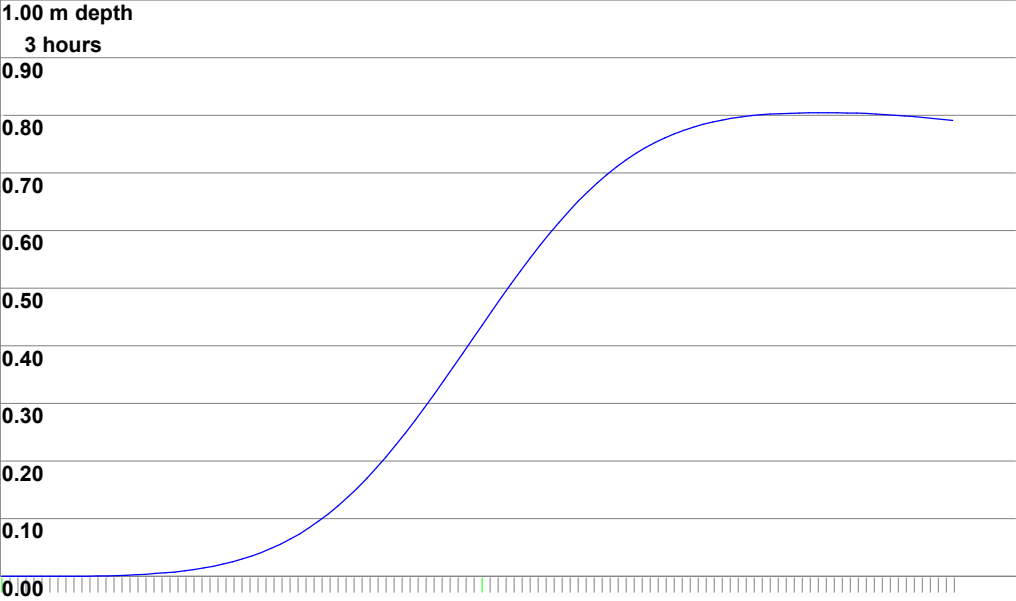
The LK Group

www.thelkgroup.com

Eton Business Park,
Eton Hill Road,
Radcliffe M26 2ZS
Tel: 0161 763 7200
email: m.jones@thelkgroup.com

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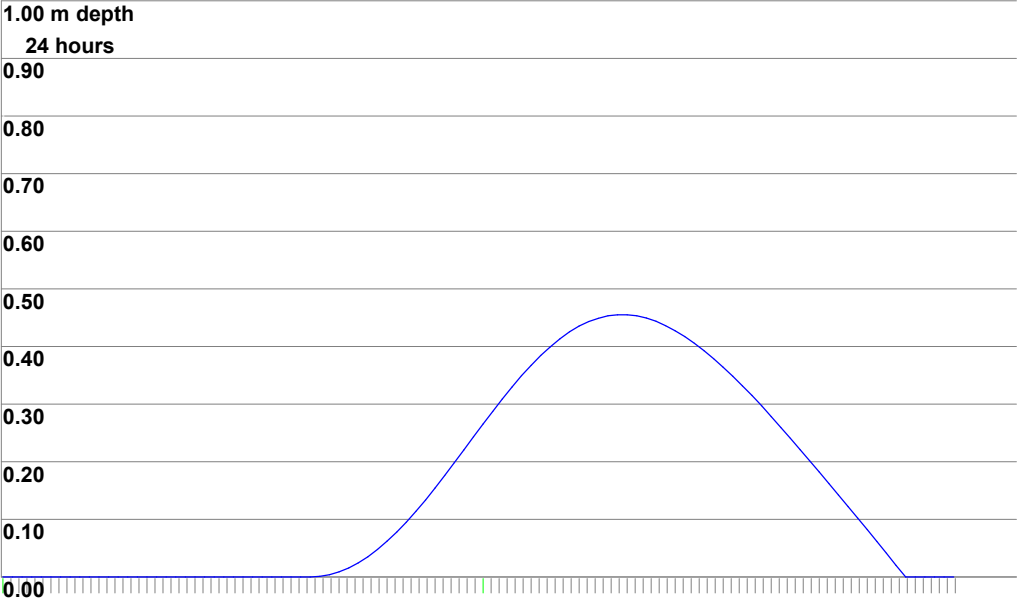
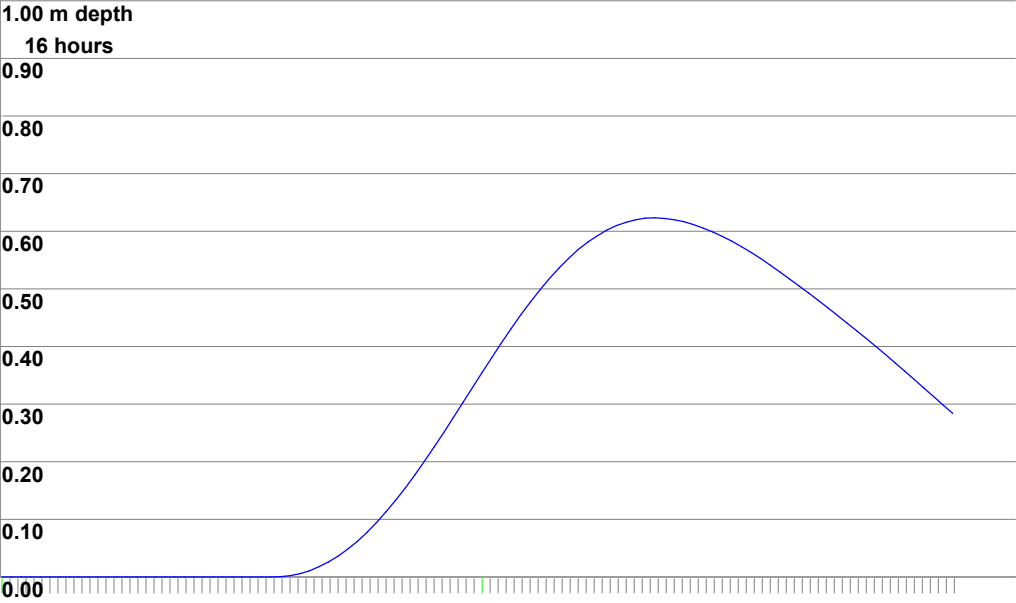
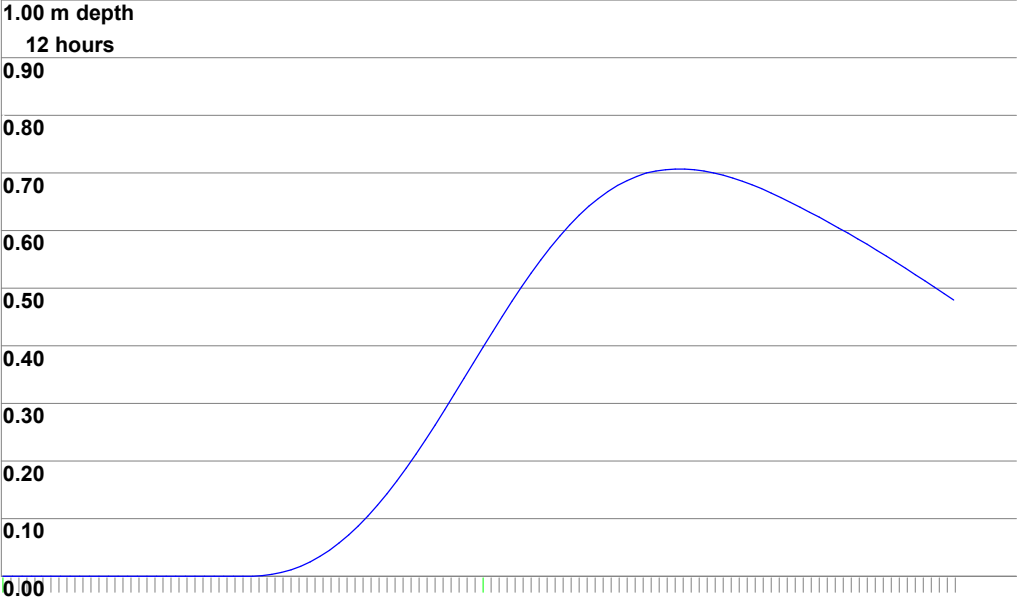
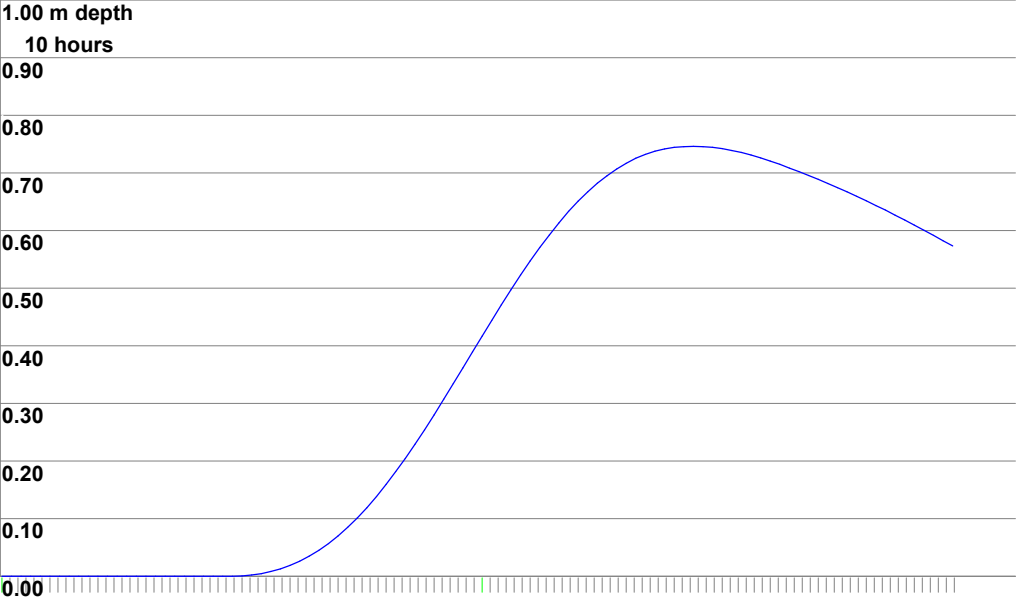
The LK Group

www.thelkgroup.com

Eton Business Park,
Eton Hill Road,
Radcliffe M26 2ZS
Tel: 0161 763 7200
email: m.jones@thelkgroup.com

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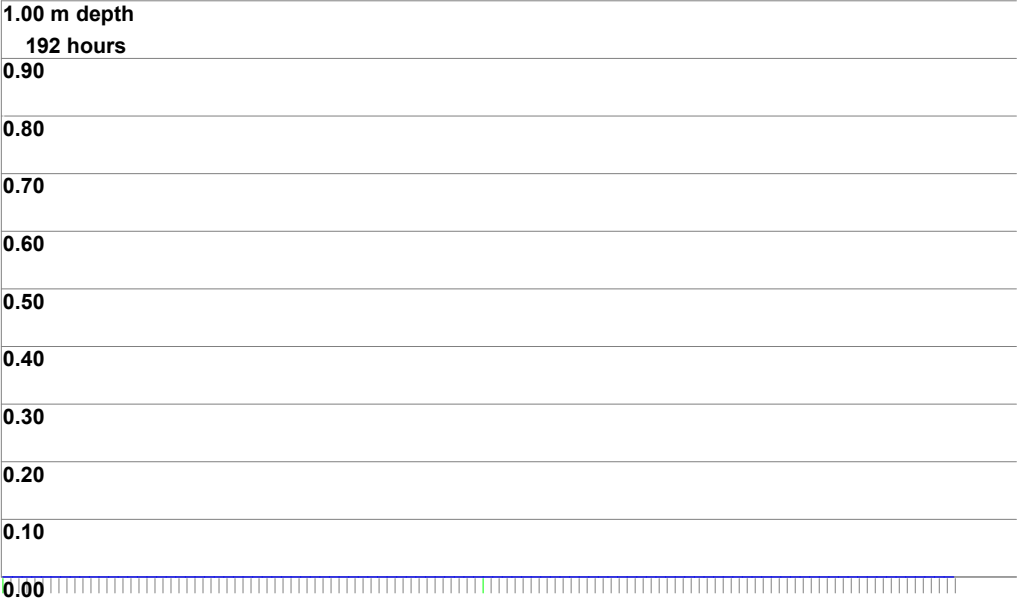
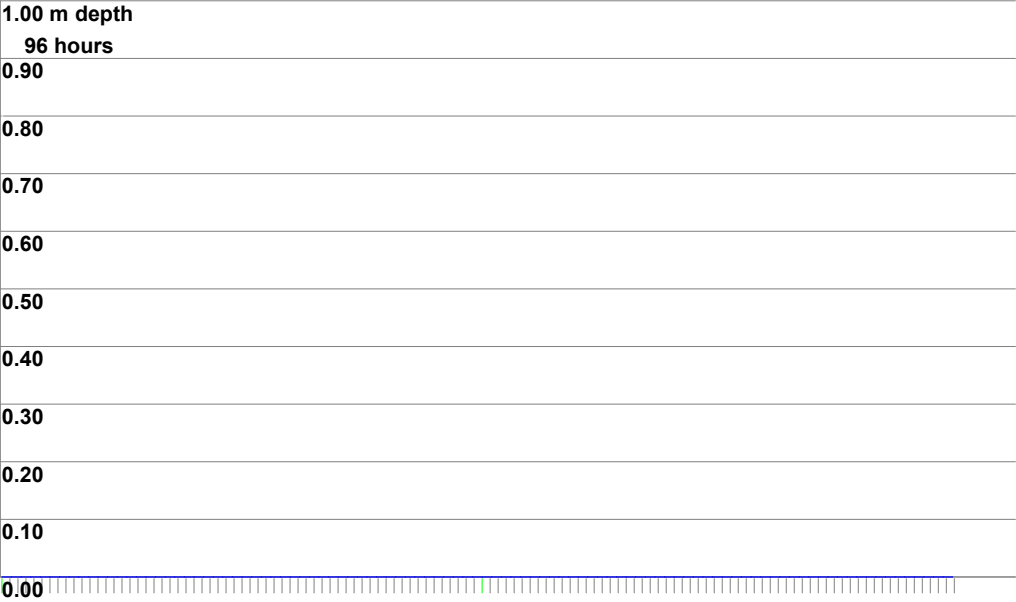
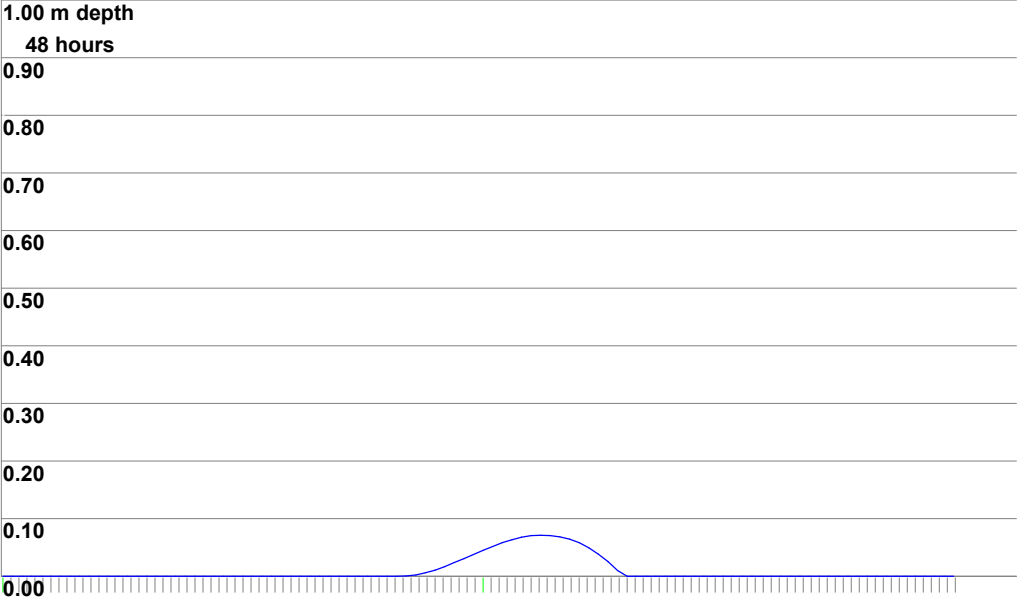
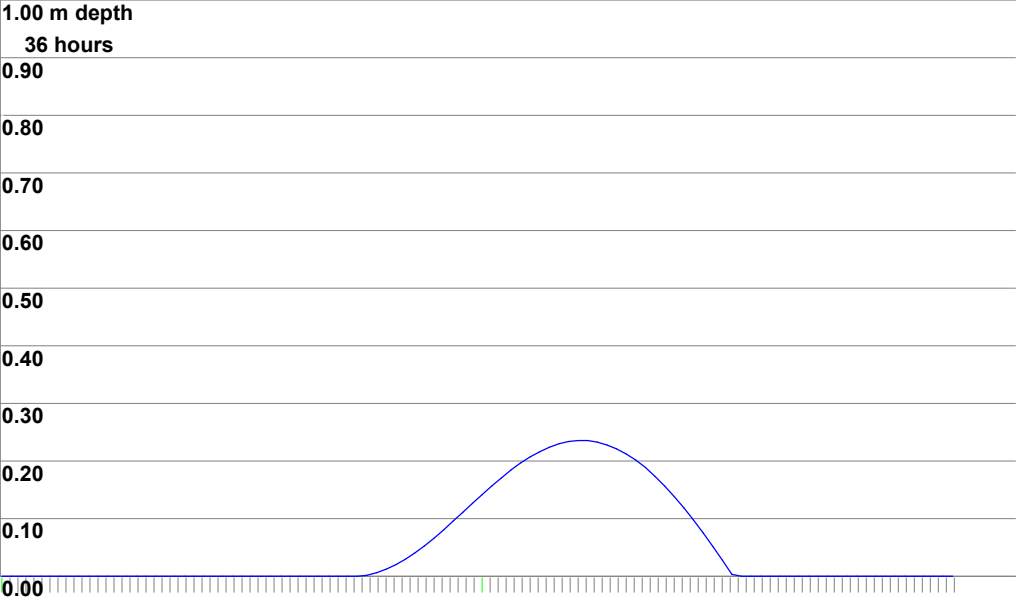
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www.thelkgroup.com

Eton Business Park,
Eton Hill Road,
Radcliffe M26 2ZS
Tel: 0161 763 7200
email: m.jones@thelkgroup.com

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Based across the UK with
offices in Manchester,
London, Liverpool and Glasgow.

Manchester (Head Office)

Unit 29,
Eton Business Park
Eton Hill Rd, Radcliffe
M26 2ZS

t: 0161 763 7200
e: info@thelkgroup.com

London

2 Falcon Gate
Welwyn Garden City
Hertfordshire
AL7 1TW

t: 01707 909059
e: info@thelkgroup.com

Glasgow

Wright Business Centre
1 Lonmay Road
Glasgow
G33 4EL

t: 0141 773 6269
e: info@thelkgroup.com

Liverpool

The Corn Exchange
Fenwick Street
Liverpool
L2 7QL

t: 0151 235 8716
e: info@thelkgroup.com



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