

 T J Booth Associates. Consulting Engineers 20A Eastgate St, Rochdale OL16 1DH	Project Newbuild - Trub Road, Castleton, Rochdale				Job Ref. rep-tjba-newbuild-trub rd-phs 2_3env-300625	
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History.

Revision	Date	Reason
0	August 2025	Original.

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Background.

To provide surface water drainage design calculations for development in accordance best practice.

The site is classified as greenfield.

The site has an existing United Utilities combined sewere to the centre south boundary.

Drainage Hierarchy.

Infiltration

Site investigations were undertaken on the 30.06.2025. The investigations recorded shallow made ground above alluvial clays. Due to a trial hole to the rear of the site which contained within it some sand & gravel, infiltration testing was undertaken.

A satisfactory infiltration rate has not been obtained, with the test resulting in rates in the order of 1x10⁻⁶.

It is assumed the sand & gravel deposit was a lens in the wider alluvial clay, which is attrubuted to the poor performance of the infiltration test.

Subsequently, infiltration has been deemed unsuitable for the site.

Refer to infiltration calculations in the Appendix.

Watercourse

There is a watercourse to the south, but this is through multiple third party land.

There is no reasonable was of dispoing via this method.

Sewer

There are no surface water sewers in the local area. There is a combined sewer to the south boundary, and it is proposed to use this for disposal of both surface and foul water flows. Surface water will be attenuated and discharged at minimal flow rates prior to is a surface water sewer.

Existing Site.

The site is a vacant plot of land adjacent formerly used for housing, demolished c1980s.

Site Area 820 sqm

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Hardstanding (considered permeable) 125 sqm

Soft landscaping 695 sqm

As the site is classified as brownfield, in accordance with the CIRIA C753, the existing site flow rates shall be estimated by undertaking a greenfield flow calculation with a high soil class used in the calculation.

Rainfall Characteristics were obtained from HR Wallingford Interactive Mapping data which indicated the following characteristics for the site:

M5-60 rainfall depth (mm): 20

'r' ratio M5-60/M5-2day: 0.3

Region: 10

Due to the difficulty in limiting site discharges within small orifices prone to blockage, it is generally accepted that 5l/s is the minimum acceptable discharge limit, and as the existing estimated greenfield flows are below this figure, a maximum 5l/s will be adopted for the proposed site up to and including the 100yr +45% climate change event.

Proposed Site.

The proposed site comprises 11No. dwellings with associated driveways/parking, and access road. The access road is understood to be private and not known to be adopted by the LPA Highways.

All external hardstanding areas are to be permeable paving with min 150mm type 3 subbase.

Site Area 2300sqm

EXISTING RAINFALL (1YR)

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.02

Design rainfall intensity

Location of catchment area	Other
Storm duration	D = 30 min
Return period	Period = 1 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.300
5-year return period rainfall of 60 minutes duration	M5_60min = 20.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.77
Rainfall for 30min storm with 5 year return period	M5_30min _i = Z1 × M5_60min = 15.4 mm
Factor Z2 (Wallingford procedure)	Z2 = 0.62
Rainfall for 30min storm with 1 year return period	M1_30min = Z2 × M5_30min _i = 9.6 mm
Design rainfall intensity	I _{max} = M1_30min / D = 19.1 mm/hr

EXISTING RAINFALL (30YR)

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.02

Design rainfall intensity

Location of catchment area	Other
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Storm duration	D = 30 min
Return period	Period = 30 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.300
5-year return period rainfall of 60 minutes duration	M5_60min = 20.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.77
Rainfall for 30min storm with 5 year return period	M5_30min _i = Z1 × M5_60min = 15.4 mm
Factor Z2 (Wallingford procedure)	Z2 = 1.53
Rainfall for 30min storm with 30 year return period	M30_30min = Z2 × M5_30min _i = 23.5 mm
Design rainfall intensity	I _{max} = M30_30min / D = 47.1 mm/hr

EXISTING RAINFALL (100YR)

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.02

Design rainfall intensity

Location of catchment area	Other
Storm duration	D = 30 min
Return period	Period = 100 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.300
5-year return period rainfall of 60 minutes duration	M5_60min = 20.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.77
Rainfall for 30min storm with 5 year return period	M5_30min _i = Z1 × M5_60min = 15.4 mm
Factor Z2 (Wallingford procedure)	Z2 = 1.99
Rainfall for 30min storm with 100 year return period	M100_30min = Z2 × M5_30min _i = 30.7 mm
Design rainfall intensity	I _{max} = M100_30min / D = 61.4 mm/hr

Proposed Drainage.

Roof areas & paving requiring attenuation	650 sqm
Permeable areas	220 sqm

Roof areas are to be attenuated by a Hydrobrake vortex flow control max 5l/s at 0.9m head. Storage comprises offline polypipe attenuation crates.

Refer to Source Control calculations in the appendix.

Maintenance Plan.

Maintenance to be undertaken by as required by site maintenance agreement as necessary.

- Construction Stage:
 - Attenuation tank and manhole to be isolated from flows during the construction phase of the development.
 - Attenuation should only be brought in to use after the drainage system has been cleared/flushed as necessary.
 - All drainage into the attenuation tank must be via the silt trap.
- Habitation Phase:

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Sediment to be removed from pre-attenuation tank silt trap & control manhole annually.

All attenuation inlets, outlets, and vents to be checked annually.

Hydro-brake flow control unit & pivoting bypass door/steel rope control to be checked annually to ensure safe and continued working order in both normal and extreme rainfall events.

Attenuation tank is offline so as to further aid in limiting siltation issues.

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Appendix.

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104 Yorkshire St
Rochdale
Lancashire OL16 1JY

Date August 2025 - rev0

File calc-tjba-newbuild-trub rd-site atte...

Micro Drainage

SW attenuation crates
newbuild devs
trub rd castleton

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Source Control W.10.4

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Summary of Results for 1 year Return Period

Storm Duration (mins)	Maximum Control (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m³)	Maximum Volume (m³)	Status
15 Summer	4.2	0.0	4.2	133.2162	0.0463	0.0	1.0	O K
30 Summer	4.2	0.0	4.2	133.2157	0.0458	0.0	1.0	O K
60 Summer	4.0	0.0	4.0	133.2002	0.0302	0.0	0.7	O K
120 Summer	3.7	0.0	3.7	133.1772	0.0073	0.0	0.2	O K
180 Summer	3.5	0.0	3.5	133.1700	0.0000	0.0	0.0	O K
240 Summer	2.9	0.0	2.9	133.1700	0.0000	0.0	0.0	O K
360 Summer	2.2	0.0	2.2	133.1700	0.0000	0.0	0.0	O K
480 Summer	1.9	0.0	1.9	133.1700	0.0000	0.0	0.0	O K
600 Summer	1.6	0.0	1.6	133.1700	0.0000	0.0	0.0	O K
720 Summer	1.4	0.0	1.4	133.1700	0.0000	0.0	0.0	O K
960 Summer	1.2	0.0	1.2	133.1700	0.0000	0.0	0.0	O K
1440 Summer	0.9	0.0	0.9	133.1700	0.0000	0.0	0.0	O K
2160 Summer	0.7	0.0	0.7	133.1700	0.0000	0.0	0.0	O K
2880 Summer	0.6	0.0	0.6	133.1700	0.0000	0.0	0.0	O K
4320 Summer	0.5	0.0	0.5	133.1700	0.0000	0.0	0.0	O K
5760 Summer	0.4	0.0	0.4	133.1700	0.0000	0.0	0.0	O K
7200 Summer	0.3	0.0	0.3	133.1700	0.0000	0.0	0.0	O K
8640 Summer	0.3	0.0	0.3	133.1700	0.0000	0.0	0.0	O K
10080 Summer	0.3	0.0	0.3	133.1700	0.0000	0.0	0.0	O K
15 Winter	4.3	0.0	4.3	133.2233	0.0533	0.0	1.2	O K
30 Winter	4.2	0.0	4.2	133.2153	0.0453	0.0	1.0	O K
60 Winter	3.9	0.0	3.9	133.1893	0.0193	0.0	0.4	O K
120 Winter	3.2	0.0	3.2	133.1700	0.0000	0.0	0.0	O K
180 Winter	2.5	0.0	2.5	133.1700	0.0000	0.0	0.0	O K
240 Winter	2.1	0.0	2.1	133.1700	0.0000	0.0	0.0	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
15 Summer	28.17	12
30 Summer	19.18	20
60 Summer	12.80	36
120 Summer	8.41	66
180 Summer	6.56	0
240 Summer	5.47	0
360 Summer	4.21	0
480 Summer	3.50	0
600 Summer	3.03	0
720 Summer	2.70	0
960 Summer	2.25	0
1440 Summer	1.73	0
2160 Summer	1.33	0
2880 Summer	1.11	0
4320 Summer	0.85	0
5760 Summer	0.71	0
7200 Summer	0.61	0
8640 Summer	0.54	0
10080 Summer	0.49	0
15 Winter	28.17	13
30 Winter	19.18	21
60 Winter	12.80	36
120 Winter	8.41	0
180 Winter	6.56	0
240 Winter	5.47	0

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Micro Drainage Source Control W.10.4		

Rainfall Details

Region	ENG+WAL	Shortest Storm (mins)	15
Return Period (years)	1	Longest Storm (mins)	10080
M5-60 (mm)	20.000	Summer Storms	Yes
Ratio-R	0.300	Winter Storms	Yes
Cv (Summer)	0.750	Climate Change %	+0
Cv (Winter)	0.840		

Time / Area Diagram

Total Area (ha) = 0.065

Time (mins)	Area (ha)
from: 0	to: 4 0.065

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Rochdale

Lancashire OL16 1JY

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Micro Drainage

SW attenuation crates

newbuild devs

trub rd castleton

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Source Control W.10.4

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Summary of Results for 30 year Return Period (+40%)

Storm Duration (mins)	Maximum Control (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m³)	Maximum Volume (m³)	Status
360 Winter	4.4	0.0	4.4	133.2337	0.0638	0.0	1.4	O K
480 Winter	3.8	0.0	3.8	133.1852	0.0153	0.0	0.3	O K
600 Winter	3.4	0.0	3.4	133.1700	0.0000	0.0	0.0	O K
720 Winter	3.0	0.0	3.0	133.1700	0.0000	0.0	0.0	O K
960 Winter	2.4	0.0	2.4	133.1700	0.0000	0.0	0.0	O K
1440 Winter	1.8	0.0	1.8	133.1700	0.0000	0.0	0.0	O K
2160 Winter	1.3	0.0	1.3	133.1700	0.0000	0.0	0.0	O K
2880 Winter	1.1	0.0	1.1	133.1700	0.0000	0.0	0.0	O K
4320 Winter	0.8	0.0	0.8	133.1700	0.0000	0.0	0.0	O K
5760 Winter	0.7	0.0	0.7	133.1700	0.0000	0.0	0.0	O K
7200 Winter	0.6	0.0	0.6	133.1700	0.0000	0.0	0.0	O K
8640 Winter	0.5	0.0	0.5	133.1700	0.0000	0.0	0.0	O K
10080 Winter	0.4	0.0	0.4	133.1700	0.0000	0.0	0.0	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
360 Winter	9.05	198
480 Winter	7.38	256
600 Winter	6.29	0
720 Winter	5.52	0
960 Winter	4.49	0
1440 Winter	3.35	0
2160 Winter	2.49	0
2880 Winter	2.02	0
4320 Winter	1.50	0
5760 Winter	1.21	0
7200 Winter	1.03	0
8640 Winter	0.90	0
10080 Winter	0.81	0

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Rainfall Details

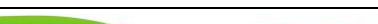
Region	ENG+WAL	Shortest Storm (mins)	15
Return Period (years)	30	Longest Storm (mins)	10080
M5-60 (mm)	20.000	Summer Storms	Yes
Ratio-R	0.300	Winter Storms	Yes
Cv (Summer)	0.750	Climate Change %	+40
Cv (Winter)	0.840		

Time / Area Diagram

Total Area (ha) = 0.065

Time	(mins)	Area
from:	to:	(ha)
0	4	0.065

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Micro Drainage

SW attenuation crates
newbuild devs
trub rd castleton

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Summary of Results for 100 year Return Period (+45%)

Storm Duration (mins)	Maximum Control (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m³)	Maximum Volume (m³)	Status
15 Summer	5.0	0.0	5.0	133.6973	0.5272	0.0	11.6	O K
30 Summer	5.0	0.0	5.0	133.8083	0.6383	0.0	14.0	O K
60 Summer	5.0	0.0	5.0	133.8522	0.6823	0.0	15.0	O K
120 Summer	5.0	0.0	5.0	133.8278	0.6578	0.0	14.5	O K
180 Summer	5.0	0.0	5.0	133.7587	0.5887	0.0	13.0	O K
240 Summer	5.0	0.0	5.0	133.6762	0.5062	0.0	11.1	O K
360 Summer	5.0	0.0	5.0	133.4952	0.3252	0.0	7.2	O K
480 Summer	5.0	0.0	5.0	133.3747	0.2047	0.0	4.5	O K
600 Summer	4.9	0.0	4.9	133.2977	0.1278	0.0	2.8	O K
720 Summer	4.7	0.0	4.7	133.2542	0.0843	0.0	1.9	O K
960 Summer	4.0	0.0	4.0	133.2027	0.0327	0.0	0.7	O K
1440 Summer	3.2	0.0	3.2	133.1700	0.0000	0.0	0.0	O K
2160 Summer	2.4	0.0	2.4	133.1700	0.0000	0.0	0.0	O K
2880 Summer	1.9	0.0	1.9	133.1700	0.0000	0.0	0.0	O K
4320 Summer	1.4	0.0	1.4	133.1700	0.0000	0.0	0.0	O K
5760 Summer	1.1	0.0	1.1	133.1700	0.0000	0.0	0.0	O K
7200 Summer	0.9	0.0	0.9	133.1700	0.0000	0.0	0.0	O K
8640 Summer	0.8	0.0	0.8	133.1700	0.0000	0.0	0.0	O K
10080 Summer	0.7	0.0	0.7	133.1700	0.0000	0.0	0.0	O K
15 Winter	5.0	0.0	5.0	133.7798	0.6098	0.0	13.4	O K
30 Winter	5.0	0.0	5.0	133.9198	0.7498	0.0	16.5	O K
60 Winter	5.0	0.0	5.0	133.9673	0.7973	0.0	17.5	O K
120 Winter	5.0	0.0	5.0	133.9093	0.7393	0.0	16.3	O K
180 Winter	5.0	0.0	5.0	133.7937	0.6238	0.0	13.7	O K
240 Winter	5.0	0.0	5.0	133.6512	0.4812	0.0	10.6	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
15 Summer	89.23	16
30 Summer	61.54	29
60 Summer	40.51	46
120 Summer	25.63	80
180 Summer	19.23	116
240 Summer	15.63	150
360 Summer	11.65	208
480 Summer	9.44	264
600 Summer	8.01	320
720 Summer	7.00	376
960 Summer	5.65	494
1440 Summer	4.17	0
2160 Summer	3.07	0
2880 Summer	2.46	0
4320 Summer	1.81	0
5760 Summer	1.45	0
7200 Summer	1.23	0
8640 Summer	1.07	0
10080 Summer	0.95	0
15 Winter	89.23	16
30 Winter	61.54	30
60 Winter	40.51	48
120 Winter	25.63	88
180 Winter	19.23	124
240 Winter	15.63	160

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Micro Drainage		Source Control W.10.4			
<u>Rainfall Details</u>					
Region	ENG+WAL	Shortest Storm (mins)	15		
Return Period (years)	100	Longest Storm (mins)	10080		
M5-60 (mm)	20.000	Summer Storms	Yes		
Ratio-R	0.300	Winter Storms	Yes		
Cv (Summer)	0.750	Climate Change %	+45		
Cv (Winter)	0.840				
<u>Time / Area Diagram</u>					
Total Area (ha) = 0.065					
Time	(mins)	Area			
from:	to:	(ha)			
0	4	0.065			
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Tank/Pond Details

Invert Level (m) 133.170 Ground Level (m) 134.800

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.00	22.0	0.50	22.0	1.00	22.0	1.50	22.0	2.00	22.0	2.50	22.0
0.10	22.0	0.60	22.0	1.10	22.0	1.60	22.0	2.10	22.0		
0.20	22.0	0.70	22.0	1.20	22.0	1.70	22.0	2.20	22.0		
0.30	22.0	0.80	22.0	1.30	22.0	1.80	22.0	2.30	22.0		
0.40	22.0	0.90	22.0	1.40	22.0	1.90	22.0	2.40	22.0		

Depth / Flow Outflow Control

Invert Level of Control 133.070

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)
0.10	3.6	0.80	4.7	2.00	7.5	4.00	10.7	7.00	14.1
0.20	4.9	1.00	5.2	2.20	7.9	4.50	11.3	7.50	14.6
0.30	5.0	1.20	5.8	2.40	8.3	5.00	11.9	8.00	15.1
0.40	4.9	1.40	6.3	2.60	8.6	5.50	12.5	8.50	15.5
0.50	4.6	1.60	6.7	3.00	9.2	6.00	13.0	9.00	16.0
0.60	4.1	1.80	7.1	3.50	10.0	6.50	13.6	9.50	16.4

Pipe Overflow Control

Pipe Diameter (m) 0.150 Entry Loss Coef 0.500
Slope (1:x) 2.0 Coef of Contraction 0.600
Length (m) 1.500 Invert Level (m) 133.970
Roughness (mm) 0.600

(c)1982-2006 Micro Drainage



T J Booth Associates.
 Consulting Engineers
 20A Eastgate St,
 Rochdale
 OL16 1DH

Project				Job Ref.	
Newbuild - Trub Road, Castleton, Rochdale				rep-tjba-newbuild-trub rd-phs 2_3env-300625	
Section				Sheet no./rev.	
Surface Water Drainage				17 0	
Calc. by	Date	Chk'd by	Date	App'd by	Date
DS	04/08/2025				

INFILTRATION TEST CALCULATIONS.

soakaway test

as per BRE Digest 365

client

Newbuild

project

Trub Rd

locn

TH1

date

30.06.2025

provide a clean vertical sided pit or trench

pit length

1.3

m

pit width

0.3

m

pit depth b GL

1.5

m

pit equiv dia

0.1

m

pit base area

0.375

sqm

TEST

DATE

INFILTRATION RATE

m/s

TEST 1

23rd oct 07

6.1E-06

TEST 2

24th oct 07

3.5E-06

TEST 3

25th oct 07

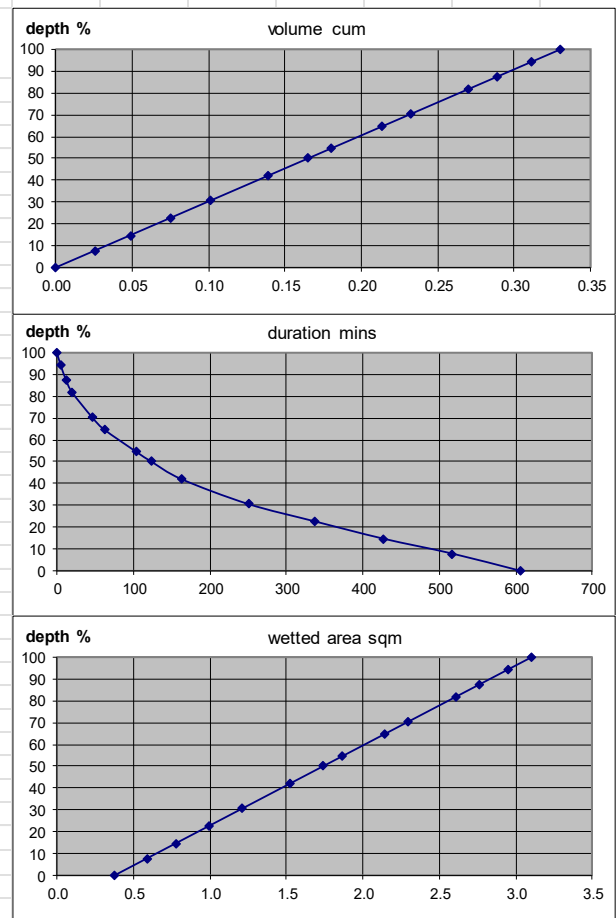
3.1E-06

Design infiltration rate

3.1E-06

 T J Booth Associates. Consulting Engineers 20A Eastgate St, Rochdale OL16 1DH	Project				Job Ref.	
	Newbuild - Trub Road, Castleton, Rochdale				rep-tjba-newbuild-trub rd-phs 2_3env-300625	
	Section				Sheet no./rev.	
Surface Water Drainage				18 0		
Calc. by	Date	Chk'd by	Date	App'd by	Date	
DS	04/08/2025					

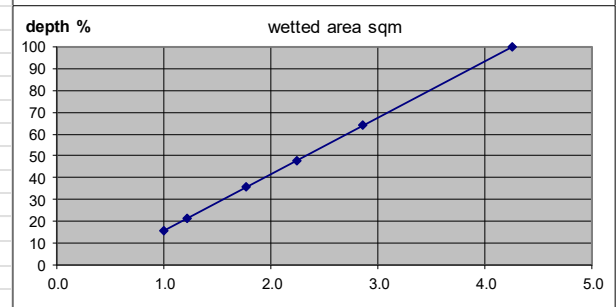
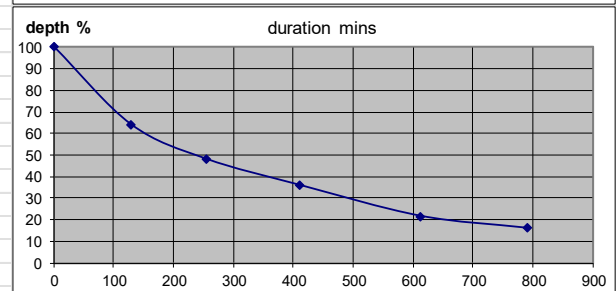
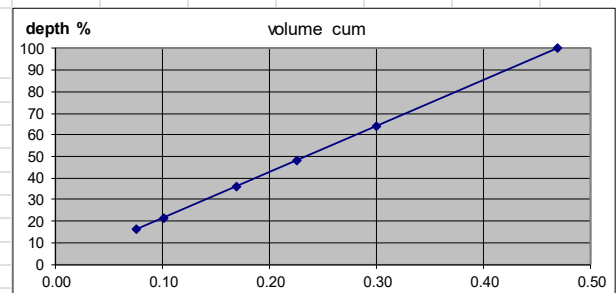
test 1		23rd oct 07									
time		duration	depth	depth	depth	%	wetted	volume			
hr	min		from GL	from base	from wt	depth			area	cum	
		mins	m	m	m		sqm	cu m			
11	23	0	0.19	1.31	0.88	100	3.1	0.33			
11	28	5	0.24	1.26	0.83	94	2.9	0.31			
11	35	12	0.3	1.2	0.77	88	2.8	0.29			
11	43	20	0.35	1.15	0.72	82	2.6	0.27			
12	9	46	0.45	1.05	0.62	70	2.3	0.23			
12	25	62	0.5	1	0.57	65	2.1	0.21			
13	7	104	0.59	0.91	0.48	55	1.9	0.18			
13	27	124	0.63	0.87	0.44	50	1.7	0.17			
14	6	163	0.7	0.8	0.37	42	1.5	0.14			
15	33	250	0.8	0.7	0.27	31	1.2	0.10			
17	0	337	0.87	0.63	0.2	23	1.0	0.08			
18	30	427	0.94	0.56	0.13	15	0.8	0.05			
20	0	517	1	0.5	0.07	8	0.6	0.03			
21	30	607	1.07	0.43	0	0	0.4	0.00			



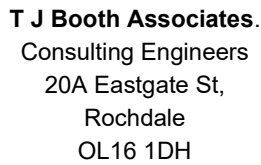
		from charts	
volume @ 75% depth	V75	0.25	cu m
volume @ 25% depth	V25	0.075	cu m
time @ 75% depth	t75	37.5	mins
time @ 25% depth	t25	320	mins
pit surface area @ 50% depth	Ap50	1.7	sq m
infiltration rate	f	6.1E-06	m/s

 T J Booth Associates. Consulting Engineers 20A Eastgate St, Rochdale OL16 1DH	Project				Job Ref.	
	Newbuild - Trub Road, Castleton, Rochdale				rep-tjba-newbuild-trub rd-phs 2_3env-300625	
	Section				Sheet no./rev.	
Surface Water Drainage				19 0		
Calc. by	Date	Chk'd by	Date	App'd by	Date	
DS	04/08/2025					

test 2		24th oct 07								
time		duration	depth from GL	depth from base	depth from wt	% depth	wetted area	volume		
hr	min	mins	m	m	m		sqm	cum		
22	0	0	0.05	1.45	1.25	100	4.3	0.47		
24	9	129	0.5	1	0.8	64	2.9	0.30		
26	15	255	0.7	0.8	0.6	48	2.2	0.23		
28	50	410	0.85	0.65	0.45	36	1.8	0.17		
32	13	613	1.03	0.47	0.27	22	1.2	0.10		
35	12	792	1.3	0.2	0.2	16	1.0	0.08		



		from charts	
volume @ 75% depth	V75	0.35	cu m
volume @ 25% depth	V25	0.12	cu m
time @ 75% depth	t75	75	mins
time @ 25% depth	t25	550	mins
pit surface area @ 50% depth	Ap50	2.3	sq m
infiltration rate	f	3.5E-06	m/s



Newbuild - Trub Road, Castleton, Rochdale

rep-tjba-newbuild-trub rd-phs 2_3env-300625

Surface Water Drainage

20 0

DS

04/08/2025

Date _____

Date _____

A scatter plot with a line of best fit showing the relationship between wetted area (sqm) on the x-axis and depth (%) on the y-axis. The x-axis ranges from 0.0 to 5.0 with major grid lines every 1.0 unit. The y-axis ranges from 0 to 100 with major grid lines every 10 units. There are 7 data points plotted as blue diamonds. A solid blue line represents the line of best fit, starting near (0.4, 0) and ending at approximately (4.3, 100).

wetted area sqm	depth %
0.4	0
0.8	12
1.4	25
1.8	38
2.3	50
2.9	65
4.3	100

			from charts	
volume @ 75% depth	V75	0.35	cu m	
volume @ 25% depth	V25	0.12	cu m	
time @ 75% depth	t75	0.75	mins	
time @ 25% depth	t25	530	mins	
pit surface area @ 50% depth	Ap50	2.3	sq m	
infiltration rate	f	3.1E-06	m/s	