

 T J Booth Associates. Consulting Engineers 20A Eastgate St, Rochdale OL16 1DH	Project Trek Group / Stocksbridge				Job Ref. calc-tjba-TGRP-stocksbridge-drainage rep-190421	
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History.

Revision	Date	Reason
0	April 2021	Original

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Introduction.

Reference:

The LLFA drainage officer has requested information on the discharge of surface water for the Site in accordance with national guidelines, and the NPPG.

T J Booth Associates have been employed by Trek Group to undertake the drainage design for the Site.

Purpose of Report:

The primary purpose of this report is to identify specific drainage proposals for parts of the proposed site in accordance with the national drainage hierarchy for surface water disposal & exceedance characteristics, also considering the proposed end adopters and their requirements.

Regarding site assessment, this report will appraise the existing site and local drainage infrastructure, assess the suitability of the proposed development, giving recommendations for drainage design & management, specifically for approval of the LLFA/EA/sewerage undertakers, as applicable.

General principles:

Drainage from new developments is to be designed to follow the national drainage hierarchy for surface water discharge to the following networks in order of preference:

- *infiltration*
- *watercourse*
- *public sewer*

Flow rates (existing & proposed) are to be estimated for approval using the following methodology:

- *Development should aim to deliver greenfield runoff on greenfield sites up to a 100yr rainfall event, considering climate change.*
- *Development should aim for a minimum reduction in surface water runoff rates of 50% for Brownfield sites on a 1yr rainfall event.*
- *Development should be designed so that there is no flooding to the development in a 30yr event and so that there is no property flooding in a 100yr event considering climate change.*

Plans.

Location Plan.

Refer to the appended Location Plan.

The planning boundary shows the car park to the north east side of the warehouse area, and includes the access from the highway from the south.

There are watercourses in the local area, but these are generally over 250m from the car park.

Site Plan.

The pre-development Site area comprises a lawned/landscaped part of the Site.

The predevelopment site areas are (refer to Existing Impermeable Area Plan in Appendix):

- *Total area* *1380 sqm*
- *Hardstanding area (impermeable & positively drained)* *0 sqm*

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- *Landscaped area (assumed permeable)* *1380 sqm.*

The proposed development is to remove the soft landscaping and turn the area into a car park.

Proposed Site areas are as follows (refer to Proposed Impermeable Area Plan in Appendix):

- *Total area* *1380 sqm*
- *Hardstanding area (impermeable & positively drained)* *1380 sqm*
- *Landscaped area (assumed permeable)* *0 sqm.*

Desk Surveys & Investigations.

Existing and proposed topography.

The Site slopes up from the current car park area at 196.50 (which is to be the lowest level of the proposed car park).

Geology & Site Investigations.

The Site is in an area of no cover according to BGS geology maps.

A trial hole was undertaken on Site at the lowest level of the car park to obtain ground conditions and to assess the potential for infiltration.

Site investigations revealed CLAY at shallow depth with gravelly CLAY (assumed weather bedrock) below this.

Ground water was noted which settled at 1.5m deep (approx. 1m below finished ground level).

Refer to Site Investigation Plan, Site Investigation Logs& photos in Appendix.

Assessments.

Flood zone category.

Site is not within a Flood Zone.

Climate change impacts.

An allowance of 40% has been added to the rainfall amounts to allow for future climate change, in accordance with EA requirements.

Existing surface water system.

The area for development is landscaped and thus is characterised as greenfield.

The Site is on a private sewerage/drainage network, and it is understood that the existing car park drainage is connected to the site surface water network.

Hydrological characteristics for the site were obtained from the HR Wallingford mapping database:

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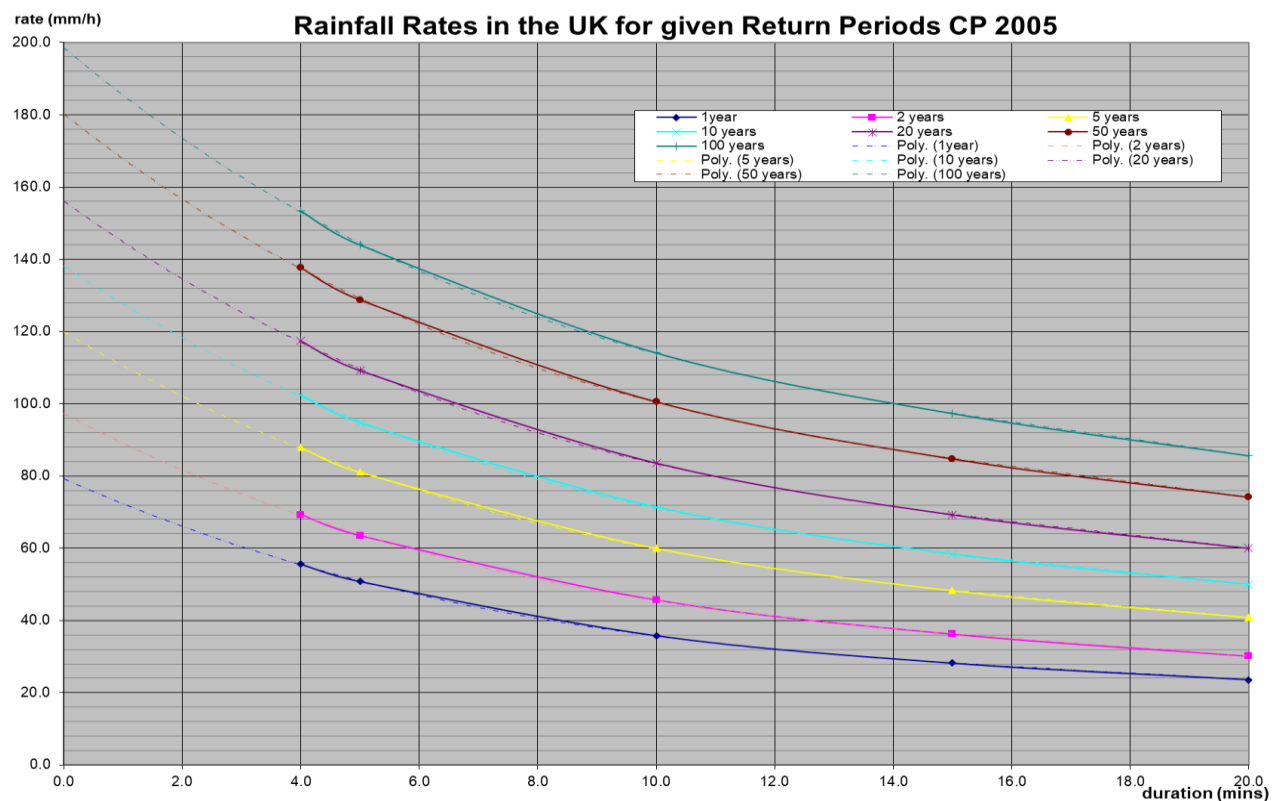
Hydrological characteristics

These data come from the click on the map. The values on the left can be edited.

	My values	Map values
SAAR (mm) 	973	973
M5-60 rainfall depth (mm) 	20	20
'r' ratio M5-60 / M5-2day 	0.3	0.3
FEH/FSR conversion factor 	1.18	1.18
Hydrological region 	3	3

In accordance with CIRIA C753, existing brownfield rainfall and drainage assessment should be undertaken as per section 24.2.3 'Design Rainfall' which states: 'the critical duration is the length of rainfall event that results in the greatest flow rate, flood volume or flood level', and that 'to ensure that the design criteria are met at all points. Return periods from 1yr to 100yrs and durations from 15 minutes to 48 hours are required'.

Thus when assessing critical existing flows from the Site, the 1yr rainfall event for all available durations including the 15minute as baseline should be used. The plot of UK rainfall rate against duration is illustrated for different return period events below:



As per the CIRIA C753 guidance section 24.6.2 – modified rational method (Wallingford procedure), rainfall intensities should be fixed (including for the 1yr 15minute storm) up to 35mm/hr for rainfall assessment of piped systems.

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Rainfall Runoff Assessment.

Existing rainfall runoff assessment was undertaken in accordance with the Ration Method as per Ciria SUDS Manual C753:

Rational Method				
ref: CIRIA C753 "The SuDS Manual"				
Assumption is that runoff C_v from tarmac area = 0.9 and from grass is 0.3				
Brownfield area (existing and will also be part of development)	0			
Greenfield area	0.14			
Total area	0.14	hectares		
	Qbar (~2yr mean annual)	30yr	100yr	100yr + 40%
Rainfall Intensity (mm/hr)	25	44.2	57.7	80.78
Rational Runoff calculation ($2.78CiA$) = $C_v \times \text{rainfall rate} \times \text{Area}$ (l/s)	0.0	0.0	0.0	0.0
Brownfield area 50% runoff reduction	0.0	0.0	0.0	0.0
Greenfield area to become impermeable (l/s). $C = 0.3$	2.9	5.2	6.7	9.4
Max permitted future discharge to sewer (l/s)	2.9	5.2	6.7	9.4

In accordance with current policy, the Site should be regulated as close as possible to greenfield values.

It is difficult to accurately attain predevelopment levels on all return periods, and lower flows are not thought to impact drainage infrastructure significantly. However, it is generally accepted that 5l/s flow is the minimum flow restriction that can be placed upon a system and this would correspond with limiting the 30yr, 100yr and 100yr +CC to below predevelopment greenfield values.

Proposed pass forward flow rates from the development, should therefore be restricted to 5/s.

Proposed Surface Water System.

Following the guidance of hierarchy for disposal of surface water (SUDS):

- **INFILTRATION:** Trial hole investigations have indicated the Site is underlain by impermeable CLAY above weathered bedrock. Shallow ground water was noted within approximately 1m from the proposed finish level.
Good practice alone indicates groundwater table should be at least 1m below infiltration devices.
Due to the above, infiltration is not feasible for this development.
- **WATERCOURSE:** There are watercourses in the wider area but these are all significant distance (approximately 250m) from the car park. In addition, direct discharge to watercourse would require significant civil works and unreasonable disruption to commercial activities.
- **SEWER:** There is an existing drainage system on Site. It is understood that the car park is part of the Site surface water system, and it is proposed the new car park drainage will discharge to this point.

As infiltration is not possible on Site, the car park area will have to be drained to the existing surface water system, via attenuation and flow control.

Attenuation will be via cellular crates, flow controlled by a Hydrobrake at not greater than 5l/s.

As the system is to ultimately discharge to watercourse via the site surface water drainage system, and the proposed car parking area is over 800sq m & 50 car parking spaces; an oil interceptor for low risk sites is required under current guidelines prior to discharge to the existing manhole.

The petrol/oil interceptor has been specified as a Klargester Bypass Separator model No.NSBP003, capable of a peak flow rate of up to 30l/s, and suitable for drainage areas of up to 1670m² (car park area is 1380m²). Bypass separators are suitable for car parks.

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The full Klargestor NSBP003 specification is tabulated below:

Product code	Flow (l/s)	Peak Flow Rate (l/s)	Drainage area (m ²)	Storage Capacity (Ltrs)	Storage Capacity (Ltrs)	Length (mm)	Diameter (mm)	Access Shaft Diameter (mm)	Base Inlet Invert (mm)	Base to Outlet Invert (mm)	Standard Fall Across (mm)	Min Inlet Invert (mm)	Standard Pipework Diameter (mm)
-	-	-	-	Silt	Oil	-	-	-	-	-	-	-	-
NSBP003	3	30	1670	300	45	1700	1350	600	1420	1320	100	500	160

Microdrainage calculations for the proposed drainage system can be found in the appendix.

Proposed Foul Water System.

Not required.

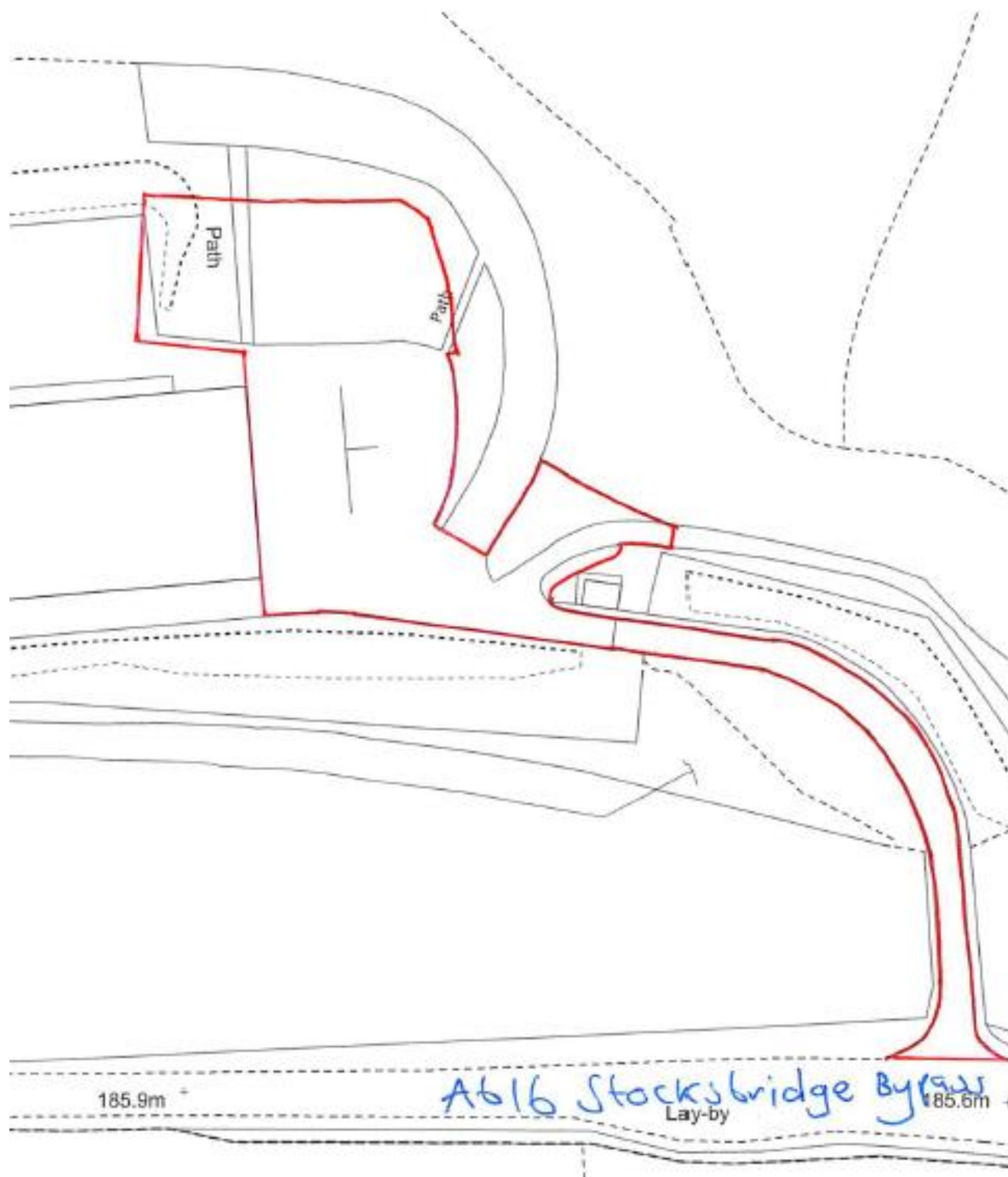
Additional Recommendations.

This report should be issued to the LPA for approval prior to construction.

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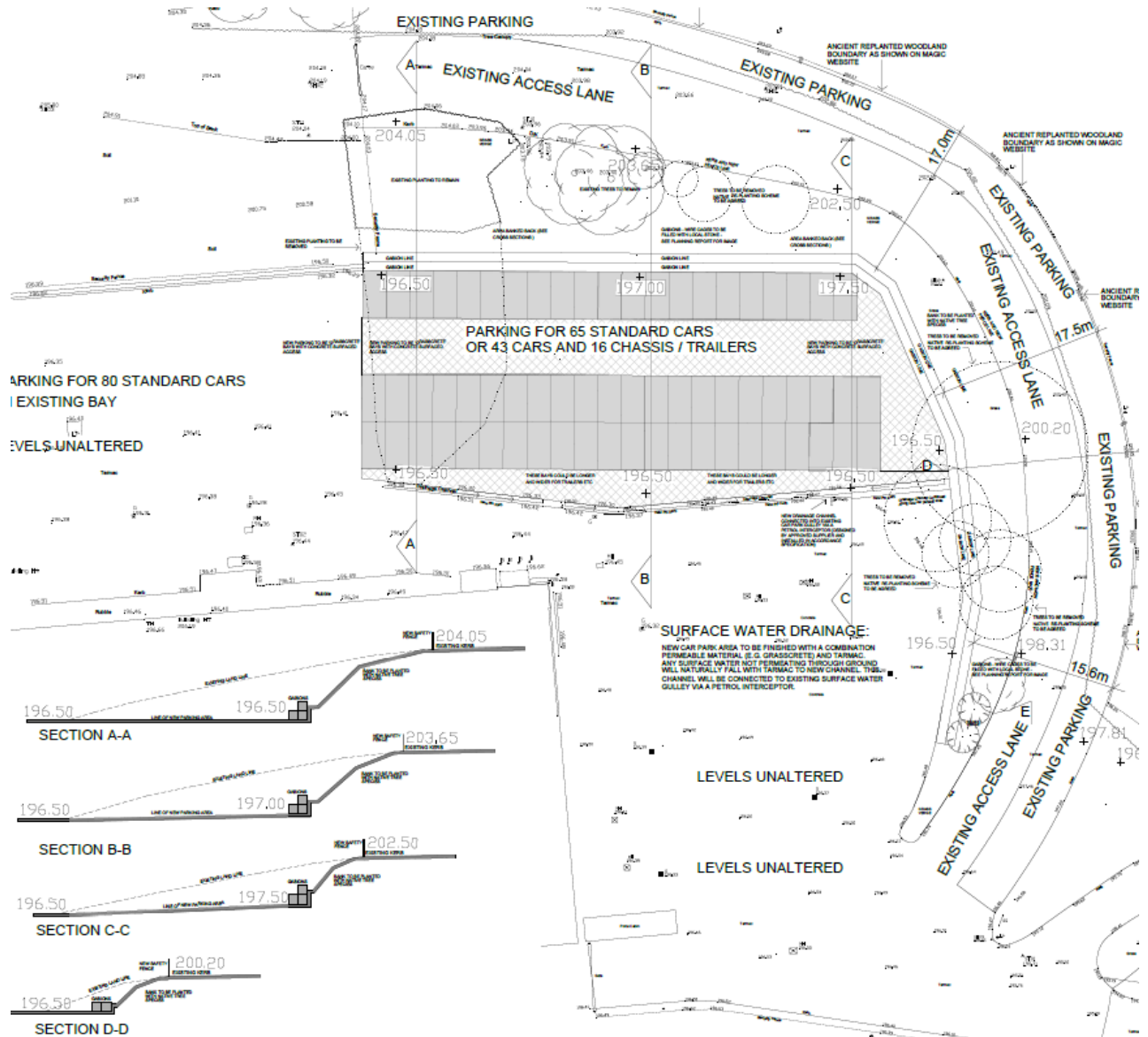
Appendix.

Location Plan.



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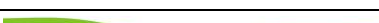
Proposed Site Plan.



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Site & TH Photographs.



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Drainage Calculations.

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Rochdale

Lancashire OL16 1JY

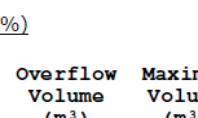
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Micro Drainage

Source Control W.10.4

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Summary of Results for 100 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
15 Summer	5.0	0.0	5.0	195.6057	0.2657	0.0	27.9	O K
30 Summer	5.0	0.0	5.0	195.6942	0.3542	0.0	37.2	O K
60 Summer	5.0	0.0	5.0	195.7772	0.4372	0.0	45.9	O K
120 Summer	5.0	0.0	5.0	195.8127	0.4727	0.0	49.6	O K
180 Summer	5.0	0.0	5.0	195.8117	0.4717	0.0	49.5	O K
240 Summer	5.0	0.0	5.0	195.8012	0.4612	0.0	48.4	O K
360 Summer	5.0	0.0	5.0	195.7727	0.4327	0.0	45.4	O K
480 Summer	5.0	0.0	5.0	195.7382	0.3982	0.0	41.8	O K
600 Summer	5.0	0.0	5.0	195.7002	0.3602	0.0	37.8	O K
720 Summer	5.0	0.0	5.0	195.6632	0.3232	0.0	33.9	O K
960 Summer	5.0	0.0	5.0	195.5983	0.2582	0.0	27.1	O K
1440 Summer	4.8	0.0	4.8	195.5152	0.1752	0.0	18.4	O K
2160 Summer	4.2	0.0	4.2	195.4532	0.1133	0.0	11.9	O K
2880 Summer	3.7	0.0	3.7	195.4247	0.0848	0.0	8.9	O K
4320 Summer	2.8	0.0	2.8	195.4017	0.0617	0.0	6.5	O K
5760 Summer	2.3	0.0	2.3	195.3882	0.0482	0.0	5.1	O K
7200 Summer	1.9	0.0	1.9	195.3792	0.0392	0.0	4.1	O K
8640 Summer	1.7	0.0	1.7	195.3732	0.0332	0.0	3.5	O K
10080 Summer	1.5	0.0	1.5	195.3687	0.0287	0.0	3.0	O K
15 Winter	5.0	0.0	5.0	195.6497	0.3097	0.0	32.5	O K
30 Winter	5.0	0.0	5.0	195.7527	0.4127	0.0	43.3	O K
60 Winter	5.0	0.0	5.0	195.8407	0.5007	0.0	52.6	O K
120 Winter	5.0	0.0	5.0	195.8817	0.5417	0.0	56.9	O K
180 Winter	5.0	0.0	5.0	195.8777	0.5377	0.0	56.5	O K
240 Winter	5.0	0.0	5.0	195.8617	0.5217	0.0	54.8	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
15 Summer	89.23	17
30 Summer	61.54	32
60 Summer	40.51	62
120 Summer	25.63	98
180 Summer	19.23	132
240 Summer	15.63	166
360 Summer	11.65	236
480 Summer	9.44	304
600 Summer	8.01	370
720 Summer	7.00	434
960 Summer	5.65	550
1440 Summer	4.17	780
2160 Summer	3.07	1128
2880 Summer	2.46	1472
4320 Summer	1.81	2204
5760 Summer	1.45	2936
7200 Summer	1.23	3672
8640 Summer	1.07	4400
10080 Summer	0.95	5128
15 Winter	89.23	18
30 Winter	61.54	32
60 Winter	40.51	60
120 Winter	25.63	112
180 Winter	19.23	140
240 Winter	15.63	180

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Micro Drainage				Source Control W.10.4			

Tank/Pond Details

Invert Level (m) 195.340 Ground Level (m) 196.500

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.00	105.0	0.60	105.0	1.20	105.0	1.80	105.0	2.40	105.0
0.10	105.0	0.70	105.0	1.30	105.0	1.90	105.0	2.50	105.0
0.20	105.0	0.80	105.0	1.40	105.0	2.00	105.0		
0.30	105.0	0.90	105.0	1.50	105.0	2.10	105.0		
0.40	105.0	1.00	105.0	1.60	105.0	2.20	105.0		
0.50	105.0	1.10	105.0	1.70	105.0	2.30	105.0		

Depth / Flow Outflow Control

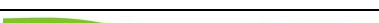
Invert Level of Control 195.330

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	3.9	0.80	5.9	2.00	9.2	4.00	13.1	7.00	17.3
0.20	5.0	1.00	6.5	2.20	9.7	4.50	13.9	7.50	17.9
0.30	4.8	1.20	7.2	2.40	10.1	5.00	14.6	8.00	18.5
0.40	4.4	1.40	7.7	2.60	10.5	5.50	15.3	8.50	19.1
0.50	4.7	1.60	8.3	3.00	11.3	6.00	16.0	9.00	19.6
0.60	5.2	1.80	8.8	3.50	12.2	6.50	16.7	9.50	20.2

Pipe Overflow Control

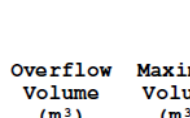
Pipe Diameter (m)	0.150	Entry Loss Coef	0.500
Slope (1:x)	100.0	Coef of Contraction	0.600
Length (m)	3.000	Invert Level (m)	195.890
Roughness (mm)	0.600		

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Ciria SUDS Proposed Attenuation Storage 30yr.

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Date april 2021 - revision 0 File CALC-T~4.SRC			Designed By ds Checked By					
Micro Drainage			Source Control W.10.4					
Summary of Results for 30 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
360 Winter	4.7	0.0	4.7	195.5058	0.1657	0.0	17.4	O K
480 Winter	4.4	0.0	4.4	195.4767	0.1368	0.0	14.4	O K
600 Winter	4.2	0.0	4.2	195.4538	0.1138	0.0	11.9	O K
720 Winter	4.0	0.0	4.0	195.4357	0.0958	0.0	10.0	O K
960 Winter	3.4	0.0	3.4	195.4177	0.0778	0.0	8.2	O K
1440 Winter	2.6	0.0	2.6	195.3972	0.0572	0.0	6.0	O K
2160 Winter	2.0	0.0	2.0	195.3812	0.0412	0.0	4.3	O K
2880 Winter	1.6	0.0	1.6	195.3717	0.0317	0.0	3.3	O K
4320 Winter	1.2	0.0	1.2	195.3613	0.0212	0.0	2.2	O K
5760 Winter	1.0	0.0	1.0	195.3552	0.0153	0.0	1.6	O K
7200 Winter	0.8	0.0	0.8	195.3517	0.0118	0.0	1.2	O K
8640 Winter	0.8	0.0	0.8	195.3492	0.0093	0.0	0.9	O K
10080 Winter	0.7	0.0	0.7	195.3472	0.0073	0.0	0.7	O K
		Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)				
		360 Winter	9.05	226				
		480 Winter	7.38	288				
		600 Winter	6.29	350				
		720 Winter	5.52	406				
		960 Winter	4.49	520				
		1440 Winter	3.35	764				
		2160 Winter	2.49	1128				
		2880 Winter	2.02	1476				
		4320 Winter	1.50	2208				
		5760 Winter	1.21	2928				
		7200 Winter	1.03	3632				
		8640 Winter	0.90	4400				
		10080 Winter	0.81	5120				

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Soil Permeability values.

Typical values of soil permeability

Some typical values of permeability coefficient are given below for different soil types. It refers to normally consolidated condition unless otherwise mentioned. These values should be used only as guideline for geotechnical problems; however, specific condition of each engineering problem often needs to be considered for an appropriate choice of geotechnical parameters.

Description	USCS	min (m/s)	max (m/s)	Specific value (m/s)	Reference
Well graded gravel, sandy gravel, with little or no fines	GW	5.00E-04	5.00E-02		[1].
Poorly graded gravel, sandy gravel, with little or no fines	GP	5.00E-04	5.00E-02		[1].
Silty gravels, silty sandy gravels	GM	5.00E-08	5.00E-06		[1].
Alluvial sand and gravel	(GM)	4.00E-04	4.00E-03		[2&3 in 4]
Clayey gravels, clayey sandy gravels	GC	5.00E-09	5.00E-06		[1].
Well graded sands, gravelly sands, with little or no fines	SW	1.00E-08	1.00E-06		[1].
Very fine sand, very well sorted	(SW)			8.40E-05	[5].
Medium sand, very well sorted	(SW)			2.23E-03	[5].
Coarse sand, very well sorted	(SW)			3.69E-01	[5].
Poorly graded sands, gravelly sands, with little or no fines	SP	2.55E-05	5.35E-04		[1]. [2&3 in 4]
Clean sands (good aquifers)	(SP-SW)	1.00E-05	1.00E-02		[5].
Uniform sand and gravel	(SP-GP)	4.00E-03	4.00E-01		[2&3 in 4]
Well graded sand and gravel without fines	(GW-SW)	4.00E-05	4.00E-03		[2&3 in 4]
Silty sands	SM	1.00E-08	5.00E-06		[1].
Clayey sands	SC	5.50E-09	5.50E-06		[1]. [5]
Inorganic silts, silty or clayey fine sands, with slight plasticity	ML	5.00E-09	1.00E-06		[1].
Inorganic clays, silty clays, sandy clays of low plasticity	CL	5.00E-10	5.00E-08		[1].
Organic silts and organic silty clays of low plasticity	OL	5.00E-09	1.00E-07		[1].
Inorganic silts of high plasticity	MH	1.00E-10	5.00E-08		[1].
Inorganic clays of high plasticity	CH	1.00E-10	1.00E-07		[1].
Compacted silt	(ML-MH)	7.00E-10	7.00E-08		[2&3 in 4]
Compacted clay	(CL-CH)	-	1.00E-09		[2&3 in 4]
Organic clays of high plasticity	OH	5.00E-10	1.00E-07		[1].
Peat and other highly organic soils	Pt	-	-		

 T J Booth Associates. Consulting Engineers 20A Eastgate St, Rochdale OL16 1DH	Project				Job Ref.	
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	Calc. by	Date	Chk'd by	Date	App'd by	Date
	DS	20/04/2021				

Drainage Utilities Maps.

Not used.