

 T J Booth Associates. Consulting Engineers 20A Eastgate St, Rochdale OL16 1DH	Project GB Services - Riverside Business Park (Proposed Units 3, 6 &				Job Ref. calc-tjba-GBS-riveside business park-units 3.6.7-DSR-071123	
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History.

Revision	Date	Reason
0	November 2023	Original to support planning application.

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Introduction.

Reference:

Riverside Business Park comprises 5No. modern built commercial units erected nominally on the footprint of a former fuel station. Central to the units is a dilapidated building, as well as a former car wash structure to the south side of the Site.

The planning proposal includes for the construction of 3No. new commercial units, one replacing the dilapidated building and Ex Unit 3, with the other two units replacing the former car wash.

This report will support and validate a planning application for development.

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 Application Site is on Todmorden Road in Littleborough.

The rear east boundary of the Site is formed by the River Roch, and the south boundary by Town House Brook. The two watercourses share a confluence at the southeast corner of the Site, continuing to flow south towards Littleborough Centre.

Town House Brook to the west of the Site, is canalised through the local area and is culverted below Todmorden Road.

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Site Plan.

The Application Site comprises a relatively newly constructed commercial complex, loosely based on the footprint of the former fuelling station under an existing and separate application.

This existing construction comprises commercial steel framed units with external powder coated metal cladding profile sheet to both the roof and walls.

There are 5No. existing units within the Site (ex units Nos. 1, 2, 3, 4 & 5), nominally central to the plot, and surrounded by car park/yard areas.

The existing car park & access areas are covered partially with permeable material & macadam to the front as part of the past development, and unmade to the rear yard area of the Site.

There is a former car wash to the south boundary, and between the existing units is a dilapidated steel building.

As part of the proposed plans 3No. units are to be erected. Pro Unit 3 will replace the dilapidated structure and Ex Unit 3 and Pro Unit 6/Pro Unit 7 will replace the former car wash to the south boundary.

The existing Site areas are as follows:

- *Ex units 1, 2, 4 & 5* *525 sqm*
- *Ex Units 3* *82 sqm (to be demolished as part of current proposals)*
- *Ex yards/car park & access* *1393 sqm (already finished as part of former planning)*
- *Ex yards/car park & access unmade* *1050 sqm (to be renewed as part of current proposals)*
- *Total Site area* *3050 sqm*

The proposed Site areas are as follows:

- *Pro Unit 3* *185 sqm*
- *Pro Unit 6* *65 sqm*
- *Pro Unit 7* *195 sqm*
- *Ex units 1, 2, 4 & 5* *525 sqm (existing & removed from proposed calculations)*
- *Ex yards/car park & access* *1050 sqm (existing & removed from proposed calculations)*
- *Proposed yards/car park & access* *1030 sqm*
- *Total Site area* *3050 sqm*

Desk Study, Surveys & Investigations.

Existing and proposed topography.

A topographic level survey of the existing Site has previously been undertaken by T J Booth Associates. Indicative levels are as follows in m aOD (also on TJBA Level Survey Plan in the Appendix):

Ex Unit 1	145.55	FFL & threshold level.
Ex Unit 2	145.79	FFL & threshold level.
Ex Unit 3	145.42	External threshold level only.
Ex Unit 4	145.78	FFL & threshold level.
Ex Unit 5	145.78	FFL & threshold level.
Dilapidated building	145.50	nominal GL

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Car wash 145.50 nominal GL

There was a concrete bund wall adjacent the Site and watercourses which had a level of 145.78-145.81 to the west side adjacent the River Roch and was between 145.53 to 145.56 to the southwest boundary adjacent Town House Brook.

Geology & site investigations.

BGS Maps indicate the Site to be underlain by alluvium locally, with terrace deposits to the west over Todmorden Road, and clay till to the east.

Site investigations undertaken by TJBA c2007 recorded alluvial soft silty clay with some minor made ground above.

Assessments.

Existing surface water system.

The existing units, access and car parking to the front of the Site are already connected to a drainage system which has an existing discharge to Town House Brook. For this reasoning, this part of the Site will be excluded from the assessment.

The proposed areas that need to be assessed are thus as follows:

- Units 3, 5 & 6 (445 sqm)
- New yard area (1030 sqm)
- Total: 1475 sqm.

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

SAAR (mm) ⓘ	1298
M5-60 rainfall depth (mm) ⓘ	20 ▾
'r' ratio M5-60 / M5-2day ⓘ	0.2 ▾
FEH/FSR conversion factor ⓘ	1.23
Hydrological region ⓘ	10

EX GREENFIELD RUNOFF

Tedds calculation version 1.0.04

EA_Defra method

Site characteristics

Location	Other
Hydrological region	3
Soil type (Wallingford Procedure W.R.A.P map)	4
Standard percentage runoff	SPR = 0.47
Average annual rainfall	SAAR = 1298 mm
5 year return period rainfall of 60 minute duration	M5_60min = 20.0 mm
Ratio 60-minute to 2 day rainfalls of 5 year return	r = 0.20
Rainfall intensity increase due to global warming	p _{climate} = 0%

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Impervious area req. attenuation storage a = **0.0** %

Catchment details

Subcatchment	Name	Area (ha)	PIMP (%)	Impermeable area (ha)
1	ex area to be developed	0.15	13.0	0.02
Total		0.15	13.0	0.02

Greenfield runoff rates

Catchment area

AREA = **50.00** hectare

Greenfield runoff rate (50 hectare site)

$$Q_{\text{rural}} = 0.00108 \text{ m}^3/\text{s} * (\text{AREA}/1\text{km}^2)^{0.89} * (\text{SAAR}/1\text{mm})^{1.17} * \text{SPR}^{2.17} = \mathbf{497.2 \text{ l/s}}$$

Greenfield runoff rate

$$Q = Q_{\text{rural}} / \text{AREA} * A = \mathbf{1.5 \text{ l/s}}$$

Greenfield runoff rate per unit area

$$Q_A = Q / A = \mathbf{9.9 \text{ l/s/hectare}}$$

Estimated site discharges

FSR growth rate (1 year)

$$\text{FSR}_{1\text{yr}} = \mathbf{0.86}$$

Discharge (1 year)

$$Q_{1\text{yr}} = Q * \text{FSR}_{1\text{yr}} = \mathbf{1.3 \text{ l/s}}$$

FSR growth rate (30 year)

$$\text{FSR}_{30\text{yr}} = \mathbf{1.75}$$

Discharge (30 year)

$$Q_{30\text{yr}} = Q * \text{FSR}_{30\text{yr}} = \mathbf{2.6 \text{ l/s}}$$

FSR growth rate (100 year)

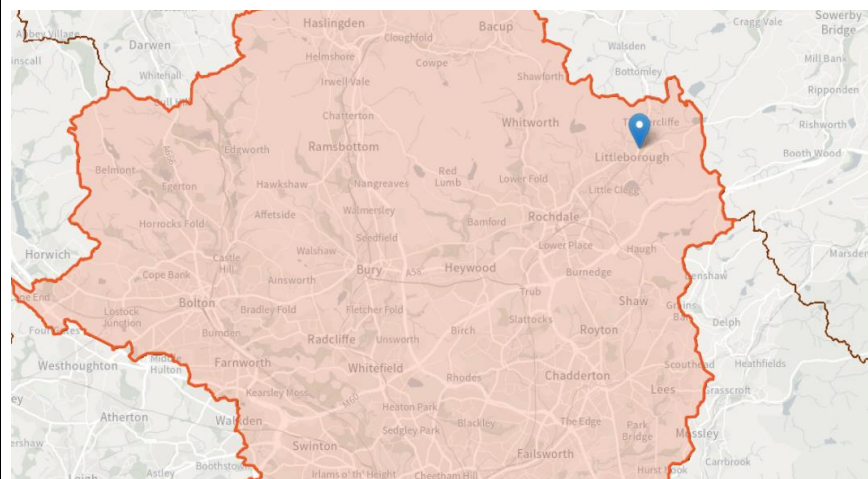
$$\text{FSR}_{100\text{yr}} = \mathbf{2.08}$$

Discharge (100 year)

$$Q_{100\text{yr}} = Q * \text{FSR}_{100\text{yr}} = \mathbf{3.1 \text{ l/s}}$$

Climate change impacts (rainfall).

Climate change allowances to peak rainfall intensity are given nationally across the whole of England. Refer to table below:



3.3% annual exceedance rainfall event

Epoch	Central allowance	Upper end allowance
2050s	25%	35%
2070s	30%	40%

1% annual exceedance rainfall event

Epoch	Central allowance	Upper end allowance
2050s	25%	40%
2070s	30%	45%

Given the commercial end use of the Site, the 2050s epoch is considered suitable for climate change allowance estimation which suggests the following allowance to be used:

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30yr rainfalls +35% climate change allowance

100yr rainfalls +40% climate change allowance

Proposed Surface Water System.

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

- **INFILTRATION:** BGS maps suggest the subsoils comprise alluvium deposits which was confirmed with site investigation information to include silty clay.

Due to the Site end use as commercial starter units, and the associated risk of contaminated runoff either polluting the ground or watercourse infiltration is discounted as a method of surface water disposal.
- **WATERCOURSE:** Town House Brook or the River Roch can be used to discharge surface water. However, flows will need to be attenuated, and controlled prior to discharge.
- The areas requiring new drainage are the proposed units 3, 5 & 6 (445 sqm), and the new yard area (1030 sqm) total: 1475 sqm.
- Yard area is over 800sqm so will require a fuel interceptor.
- Qbar for the existing equivalent greenfield area is 1.5l/s. Considering 5l/s is considered the minimum flow rate for development, the proposed development should utilise attenuation and flow control (hydrobrake or
- **SEWER:** Not required.

Highway SW flows will be kept separate from the FW systems, and combined in the last manhole before connection into the public sewer.

Proposed Foul Water System.

Foul water flows from the proposed development buildings will be connected into the existing combined system that discharges into Todmorden Road.

Additional Recommendations.

If approved, the drainage strategy above should form the basis of the detailed design proposal in due course.

The existing drainage system should also be fully surveyed & jetted as part of the above detailed design process, and any existing outfalls to the watercourse should be fitted with non-return valves.

This report should be issued to the LPA to approve and/or comment on the proposed drainage strategy.

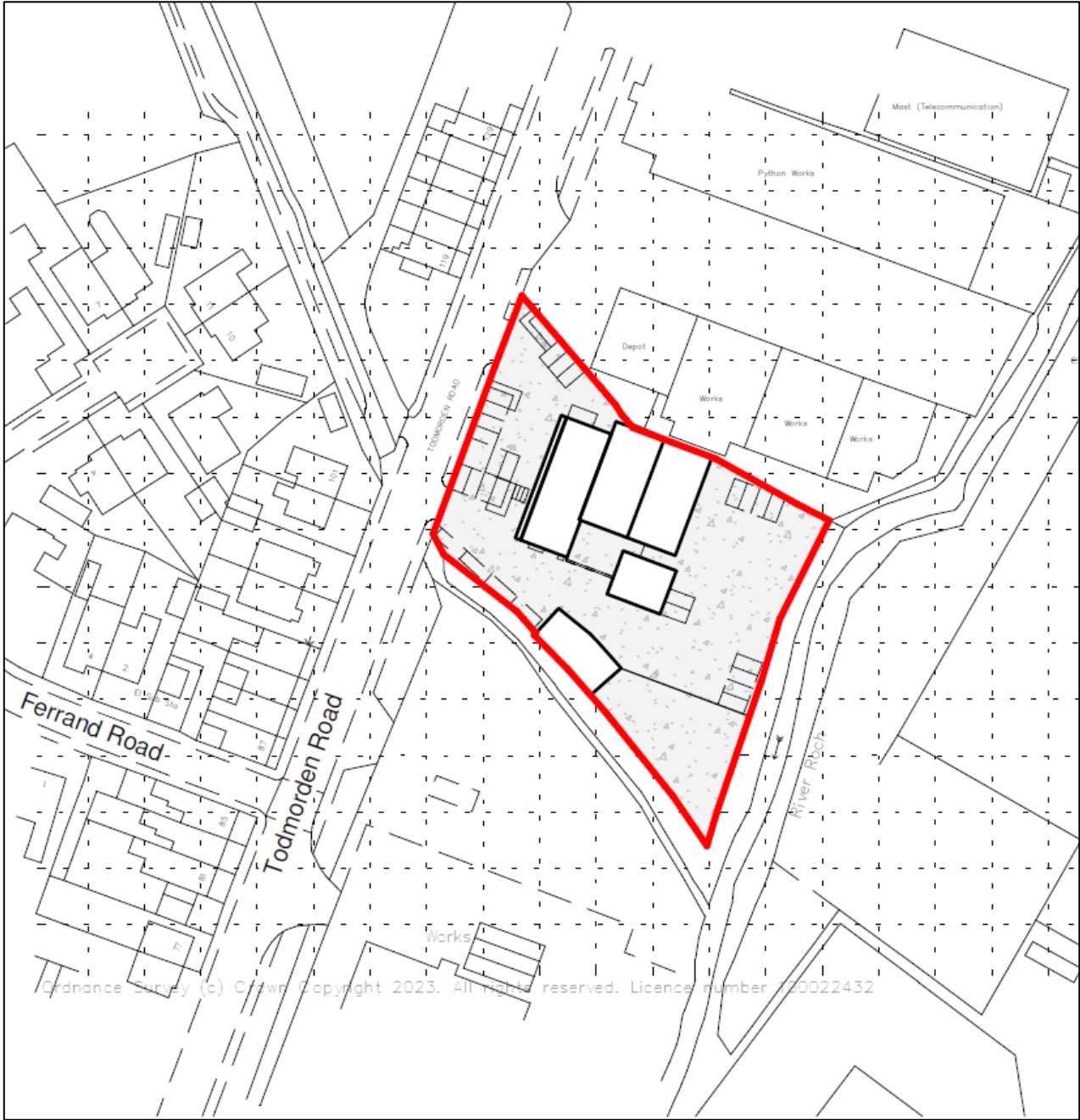


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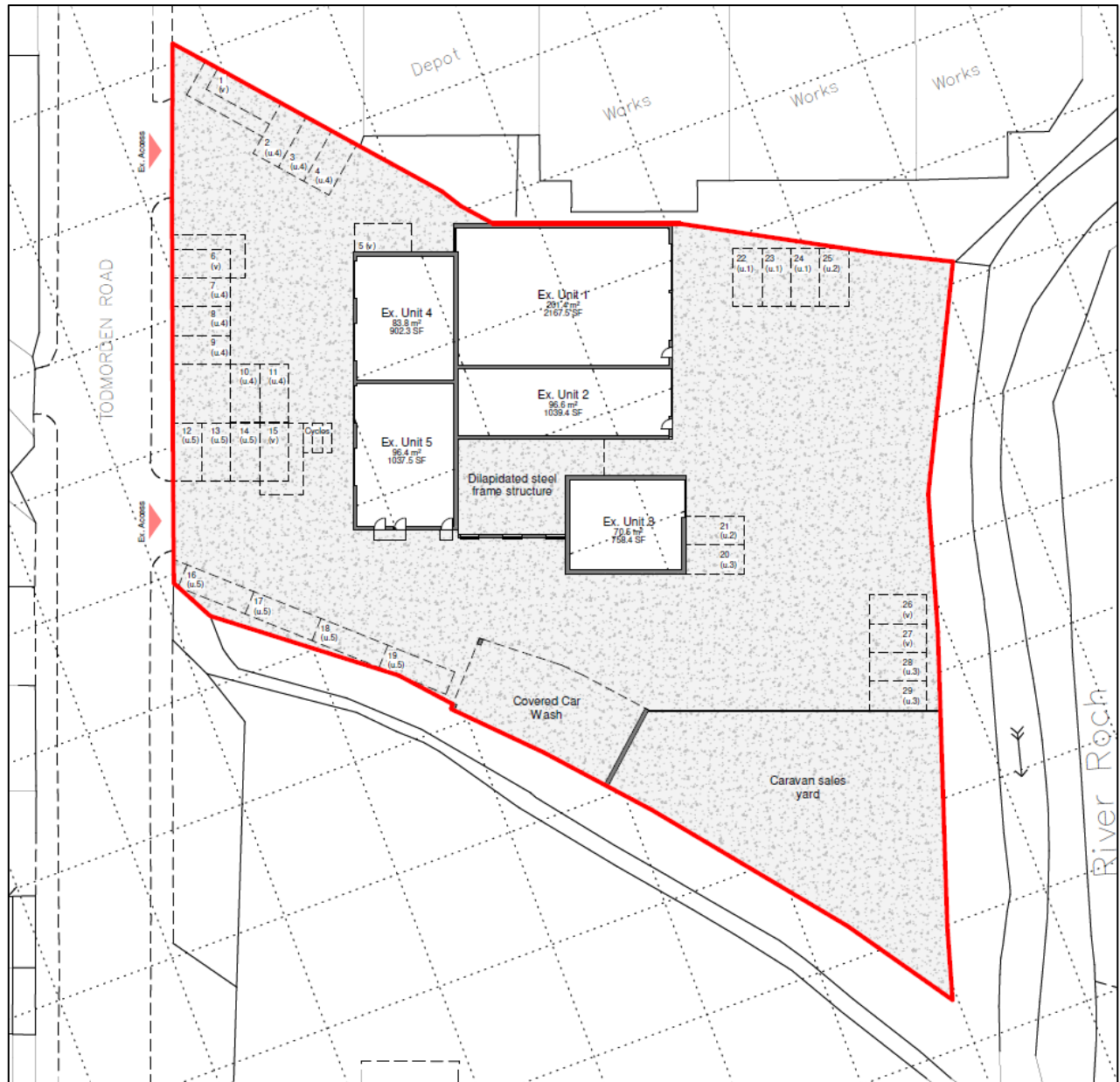
Appendix.

Location Plan.



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Existing Site Plan.



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Drainage Calculations.

Proposed Attenuation Estimates.

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Section: Rainfall Area Attenuation Requirement				Job No:		Revision	
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GENERAL DATA	
site location:	England and Wales
60 min rainfall depth of 5 year return period 'R' [mm] =	20
M5-60 to M5-2d rainfall ratio 'r' =	0.30
proposed discharge rate 'v ₁ ' [litre/s] =	5.00
proposed discharge rate 'v ₂ ' [litre/s] =	5.00
allowance for climate change:	40%

SUMMARY OF CALCULATIONS		
required storage volume for discharge rate 'v ₁ ' =	45.74	m ³
required storage volume for discharge rate 'v ₂ ' =	67.77	m ³

AREA DATA	impermeability [%]	effective area [m ²]
impermeable area 'A ₁ ' [m ²] =	1475	1475
landscaping and/or green roof area 'A ₂ ' [m ²] =	0	0
other partially permeable area 'A ₃ ' [m ²] =	0	0
AREA DRAINED TO ATTENUATION TANK =		1475 m²

REQUIRED STORAGE VOLUME PER RAINFALL DURATION FOR DISCHARGE RATE v_1													
rainfall duration [min]	rainfall factor Z1	M5-D rainfalls [mm]	ignore			ignore			M30-D			outflow from attenuation tank [m ³]	required storage [m ³]
			Z2	rainfalls [mm]	inflow [m ³]	Z2	rainfalls [mm]	inflow [m ³]	Z2	rainfalls [mm]	inflow [m ³]		
5	0.34	6.80							1.45	13.80	20.35	1.50	18.85
10	0.49	9.80							1.49	20.41	30.10	3.00	27.10
15	0.59	11.80							1.50	24.83	36.63	4.50	32.13
30	0.77	15.40							1.53	32.94	48.59	9.00	39.59
60	1.00	20.00							1.54	43.21	63.74	18.00	45.74
120	1.25	25.00							1.53	53.67	79.16	36.00	43.16
240	1.57	31.40							1.51	66.24	97.70	72.00	25.70
360	1.78	35.60							1.49	74.12	109.33	108.00	1.33
600	2.12	42.40							1.46	86.40	127.43	180.00	0.00
1440	2.84	56.80							1.40	111.26	164.11	432.00	0.00

* Z2 is a growth factor from M5 rainfalls

REQUIRED STORAGE VOLUME PER RAINFALL DURATION FOR DISCHARGE RATE v_2													
rainfall duration [min]	rainfall factor Z1	M5-D rainfalls [mm]	ignore			ignore			M100-D			outflow from attenuation tank [m ³]	required storage [m ³]
			Z2	rainfalls [mm]	inflow [m ³]	Z2	rainfalls [mm]	inflow [m ³]	Z2	rainfalls [mm]	inflow [m ³]		
5	0.34	6.80							1.83	17.45	25.74	1.50	24.24
10	0.49	9.80							1.91	26.14	38.56	3.00	35.56
15	0.59	11.80							1.94	32.03	47.24	4.50	42.74
30	0.77	15.40							1.99	42.97	63.39	9.00	54.39
60	1.00	20.00							2.03	56.84	83.84	18.00	65.84
120	1.25	25.00							2.01	70.35	103.77	36.00	67.77
240	1.57	31.40							1.96	86.11	127.01	72.00	55.01
360	1.78	35.60							1.93	95.95	141.53	108.00	33.53
600	2.12	42.40							1.87	111.05	163.80	180.00	0.00
1440	2.84	56.80							1.76	140.25	206.87	432.00	0.00

* Z2 is a growth factor from M5 rainfalls

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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	-	-		

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Site Photographs.

Not used.

Drainage Utilities Maps.

Not used.