SUDS REPORT FOR LAND ADJACENT TO 1 MOUNT VIEW, ENFIELD, EN2 8LF

DOCUMENT NUMBER.: C2362-R1-REV-A

PREPARED BY

Nimbus
ENGINEERING CONSULTANTS

Contents

APPENDICES

1. INTRODUCTION

1.1 Appointment

Nimbus Engineering have been appointed by John Perrin & Sons to provide an outline solution on the management of Surface Water run-off and to ensure that there is no risk of flooding caused by the proposed construction of a three story dwelling, with associated, hard standing, car parking, and landscaping.

1.2 Objectives

This report will provide information on a suitable Sustainable Urban Drainage System (SuDS) in order to reduce the surface water run off leaving the site and show that the proposed development will not increase Flood Risk at the site or elsewhere.

1.3 Limitations

The general limitations of this report are:

- A number of data and information sources have been used to prepare this report. Whilst Nimbus Engineering believes them to be trustworthy, Nimbus Engineering is unable to guarantee the accuracy of data and information that has been provided by others;

- This report has been prepared using the best data and information that was available at the time of writing. There is the potential for further information or data to become available, leading to changes in the conclusions drawn by this report, for which Nimbus Engineering cannot be held responsible.

2. GEOLOGY OF THE AREA

According to, the British geological survey, the superficial deposits at the proposed site consist of an amalgamation of clay, silt, sand and gravel as shown in Figure 1, below. The bedrock in the area is a member of London Clay Formation, as shown in Figure 2, below.

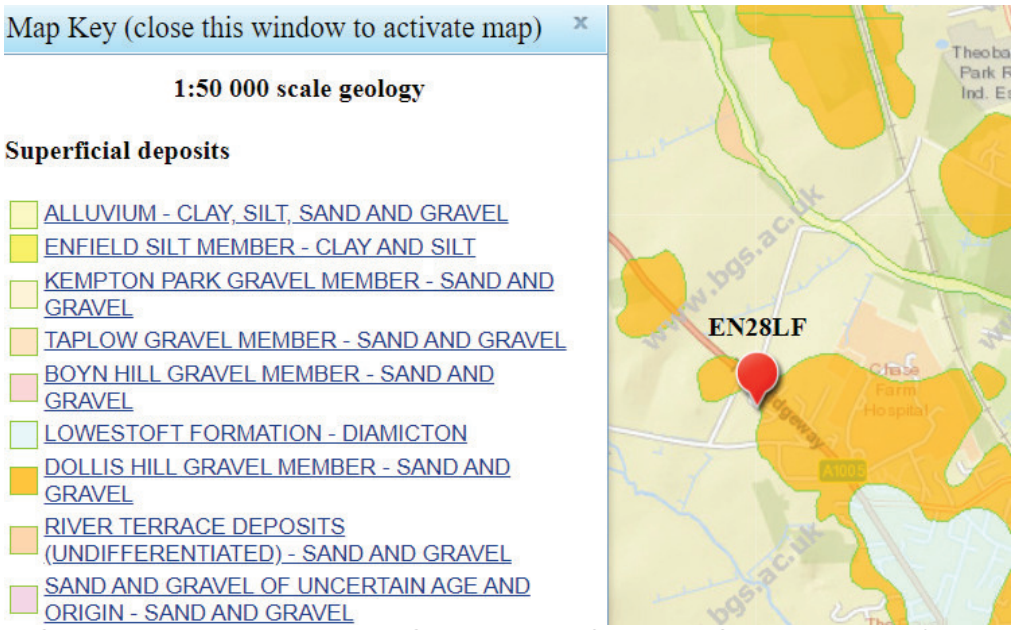


Figure 1- Superficial Deposits at the site. (Source: British Geological Society Website (Contains British Geological Survey materials © URKI [2020]. Base mapping is provided by ESRI)).

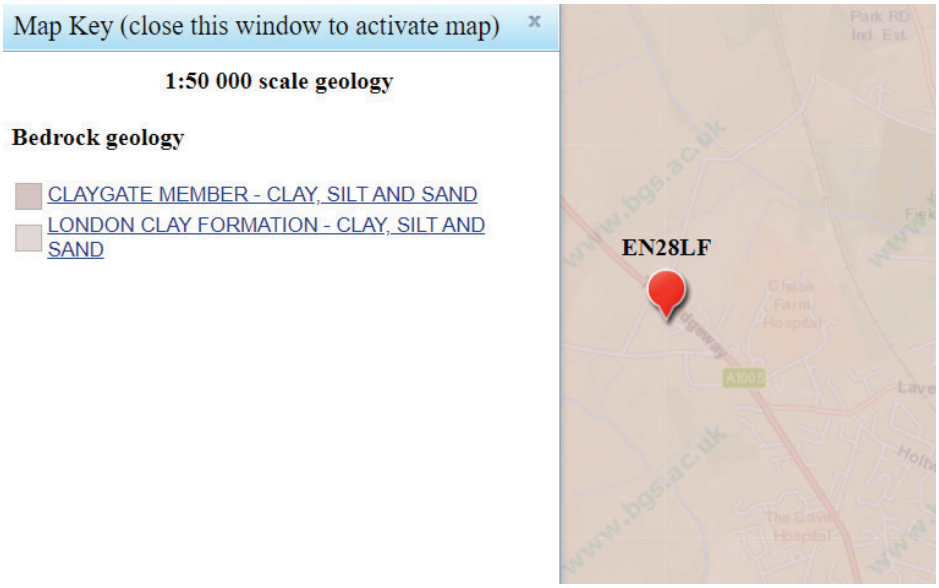


Figure 2 – Bedrock at the site. (Source: British Geological Society Website (Contains British Geological Survey materials © URKI [2020]. Base mapping is provided by ESRI)).

The London Borough of Enfield have requested that historic boreholes within the vicinity of the site are consulted in order to ascertain the suitability of infiltration, the location of the boreholes is shown on the plan overleaf, and the results can be found in Appendix A.

Figure 3 - Historic Boreholes at the site. (Source: British Geological Society Website (Contains British Geological Survey materials © URKI [2019]. Base mapping is provided by ESRI)).

The results of these boreholes show that infiltration is not feasible. A percolation test was also undertaken on site on the 23rd and 24th November which confirmed infiltration was not feasible these results can be found in Appendix A.

3. SUSTAINABLE URBAN DRAINAGE SYSTEMS

The total area of the site is 283m^2, and the existing impermeable areas at the site are 0m^2. Following the development proposals, the impermeable areas at the site will have increased to 173m^2. Surface water run off calculations can be found in Appendix B.

Surface water arising from a developed site should, as far as is practicable, be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development, while reducing the flood risk to the site itself and elsewhere, taking climate change into account.

Reducing the rate of surface water discharge from urban sites is one of the most effective ways of reducing and managing flood risk.

Traditional piped surface water systems work by removing surface water from our developments as quickly as possible, however this can cause various adverse impacts:

- Increased downstream flooding, and sudden rises in flow rates and water levels in local water courses.
- Reduction in groundwater levels and dry weather flows in watercourses.
- Reduce amenity and adversely affect biodiversity due to the surface water run-off containing contaminants such as oil, organic matter and toxic materials.

SuDS are defined as a sequence of management principles and control structures designed to drain surface water in a more sustainable fashion than conventional piped drainage techniques. SuDS should utilise the natural landscape of an area which as well as slowing down the rate of runoff provides a number of environmental, ecological and social benefits.

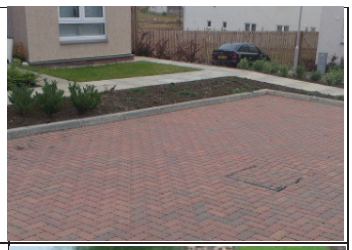
These include:

- Protection and enhancement of water quality. As well as providing on-site attenuation, SuDS treat the water, resulting in an improved quality of water leaving the site. This is achieved when the water passes through fine soils and the roots of specially selected plants. Pollutants washed off the hard landscaping by rainfall will be safely removed before the water reaches the natural receiving water course.

- A sympathetic approach to the environmental setting by providing opportunities to create habitats for flora and fauna in urban watercourses and open spaces.

- Meeting the amenity and social needs of the local community and residents in the creation of attractive green spaces.

The various types of SuDS include:

Permeable paving	
Soakaways;	
Swales and basins;	
Bioretention/ rain gardens;	
Green roofs and rainwater re-use;	

Preferably a combination of these techniques should be used as part of the surface water management train, and it is important for all stakeholders, such as developers, architects, landscape architects and engineers to work in order to determine a feasible solution.

4. PROPOSED SOLUTION

In order to ensure that the SuDS management train has been followed, the proposals involve raingarden planters for the two rainwater downpipes at the eastern edge of the building, in order to treat and slow down the peak rate of surface water runoff from the roof areas.

All proposed hardstanding areas will be formed of permeable paving, and slot drains will be provided for all sloped areas.

The percolation test calculations showed an infiltration rate of $5x10^{-6}$ m/s and would require a soakaway of $35m^2$ footprint which would not be feasible due to spatial constraints at both the front and rear of the property.

Hydrograph run off storage calculations were carried out using the total contributing area, for a 1 in 100 year storm event, with a 40% allowance for climate change, with a flow restriction leaving the site set to 0.5 l/s, the existing site's greenfield run-off rate was 0.118l/s, and as the solution had to be pumped it was deemed this was too small and could potentially lead to pump failure. Having a discharge rate of 0.5 l/s it was calculated that $8.6m^3$ of storage was required. This surface water run-off will be stored in the sub-base of the permeable paving within the car parking out with the basement's extents, as shown on drawing number C2362-03, in Appendix C.

We believe the Sustainable Urban Drainage System hierarchy has been considered fully, with as much of the surface water runoff to be treated at source and attenuated within the

permeable paving sub-base and restricted to a lower rate of 0.5l/s, in line with the London Borough of Enfield's requirements. All surface water run off calculations can be found in Appendix B.

This restricted surface water run-off will be from the pumping station will then connect into a combined sewer manhole within 1 Mount View as previously agreed with Enfield Council as shown on drawing number C2362-03, in Appendix C, and on the asset plans provided in Appendix D.

5. TIMESCALE AND MAINTENANCE OF WORKS

All drainage works will be completed prior to first occupation and there will be no adoption of any of the drainage works within the site, a management company will be formed, which will be responsible in overseeing the long-term maintenance of all the communal drains.

- Gullies should be cleaned every 3 months in order to ensure that there are no blockages.

- The catch pit chambers to the sub-base storage and flow control chamber should be checked and emptied every 3 months, especially after a heavy rain storm, this to ensure that the system does not get clogged up with silt or blocked.

The following table outlines the maintenance requirements for the permeable paving:

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations or clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this is the most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphospate applied directly into the weeds by an applicator rather than spraying	As required
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving.	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material.	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to

		significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48hr after large storms in six months
	Inspect slit accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

The following table outlines the maintenance requirements for the raingarden planters:

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Pipe inlets to the raingarden planters should be checked every month and especially after an extreme rainstorm to ensure that there are no blockages.	Monthly
	Periodic inspections & removal of debris or other items that represent blockage risks particularly in vicinity of the inlet to the raingarden planters	Monthly
	Weeding, cutting of plants and removal of any dead plants to ensure that the system works effectively	Every three months
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockages by sediment, algae or other matter: remove and replace surface infiltration medium as necessary.	Annually
Remedial actions	Repair inlets, outlets, overflows	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that the are in good condition and operating as designed	Annually

6. CONCLUSIONS

The purpose of this report and associated drawings, is to satisfy the local planning authority that the surface water run of arising from the proposed development will be dealt with at source, through the use of Sustainable Urban Drainage Systems.

The timetable of works is to complete all drainage prior to occupation of dwellings, and maintenance requirements are also included in this report.

APPENDIX A – HISTORIC BOREHOLES & PERCOLATION TEST RESULTS

London Analytical Surveys Ltd.
Tel: 081-503 0375
Fax: 081-503 0024

Ref. No. 91/443

BORING RECORD

Location Medium Secure Unit Chase Farm Hospital — Borehole No. 3
Client Turner & Townsend — Date 21 March 1991
Ground Level 56.7m ND — Diameter of Boring 150 mm — Depth of Lining Tubes - m

Description	D. Level m	Legend	Sample	Depth m	Thickness m	S.P. or Vane Test	Depth of Water below ground level
TOPSOIL.	56.70			0.00	0.40		
Firm to stiff light brown mottled light grey brown & orange slightly silty CLAY with some fine medium flint & chalk gravel. Hair roots.	56.30		1	0.40	0.60		
Stiff light brown to brown with light grey veining fissured CLAY. Calcareous concretions to 1.5m. Occasional hair roots.	55.70		2, 3, 4	1.00	1.00		
Stiff brown with light blue grey veining slightly fissured CLAY. Pockets of yellow brown ferruginous silt & fine sand to 2.7m. occasional partings of yellow brown fine sand and pockets of weathered gypsum below 3.0m. Gypsum becoming less weathered and diseminated with depth.	54.70		5, 6, 7, 8, 9, 10, 11, 12, 13	2.00	4.00	N 17	
Stiff dark brown fissured CLAY with yellow brown staining on fissure planes. Diseminated gypsum. Becoming dark grey brown below 9.0m.	50.70		14, 15, 16, 17, 18, 19, 20, 21, 22	6.00	4.00 penetrated	N 24, N 27	Dry throughout
	46.70			10.00			

Scale: 1:50

Tube Sample | N Standard Penetration Test | ▲ Water Sample
D Disturbed Sample | + Vane Test (shear strength in kN/m²)

Fig. No. 3

GROUND EXPLORATIONS LIMITED

BOREHOLE SECTION SHEET

Date October, 19 51.

CONTRACT NAME RHFIELD. ORDER NO. -

Bored for : Messrs. James & Partners.

Address : 6a, Lower Grosvenor Place, S.W.1.

Address of Site : Chase Farm Hospital.

District or Town : Enfield. County : Middx.

Standing Water Level : 3' 9" Below Surface Dia. of Borehole : 6 Inches.

Water Struck (1) 3'9" Ft. B.S. (2) : Ft. B.S. (3) : Ft. B.S.

Boring Commenced : 5. 10. 51. Boring Completed : 5. 10. 51.

Special Remarks : Surface Level 223.0

Jar Samples : 5'0"-6048; 7'6"-6049; 15'0"-6050; 20'0"-6051; 24'0"-6052; Water-6053;

Core Samples : 10'0"-11'6"-6054;

DESCRIPTION OF STRATA		Thickness Feet	Thickness Inches	Depth Below Surface Feet	Depth Below Surface Inches	(m)
Clients are requested to examine the samples of the Strata submitted, as the descriptions employed below are general terms and responsibility is not accepted for their application to commercial purposes.						
(C) No. 3 Boring.						
Topsoil	0.30m	1	0	1	0	0.30
Clay and Stones	1.52m	5	0	6	0	1.83
Gravel	0.76m	2	6	8	6	2.59
Brown London Clay	3.12m	10	3	18	9	5.72
Blue London Clay	1.60m	5	3	24	0	7.32
TOTAL FROM SURFACE ... 7.32 m		24	0	24	0	7.32

This form is to be returned to Head Office immediately the borehole is finished.

Foreman's Signature..... *Date* October, 1951.

P. & R. Ltd.—6376

TQ38/803

258.

Page 1 of 3

GROUND EXPLORATIONS LIMITED

BOREHOLE SECTION SHEET

Date October, 19 51.

CONTRACT NAME ENFIELD. ORDER NO. -

Bored for : Messrs. R. T. James & Partners.

Address : 6a, Lower Grosvenor Place, S.W.1.

Address of Site : Chase Farm Hospital, 127 The Ridgeway.

District or Town : Enfield. County : Middx.

Standing Water Level : 3' 6" Below Surface Dia. of Borehole : 6 Inches.

Water Struck (1) : 3½ Ft. B.S. (2) : Ft. B.S. (3) : Ft. B.S.

Boring Commenced : Boring Completed :

Special Remarks : Surface Level = 325.4

Jar Samples : 3'0"-6028; 5'0"-6029; 8'0"-6030; 10'0"-6031; 15'0"-6032; 20'0"-6033; 25'0"-6034; 35'0"-6035;

Core Samples : 22'0"-23'6"-6037; 33'0"-34'6"-6038;

DESCRIPTION OF STRATA		Thickness Feet	Thickness Inches	Depth Below Surface Feet	Depth Below Surface Inches	
Clients are requested to examine the samples of the Strata submitted, as the descriptions employed below are general terms and responsibility is not accepted for their application to commercial purposes.						
(A) No. 1 Boring.						
						(M)
Topsoil	0.23m	0	9	0	9	0.23
Clay and Stones	0.84m	2	9	3	6	1.07
Gravel and Sandy Clay	1.07m	3	6	7	0	2.13
Sand	0.46m	1	6	8	6	2.59
Clay and Stones	0.61m	2	0	10	6	3.20
Black Stones	2.13m	7	0	17	6	5.33
Blue London Clay	8.69m	28	6	46	0	14.02
TOTAL FROM SURFACE ... 14.02m		46	0	46	0	14.02m

This form is to be returned to Head Office immediately the borehole is finished.

October, 1951.

Foreman's Signature..... *Date*.....

P. & R. Ltd.—6376

Ref. No. 91/443

London Analytical Surveys Ltd.

BORING RECORD

Tel: 081-503 0375
Fax: 081-503 0024

Location Medium Secure Unit Chase Farm Hospital — Borehole No. 1
Client Turner & Townsend — Date 21 March 1991
Ground Level 57.90m ND — Diameter of Boring 150 mm — Depth of Lining Tubes m

Description	D. Level m	Legend	Sample	Depth m	Thickness m	S.P. or Vane Test	Depth of Water below ground level
TOPSOIL.	57.90			0.00	0.30		
Firm light brown mottled light grey brown & orange CLAY with a little gravel. Pockets of yellow brown & light grey clayey sand and fine medium coarse gravel below 1.3m. Some hair roots.	57.60		1 2 3	0.30	1.50		
Stiff brown with light blue grey veining slightly fissured CLAY. Occasional calcareous concretions. Some partings of orange ferruginous fine sand to 2.5m. Becoming more fissured below 2.5m. Occasional gypsum below 4.0m.	56.10		4 5 6 7 8 9 10 11 12	1.80	4.00	N 8 N 27	
Stiff dark brown fissured CLAY, yellow brown on fissure planes. Partings of yellow brown fine sand. Disseminated gypsum.	52.10		13 14 15 16 17 18 19 20	5.80	3.70		
Stiff dark brown grey slightly fissured CLAY.	48.40 47.90		21 22	9.50 10.00	0.50 pene-trated		Dry throughout 22 PM Dry

Scale: 1:50

▮ Tube Sample N Standard Penetration Test ▲ Water Sample
O Disturbed Sample + Vane Test (shear strength in kN/m²)

Fig. No. 1

Nimbus Engineering Consultants Ltd
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email: info@nimbusengineering.co.uk

MasterDrain
SW 16.02

Job No.	C2362
Sheet no.	1
Date	15/12/20
Project	Land Adjacent to 1 Mount View
Title	BRE365 Trench Soakaway calcs
By	S.L
Checked	
Reviewed	

Rectangular pit design data:-

Pit length	= 8 m	Pit width	= 4.5 m
Depth below invert	= 1.2 m	Percentage voids	= 100.0%
Imperm. area	= 173 m²	Infilt. factor	= 0.000005 m/s
Return period	= 100 yrs	Climate change	= 30%

Calculations :-

Surface area of soakaway to 50% storage depth (not inc. base):-

a_{s50} = 2 x (length + width) x depth/2 = 15.0 m²

Outflow factor : O = a_{s50} x Infiltration rate = 0.000075 m/s

Soakaway storage volume : S_{actual} = length x width x depth x %voids/100 = 43.2 m³

Duration	Rainfall mm/hr	Inflow m³	Depth (hmax) m	Outflow m³	Storage m³
5 mins	222.4	3.2	0.09	0.02	3.17
10 mins	164.6	4.7	0.13	0.04	4.68
15 mins	131.6	5.7	0.16	0.07	5.62
30 mins	85.3	7.4	0.20	0.14	7.25
1 hrs	52.7	9.1	0.25	0.27	8.84
2 hrs	31.4	10.9	0.29	0.54	10.33
4 hrs	18.3	12.6	0.32	1.08	11.55
6 hrs	13.2	13.7	0.33	1.62	12.04
10 hrs	8.7	15.1	0.34	2.70	12.39
24 hrs	4.3	17.8	0.31	6.48	11.29

Actual volume : S_{actual} = 43.200 m³

Required volume : $S_{reqd.}$ = 12.390 m³

Soakaway volume storage OK.

Minimum required a_{s50} : 4.30 m²

Actual a_{s50} : 15.00 m²

Minimum depth required: 0.34 m

Time to maximum 10 hrs

Emptying time to 50% volume = t_{s50} = S_{reqd} x 0.5 / (a_{s50} x Infiltration rate) = 22:56 (hr:min))

Soakaway emptying time is OK.

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Job No.	C2362
Sheet no.	2
Date	15/12/20

MasterDrain
SW 16.02

Project	Land Adjacent to 1 Mount View	By	S.L
Title	BRE365 Trench Soakaway calcs	Checked	
		Reviewed	

Location hydrological data (FSR):-

Location	= ENFIELD	Grid reference	= TQ3296
M5-60 (mm)	= 20	r	= 0.43
Soil index	= 0.45	SAAR (mm/yr)	= 670
WRAP	= 4	Area = England and Wales	

Soil classification for WRAP type 4
Clayey, or loamy over clayey soils with an impermeable layer at shallow depth.

N.B. The rainfall rates are calculated using the location specific values above in accordance with the Wallingford procedure.

CHECK SHEET

1. Please specify the size of the soakaway that you are proposing to use:

Width (m) **Length (m)** **Depth (m)**

2. Please specify the area that is to be drained to the soakaway:

m^2

3. Please specify the size of the trial pit:

Width (m)	**Length (m)**	**Depth (m)**
1m	1m	1m

4. Please specify the proposed invert level of the drain:

m

5. Below is a table for you to input the data (times) gathered from the Soil Infiltration Rate tests:

Test Number	**75%**	**25%**	**25% - 75%**
1	50 minutes	570 minutes	520 minutes
2	60 minutes	630 minutes	530 minutes
3	60 minutes	630 minutes	530 minutes

Key: 75% - The time taken in minutes for the water level to fall to 75% full. 25% - The time taken in minutes for the water level to fall to 25% full. 25% - 75% - The 25% time minus the 75% time. (This will give the time for the water level to fall from 75% full to 25% full.)

Name: Sarah Curtis

Signature: 

Date: 21/11/2020

APPENDIX B – SURFACE WATER RUN OFF CALCULATIONS

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Job No.	Sheet no.	Date
C2362	1	27/07/20

MasterDrain SW

Project	By	Checked	Reviewed
Land Adjacent to 1 Mount View, Enfield, EN2 8LF	S.L		

Title: Hydrograph storage calcs with 0.5 l/s discharge

Data:-

Location = ENFIELD
M5-60 (mm) = 20
Soil index = 0.45
Return period = 100
UCWI = 0.0

Grid reference = TQ3296
r = 0.43
SAAR (mm/yr) = 670
WRAP = 4
Climate change = 40%

Clayey, or loamy over clayey soils with an impermeable layer at shallow depth.

Pipeline storage = 0.0 m³
Offline storage = 0.0 m³

Available MH storage = 0.0 m³

Percentage runoff = 100.0% (manual setting)

Imperv. area = 173 m²
Total area = 173 m²
Total runoff = 11.7 m³

Pervious area = 0 m²
Equiv area = 173 m² (Tot. area x % runoff).
Discharge rate = 0.500 l/s

Storage (m³) = 8.6 m³ (Sum of all balance quantities)

Total rainfall depth = 67.7 mm

Calculations :-

Time (hrs)	%Mean intens	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)	Cumulative (m3)
0.020	20.0	6.8	0.023	0.036	0.000	0.000
0.040	20.0	6.8	0.023	0.036	0.000	0.000
0.060	21.0	7.1	0.025	0.036	0.000	0.000
0.080	21.0	7.1	0.025	0.036	0.000	0.000
0.100	22.0	7.4	0.026	0.036	0.000	0.000
0.120	23.0	7.8	0.027	0.036	0.000	0.000
0.140	24.0	8.1	0.028	0.036	0.000	0.000
0.160	26.0	8.8	0.030	0.036	0.000	0.000
0.180	27.0	9.1	0.032	0.036	0.000	0.000
0.200	29.0	9.8	0.034	0.036	0.000	0.000
0.220	31.0	10.5	0.036	0.036	0.000	0.000
0.240	32.0	10.8	0.037	0.036	0.001	0.002
0.260	33.0	11.2	0.039	0.036	0.003	0.004
0.280	34.0	11.5	0.040	0.036	0.004	0.008
0.300	36.0	12.2	0.042	0.036	0.006	0.014
0.320	38.0	12.9	0.044	0.036	0.008	0.023
0.340	39.0	13.2	0.046	0.036	0.010	0.033
0.360	40.0	13.5	0.047	0.036	0.011	0.043
0.380	42.0	14.2	0.049	0.036	0.013	0.057
0.400	45.0	15.2	0.053	0.036	0.017	0.073
0.420	49.0	16.6	0.057	0.036	0.021	0.095
0.440	53.0	17.9	0.062	0.036	0.026	0.121
0.460	57.0	19.3	0.067	0.036	0.031	0.151
0.480	62.0	21.0	0.073	0.036	0.037	0.188
0.500	66.0	22.3	0.077	0.036	0.041	0.229
0.520	71.0	24.0	0.083	0.036	0.047	0.276
0.540	77.0	26.1	0.090	0.036	0.054	0.330
0.560	84.0	28.4	0.098	0.036	0.062	0.393
0.580	91.0	30.8	0.107	0.036	0.071	0.463
0.600	98.0	33.2	0.115	0.036	0.079	0.542
0.620	105.0	35.5	0.123	0.036	0.087	0.629
0.640	114.0	38.6	0.133	0.036	0.097	0.727
0.660	125.0	42.3	0.146	0.036	0.110	0.837
0.680	135.0	45.7	0.158	0.036	0.122	0.959
0.700	143.0	48.4	0.167	0.036	0.131	1.090
0.720	154.0	52.1	0.180	0.036	0.144	1.235
0.740	164.0	55.5	0.192	0.036	0.156	1.391
0.760	173.0	58.5	0.203	0.036	0.167	1.557
0.780	183.0	61.9	0.214	0.036	0.178	1.735
0.800	194.0	65.6	0.227	0.036	0.191	1.927

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Job No.	Sheet no.	Date
C2362	2	27/07/20

MasterDrain SW

Project	By	Checked	Reviewed
Land Adjacent to 1 Mount View, Enfield, EN2 8LF	S.L		

Title: **Hydrograph storage calcs with 0.5 l/s discharge**

Calculations (cont.) :-

Time (hrs)	%Mean intens	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)	Cumulative (m3)
0.820	204.0	69.0	0.239	0.036	0.203	2.129
0.840	212.0	71.7	0.248	0.036	0.212	2.342
0.860	219.0	74.1	0.256	0.036	0.220	2.562
0.880	226.0	76.5	0.265	0.036	0.229	2.791
0.900	233.0	78.8	0.273	0.036	0.237	3.027
0.920	239.0	80.9	0.280	0.036	0.244	3.271
0.940	244.0	82.6	0.286	0.036	0.250	3.521
0.960	248.0	83.9	0.290	0.036	0.254	3.775
0.980	249.0	84.3	0.292	0.036	0.256	4.031
1.000	250.0	84.6	0.293	0.036	0.257	4.288
1.020	250.0	84.6	0.293	0.036	0.257	4.544
1.040	249.0	84.3	0.292	0.036	0.256	4.800
1.060	248.0	83.9	0.290	0.036	0.254	5.054
1.080	244.0	82.6	0.286	0.036	0.250	5.304
1.100	239.0	80.9	0.280	0.036	0.244	5.548
1.120	233.0	78.8	0.273	0.036	0.237	5.784
1.140	226.0	76.5	0.265	0.036	0.229	6.013
1.160	219.0	74.1	0.256	0.036	0.220	6.233
1.180	212.0	71.7	0.248	0.036	0.212	6.446
1.200	204.0	69.0	0.239	0.036	0.203	6.649
1.220	194.0	65.6	0.227	0.036	0.191	6.840
1.240	183.0	61.9	0.214	0.036	0.178	7.018
1.260	173.0	58.5	0.203	0.036	0.167	7.184
1.280	164.0	55.5	0.192	0.036	0.156	7.340
1.300	154.0	52.1	0.180	0.036	0.144	7.485
1.320	143.0	48.4	0.167	0.036	0.131	7.616
1.340	135.0	45.7	0.158	0.036	0.122	7.738
1.360	125.0	42.3	0.146	0.036	0.110	7.849
1.380	114.0	38.6	0.133	0.036	0.097	7.946
1.400	105.0	35.5	0.123	0.036	0.087	8.033
1.420	98.0	33.2	0.115	0.036	0.079	8.112
1.440	91.0	30.8	0.107	0.036	0.071	8.182
1.460	84.0	28.4	0.098	0.036	0.062	8.245
1.480	77.0	26.1	0.090	0.036	0.054	8.299
1.500	71.0	24.0	0.083	0.036	0.047	8.346
1.520	66.0	22.3	0.077	0.036	0.041	8.387
1.540	62.0	21.0	0.073	0.036	0.037	8.424
1.560	57.0	19.3	0.067	0.036	0.031	8.455
1.580	53.0	17.9	0.062	0.036	0.026	8.481
1.600	49.0	16.6	0.057	0.036	0.021	8.502
1.620	45.0	15.2	0.053	0.036	0.017	8.519
1.640	42.0	14.2	0.049	0.036	0.013	8.532
1.660	40.0	13.5	0.047	0.036	0.011	8.543
1.680	39.0	13.2	0.046	0.036	0.010	8.552
1.700	38.0	12.9	0.044	0.036	0.008	8.561
1.720	36.0	12.2	0.042	0.036	0.006	8.567
1.740	34.0	11.5	0.040	0.036	0.004	8.571
1.760	33.0	11.2	0.039	0.036	0.003	8.573
1.780	32.0	10.8	0.037	0.036	0.001	8.575
1.800	31.0	10.5	0.036	0.036	0.000	8.575
1.820	29.0	9.8	0.034	0.036	0.000	8.573
1.840	27.0	9.1	0.032	0.036	0.000	8.569
1.860	26.0	8.8	0.030	0.036	0.000	8.563
1.880	24.0	8.1	0.028	0.036	0.000	8.555
1.900	23.0	7.8	0.027	0.036	0.000	8.546
1.920	22.0	7.4	0.026	0.036	0.000	8.536
1.940	21.0	7.1	0.025	0.036	0.000	8.525
1.960	21.0	7.1	0.025	0.036	0.000	8.513
1.980	20.0	6.8	0.023	0.036	0.000	8.501
2.000	20.0	6.8	0.023	0.036	0.000	8.488

Storage volume (m^3) = 8.6 m^3 (Sum of all balance quantities)

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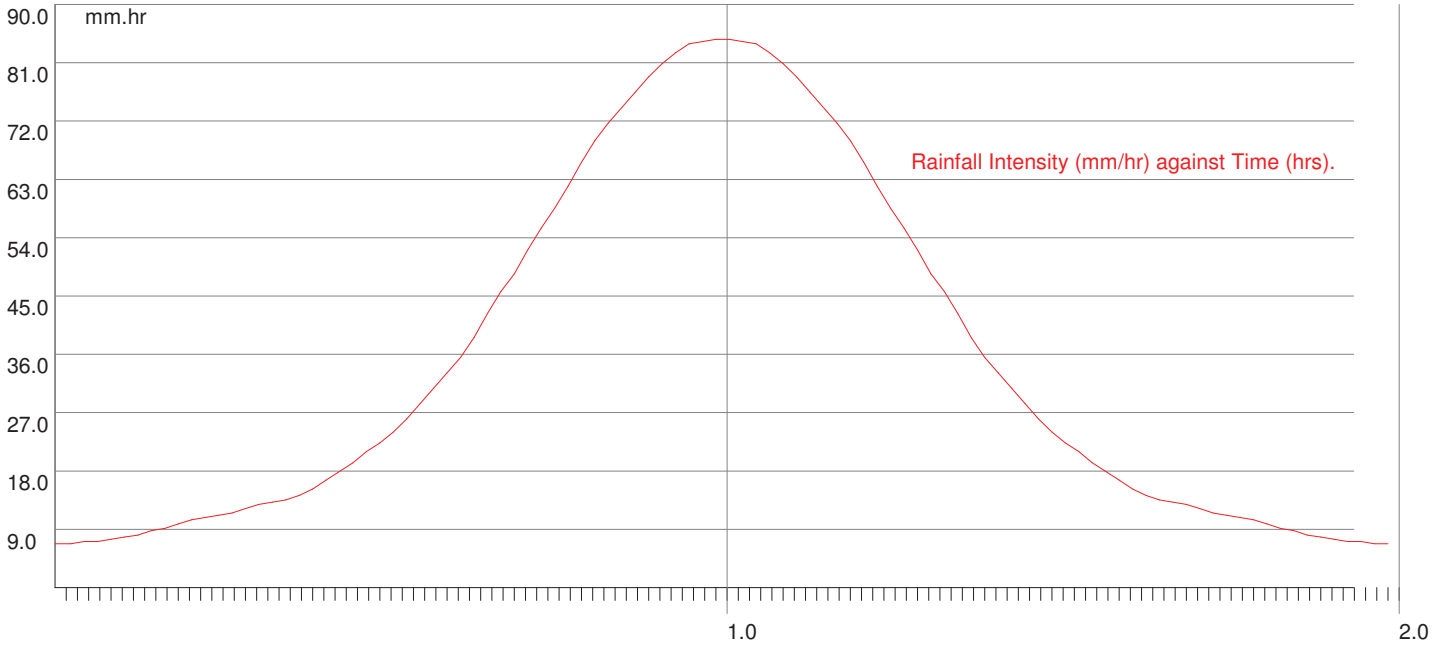
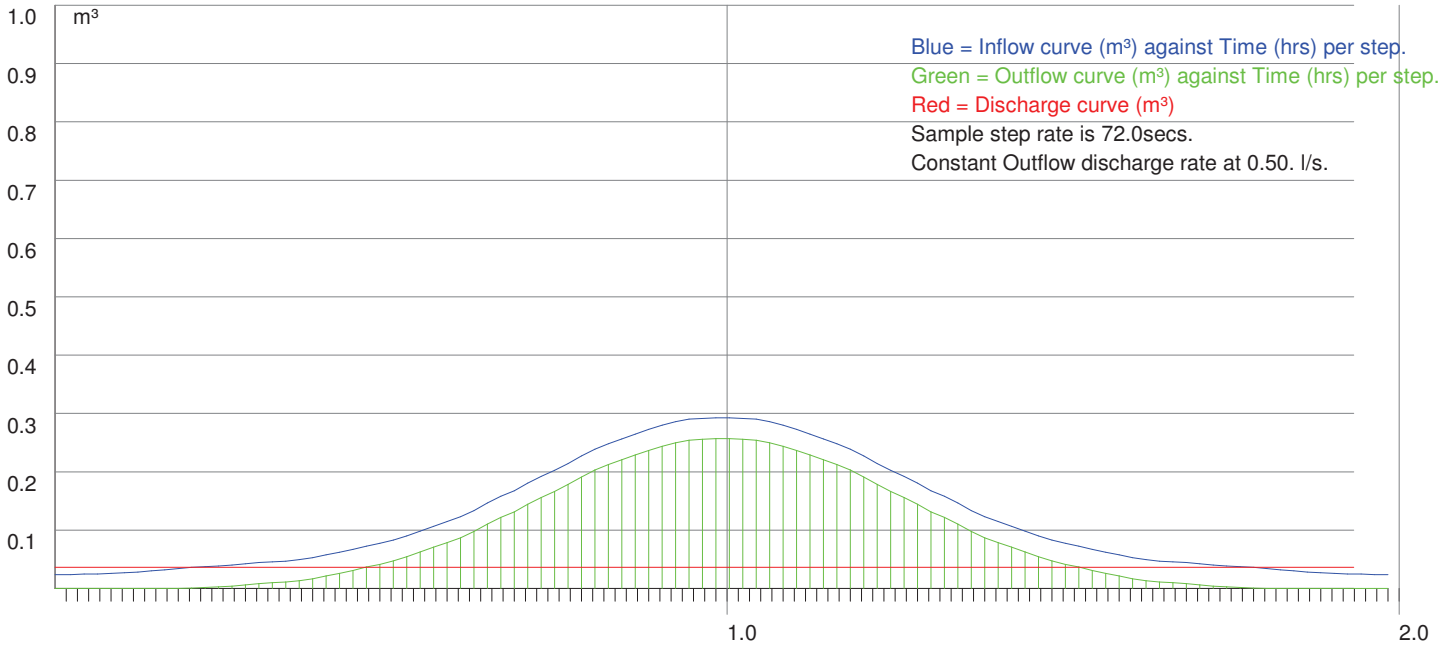
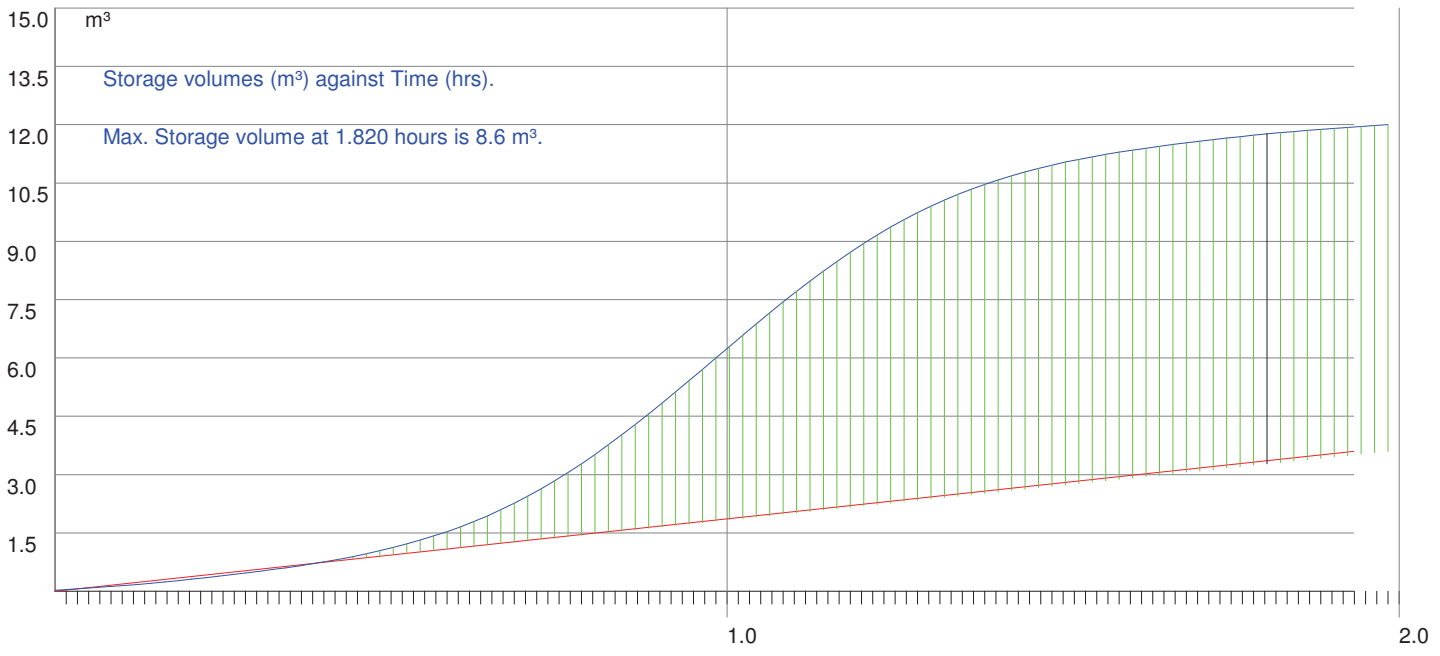
Job No.	C2362
Sheet no.	3
Date	27/07/20

MasterDrain SW

Project	Land Adjacent to 1 Mount View, Enfield, EN2 8LF	By	S.L
Title	Hydrograph storage calcs with 0.5 l/s discharge	Checked	
		Reviewed	







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Job No.	C2362
Sheet no.	4
Date	27/07/20
Project	Land Adjacent to 1 Mount View, Enfield, EN2 8LF
Title	Hydrograph storage calcs with 0.5 l/s discharge

By	Checked	Reviewed
S.L		

Maximum storage volumes for varying duration storms.

Storm length (hrs)	Max. Vol (m^3)	Max. Vol time	Mean intens (mm/hr)	Step time. (mins)	Peak found
0.25	5.83	0.25	141.69	0.2	
0.5	7.25	0.50	91.88	0.3	
1	8.26	1.00	56.71	0.6	
2	8.58	2.00	33.84	1.2	Peak found
3	8.36	---	24.70	1.8	
4	7.99	---	19.66	2.4	
5	7.53	---	16.41	3.0	
6	7.07	---	14.18	3.6	
7	6.60	---	12.52	4.2	
8	6.13	---	11.25	4.8	
9	5.67	---	10.23	5.4	
10	5.21	---	9.39	6.0	
12	4.33	---	8.10	7.2	
15	3.10	---	6.76	9.0	
18	2.03	---	5.83	10.8	
20	1.40	---	5.35	12.0	
24	0.42	---	4.61	14.4	
30	0.00	---	3.84	18.0	
36	0.00	---	3.31	21.6	
42	0.00	---	2.91	25.2	
48	0.00	---	2.61	28.8	
54	0.00	---	2.37	32.4	
60	0.00	---	2.17	36.0	
66	0.00	---	2.01	39.6	
72	0.00	---	1.87	43.2	
84	0.00	---	1.65	50.4	
96	0.00	---	1.47	57.6	
120	0.00	---	1.22	72.0	
150	0.00	---	1.02	90.0	
175	0.00	---	0.89	105.0	
200	0.00	---	0.80	120.0	
250	0.00	---	0.66	150.0	
300	0.00	---	0.57	180.0	
375	0.00	---	0.47	225.0	
500	0.00	---	0.37	300.0	
750	0.00	---	0.27	450.0	
1000	0.00	---	0.21	600.0	
1250	0.00	---	0.17	750.0	
1500	0.00	---	0.15	900.0	
1570	0.00	---	0.14	942.0	
2000	0.00	---	0.12	1200.0	
2500	0.00	---	0.10	1500.0	
3000	0.00	---	0.08	1800.0	
3500	0.00	---	0.07	2100.0	
4000	0.00	---	0.07	2400.0	

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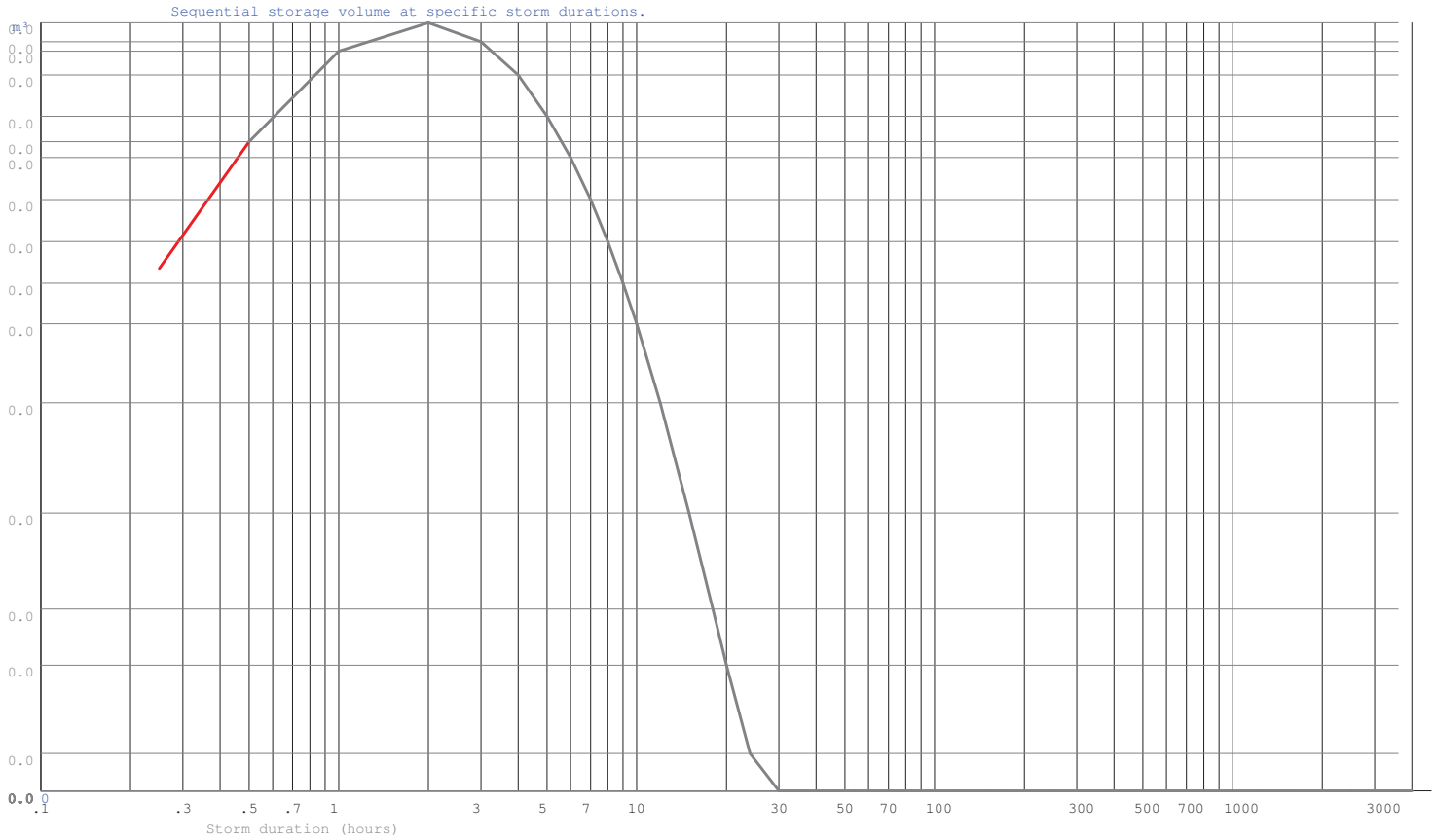
Job No.	C2362
Sheet no.	5
Date	27/07/20
By	S.L
Checked	
Reviewed	

Project: **Land Adjacent to 1 Mount View, Enfield, EN2 8LF**

Title: **Hydrograph storage calcs with 0.5 l/s discharge**



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Job No. C2362			
Sheet no. 6			
Date 27/07/20			
Project: Land Adjacent to 1 Mount View, Enfield, EN2 8LF	By S.L	Checked	Reviewed
Title: Hydrograph storage calcs with 0.5 l/s discharge			

Explanatory notes for Peak Flow Storage

1) This system uses the rainfall intensity/ duration curve calculated using either the Wallingford or FEH method as selected.
2) The balance is calculated from the inflow minus the outflow.
3) The storage volume is the maximum value of the balance curve.
4) This method was described by Davis (1963) - see Butler & Davies, 2nd edition, p294
5) References to 'storm duration' relate only to the hydrograph method (qv).
6) There are always 600 steps in the calculation process, thus a 'run' time of 10 hours will be sampled every minute,

Explanatory notes for Hydrograph Storage

1) The user has the choice of Summer or Winter curves
2) The mean intensity varies with the duration of the storm curve
3) There are always 120 steps in the calculation process, irrespective of storm duration.
4) The balance is calculated from the inflow minus the outflow.
5) The storage volume is the sum of the balance values for each step.
6) Varying durations should be tried to find the maximum storage value - this can be narrowed down very closely.

*Modelling using the flow characteristics of the restrictor is available using Vortex Control modelling function. Please be aware that this function needs the full design data file to function.

Why do the two methods give different results?

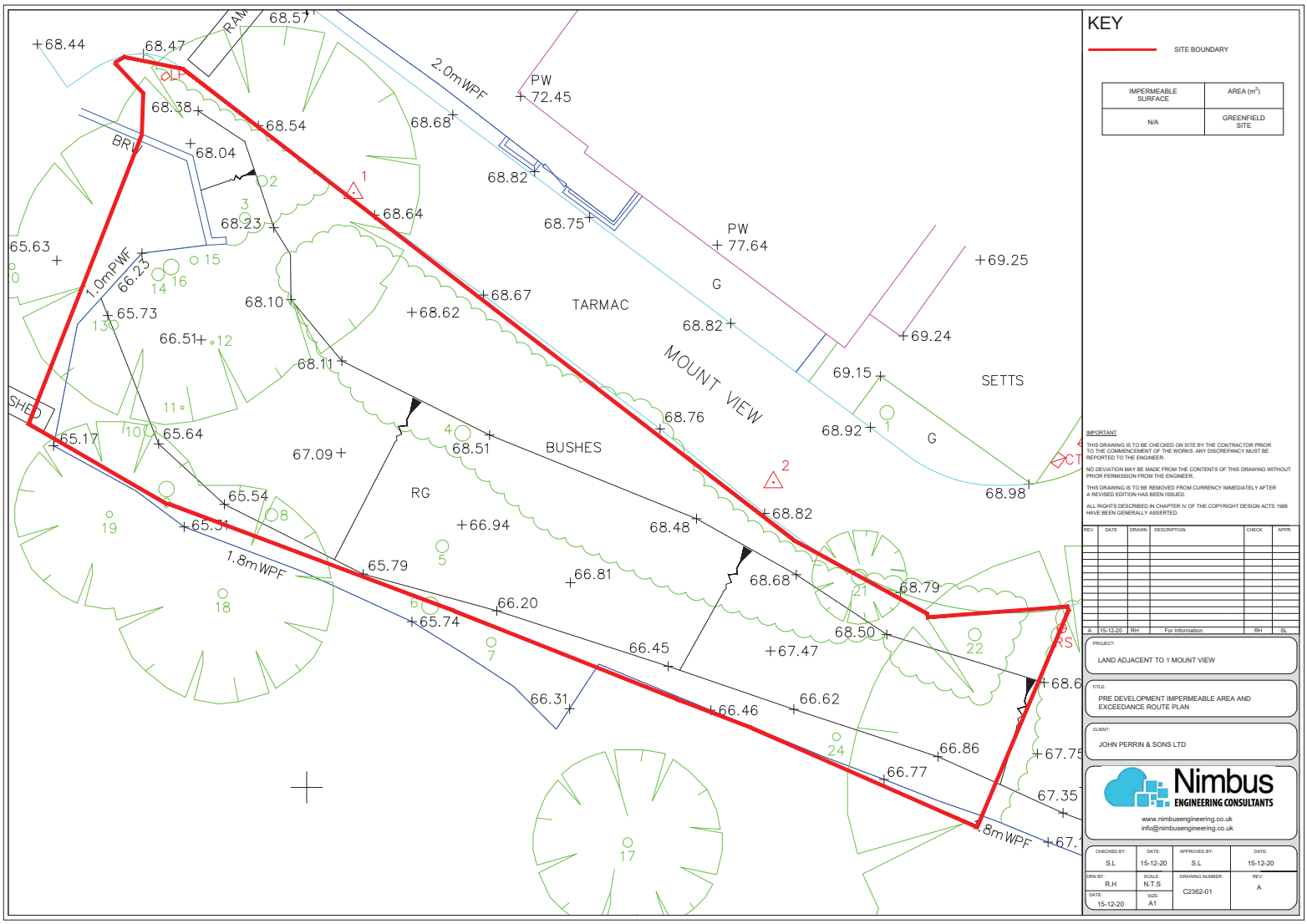
The rainfall characteristics for each method are very different.

The Peak flow (using the Intensity/Duration/Frequency curve) does not model the actual rainfall. This curve is joined points which represent the mean intensity of a storm at a given duration i.e. a value of 19.5 mm/hr for a 60 minute storm indicates that over the sixty minute period, the mean intensity was 19.5 mm/hr. The calculation method samples the IDF curve for a given location and frequency (Return Period) and calculates the storage for that rate and duration less the outflow volume. The maximum value is displayed as the 'worst case' storage.

The hydrograph method uses a standard curve for either Winter or Summer storms. Traditionally these are symmetrical about the central peak. UK rainfall does not fit into this convenient curve, so the calculations are dealing with a stylised set of data. The mean intensity for the storm is calculated from the IDF curve and applied to the curve data, calculating the storage for that step less the outflow volume. The final storage volume is the sum of the storage for all the steps.

It can be seen that these two methods are very different, and the user may have the choice of which result to use. This is not an exact science, though is often treated as such by those that do not understand the principles of the calculations.

APPENDIX C – DRAWINGS


KEY
SITE BOUNDARY
IMPERMEABLE SURFACE
AREA (m²)
N/A
GREENFIELD SITE
IMPORTANT
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A 15-12-20 RH For Information RH SL
PROJECT: LAND ADJACENT TO 1 MOUNT VIEW
TITLE: PRE DEVELOPMENT IMPERMEABLE AREA AND EXCEEDANCE ROUTE PLAN
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CHECKED BY: S.L DATE: 15-12-20 APPROVED BY: S.L DATE: 15-12-20
DRN BY: R.H SCALE: N.T.S DRAWING NUMBER: C2362-01 REV: A
DATE: 15-12-20 SIZE: A1
MOUNT VIEW
TARMAC
BUSHES
RG
SETTS
SHED
BRK
RAMP
LP
CT
RS
2.0m WPF
1.0m PWF
1.8m WPF
PW
68.44
68.47
68.57
68.38
68.54
68.04
68.68
68.82
72.45
68.64
68.23
68.75
77.64
65.63
66.23
68.10
68.67
68.62
68.82
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69.24
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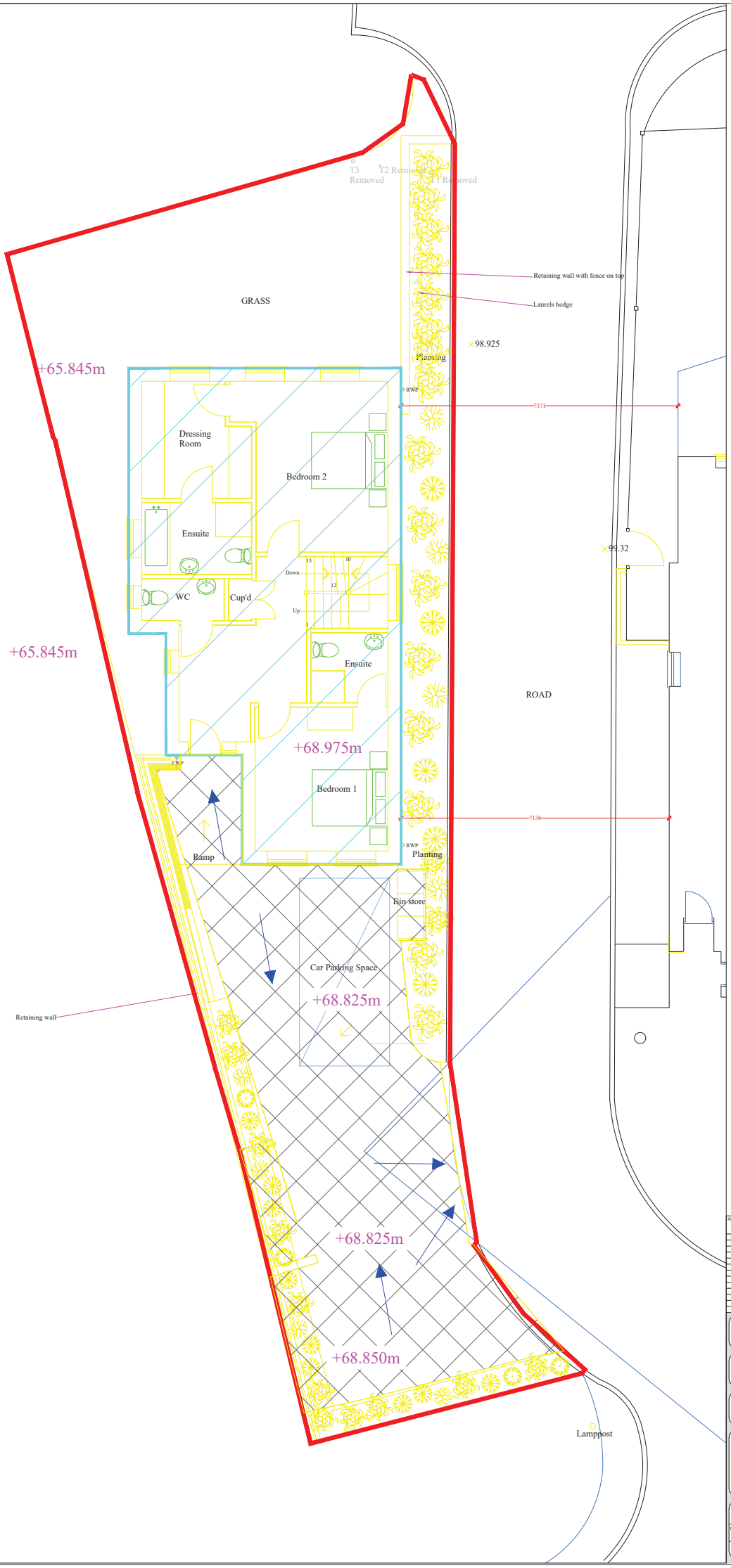

KEY

ROOF AREAS

HARDSTANDING AREAS

EXCEEDANCE ROUTE DIRECTION

IMPERMEABLE AREA	
RA1	83.793
HS1	89.234

IMPORTANT

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PROJECT: LAND ADJACENT TO 1 MOUNT VIEW

TITLE: POST DEVELOPMENT IMPERMEABLE AREA AND EXCEEDANCE ROUTE PLAN

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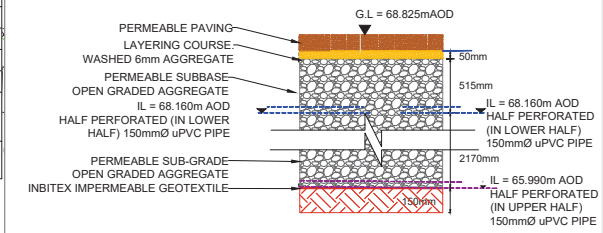
DRN BY: C.H	SCALE: 1:50	DRAWING NUMBER: C2362-02	REV: A
DATE: 15-12-20	SIZE: A1		

SCHEDULE OF SURFACE WATER MANHOLE CHAMBERS *COVER LEVELS TO BE CONFIRMED ON SITE PRIOR TO CONSTRUCTION					
IC	SIZE	COVER LEVEL* mAOD	INVERT LEVEL mAOD	APPROX DEPTH (mm)	NOTES
S1	300mmØ	68.825	68.475	0.350	
S2	450mmØ	68.825	68.350	0.475	
S3-CATCHPIT	600mmØ	68.825	68.190	0.635	
S4-CATCHPIT	600mmØ	68.825	68.190	0.635	
S5 - PUMPING STATION	600mmØ	68.825	PS INLET: 65.980	2.845	
			PS OUTLET: 68.130	0.690	



PERMEABLE PAVING CROSS-SECTION - FOR STORAGE INTO THE SUB-BASE, AREA HIGHLIGHTED BY CYAN BOX ON PLAN - N.T.S

KEY

- ROOF AREAS
- PERMEABLE PAVING
- GRANULAR SUB-BASE STORAGE FOOTPRINT
- HALF BARREL PERFORATED SURFACE WATER UPVC PIPES IN LOWER HALF
- HALF PERFORATED SURFACE WATER UPVC PIPES IN UPPER HALF
- SURFACE WATER UPVC PIPES
- SURFACE WATER INSPECTION CHAMBERS

1. SURFACE WATER DRAINS ARE TO BE 150mm NOMINAL DIAMETER LAID AT A GRADIENT NOT FLATTER THAN 1/125 UNLESS STATED OTHERWISE, SHOWN ON THE MANHOLE SCHEDULE
2. DRAINS ARE TO BE CONSTRUCTED USING UPVC PIPES TO BS4660, ALL WITH FLEXIBLE JOINTS, BEDDED AND BACKFIELD IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS AND BS8301. SEE NIMBUS GENERAL DETAILS OF DRAINAGE WORKS.
3. FLEXIBLE PIPES WITH LESS THAN 600mm COVER IN TRAFFICKED AREAS ARE TO BE SURROUNDED WITH CONCRETE, OR TO HAVE CONCRETE PAVING SLABS LAID AS BRIDGING ABOVE THE PIPE.
4. COVERS AND FRAMES FOR MANHOLES/INSPECTION CHAMBERS MUST COMPLY WITH BS EN 124, CLASS C250, EXCEPT FOR COVERS IN ROADWAY WHICH ARE TO COMPLY WITH CLASS D400.
5. ALL GULLIES AND RAINWATER PIPES SHOULD BE PROVIDED WITH RODDABLE ACCESS.
6. ALL PIPE SOFFITS TO BE LAID LEVEL UNLESS NOTED OTHERWISE.
7. ALL COVER LEVELS ARE BASED UPON ARCHITECTS PROPOSED SECTIONAL DRAWINGS FINAL GROUND LEVELS TO BE CONFIRMED PRIOR TO CONSTRUCTION.
8. PROPOSED GROUND LEVELS TO BE CROSS CHECKED WITH MANHOLE SCHEDULE TO HIGHLIGHT ANY INSUFFICIENT DEPTHS FOR PROPOSED MANHOLES.
9. LOCATION OF PROPOSED TIE-IN MANHOLE WITHIN 1 MOUNT VIEW, AS PER TOPOGRAPHICAL SURVEY AND SITE SURVEY UNDERTAKEN BY CLIENT.
10. PROPOSED TIE-IN LOCATION IS INTO AN EXISTING COMBINED MANHOLE AS AGREED WITH ENFIELD COUNCIL.
11. ALL RAINWATER PIPES ARE TO BE A MINIMUM OF 450mm BELOW FFL UNLESS NOTED OTHERWISE.
12. PRIVATE HARDSTANDING AREA GULLIES TO HAVE FRAMES TO BS EN 124 CLASS C250.
13. ALL DRAINAGE IS TO BE TESTED AND THOROUGHLY CLEANED ON COMPLETION. EXISTING DRAINAGE WHERE RE-USED, IN THE SYSTEM, IS TO BE JETTED THROUGH.
14. FOR ALL MANHOLES <1.2m Ø REFER TO TURTLE ENVIRO PRODUCT CATALOGUE OR OSMADRAIN PRODUCTS (OR SIMILARLY APPROVED PRODUCT).
15. PERMEABLE PAVING TO BE ADOPTED ON ALL NEW HARDSTANDING AREAS FOR PROPOSED DEVELOPMENT.
16. SUB-BASE STORAGE TO HAVE WATERPROOF MEMBRANE SURROUND AROUND PERIMETER AND BASE TO ENSURE NO DISPERSION OF RUN-OFF INTO ADJACENT GROUND.
17. PLANTING ON EASTERN PERIMETER TO BE UTILISED FOR RAINGARDEN PLANTERS TO PROVIDE A LEVEL OF TREATMENT.
18. REFER TO DWG C2362-04 FOR DRAINAGE DETAILS.

REV	DATE	DRAWN	DESCRIPTION	CHECK	APPR
A	15-12-20	RH	For Information	RH	SL

PROJECT: LAND ADJACENT TO 1 MOUNT VIEW

TITLE: SURFACE WATER NETWORK AND SuDS LAYOUT PLAN

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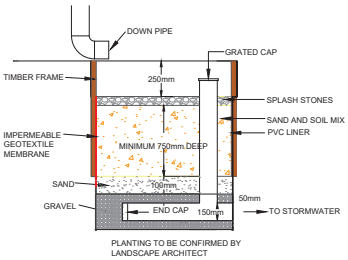
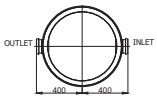
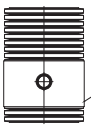
DATE: 19-08-20	SIZE: A1		



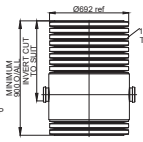
RAINGARDEN PLANTER CROSS SECTION (NTS)



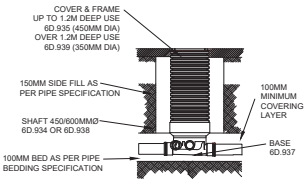
CATCHPIT CHAMBER PLAN



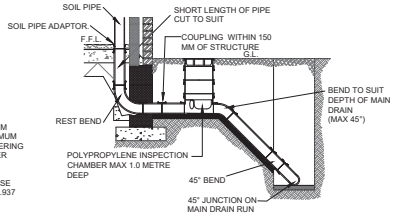
CATCHPIT CHAMBER ELEVATION



CATCHPIT CHAMBER ELEVATION

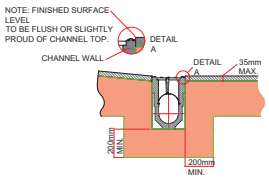


TYPICAL INSPECTION CHAMBER DETAIL

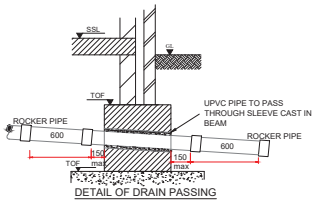


SHALLOW INSPECTION CHAMBER DETAIL

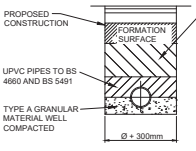
TRENCH BEDDING AND FILL MATERIALS								
GRANULAR BEDDING TYPE A								
TYPE	USE FOR NOMINAL PIPE (DIA.)	% PASSING BY MASS BS 410 SIEVE SIZES (mm)						
		63	37.5	20	14	10	5	2.36
A40	>1350	100	85-100	0-25	-	0-5	-	-
A20	600-1350	-	100	85-100	-	0-25	0-5	-
A14	300-525	-	-	100	85-100	0-50	0-10	-
A10	<300	-	-	-	100	85-100	0-25	0-5



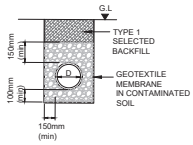
ACO ROAD DRAIN DETAIL



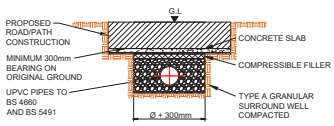
DETAIL OF DRAIN PASSING THROUGH GROUND BEAM OR OTHER STRUCTURE



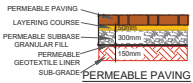
TYPICAL PIPE BEDDING DETAIL (UPVC PIPES)



FULL GRANULAR SURROUND CLASS S



PROTECTION FOR PIPES LAID AT SHALLOW DEPTHS (UPVC PIPES)



PERMEABLE PAVING CROSS-SECTION (NON-STORAGE ROAD MAKE-UP)

IMPORTANT

THIS DRAWING IS TO BE CHECKED ON SITE BY THE CONTRACTOR PRIOR TO THE COMMENCEMENT OF THE WORKS. ANY DISCREPANCY MUST BE REPORTED TO THE ENGINEER.

NO DEVIATION MAY BE MADE FROM THE CONTENTS OF THIS DRAWING WITHOUT PRIOR PERMISSION FROM THE ENGINEER.

THIS DRAWING IS TO BE REMOVED FROM CURRENCY IMMEDIATELY AFTER A REVISED EDITION HAS BEEN ISSUED.

REV	DATE	DRAWN	DESCRIPTION	CHECK	APPR.
A	15-12-20	CH	For Information	RH	SL

PROJECT:
LAND ADJACENT TO 1 MOUNT VIEW

TITLE:
SURFACE WATER NETWORK AND SuDS DRAINAG E DETAILS

CLIENT:
JOHN PERRIN & SONS LTD

Nimbus ENGINEERING CONSULTANTS
www.nimbusengineering.co.uk
info@nimbusengineering.co.uk

CHECKED BY:	DATE:	APPROVED BY:	DATE:
S.L	15-12-20	S.L	15-12-20
DRN BY: C.H	SCALE: N.T.S	DRAWING NUMBER: C2362-04	REV: A
DATE: 15-12-20	SIZE: A1		

APPENDIX C – WATER AUTHORITY ASSET PLANS

SUDS REPORT FOR LAND ADJACENT TO 1 MOUNT VIEW, ENFIELD, EN2 8LF

DOCUMENT NUMBER.: C2362-R1-REV-A

PREPARED BY

Nimbus
ENGINEERING CONSULTANTS

Contents

APPENDICES

1. INTRODUCTION

1.1 Appointment

Nimbus Engineering have been appointed by John Perrin & Sons to provide an outline solution on the management of Surface Water run-off and to ensure that there is no risk of flooding caused by the proposed construction of a three story dwelling, with associated, hard standing, car parking, and landscaping.

1.2 Objectives

This report will provide information on a suitable Sustainable Urban Drainage System (SuDS) in order to reduce the surface water run off leaving the site and show that the proposed development will not increase Flood Risk at the site or elsewhere.

1.3 Limitations

The general limitations of this report are:

- A number of data and information sources have been used to prepare this report. Whilst Nimbus Engineering believes them to be trustworthy, Nimbus Engineering is unable to guarantee the accuracy of data and information that has been provided by others;

- This report has been prepared using the best data and information that was available at the time of writing. There is the potential for further information or data to become available, leading to changes in the conclusions drawn by this report, for which Nimbus Engineering cannot be held responsible.

2. GEOLOGY OF THE AREA

According to, the British geological survey, the superficial deposits at the proposed site consist of an amalgamation of clay, silt, sand and gravel as shown in Figure 1, below. The bedrock in the area is a member of London Clay Formation, as shown in Figure 2, below.

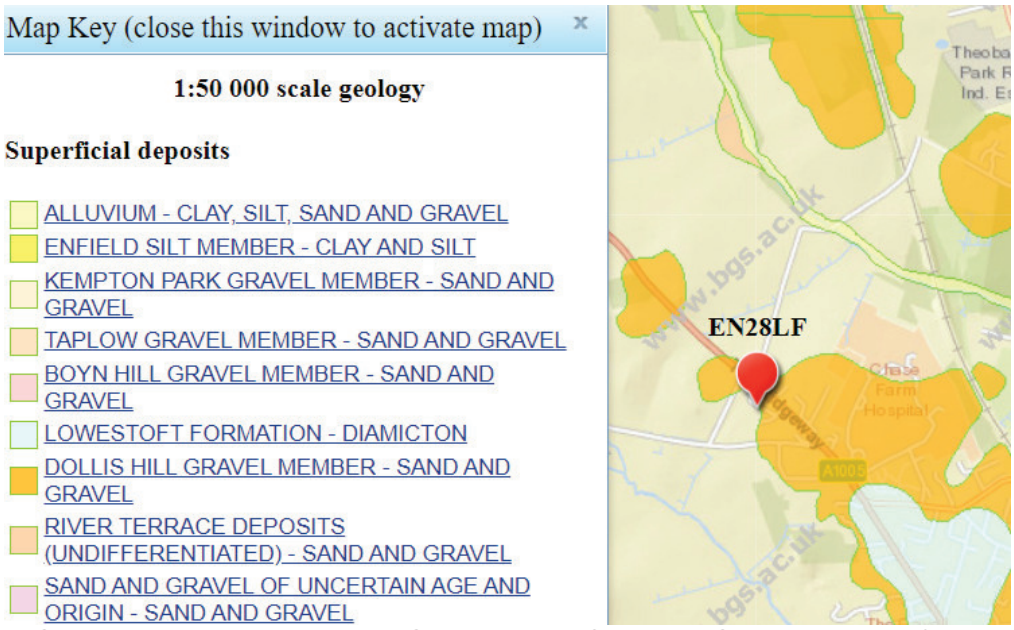


Figure 1- Superficial Deposits at the site. (Source: British Geological Society Website (Contains British Geological Survey materials © URKI [2020]. Base mapping is provided by ESRI)).

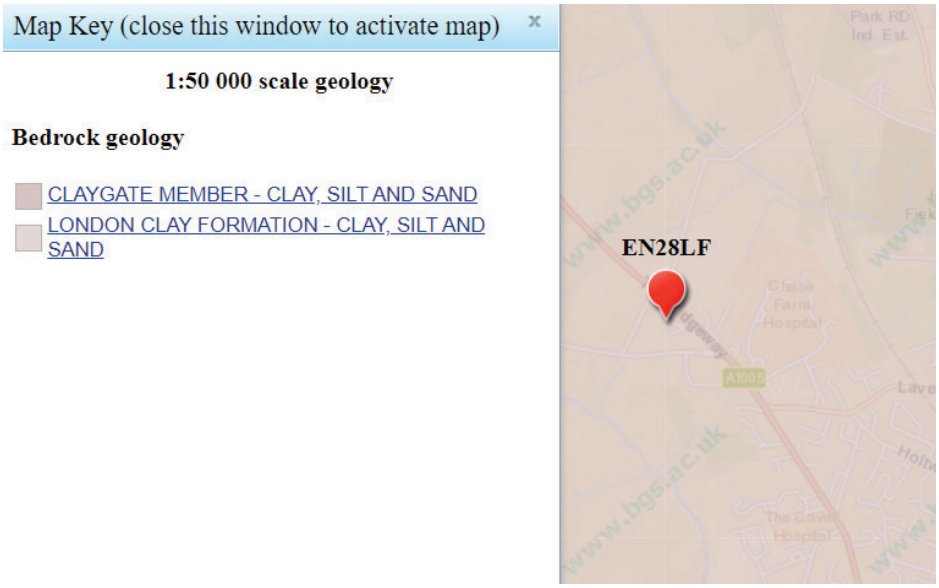


Figure 2 – Bedrock at the site. (Source: British Geological Society Website (Contains British Geological Survey materials © URKI [2020]. Base mapping is provided by ESRI)).

The London Borough of Enfield have requested that historic boreholes within the vicinity of the site are consulted in order to ascertain the suitability of infiltration, the location of the boreholes is shown on the plan overleaf, and the results can be found in Appendix A.

Figure 3 - Historic Boreholes at the site. (Source: British Geological Society Website (Contains British Geological Survey materials © URKI [2019]. Base mapping is provided by ESRI)).

The results of these boreholes show that infiltration is not feasible. A percolation test was also undertaken on site on the 23rd and 24th November which confirmed infiltration was not feasible these results can be found in Appendix A.

3. SUSTAINABLE URBAN DRAINAGE SYSTEMS

The total area of the site is 283m^2, and the existing impermeable areas at the site are 0m^2. Following the development proposals, the impermeable areas at the site will have increased to 173m^2. Surface water run off calculations can be found in Appendix B.

Surface water arising from a developed site should, as far as is practicable, be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development, while reducing the flood risk to the site itself and elsewhere, taking climate change into account.

Reducing the rate of surface water discharge from urban sites is one of the most effective ways of reducing and managing flood risk.

Traditional piped surface water systems work by removing surface water from our developments as quickly as possible, however this can cause various adverse impacts:

- Increased downstream flooding, and sudden rises in flow rates and water levels in local water courses.
- Reduction in groundwater levels and dry weather flows in watercourses.
- Reduce amenity and adversely affect biodiversity due to the surface water run-off containing contaminants such as oil, organic matter and toxic materials.

SuDS are defined as a sequence of management principles and control structures designed to drain surface water in a more sustainable fashion than conventional piped drainage techniques. SuDS should utilise the natural landscape of an area which as well as slowing down the rate of runoff provides a number of environmental, ecological and social benefits.

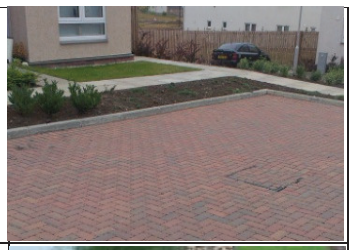
These include:

- Protection and enhancement of water quality. As well as providing on-site attenuation, SuDS treat the water, resulting in an improved quality of water leaving the site. This is achieved when the water passes through fine soils and the roots of specially selected plants. Pollutants washed off the hard landscaping by rainfall will be safely removed before the water reaches the natural receiving water course.

- A sympathetic approach to the environmental setting by providing opportunities to create habitats for flora and fauna in urban watercourses and open spaces.

- Meeting the amenity and social needs of the local community and residents in the creation of attractive green spaces.

The various types of SuDS include:

Permeable paving	
Soakaways;	
Swales and basins;	
Bioretention/ rain gardens;	
Green roofs and rainwater re-use;	

Preferably a combination of these techniques should be used as part of the surface water management train, and it is important for all stakeholders, such as developers, architects, landscape architects and engineers to work in order to determine a feasible solution.

4. PROPOSED SOLUTION

In order to ensure that the SuDS management train has been followed, the proposals involve raingarden planters for the two rainwater downpipes at the eastern edge of the building, in order to treat and slow down the peak rate of surface water runoff from the roof areas.

All proposed hardstanding areas will be formed of permeable paving, and slot drains will be provided for all sloped areas.

The percolation test calculations showed an infiltration rate of $5x10^{-6}$ m/s and would require a soakaway of $35m^2$ footprint which would not be feasible due to spatial constraints at both the front and rear of the property.

Hydrograph run off storage calculations were carried out using the total contributing area, for a 1 in 100 year storm event, with a 40% allowance for climate change, with a flow restriction leaving the site set to 0.5 l/s, the existing site's greenfield run-off rate was 0.118l/s, and as the solution had to be pumped it was deemed this was too small and could potentially lead to pump failure. Having a discharge rate of 0.5 l/s it was calculated that $8.6m^3$ of storage was required. This surface water run-off will be stored in the sub-base of the permeable paving within the car parking out with the basement's extents, as shown on drawing number C2362-03, in Appendix C.

We believe the Sustainable Urban Drainage System hierarchy has been considered fully, with as much of the surface water runoff to be treated at source and attenuated within the

permeable paving sub-base and restricted to a lower rate of 0.5l/s, in line with the London Borough of Enfield's requirements. All surface water run off calculations can be found in Appendix B.

This restricted surface water run-off will be from the pumping station will then connect into a combined sewer manhole within 1 Mount View as previously agreed with Enfield Council as shown on drawing number C2362-03, in Appendix C, and on the asset plans provided in Appendix D.

5. TIMESCALE AND MAINTENANCE OF WORKS

All drainage works will be completed prior to first occupation and there will be no adoption of any of the drainage works within the site, a management company will be formed, which will be responsible in overseeing the long-term maintenance of all the communal drains.

- Gullies should be cleaned every 3 months in order to ensure that there are no blockages.

- The catch pit chambers to the sub-base storage and flow control chamber should be checked and emptied every 3 months, especially after a heavy rain storm, this to ensure that the system does not get clogged up with silt or blocked.

The following table outlines the maintenance requirements for the permeable paving:

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations or clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this is the most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphospate applied directly into the weeds by an applicator rather than spraying	As required
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving.	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material.	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to

		significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48hr after large storms in six months
	Inspect slit accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

The following table outlines the maintenance requirements for the raingarden planters:

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Pipe inlets to the raingarden planters should be checked every month and especially after an extreme rainstorm to ensure that there are no blockages.	Monthly
	Periodic inspections & removal of debris or other items that represent blockage risks particularly in vicinity of the inlet to the raingarden planters	Monthly
	Weeding, cutting of plants and removal of any dead plants to ensure that the system works effectively	Every three months
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockages by sediment, algae or other matter: remove and replace surface infiltration medium as necessary.	Annually
Remedial actions	Repair inlets, outlets, overflows	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that the are in good condition and operating as designed	Annually

6. CONCLUSIONS

The purpose of this report and associated drawings, is to satisfy the local planning authority that the surface water run of arising from the proposed development will be dealt with at source, through the use of Sustainable Urban Drainage Systems.

The timetable of works is to complete all drainage prior to occupation of dwellings, and maintenance requirements are also included in this report.

APPENDIX A – HISTORIC BOREHOLES & PERCOLATION TEST RESULTS

London Analytical Surveys Ltd.
Tel: 081-503 0375
Fax: 081-503 0024

Ref. No. 91/443

BORING RECORD

Location Medium Secure Unit Chase Farm Hospital — Borehole No. 3
Client Turner & Townsend — Date 21 March 1991
Ground Level 56.7m ND — Diameter of Boring 150 mm — Depth of Lining Tubes - m

Description	D. Level m	Legend	Sample	Depth m	Thickness m	S.P. or Vane Test	Depth of Water below ground level
TOPSOIL.	56.70			0.00	0.40		
Firm to stiff light brown mottled light grey brown & orange slightly silty CLAY with some fine medium flint & chalk gravel. Hair roots.	56.30		1	0.40	0.60		
Stiff light brown to brown with light grey veining fissured CLAY. Calcareous concretions to 1.5m. Occasional hair roots.	55.70		2, 3, 4	1.00	1.00		
Stiff brown with light blue grey veining slightly fissured CLAY. Pockets of yellow brown ferruginous silt & fine sand to 2.7m. occasional partings of yellow brown fine sand and pockets of weathered gypsum below 3.0m. Gypsum becoming less weathered and diseminated with depth.	54.70		5, 6, 7, 8, 9, 10, 11, 12, 13	2.00	4.00	N 17	
Stiff dark brown fissured CLAY with yellow brown staining on fissure planes. Diseminated gypsum. Becoming dark grey brown below 9.0m.	50.70		14, 15, 16, 17, 18, 19, 20, 21, 22	6.00	4.00 penetrated	N 24, N 27	Dry throughout
	46.70			10.00			

Scale: 1:50

Tube Sample | N Standard Penetration Test | ▲ Water Sample
D Disturbed Sample | + Vane Test (shear strength in kN/m²)

Fig. No. 3

GROUND EXPLORATIONS LIMITED

BOREHOLE SECTION SHEET

Date October, 19 51.

CONTRACT NAME RHFIELD. ORDER NO. -

Bored for : Messrs. James & Partners.

Address : 6a, Lower Grosvenor Place, S.W.1.

Address of Site : Chase Farm Hospital.

District or Town : Enfield. County : Middx.

Standing Water Level : 3' 9" Below Surface Dia. of Borehole : 6 Inches.

Water Struck (1) 3'9" Ft. B.S. (2) : Ft. B.S. (3) : Ft. B.S.

Boring Commenced : 5. 10. 51. Boring Completed : 5. 10. 51.

Special Remarks : Surface Level 223.0

Jar Samples : 5'0"-6048; 7'6"-6049; 15'0"-6050; 20'0"-6051; 24'0"-6052; Water-6053;

Core Samples : 10'0"-11'6"-6054;

DESCRIPTION OF STRATA		Thickness Feet	Thickness Inches	Depth Below Surface Feet	Depth Below Surface Inches	(m)
Clients are requested to examine the samples of the Strata submitted, as the descriptions employed below are general terms and responsibility is not accepted for their application to commercial purposes.						
(C) No. 3 Boring.						
Topsoil	0.30m	1	0	1	0	0.30
Clay and Stones	1.52m	5	0	6	0	1.83
Gravel	0.76m	2	6	8	6	2.59
Brown London Clay	3.12m	10	3	18	9	5.72
Blue London Clay	1.60m	5	3	24	0	7.32
TOTAL FROM SURFACE ... 7.32 m		24	0	24	0	7.32

This form is to be returned to Head Office immediately the borehole is finished.

Foreman's Signature..... *Date* October, 1951.

P. & R. Ltd.—6376

TQ38/803

258.

Page 1 of 3

GROUND EXPLORATIONS LIMITED

BOREHOLE SECTION SHEET

Date October, 19 51.

CONTRACT NAME ENFIELD. ORDER NO. -

Bored for : Messrs. R. T. James & Partners.

Address : 6a, Lower Grosvenor Place, S.W.1.

Address of Site : Chase Farm Hospital, 127 The Ridgeway.

District or Town : Enfield. County : Middx.

Standing Water Level : 3' 6" Below Surface Dia. of Borehole : 6 Inches.

Water Struck (1) : 3½ Ft. B.S. (2) : Ft. B.S. (3) : Ft. B.S.

Boring Commenced : Boring Completed :

Special Remarks : Surface Level = 325.4

Jar Samples : 3'0"-6028; 5'0"-6029; 8'0"-6030; 10'0"-6031; 15'0"-6032; 20'0"-6033; 25'0"-6034; 35'0"-6035;

Core Samples : 22'0"-23'6"-6037; 33'0"-34'6"-6038;

DESCRIPTION OF STRATA		Thickness Feet	Thickness Inches	Depth Below Surface Feet	Depth Below Surface Inches	
Clients are requested to examine the samples of the Strata submitted, as the descriptions employed below are general terms and responsibility is not accepted for their application to commercial purposes.						
(A) No. 1 Boring.						
						(M)
Topsoil	0.23m	0	9	0	9	0.23
Clay and Stones	0.84m	2	9	3	6	1.07
Gravel and Sandy Clay	1.07m	3	6	7	0	2.13
Sand	0.46m	1	6	8	6	2.59
Clay and Stones	0.61m	2	0	10	6	3.20
Black Stones	2.13m	7	0	17	6	5.33
Blue London Clay	8.69m	28	6	46	0	14.02
TOTAL FROM SURFACE ... 14.02m		46	0	46	0	14.02m

This form is to be returned to Head Office immediately the borehole is finished.

October, 1951.

Foreman's Signature..... *Date*.....

P. & R. Ltd.—6376

Ref. No. 91/443

London Analytical Surveys Ltd.

BORING RECORD

Tel: 081-503 0375
Fax: 081-503 0024

Location Medium Secure Unit Chase Farm Hospital — Borehole No. 1
Client Turner & Townsend — Date 21 March 1991
Ground Level 57.90m ND — Diameter of Boring 150 mm — Depth of Lining Tubes m

Description	D. Level m	Legend	Sample	Depth m	Thickness m	S.P. or Vane Test	Depth of Water below ground level
TOPSOIL.	57.90			0.00	0.30		
Firm light brown mottled light grey brown & orange CLAY with a little gravel. Pockets of yellow brown & light grey clayey sand and fine medium coarse gravel below 1.3m. Some hair roots.	57.60		1 2 3	0.30	1.50		
Stiff brown with light blue grey veining slightly fissured CLAY. Occasional calcareous concretions. Some partings of orange ferruginous fine sand to 2.5m. Becoming more fissured below 2.5m. Occasional gypsum below 4.0m.	56.10		4 5 6 7 8 9 10 11 12	1.80	4.00	N 8 N 27	
Stiff dark brown fissured CLAY, yellow brown on fissure planes. Partings of yellow brown fine sand. Disseminated gypsum.	52.10		13 14 15 16 17 18 19 20	5.80	3.70		
Stiff dark brown grey slightly fissured CLAY.	48.40 47.90		21 22	9.50 10.00	0.50 pene-trated		Dry throughout 22 PM Dry

Scale: 1:50

▮ Tube Sample N Standard Penetration Test ▲ Water Sample
O Disturbed Sample + Vane Test (shear strength in kN/m²)

Fig. No. 1

Nimbus Engineering Consultants Ltd
www.nimbusengineering.co.uk

Kemp House,
152 City Road,
London, EC1V 2NX
Mob:0772 339 3155
email: info@nimbusengineering.co.uk

MasterDrain
SW 16.02

Job No.	C2362
Sheet no.	1
Date	15/12/20
Project	Land Adjacent to 1 Mount View
Title	BRE365 Trench Soakaway calcs
By	S.L
Checked	
Reviewed	

Rectangular pit design data:-

Pit length	= 8 m	Pit width	= 4.5 m
Depth below invert	= 1.2 m	Percentage voids	= 100.0%
Imperm. area	= 173 m²	Infilt. factor	= 0.000005 m/s
Return period	= 100 yrs	Climate change	= 30%

Calculations :-

Surface area of soakaway to 50% storage depth (not inc. base):-

a_{s50} = 2 x (length + width) x depth/2 = 15.0 m²

Outflow factor : O = a_{s50} x Infiltration rate = 0.000075 m/s

Soakaway storage volume : S_{actual} = length x width x depth x %voids/100 = 43.2 m³

Duration	Rainfall mm/hr	Inflow m³	Depth (hmax) m	Outflow m³	Storage m³
5 mins	222.4	3.2	0.09	0.02	3.17
10 mins	164.6	4.7	0.13	0.04	4.68
15 mins	131.6	5.7	0.16	0.07	5.62
30 mins	85.3	7.4	0.20	0.14	7.25
1 hrs	52.7	9.1	0.25	0.27	8.84
2 hrs	31.4	10.9	0.29	0.54	10.33
4 hrs	18.3	12.6	0.32	1.08	11.55
6 hrs	13.2	13.7	0.33	1.62	12.04
10 hrs	8.7	15.1	0.34	2.70	12.39
24 hrs	4.3	17.8	0.31	6.48	11.29

Actual volume : S_{actual} = 43.200 m³

Required volume : $S_{reqd.}$ = 12.390 m³

Soakaway volume storage OK.

Minimum required a_{s50} : 4.30 m²

Actual a_{s50} : 15.00 m²

Minimum depth required: 0.34 m

Time to maximum 10 hrs

Emptying time to 50% volume = t_{s50} = S_{reqd} x 0.5 / (a_{s50} x Infiltration rate) = 22:56 (hr:min))

Soakaway emptying time is OK.

Nimbus Engineering Consultants Ltd
www.nimbusengineering.co.uk

Kemp House,
152 City Road,
London, EC1V 2NX
Mob:0772 339 3155
email: info@nimbusengineering.co.uk

Job No.	C2362
Sheet no.	2
Date	15/12/20

MasterDrain
SW 16.02

Project	Land Adjacent to 1 Mount View	By	S.L
Title	BRE365 Trench Soakaway calcs	Checked	
		Reviewed	

Location hydrological data (FSR):-

Location	= ENFIELD	Grid reference	= TQ3296
M5-60 (mm)	= 20	r	= 0.43
Soil index	= 0.45	SAAR (mm/yr)	= 670
WRAP	= 4	Area = England and Wales	

Soil classification for WRAP type 4
Clayey, or loamy over clayey soils with an impermeable layer at shallow depth.

N.B. The rainfall rates are calculated using the location specific values above in accordance with the Wallingford procedure.