Sustainable Drainage Strategy

For

Block of New Flats

Land to Rear of

39-41 London Road

Enfield

EN2 6LX

Local Planning Authority *London Borough of Enfield*

Lead Local Flood Authority *London Borough of Enfield*

Alan Cox Associates
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23107
R01 November 2023

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Revision	Prepared by	Checked by	Date	Status
01	NK	CC	20/11/2023	Preliminary

Architects drawing of proposed development

\1.0 Projects\21000\21000\21001 - 54 Waggon Road\3 Calcs\1.0 Drainage\1.2 SuDS\21001 SuDS Design Statement R00.docx

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1 Introduction

1.1 It is proposed to develop a new 2 storey block of 3 flats on an area bounded by existing buildings fronting London Road, Southbury Road and Genotin Road. The existing surface is a concrete slab used for car parking. Drainage is to channels and gullies with no SuDS features or any Gas/Oil Interceptors (*petrol separators*)

Aerial view ste as existing outlined in red.

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1.2 With the increase in urban development, it was realised that the traditional collection of ever larger volumes of surface water into public sewers was not sustainable and that measures were required to control the amount of water discharged off-site and to improve the quality of the water discharged.

1.3 The UK Government sets out a National Planning Policy Framework for England and to support decision making provides guidance in a document "Guidance-Flood risk and coastal change this includes requirements for Sustainable Drainage Systems (SuDS)" Paragraph 51 states.

"Why are sustainable drainage systems important?
Sustainable drainage systems are designed to control surface water run off close to where it falls and mimic natural drainage as closely as possible. They provide opportunities to:
reduce the causes and impacts of flooding;
remove pollutants from urban run-off at source;
combine water management with green space with benefits for amenity, recreation and wildlife."

1.4 The London Borough of Enfield has Development Management Policies and Policies DMD 59 *Avoiding and Reducing Flood Risk* and DMD 61 *Managing Surface Water* related to SuDS. The borough also Publishes a document "*Sustainable Drainage Design and Evaluation Guide*". Which includes inter alia the London Plan Drainage Hierarchy and a description of the principles of a SuDS Management Train.

1.5 This document is prepared for the planning application and seeks to present the strategy to meet the objectives of the NPPF and the Borough's policies..

1.6 The London Plan 2021 contains the following policy

Policy SI.13 Sustainable drainage Policy
Planning decisions

A Development should utilise sustainable urban drainage systems (SUDS) unless there are practical reasons for not doing so, and should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible in line with the following drainage hierarchy:

1 store rainwater for later use
2 use infiltration techniques, such as porous surfaces in non-clay areas
3 attenuate rainwater in ponds or open water features for gradual release
4 attenuate rainwater by storing in tanks or sealed water features for gradual release

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5 discharge rainwater direct to a watercourse
6 discharge rainwater to a surface water sewer/drain
7 discharge rainwater to the combined sewer.

Drainage should be designed and implemented in ways that deliver other policy objectives of this Plan, including water use efficiency and quality, biodiversity, amenity and recreation.

The application of this hierarchy is addressed belowq

1.7 This document is not a flood risk assessment (FRA), however a review of the London Borough of Enfield Surface Water Management Plan, Strategic FRA, and Environment Agency Flood maps indicates that:-

The site is in Flood Zone 1
The site is at very low risk of flooding from surface water.
The site very low risk from rivers and sea.
The site is in a Critical Drainage Area Group 4 028
Critical Drainage Areas are catchments that drain to areas at risk of flooding and therefore require particular attention.

1.8 A LB Enfield Proforma Has been completed and is attached to this document.

2 Proposed Sustainable Drainage Scheme

2.1 This document describes a proposed SuDS Scheme for the project showing the SuDS elements and proposing a discharge rate. Hydraulic calculations are provided for the SuDS elements. This scheme has been prepared with the proposed development plans and may be subject to design development once the construction details are known.

3 Management and Maintenance

3.1 Blocks of flats require management by the freeholder. The SuDS described in this document will be within a a single house development and management and maintenance will be the responsibility of the freeholder.

3.2 For the continued efficiency and effectiveness of the SuDS system maintenance is required. A schedule of anticipated maintenance is included. London Borough of Enfield suggest a laminated drawing with the schedule on the back be prepared.

4 Constraints and Opportunities

4.1 The site area is 233 sq m or 0.023 hectare, all of which concrete slab before development., the pre-development drained area is 233 sq m and the post development drained area 191 sq m.

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4.2 The Enfield Borough Planning Geological map indicates that the superficial geology is Enfield Silt, notwithstanding the potential for infiltration the extent of the site and the closeness of adjoining buildings precludes further consideration of infiltration.

4.3 The Enfield Borough Watercourses map shows that there is a watercourse in culvert on the north side of Southbury Road. The site has no direct access to this watercourse but it is expected that surface water sewers in Sudbury Road discharge to this watercourse. The watercourse is an *ordinary watercourse*. managed by the London Borough of Enfield as the drainage authority.

4.4 The site level with local falls in the car park draining to collector channels to the South.. The new outhouse will be constructed with level thresholds to meet Part M of the Building Regulations.

4.5 The building will have blue roofs. The lower roof will be a green roof. The upper roof will be covered in photovoltaic cells.

4.6 No vehicles will park on the site.

4.7 There is no scope for surface features such as swales ponds or similar.

4.8 Because of the small area drained some adjustments will be made.
Flows from the roof using the Bauder Variable flow gullies will be on their lowest setting of 10 mm
Flows for storms up to a 1 year return period is controlled by an orifice plate limited to no smaller than 10 mm this gives flows greater than Qbar but is the lowest reasonable control.
Q Bar 100 for all storms up to a 100 year return period with uplift for climate change will be discharged at 1 l/s this is greater than Qbar 100 but is the lowest practical to avoid frequent blockages.

4.9 Areas of paving will be permeable over stone drainage layer to provide water quality treatment and in combination with the blue roofs attenuation..

5 Application of the Hierarchy of Drainage Control

Ref	Hierarchy	Discussion on suitability	Suitable	Adopted
1	*store rainwater for later use*	Not practicable	No	No
2	*use infiltration techniques, such as porous surfaces in non-clay areas*	Not possible as nowhere to locate the soakaways.	No	No
3	*attenuate rainwater in ponds or open water features for gradual release*	Not possible due to the intensity of development.	No	No

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4	*attenuate rainwater by storing in tanks or sealed water features for gradual release*	Surface Water to be stored in blue roofs and underground stone tank under paving.	Yes	Yes
5	*discharge rainwater direct to a watercourse*	None accessible from site.	No	No
6	*discharge rainwater to a surface water sewer/drain*	the SW Sewer in Southbury Road	Yes	Yes
7	*discharge rainwater to the combined sewer.*	Not necessary to consider	N/A	N/A

6 SuDS Treatment Train & Water Quality

6.1 Water falling on the roofs will drain through a green roof on the lower roof and from there to a stone drainage tank under the permeable paving. Water falling on the terraces and paving discharges directly to the stone tank.

6.2 To minimise the risk of silt flowing into the stone drainage tank, rainwater pipes where possible will flow onto the permeable paving.

6.3 The stone tanks will treat the run off water

6.4 Here are the indices from the Index Based Analysis using The Simple Index Method as Chapter 26 of the SuDS Manual.

Ref	Source	Pollution Indices T26.2 SuDS Manual			
	Land Use	Pollution Risk Level	TTS	Metals	Hydrocarbons
a	Residential Roofs	Very Low	0.2	0.2	0.05

6.5 It is proposed to provide both green roofs off and stone tanks under permeable paving.

Ref	Source	Treatment Indices T26.3 SuDS Manual		
	SuDS Component	TTS	Metals	Hydrocarbons
a	Green Roofs	0.8	0.7	0.9
b	Permeable Paving	0.7	0.6	0.7

6.6 It can be seen that the treatment index for either of the SuDS components is bigger than the pollution hazard index.

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7 Amenity and Bio-Diversity

7.1 The SuDS itself does not provide amenity. but by replacing concrete car parking by residential buildings and gardens provides increased amenity.

7.2 The green roofs provide habitats that act as staging posts and feeding sites for mobile species like insects and birds to use.

8 Description of the Sustainable Drainage System.

8.1 The surface water drainage system is shown on drawings 23107-130100-P1.

8.2 For flows up to a 1 in 1 yearstorm $Q_{bar1in1}$ = 0.011 which is too low 0.09l/s

For storms up to 100 years + climate change $Q_{bar1in\ 100}$ =1.00 l/s

8.3 The upper roof will be a blue roof with proprietary plastic storage units and gullies.

8.4 The low level roof will be a green roof over a blue roof as for the upper roof. The choice of planting to be by others.

8.5 Permeable paving will allow water to percolate to a stone drainage tank. is provided under the permeable paving, contain the storm water up to a 1 in 100 Year storm with uplift for climate change in conjunction with the blue roofs..

8.6 These attenuation tanks drain to a manhole with a baffle and orifice plate for high frequency low intensity storms and a vortex flow control unit for low frequency high intensity storms.

8.7 The drainage system is designed to intercept the first 5 mm of any rainfall to reduce the total volume of surface water discharged from site over the year as a whole. Interception will be provided by the green roofs, and the permeable pavement with the stone tank underneath.

8.8 Discharge of the surface water is proposed to the surface water manhole No 9501 or through a surface water sewer yet to be identified on site.

9 Hydraulic Calculations & Parameters

9.1 The calculations are attached, parameters are based on the Enfield Design Guide.

9.2 $Q_{bar\ rural}$ is calculated in accordance with the “Flood estimation for small catchments Marshall DCW and Bayliss AC. IOH Report No.124. Institute of hydrology, Wallingford, 1994,“ see spread sheet.

Q_{bar} Rural	0.013	l/s
Q_{bar} 1 Year Return	0.011	l/s

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Q_{bar} 30 Year Return	0.031	l/s
Q_{bar} 100 Year Return	0.042	l/s

9.3 C_v is taken from the Enfield Guidance Document as .95 for roofs and .9 for paving. CvCr are taken as 1.1.

9.4 The uplift for Climate Change was considered in the range 20% Centre to 40% Upper (NPPF) and a value of 40% was selected given the sensitivity of the site.

9.5 The volume to be stored is considered by balancing storm inflows and limited outflows with a hydrograph based on the Wallingford Modified Rational Method.

9.6 The flow/head characteristics of the orifice and vortex flow control device are used in calculating storage volumes.

9.7 The volume of storage is not increased for Urban Creep by 10%.

9.8 The total volume required is 6.2 cu m. 11 cu m is to be provided. No reduction is made for the interception storage on the green roof.

9.9 Time to empty after the 100 Year +CC storm is 2 hours 56 minutes which is better than required.

9.10 Abstracted from the spreadsheets in the hydraulic calculations the comparative flow and volumes are tabulated below.

9.11 Table of Flows.

Storm	*Flow*			Betterment
Return Period	Proposed Q_{peak}	Greenfield Q_{bar}	Existing Q_{peak}	
Years	l/s	l/s	l/s	
1	.092	.011	3.6	97.4%
30	1.0	.21	10.5	90.5%
100	1.0	.28	13.8	92.3%
Add for cc	40%			
100 +CC	1.0		19.3	94.8%

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9.12 Table of Volumes

Storm		Existing	After Development		
Return Period	Duration	Run Off Volume	Run Off Volume	Reduction in Run Off	Attenuation Volume Required
Years	Mins	cu m	cu m		cu m
1	15	3.2	1.8	43%	2.3
30	240	10	6.3	37%	3.3
100	720	13	9.0	30%	4.8
100+CC	720	18	12.6	30%	6.1

The attenuation figures take int account the water held back by the baffle in the flow control manhole.

10 Exceedance Flows

10.1 Exceedance flows will be as existing the building acts as an island but does not agffect the flow paths.

11 Management of the SuDS

11.1 The SuDS is intended to be simple and robust.

11.2 The system will need to be managed by those responsible for common areas generally, probably a managing agent on behalf of the freeholders.

11.3 Further guidance on management of SuDS can be found in the SuDS Manual published by CIRIA as Report C735. It is available as a free download from http://www.ciria.org/Resources/Free_publications/SuDS_manual_C753.aspx

12 Maintenance of the SuDS

12.1 A SuDS maintenance table is attached below.

12.2 SuDS maintenance may be considered to be

a) Regular maintenance, including inspections,
b) Occasional Maintenance, and
c) Remedial Maintenance.

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12.3 Items described as regular or occasional can be included in the landscape maintenance. Items described as remedial may require design and result in a capital expenditure.

12.4 The frequency of maintenance may require to be ascertained after the system has been in use.

12.5 Where SuDS elements need to be replaced then the design drawings should be used to specify replacement material.

12.6 At the end of construction this schedule will be updated as required, combined with a plan and laminated for maintenance contractors as described in the Enfield guide.

12.7 Maintenance Schedule starts on next page.

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13 Maintenance Schedule

Ref	SuDS Element	Activity	Frequency	Type & Notes
1.	Gullies & Drainage Channels	Inspect to check for sediment and empty if full.	Annually or as required.	Routine/Occasional Material removed should be disposed of as contaminated.
2.	Underground drains	Pipes to be cleaned if blocked	As required	Occasional
3.	Flow Control Unit Orifice Plate	Inspect for blocked flow control unit in Spring and Autumn. Unblock if necessary.	When Blocked .	Routine/Remedial
4.	Vortex Control Unit	Un block if blocked	When Blocked	Routine A bypass is fitted opened with a chain attached below the manhole lid.
5.	Permeable Paving	Sweep and remove debris and leaf litter	Monthly or more often as required	Regular Maintenance
6.	Permeable Paving	Vacuum clean	5 yearly	Regular Maintenance
7.	Permeable Paving	Lift and relay	Intervals of 20 years approximately	Remedial Maintenance
8.	Stone Drainage Blanket	Lifted, cleaned of silt and re-laid.	After 20 to 40 years anticipated	Remedial Maintenance Trial area be exposed and checked when paving re-laid. Material removed should be disposed of as contaminated.

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Ref	SuDS Element	Activity	Frequency	Type & Notes
9.	Blue Roofs	Inspect Gullies	Annually	Routine Safe working at heights procedures to be used
10.	Green Roof	Monitoring & Inspection	At the beginning and end of winter.	Routine
11.		Fertiliser	Annually.	Routine Application of a granular, organic slow release fertiliser is essential to provide the plants with nutrients enabling them to become hardy enough to resist extreme cold, heat and drought.
12.		Debris, Plant encroachment, & Weeding	Annually or As Required	Routine Removal of all debris and leaves from the roof surface, rainwater outlets, chutes and gutters. Removing excess vegetation that is encroaching into areas surrounding rainwater outlets,
13.	Repair of bare patches.	Annually or As Required		Routine Repairing bare patches – after weeding any, bare patches can remain which are covered using remaining sedum vegetation from cuttings

13.1 Health and Safety related to schedule

i. Confined space precautions may be required before entry into any underground chamber.

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ii. There is a risk to operatives who maintain drainage of Leptospirosis, (Weil's Disease.) The danger is that the symptoms may be missed as a cold or flu. Operatives should be briefed to advise their GP to check for Weil's Disease which can be readily treated but if neglected could cause organ damage.

iii. Work on the blue roof over second floor will require protection against falling (as will maintenance of the solar panels). Work on the green roof will require fall protection.

14 Attached documents

14.1 Documents referred to in the text, prepared by AMA Construction Engineers

Annex A :- Completed London Borough of Enfield Pro Forma

Annex B :- SuDS & Drainage Scheme Drawings

i. 23107 D100 Existing site plan with flow paths

ii. 23107 D101 Drainage General Arrangement Plan

iii. 23107D102 Drainage Construction Details

Annex C :- Hydraulic Calculations

SuDS Hydraulic Calculations.

14.2 Documents provided by others

Annex D :- Existing & Proposed Plans

Existing and Proposed Architect's Plans.

i. 519822-1 Existing Site Survey and Location Plan

ii. 519822-2 Proposed Roofs and Site Plan

iii. 519822-3 Proposed Floor plans and Elevations

Annex E :- Site Data - L B Enfield, Environment Agency & TW

i. Abstract from LB Enfield Watercourse and Geology Maps

ii. EA Surface Water, Reservoir, and River Flood Maps

iii. Thames Water Asset Survey

Group 4
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20/09/2023

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Annex A Checklist

Completed London Borough of Enfield Check List

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ENFIELD Council

GREATER**LONDON**AUTHORITY

LoDEG

1. Project & Site Details		
	Project / Site Name (including sub-catchment / stage / phase where appropriate)	Block of Flats 29-41 London Road
	Address & post code	Land Rear of 39-41 London Road Enfield Town,EN2 6LX
	OS Grid ref. (Easting, Northing)	E 532904
		N 196538
	LPA reference (if applicable)	
	Brief description of proposed work	New build 2 storey block of 3 flats on existing concrete slab car parking in courtyard behind buildings
	Total site Area	233 m^2
	Total existing impervious area	233 m^2
	Total proposed impervious area	190 m^2
	Is the site in a surface water flood risk catchment (ref. local Surface Water Management Plan)?	The site is in critical drainage area Group 4.028
	Existing drainage connection type and location	TBC Drains to SW Sewers in London Road
	Designer Name	Nick Kramer
	Designer Position	Retired Technical Director
	Designer Company	AMA Consulting Engineers

2. Proposed Discharge Arrangements			
	2a. Infiltration Feasibility		
	Superficial geology classification	Ealing Silt	
	Bedrock geology classification	NA	
	Site infiltration rate	m/s	
	Depth to groundwater level	m below ground level	
	Is infiltration feasible?	No	
	2b. Drainage Hierarchy		
		Feasible (Y/N)	*Proposed (Y/N)*
	1 store rainwater for later use	N	N
	2 use infiltration techniques, such as porous surfaces in non-clay areas	N	N
	3 attenuate rainwater in ponds or open water features for gradual release	N	N
	4 attenuate rainwater by storing in tanks or sealed water features for gradual release	Y	Y
	5 discharge rainwater direct to a watercourse	N	N
	6 discharge rainwater to a surface water sewer/drain	Y	Y
	7 discharge rainwater to the combined sewer.	N	N
	2c. Proposed Discharge Details		
	Proposed discharge location	Surface Water Sewer in Suouthsbury Road	
	Has the owner/regulator of the discharge location been consulted?	Not Yet	

3. Drainage Strategy

3a. Discharge Rates & Required Storage

	Greenfield (GF) runoff rate (l/s)	*Existing discharge rate (l/s)*	*Required storage for GF rate (m^3)*	*Proposed discharge rate (l/s)*
Qbar	0.013			
1 in 1	0.011	3.6	3	0.092
1 in 30	0.031	10.5	6	1
1 in 100	0.042	13.8	8	1
1 in 100 + CC			12	
Climate change allowance used		40%		
3b. Principal Method of Flow Control		Orifice plates and vortex flow control		

3c. Proposed SuDS Measures

	Catchment area (m^2)	*Plan area (m^2)*	*Storage vol. (m^3)*
Rainwater harvesting	0		0
Infiltration systems	0		0
Green roofs	37	37	4
Blue roofs	65	65	4
Filter strips	0	0	0
Filter drains	0	0	0
Bioretention / tree pits	0	0	0
Pervious pavements	45	45	4
Swales	0	0	0
Basins/ponds	0	0	0
Attenuation tanks	43		0
Total	**190**	**147**	**12**

4. Supporting Information

4a. Discharge & Drainage Strategy	*Page/section of drainage report*
Infiltration feasibility (2a) – geotechnical factual and interpretive reports, including infiltration results	Section 4 Page 5
Drainage hierarchy (2b)	Section 5 Page 6
Proposed discharge details (2c) – utility plans, correspondence / approval from owner/regulator of discharge location	Drawing Annex B TW Plans Annex E
Discharge rates & storage (3a) – detailed hydrologic and hydraulic calculations	TW Plans Annex E
Proposed SuDS measures & specifications (3b)	Section 8 Drawings Annex B
4b. Other Supporting Details	*Page/section of drainage report*
Detailed Development Layout	Annex D
Detailed drainage design drawings, including exceedance flow routes	Annex B
Detailed landscaping plans	not Available
Maintenance strategy	Section 11, 12, 1nd 13 Pages 10
Demonstration of how the proposed SuDS measures improve:	
a) water quality of the runoff?	Section 6 Page 7
b) biodiversity?	Section 7 Page 8
c) amenity?	Section 7 Page 8

Annex B SuDS & Drainage Scheme Drawings

i. 23107 D100 Existing site plan with flow paths

ii. 23107 D101 Drainage General Arrangement Plan (Includes schedule of areas)

iii. 23107D102 Drainage Construction Details

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DENOTES DIRECTION OF FLOOD EXCEEDANCE

DENOTES PURPLE LINE OF PROPOSED SITE

P01	Preliminary	JL	RR	2023/11/xx
REV	DETAIL	Dr	Ch	DATE

Client Name:
R. Mason

Project Name:
39-41 London Road,
Enfield, EN2 6LX

Drawing Title:
Existing Site Exceedance Layout

AMA Project N°:
23107

Drawn By: JL | Checked By: RR

First Issued: Nov 2023 | Scale @ A1: 1:100

Status: S2 | Revision: P01

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PROJECT N° - ORIGINATOR - VOLUME - LEVEL - FILE TYPE - ROLE - DRAWING N°

EXISTING DIRECTION OF FLOOD EXCEEDANCE

PROPOSED PERIMETER OF PROPOSED SITE

UNDRAINED HATCH LEGEND

HATCH	DESIGNATION	AREA (m²)
	SOFT LANDSCAPE	42.0
TOTAL AREA (m²)		42.0

DRAINED HATCH LEGEND

HATCH	DESIGNATION	AREA (m²)
	DRAINED BLUE ROOF	65.8
	DRAINED BLUE/GREEN ROOF	37.1
	DRAINED BALCONY	25.8
	DRAINED ROOF	9.5
	DRAINED HARD LANDSCAPE (PERMEABLE)	36.4
	DRAINED HARD LANDSCAPE (IMPERMEABLE)	16.3
TOTAL AREA (m²)		190.9

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DRAINAGE NOTES

NOTATION KEY

- COMBINED WATER PIPE RUN
- COMBINED WATER MANHOLE OR INSPECTION CHAMBER
- FOUL WATER PIPE RUN
- FOUL WATER MANHOLE OR INSPECTION CHAMBER
- SURFACE WATER PIPE RUN
- SURFACE WATER MANHOLE OR INSPECTION CHAMBER

RWP:	RAIN WATER PIPE
SVP:	SOIL AND VENT PIPE
SS	STUB STACK
CP	CEMENTATED PIPE
AD	UNDER DRAIN ACCORDS SIMILAR
TG	TRAPPED GULLY

SPECIFICATION

1. FOUL DRAINS ARE TO BE 100mm NOMINAL UNPLASTICISED PVC-U PIPES AT A GRADIENT NOT SHALLOWER THAN 1:40.
2. DRAINS ARE TO BE CONSTRUCTED USING HEAVY DUTY PIPES TO BS4660 OR VITRIFIED CLAY PIPES TO BS EN 295 WITH FLEXIBLE JOINTS BEDDED AND BACKFILLED IN ACCORDANCE WITH BS EN 1610 AND BS 8301.
3. 100mm DIA PIPES WITH LESS THAN 300mm COVER OR PIPES OF 150mm OR GREATER DIAMETER WITH LESS THAN 600mm COVER ARE TO BE SURROUNDED BY 150mm CONCRETE SURROUND WITH MOVEMENT JOINTS PROVIDED AT EVERY PIPE JOINT.
4. PIPES IN PIPES WITH LESS THAN 600mm COVER ARE TO BE SURROUNDED WITH CONCRETE OR TO HAVE CONCRETE PAVING SLABS LAID AS BRIDGING SLAB. ALL PIPES UNDER BUILDING ARE TO BE SURROUNDED WITH 150mm OF GRANULAR MATERIAL.
5. ACCESS TO DRAINS MAY PROVIDED BY STREET TRAY, SRP OR POLYPROPYLENE INSPECTION CHAMBERS TO BE RISE OR MANHOLES CONSTRUCTED FROM CLASS B ENGINEERS BRICKS TO BS 3921, OR PRECAST CONCRETE SECTIONS SURROUNDED WITH 150MM OF CONCRETE MINIMUM DIMENSIONS TO CONFORM TO TABLE 8 OF BS 539. COVERS AND FRAMES FOR MANHOLES/INSPECTION CHAMBERS MUST COMPLY WITH THE APPROPRIATE LOADING GRADE OF BS 497 OR BS 5834.
6. PROVIDE MANHOLES AND RODDING EYES WITH REQUIRED ACCESS.
7. ALL PIPES THAT CONNECT TO MAIN RUN DRAINAGE MANHOLES TO BE FIXED CROWNS ADJACENT.
8. NON-DOMESTIC BUILDING & SURFACE WATER DRAINAGE SYSTEM TO BE DESIGNED TO ACCOMMODATE THE 1 IN 30 YEAR RAINFALL EVENT WITHOUT FLOODING AND THE 1 IN 100 YEAR RAINFALL EVENT WITHIN THE CURTILAGE OF THE SITE.
9. ALL RWPS TO CONNECT INTO TRAPPED GULLIES.

REV	DETAIL	Dr	Ch	DATE
P01	Preliminary	JL	RR	2023/11/xx

Client Name:
R. Mason

Project Name:
39-41 London Road,
Enfield, EN2 6LX

Drawing Title:
Proposed Site Exceedance & Surfaces Layout

AMA Project N°: 23107

Drawn By: JL | Checked By: RR

First Issued: Nov 2023 | Scale @ A1: 1:100

Status: S2 | Revision: P01

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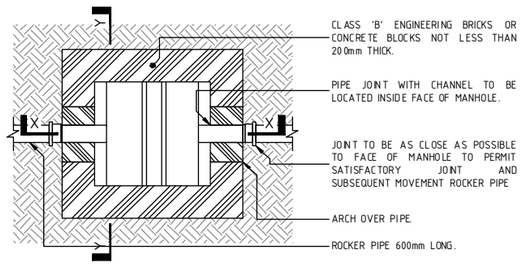
BIM Document Ref:
23107 - AMA - 01 - 00 - DR - D - 139101
PROJECT N° - ORIGINATOR - VOLUME - LEVEL - FILE TYPE - ROLE - DRAWING N°

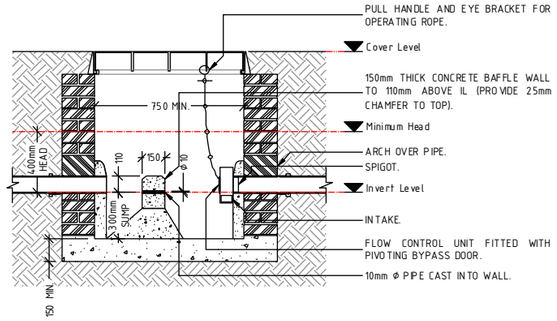
DETAIL 1: TRADITIONAL RECTANGULAR BRICK MANHOLE (TRAD.) WITH F.C.U., SUMP, & BAFFLE WALL WITH ORIFICE 0.6 - 1.2m DEEP

NOT TO SCALE



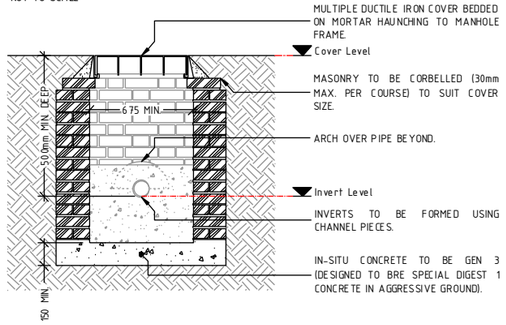
SECTION X-X

NOT TO SCALE



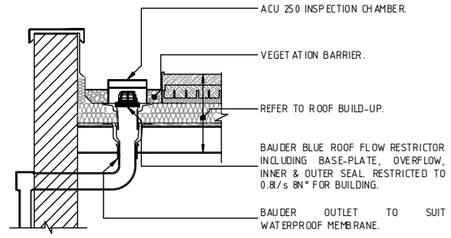
SECTION Y-Y

NOT TO SCALE



BAUDER GREEN/BLUE & BLUE ROOF OUTLET (SECTION)

NOT TO SCALE



RWP DISCHARGING ONTO PAVING DETAIL (ELEVATION)

1:10 @ A1/1:20 @ A3

PERMEABLE PAVING OVER 300mm DEEP DRAINAGE BLANKET BUILD-UP (SECTION)

1:10 @ A1/1:20 @ A3

BAUDER GREEN/BLUE ROOF BUILD-UP (SECTION)

1:10 @ A1/1:20 @ A3

- 80mm BAUDER EXTENSIVE SUBSTRATE SOWN WITH BAUDER FLORA 5 SEED MIX.
- BAUDER FILTER FLEECE OVER,
- 40mm DSE40 DRAINAGE AND PROTECTION FILLED WITH INERT MINERAL GRANULAR MATERIAL OVER,
- 100mm BAUDER ATTENUATION CELL 100 OVER,
- INSULATION BY OTHERS OVER,
- BAUDER WATERPROOF MEMBRANE BY OTHERS OVER,
- PLY DECK ON STEEL BEAM ROOF STRUCTURE (REFER TO STRUCTURAL DRAWINGS).

BAUDER BLUE ROOF BUILD-UP (SECTION)

1:10 @ A1/1:20 @ A3

- WATERPROOF LAYER TO ARCHITECT'S SPECIFICATION OVER,
- 40mm DSE40 DRAINAGE AND PROTECTION FILLED WITH INERT MINERAL GRANULAR MATERIAL OVER,
- 100mm BAUDER ATTENUATION CELL 100 OVER,
- INSULATION BY OTHERS OVER,
- BAUDER WATERPROOF MEMBRANE BY OTHERS OVER,
- PLY DECK ON STEEL BEAM ROOF STRUCTURE (REFER TO STRUCTURAL DRAWINGS).

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REV	DETAIL	Dr	Ch	DATE
P01	Preliminary	JL	RR	2023/11/xx

Client Name:
R. Mason

Project Name:
39-41 London Road,
Enfield, EN2 6LX

Drawing Title:
Proposed Drainage Details Sheet

AMA Project N°:
23107

Drawn By: JL | Checked By: RR

First Issued: Nov 2023 | Scale @ A1: As Noted

Status: S2 | Revision: P01

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BIM Document Ref:
23107 - AMA - 01 - 00 - DR - D - 139102
PROJECT N° - ORIGINATOR - VOLUME - LEVEL - FILE TYPE - ROLE - DRAWING N°

Annex C Hydraulic Calculations

SuDS Hydraulic Calculations.
- Introduction
- Whole site 1 in 100 +CC
- Whole Site 1 in 1
- Upper level Blue Roof
- Lower Level Blue Roof

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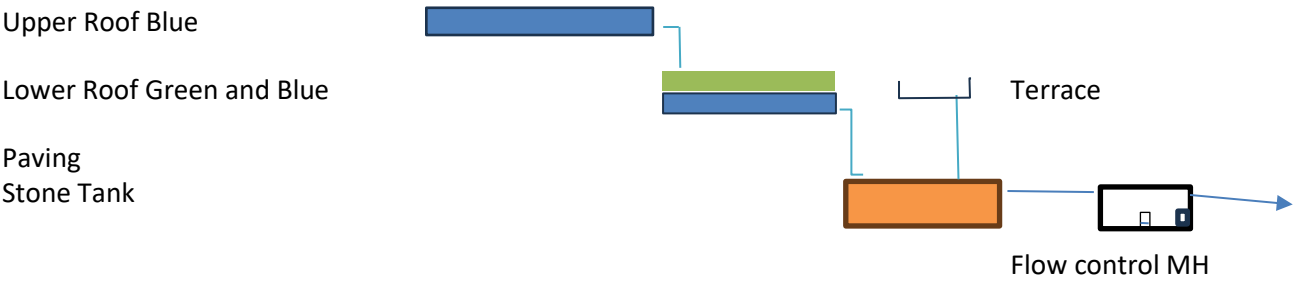
1. These calculations combine values for the storage from two roofs and a stone tank.

2. Diagram of System



3. The calculations provided are for

    a. The 100 year +CC for the whole site from the vortexvflow control unit

    b. The 1 year flow for the whole site controlled by a orifice plate and baffle

    c. The 100 year + CC storm retained on the high level roof.

    d. The 100 year + CC storm retained on the low level roof.

Notes

The Qbar flow from such a small site is negligeable flows have been limited to

10 mm orifice plates on the roofs and in the baffle

1 l/s for the vortex as the smallest viable level that will not regularly block leading to the bypass remaining open

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Volumes Before and After Development

Project Name 39-41 London Rd

Location Enfield

Summary of Results

Areas

	sq m
Exist Drained	233
Drained	191
Increase =	-42
Total Site	233

Existing 1 in 1 Year 3.6 l/s 50% 1.8 l/s

Flows

Existing Drained Area A= 233 sq m
0.0233 ha

Post Development Area A= 191 sq m
0.0191 ha

Q_{peak}= 2.78 C i A C=Cr.Cv= 1.1 A Area in ha i=MT-D/D mm/hr
Time of Concentration 4 Mins

Volumes Existing					Existing		Development	
Return Period	*Duration*	*MT-D*	i_{mean}	Qmean l/sec	*Volume V=Q x D*	Q	V_{runoff} (Spreadsheets)	Reduction
Years	Mins	mm	mm/hr					
1	15	-	50	3.56	3.206		1.80	24%
30	240	39.0046	9.75	0.69	10.005		6.32	37%
100	360	50.9888	8.50	0.61	13.079		8.99	31%
			40%					
100CC	360		11.90	0.85	18.310		12.58	31%

Project Name 39-41 London Rd

20/11/2023

Location Enfield **Hydrometric Area** 6 & 7

Area Based on	Drained Area		
Area of For Qbar Determination	191	m^2	
SAAR	678	mm	
SOIL	4.7		ii

Hydrometric Area	6 & 7
1 Year Growth Factor	0.85
30 Year Growth Factor	2.40
100 Year Growth Factor	3.19

Suds Manual Fig 24.1 and Table 24.2

km	kilometer	
ha	Hectare	= 10,000 sq metres
Q	Flow rate	l/sec
i	Rainfall intensity in mm / hr	
QBAR	Mean Annual greenfield runoff rate as ref i and ref iii.	
SAAR	Annual Rainfall Parameter ref i	
SOIL	Soil type parameter see ref i & ii	

SOIL also called SPR

QBAR has return period of 2.3 Years

Greenfield Site A_{site} < 200 ha

Calculate the annual mean Run off QBAR Ref

$QBAR_{rural}=0.00108 \times A^{0.89} \times SAAR^{1.17} \times SOIL^{2.17}$ i

\Where *A = total site area in km^2*

***If A_{site} < 50 ha**, set A= 0.5 km^2* [=50 ha] *and interpolate QBAR linearly so equation becomes* iii

$QBAR=(A_{site}/0.5) \times 0.00108 \times 0.5^{0.89} \times SAAR^{1.17} \times SOIL^{2.17}$

For				
	SAAR =	678	mm	i
	SOIL =	4.7		ii
	$QBAR_{rural}$=	0.013139	l/s	

Return Period	Growth Factor	Qbar	
1 Year	0.85	1.12E-02	l/s
30 Years	2.40	3.15E-02	l/s
100 Years	3.19	4.19E-02	l/s

Units

1	ha =	10,000	sq m
1	km^2=	1,000,000	sq m
1	ha =	0.01	km^2
50	ha =	0.50	km^2
1	cu m=	1000	l

References

i Flood estimation for small catchments", Marshall DCW and Bayliss AC. IOH Report No.124. Institute of hydrology, Wallingford, 1994

ii FSR map of Winter Rain Acceptance Potential (NERC, 1975, Vol V1.4.18(S), revised 1978: FSSR 7)

iii CIRIA SUDS MANUAL

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Job No	23107
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	17/11/2023

SURF1 - SURFACE WATER; HYDRAULIC CALCULATIONS

i

Project Name 39-41 London Rd

Location Enfield

1. Schedule of Areas

1.1	Area of Site	A_{site}	233	m^2
1.2	Impermeable Area Before Developr	A_{dbd}	233	m^2
1.3	Impermeable Area After Developme	A_{dad}	191	m^2

2. Location Specific Hydological Data

2.1	*Wallingford Coefficients*	M5-60	20	*mm*
		r	0.4	
2.2	*Flood Esimate for small catchment areas*			
		SAAR	678	*mm*
	WRAP Soil type 4 →	SOIL	4.7	

Increase for Climate Change NPPF Guidance Table 2 50-95 Yr Life

2.3	Central	20%
	High (Upper)	40%
	None	0%
	%age increase on i	High (Upper) 40%

Urban Drift

2.4 Uplift on storage: N/A

Applies to developments with houses only.

WRAP - Winter Rain Acceptance Potential

Flow Control Method: Vortex

Project Name	**39-41 London Rd**		17/11/2023
Location	**Enfield**	**Hydrometric Area**	**6 & 7**

Area Based on	**Drained Area**		
Area of For Qbar Determination	**191**	m^2	
SAAR	**678**	*mm*	
SOIL	**4.7**		ii

Hydrometric Area	6 & 7
1 Year Growth Factor	**0.85**
30 Year Growth Factor	**2.40**
100 Year Growth Factor	**3.19**

Suds Manual Fig 24.1 and Table 24.2

km	kilometer	
ha	Hectare	= 10,000 sq metres
Q	Flow rate	l/sec
i	Rainfall intensity in mm / hr	
QBAR	Mean Annual greenfield runoff rate as ref i and ref iii.	
SAAR	Annual Rainfall Parameter ref i	
SOIL	Soil type parameter see ref i & ii	

SOIL also called SPR

QBAR has return period of 2.3 Years

Greenfield Site A_{site} < 200 ha — Ref

Calculate the annual mean Run off QBAR — i

$QBAR_{rural}=0.00108 \times A^{0.89} \times SAAR^{1.17} \times SOIL^{2.17}$

\Where *A = total site area in km²*

***If A site < 50 ha**, set A= 0.5 km² [=50 ha] and interpolate QBAR linearly so equation becomes* — iii

$QBAR=(A_{site}/0.5) \times 0.00108 \times 0.5^{0.89} \times SAAR^{1.17} \times SOIL^{2.17}$

For	SAAR =	678	*mm*	i
	SOIL =	4.7		ii
	$QBAR_{rural}$=	0.013139	*l/s*	

Return Period	Growth Factor	**Qbar**	
1 Year	0.85	1.12E-02	*l/s*
30 Years	2.40	3.15E-02	*l/s*
100 Years	3.19	4.19E-02	*l/s*

Units

1	*ha =*	10,000	*sq m*
1	*km²=*	1,000,000	*sq m*
1	*ha =*	0.01	*km²*
50	*ha =*	0.50	*km²*
1	*cu m=*	1000	*l*

References

i Flood estimation for small catchments", Marshall DCW and Bayliss AC. IOH Report No.124. Institute of hydrology, Wallingford, 1994

ii FSR map of Winter Rain Acceptance Potential (NERC, 1975, Vol V1.4.18(S), revised 1978: FSSR 7)

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Project Name	**39-41 London Rd**	Job No	**23107**
		Page No	
		Rev	
			17/11/2023

The Greenfield Run off rate Q_{bar} is calculated using Marshall and Bayliss IHR124
See separate Calculation
The Greenfield Volume is calculated from the NERC FSSR16 As follows.

V = PR x A x Rainfall100 6 Hours /1000

A (m²)= 233
Rainfall100(mm)= **63** mm UK SuDS Tool Note No CC

S1=	1	SAAR =	678	
S2=		CWI=	**120**	*Fig 24.3 , SuDS Manual*
S3=		DPR_{CWI}=	-1.25	*0.25(CWI-125)*
S4=	0	P	63	*mm*
S5=		DPR Rain	4.04	*If P>40 , .045(P-40)$^{0.7}$ If P≤40, 0*
SPR=	10	*SPR=10.S1+30.S2+37.S3+47.S4+54*S5*		

EQ. 24.4 Fixed percentage runoff model (from NERC, 1985)

The fixed percentage runoff method correlates runoff volume (as percentage runoff) with soil type, storm depth and other easily derived parameters:

$$PR_{RURAL} = SPR + DPR_{CWI} + DPR_{RAIN}$$

PR rural= 4.71 %

100 Year Volume on Greenfield Site

V= 0.7 cu m

Developed Site

The developed site run off volume is calculated using Wallingford Fixed Method.

SuDS Manual Eqn 24.7

EQ. 24.7 Variable UK runoff model

$$PR = IF \times PIMP + (100 - IF \times PIMP) \times \frac{NAPI}{PF}$$

IF=	0.7	SuDS Manual
A imperv=	191	sq m
PIMP =	Aimp/Atotal= 81.97 %	
NAPI=	20	SuDS Manual
PF=	200	SuDS Manual

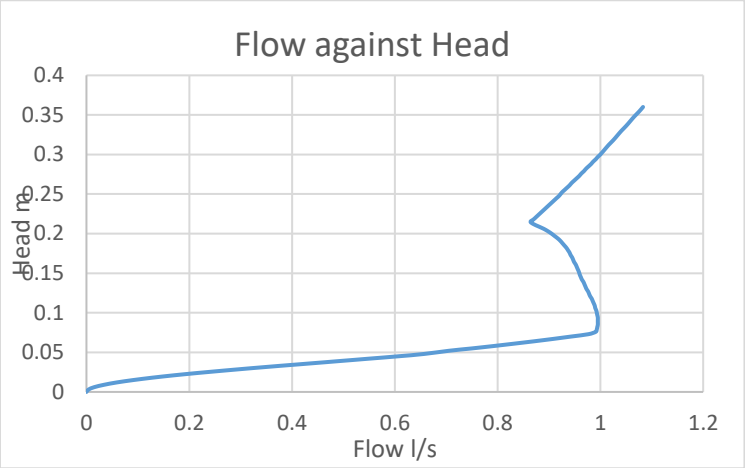
PR= 62% %
Asite= 0.0233
PR * Asite= 0.0144 ha
143.6 m Using this to calculate storage

Hydraulic Data for Hydro International for Hydro-Brake Optimum®

Ref *SHE-0056-1000-0300-1000*

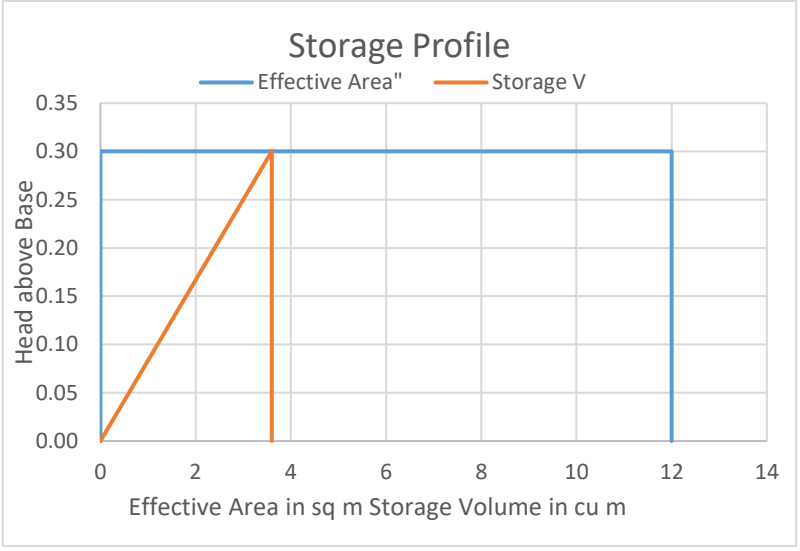
Head (m)	Flow (l/s)	Head (m)	Flow (l/s)
0.00	0.00	0.06	0.10
0.00	0.00	0.06	0.10
0.01	0.02	0.06	0.10
0.01	0.03	0.06	0.10
0.01	0.06	0.06	0.10
0.02	0.09	0.06	0.10
0.02	0.13	0.06	0.10
0.02	0.17	0.06	0.10
0.02	0.22	0.06	0.11
0.03	0.27	0.06	0.11
0.03	0.32	0.07	0.11
0.03	0.38	0.07	0.11
0.04	0.44	0.07	0.11
0.04	0.49	0.07	0.11
0.04	0.55	0.07	0.11
0.05	0.61	0.07	0.11
0.05	0.66	0.07	0.11
0.05	0.71	0.07	0.11
0.06	0.75	0.07	0.11
0.06	0.79	0.07	0.11
0.06	0.83	0.08	0.11
0.06	0.87	0.08	0.12
0.07	0.91	0.08	0.12
0.07	0.94	0.08	0.12
0.07	0.98	0.08	0.12
0.08	0.99	0.08	0.12
0.08	0.99	0.08	0.12
0.08	0.99	0.08	0.12
0.09	1.00	0.08	0.12
0.09	1.00	0.17	0.12
0.09	1.00	0.17	0.12
0.09	1.00	0.17	0.12
0.10	0.99	0.18	0.12
0.10	0.99	0.18	0.12
0.10	0.99	0.18	0.13
0.11	0.99	0.19	0.13
0.11	0.99	0.19	0.13
0.11	0.99	0.19	0.13
0.12	0.99	0.19	0.13
0.12	0.98	0.20	0.13
0.12	0.98	0.20	0.13
0.12	0.98	0.20	0.13
0.13	0.98	0.21	0.13
0.13	0.97	0.21	0.13
0.13	0.97	0.21	0.13
0.14	0.97	0.22	0.13
0.14	0.97	0.22	0.13
0.14	0.96	0.22	0.13
0.15	0.96	0.22	0.13
0.15	0.96	0.23	0.14
0.15	0.96	0.23	0.14
0.16	0.96	0.23	0.14
0.16	0.95	0.24	0.14
0.16	0.95	0.24	0.14
0.16	0.95	0.24	0.14

TECHNICAL SPECIFICATION	Head (m)	Flow (l/s)
Design	0.3	1
Flush-Flo	0.089	0.995
Kick-Flo®	0.214	0.862
Mean Flow over head		0.827
Minimum Clearance (m²)		0



Storage Profile

Head m	Area sq m	Voids Ratio	Aeff=A.VR	Storage V	Type
0	40	0.3	12	0	Stone
0.3	40	0.3	12	3.6	Stone
0.3001	0	0	0	3.6	-
0	0	0	0	3.6	-
0	0	0	0	3.6	-
0	0	0	0	3.6	-
0	0	0	0	3.6	-
0	0	0	0	3.6	-
0	0	0	0	3.6	-
0	0	0	0	3.6	-
0	0	0	0	3.6	-
0	0	0	0	3.6	-



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Project	39-41 London Rd	Job ref.	23107
Date	17-Nov-23	Page No.	
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1 in 1 Year Storm 15 Mins Duration
Outflow based on Hydraulic Curves

i=50 mm/hr, as the Wallingford Rational Method coefficients are not applicable for T < 5 Years

Area **0.01436** ha

Storage profile described on adjoining sheet
Volume = 3.60 cu m

Out Flow fron Hydraulic Tables for Head
Head based on Stored Volume of previous line.

D	i	Q_{peak}	Run Off	Head	Out Flow	Disch.	Stored Volume
mins	*mm/hr*	*l/sec*	*cu m*		*l/s*	*cu m*	*cu m*
1	50.00	2.00	0.12	0.00	0.00	0.01	**0.11**
2	50.00	2.00	0.24	0.01	0.01	0.01	**0.23**
3	50.00	2.00	0.36	0.02	0.09	0.02	**0.34**
4	50.00	2.00	0.48	0.03	0.27	0.03	**0.45**
5	50.00	2.00	0.60	0.04	0.38	0.06	**0.54**
6	50.00	2.00	0.72	0.05	0.61	0.09	**0.63**
7	50.00	2.00	0.84	0.05	0.70	0.13	**0.70**
8	50.00	2.00	0.96	0.06	0.75	0.18	**0.78**
9	50.00	2.00	1.08	0.06	0.87	0.23	**0.85**
10	50.00	2.00	1.20	0.07	0.94	0.29	**0.91**
11	50.00	2.00	1.32	0.07	0.94	0.34	**0.97**
12	50.00	2.00	1.44	0.08	0.99	0.40	**1.03**
13	50.00	2.00	1.56	0.09	1.00	0.46	**1.09**
14	50.00	2.00	1.68	0.09	1.00	0.52	**1.15**
15	50.00	2.00	1.80	0.09	1.00	0.58	**1.21**
20	50.00	2.00	2.40	0.10	0.99	0.88	**1.52**
25	50.00	2.00	2.99	0.12	0.98	1.17	**1.82**
30	50.00	2.00	3.59	0.15	0.96	1.46	**2.13**
35	50.00	2.00	4.19	0.18	0.94	1.75	**2.45**
40	50.00	2.00	4.79	0.20	0.91	2.02	**2.77**
45	50.00	2.00	5.39	0.23	0.89	2.28	**3.11**
					Max Volume to be Stored		**1.21** *cu m*

Mean Outflow **0.648** *l/sec*

Calculation ignores *Interception Storage* of 1st 5 mm rainfall -0.71815 *cu m*
Nett storage requirement 0.50 *cu m*

D Duration in minutes Q_{peak} Peak Flow l/s =2.78 Cv.Cr.i.A
T Return Period in Years CvCr=1
I Rainfall Intensity in mm/hour A Area in hectares
(10,000sq m = 1ha)

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Project	39-41 London Rd	Job ref	23107
Date	17-Nov-23	Page No	
		Calc by	

4 Hour Event

Outflow based on Hydraulic Curves

Return Period T	30	*Years*
M5-60	20	*mm*
r	0.4	
Area	0.0144	*ha*

Out Flow fron Hydraulic table based on Head
Head based on Storage Volume of previous line.

D	Z1	M5-D	Z2	M30-D	i	Q_{peak}	Run Off	Head	Out Flow	Allow. Disch.	Stor. Vol.
mins		*mm*		*mm*	*mm/hr*	*l/sec*	*cu m*		*l/s*	*cu m*	*cu m*
5	0.37	7.41	1.45	10.78	129.32	5.16	1.55	0.00	0.00	0.01	**1.54**
10	0.53	10.59	1.49	15.82	94.93	3.79	2.27	0.13	0.98	0.30	**1.97**
15	0.63	12.59	1.51	19.01	76.03	3.04	2.73	0.16	0.95	0.59	**2.14**
20	0.70	14.06	1.52	21.35	64.06	2.56	3.07	0.18	0.94	0.87	**2.20**
25	0.76	15.22	1.53	23.21	55.70	2.22	3.34	0.18	0.94	1.15	**2.18**
30	0.81	16.18	1.53	24.75	49.50	1.98	3.56	0.18	0.94	1.43	**2.13**
35	0.85	17.01	1.53	26.07	44.69	1.78	3.75	0.18	0.94	1.71	**2.03**
40	0.89	17.73	1.54	27.22	40.84	1.63	3.91	0.17	0.95	2.00	**1.91**
45	0.92	18.38	1.54	28.25	37.67	1.50	4.06	0.16	0.95	2.29	**1.78**
50	0.95	18.97	1.54	29.18	35.02	1.40	4.20	0.14	0.96	2.57	**1.62**
55	0.98	19.50	1.54	30.03	32.76	1.31	4.32	0.13	0.97	2.87	**1.45**
60	1.00	20.00	1.54	30.81	30.81	1.23	4.43	0.12	0.98	3.16	**1.27**
90	1.12	22.39	1.54	34.52	23.01	0.92	4.96	0.10	0.99	4.95	**0.02**
120	1.21	24.19	1.54	37.23	18.61	0.74	5.35	0.00	0.00	4.95	**0.40**
180	1.34	26.87	1.53	41.15	13.72	0.55	5.91	0.03	0.32	6.10	**0.00**
240	1.45	28.91	1.52	43.98	10.99	0.44	6.32	0.00	0.00	6.10	**0.22**
										Max Volume to be Stored	**2.20** *cu m*

Storage profile described on adjoining sheet

Volume : 3.60 cu m Storage **OK < Provided**

1] T= Return Period of Storm (Years)
2] D= Duration of Storm (Mins)
3] i =[MT-D]*60/D
4] Q = 2.78 * Area * i
5] Run Off = Q *D *60/1000
6] Allowable Discharge = Va * D / 1000
Valid Range for T is 5 to 100 Years

7] M5-D=Z1 * M5-60
8] MT-D=Z2 * M5-D
9]Z1 & Z2 Wallingford Procedure Vols 1 and 4

This calculation uses a hydrograph described in the Wallingford Modified Rational Method. Whilst more advanced methods exist based on the Flood Estimation Handbook (1999), the Revitalised Flood Hydrograph (ReFH)(2007) and the Revitalised Flood Hydrograph rainfall-runoff method version 2 (ReFH 2)(2015). As at May 2020 ReFH 2.3 which incorporates urban modelling is currant.
It should be noted that ReFH was rural only and only for catchments > 0.5 sq km or 50 hectares which is a much larger than any project for which these calculations apply.
A calibration study of ReFH2 considered a 40 sq km catchment (4,000 hectares) small, the FEH method has only been calibrated for catchments of over 200 ha, whilst the typical catchment for which these calculations are made is less than 5 ha and frequently less than 1.
Bearing in mind the small catchments and that ReFH and FEH are proprietary, the Wallingford Modified Rational method does not appear inappropriate.

AMA Consulting Engineers

Project	39-41 London Rd	Job ref	23107
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6 Hour Event

Outflow based on Hydraulic Curves

Return Period T	100	*Years*
M5-60	20	*mm*
r	0.4	
Area	0.0144	*ha*

Allowance for Climate Change

High (Upper)	**40%**	Refer NPPF Table 2

Out Flow fron supplier data based on Head
Head based on Storage Volume of previous line.

D	Z1	M5-D	Z2	M100-D	i	i + %age	Q_{peak}	Run Off	Head	Out Flow	Allow. Disch.	Stor. Vol.
mins		*mm*		*mm*	*mm/hr*	*mm/hr*	*l/sec*	*cu m*			*cu m*	*cu m*
5	0.37	7.41	1.84	13.66	163.91	229.48	9.16	2.75	0.00	0.00	0.01	**2.74**
10	0.53	10.59	1.93	20.40	122.40	171.36	6.84	4.11	0.23	0.88	0.27	**3.83**
15	0.63	12.59	1.96	24.67	98.68	138.15	5.52	4.96	0.36	1.08	0.60	**4.37**
20	0.70	14.06	1.98	27.82	83.46	116.85	4.67	5.60	0.36	1.08	0.92	**4.68**
25	0.76	15.22	1.99	30.32	72.77	101.88	4.07	6.10	0.36	1.08	1.25	**4.85**
30	0.81	16.18	2.00	32.39	64.79	90.70	3.62	6.52	0.36	1.08	1.57	**4.95**
35	0.85	17.01	2.01	34.17	58.57	82.00	3.27	6.88	0.36	1.08	1.90	**4.98**
40	0.89	17.73	2.01	35.72	53.58	75.01	3.00	7.19	0.36	1.08	2.22	**4.96**
45	0.92	18.38	2.02	37.10	49.47	69.25	2.77	7.47	0.36	1.08	2.55	**4.92**
50	0.95	18.97	2.02	38.34	46.01	64.41	2.57	7.72	0.36	1.08	2.87	**4.84**
55	0.98	19.50	2.02	39.47	43.06	60.28	2.41	7.94	0.36	1.08	3.20	**4.75**
60	1.00	20.00	2.03	40.51	40.51	56.71	2.26	8.15	0.36	1.08	3.52	**4.63**
90	1.12	22.39	2.03	45.40	30.27	42.38	1.69	9.14	0.36	1.08	5.47	**3.66**
120	1.21	24.19	2.02	48.92	24.46	34.25	1.37	9.85	0.36	1.08	7.42	**2.42**
180	1.34	26.87	2.01	53.89	17.96	25.15	1.00	10.85	0.20	0.90	10.68	**0.17**
240	1.45	28.91	1.98	57.37	14.34	20.08	0.80	11.54	0.01	0.06	10.89	**0.65**
270	1.49	29.77	1.97	58.76	13.06	18.28	0.73	11.83	0.05	0.70	12.16	**0.00**
300	1.53	30.57	1.97	60.11	12.02	16.83	0.67	12.10	0.00	0.00	12.16	**0.00**
330	1.57	31.30	1.96	61.36	11.16	15.62	0.62	12.35	0.00	0.00	12.16	**0.19**
360	1.60	31.98	1.95	62.51	10.42	14.58	0.58	12.58	0.01	0.06	12.27	**0.31**
										Max Volume to be Stored		**4.98**

Storage profile described on adjoining sheet Volume : 3.60 cu m Storage **NOT OK**

1] T= Return Period of Storm (Years)
2] D= Duration of Storm (Mins)
3] i =[MT-D]*60/D
4] Q = 2.78 * Area * i
5] Run Off = Q *D *60/1000
6] Allowable Discharge = Va * D / 1000
Valid Range for T is 5 to 100 Years

7] M5-D=Z1 * M5-60
8] MT-D=Z2 * M5-D
9]Z1 & Z2 Wallingford Procedure Vols 1 and 4

NPPF/EA UPLIFT FOR CC

Central	**0.2**
High (Upper)	**0.4**
None	**0**

This calculation uses a hydrograph described in the Wallingford Modified Rational Method. Whilst more advanced methods exist based on the Flood Estimation Handbook (1999), the Revitalised Flood Hydrograph (ReFH)(2007) and the Revitalised Flood Hydrograph rainfall-runoff method version 2 (ReFH 2)(2015). As at May 2020 ReFH 2.3 which incorporates urban modelling is currant.
It should be noted that ReFH was rural only and only for catchments > 0.5 sq km or 50 hectares which is a much larger than any project for which these calculations apply.
A calibration study of ReFH2 considered a 40 sq km catchment (4,000 hectares) small, the FEH method has only been calibrated for catchments of over 200 ha, whilst the typical catchment for which these calculations are made is less than 5 ha and frequently less than 1.
Bearing in mind the small catchments and that ReFH and FEH are proprietary, the Wallingford Modified Rational method does not appear inappropriate.

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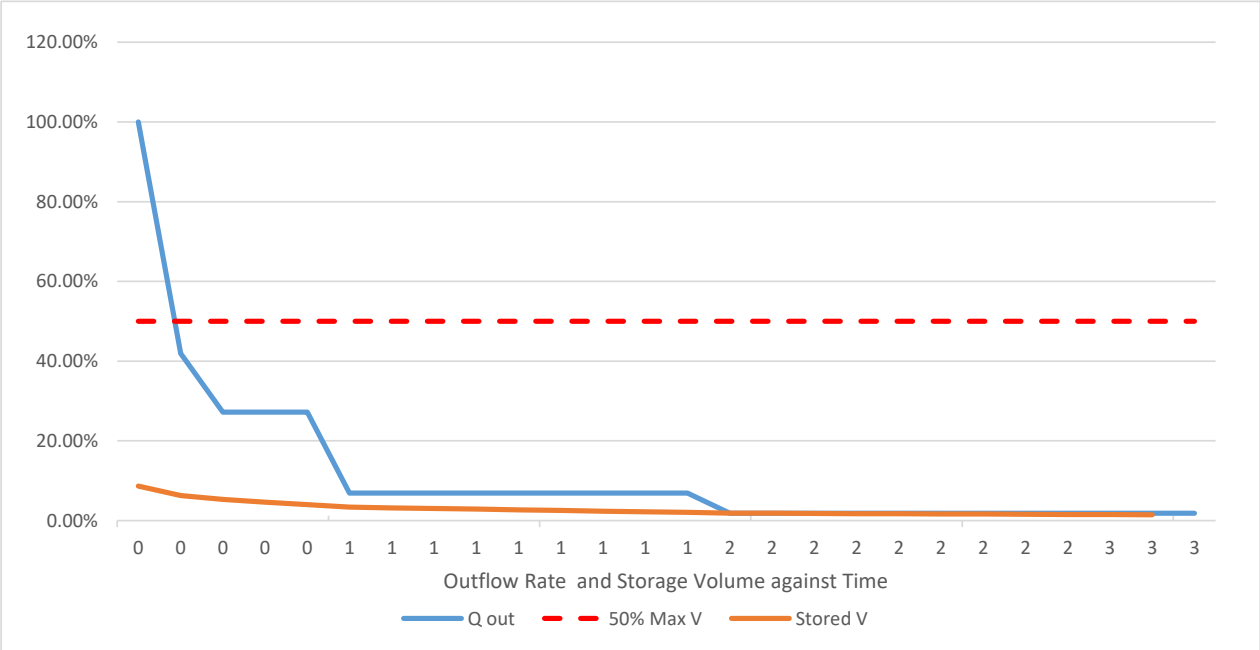
Time to 50 % Empty **Storage** **3.60** cu m

Time Hrs	**Stored V**	**Head**	**Q out**	**Head**	**Q out**	**Stored V**
	cu m	**m**	*l/sec*	*% Max*	*% Max*	*% of Total*
0.0	0.31	0.02	0.22	1.00	1.00	9%
0.1	0.23	0.02	0.09	0.75	0.42	6%
0.2	0.19	0.01	0.06	0.62	0.27	5%
0.3	0.17	0.01	0.06	0.50	0.27	5%
0.4	0.14	0.01	0.06	0.50	0.27	4%
0.5	0.12	0.01	0.01	0.37	0.07	3%
0.7	0.12	0.01	0.01	0.37	0.07	3%
0.8	0.11	0.01	0.01	0.37	0.07	3%
0.9	0.10	0.01	0.01	0.25	0.07	3%
1.0	0.10	0.01	0.01	0.25	0.07	3%
1.1	0.09	0.01	0.01	0.25	0.07	3%
1.2	0.09	0.01	0.01	0.25	0.07	2%
1.3	0.08	0.01	0.01	0.25	0.07	2%
1.4	0.07	0.01	0.01	0.25	0.07	2%
1.5	0.07	0.00	0.00	0.13	0.02	2%
1.6	0.07	0.00	0.00	0.13	0.02	2%
1.7	0.06	0.00	0.00	0.13	0.02	2%
1.9	0.06	0.00	0.00	0.13	0.02	2%
2.0	0.06	0.00	0.00	0.13	0.02	2%
2.1	0.06	0.00	0.00	0.13	0.02	2%
2.2	0.06	0.00	0.00	0.13	0.02	2%
2.3	0.06	0.00	0.00	0.13	0.02	2%
2.4	0.06	0.00	0.00	0.13	0.02	2%
2.5	0.05	0.00	0.00	0.13	0.02	1%
2.6	0.05	0.00	0.00	0.13	0.02	1%
2.7	0.05	0.00	0.00	0.13	0.02	1%

Time to 50%= **0.00** Hours

Time to 100%= 2.68 Hours



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SURF1 - SURFACE WATER; HYDRAULIC CALCULATIONS

i

Project Name 39-41 London Road

Location Enfield

The following pages relate to the 1 in 1 Year storm limited to Qbar 1 Year return.

An orifice plate will be installed in a baffle

Area Drained	191	sq m

h is the height of water stored for a 1 in 1 year Storm of 15 Minutes Duration

Qbar 1 Year	0.011	l/s

For storms of greater intensity the water will overtop the baffle and be controlled by a Vortex Flow Control.

Orifice Plate			Max Flow	
Diameter	10	mm	0.092	l/s/hole
Max Head	0.11	m		
No of Holes		1	0.092	l/s

The baffle will be	110	mm high

Type of Control	Orifice Pl

Filename AMA SuDS Storage 1 in 1 Orifice Plate1.xlsm
Short Path https://amacl-my.sharepoint.com/personal/nick_kramer_amacl_co_uk/Documents/De

Hydraulic Data for Orifice Plater

h m	Q l/s	h m	Q l/s
0.00	0.00	0.06	0.07
0.00	0.01	0.06	0.07
0.00	0.01	0.06	0.07
0.00	0.02	0.06	0.07
0.00	0.02	0.07	0.07
0.01	0.02	0.07	0.07
0.01	0.02	0.07	0.07
0.01	0.02	0.07	0.07
0.01	0.03	0.07	0.07
0.01	0.03	0.07	0.07
0.01	0.03	0.07	0.07
0.01	0.03	0.07	0.08
0.01	0.03	0.07	0.08
0.01	0.03	0.08	0.08
0.02	0.03	0.08	0.08
0.02	0.04	0.08	0.08
0.02	0.04	0.08	0.08
0.02	0.04	0.08	0.08
0.02	0.04	0.08	0.08
0.02	0.04	0.08	0.08
0.02	0.04	0.08	0.08
0.02	0.04	0.08	0.08
0.02	0.04	0.09	0.08
0.03	0.04	0.09	0.08
0.03	0.05	0.09	0.08
0.03	0.05	0.09	0.08
0.03	0.05	0.09	0.08
0.03	0.05	0.09	0.08
0.03	0.05	0.09	0.08
0.03	0.05	0.09	0.09
0.03	0.05	0.09	0.09
0.03	0.05	0.10	0.09
0.04	0.05	0.10	0.09
0.04	0.05	0.10	0.09
0.04	0.05	0.10	0.09
0.04	0.05	0.10	0.09
0.04	0.06	0.10	0.09
0.04	0.06	0.10	0.09
0.04	0.06	0.10	0.09
0.04	0.06	0.10	0.09
0.04	0.06	0.11	0.09
0.05	0.06	0.11	0.09
0.05	0.06	0.11	0.09
0.05	0.06	0.11	0.09
0.05	0.06	0.11	0.09
0.05	0.06	0.11	0.09
0.05	0.06	0.11	0.09
0.05	0.06	0.11	0.09
0.05	0.06	0.11	0.09
0.05	0.06	0.12	0.09
0.06	0.07	0.12	0.10
0.06	0.07	0.12	0.10
0.06	0.07	0.12	0.10
0.06	0.07	0.12	0.10
0.06	0.07	0.12	0.10

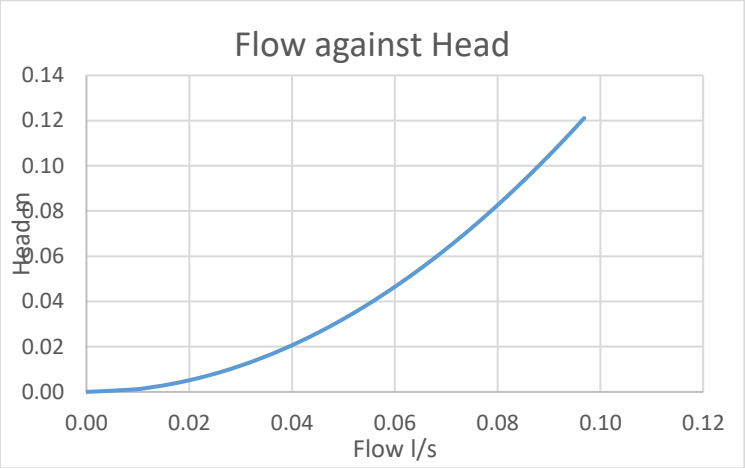
TECHNICAL SPECIFICATION		
Q Max	0.092	l/sec
Diameter	10	mm
No of Holes		1
Max Head	0.11	m

Eqn 28.1 SuDS Manual

EQ. 28.1 Standard orifice equation

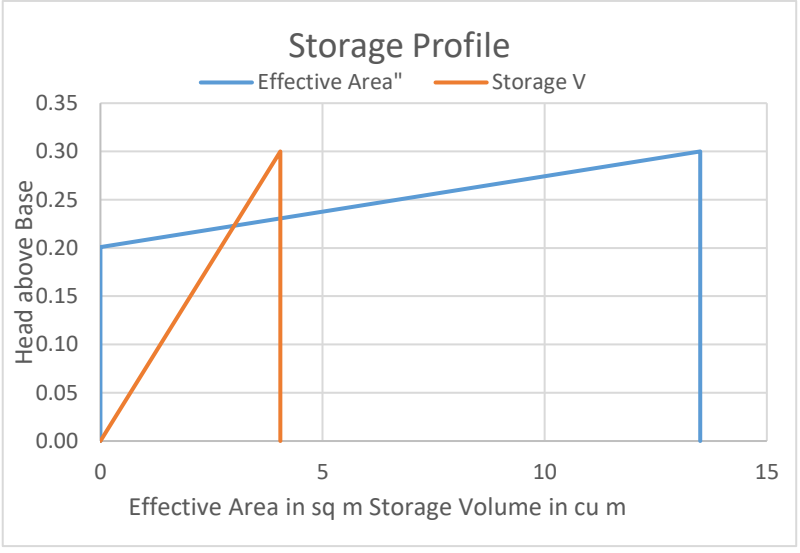
$$Q = C_d A_o \sqrt{2gh}$$

C_d = 0.8



Storage Profile

Head m	Area sq m	Voids Ratio	Aeff=A.VR	Storage V	Type
0	45	0.3	13.5	0	Stone
0.3	45	0.3	13.5	4.05	Stone
0.201	0	0	0	4.05	-
0	0	0	0	4.05	-
0	0	0	0	4.05	-
0	0	0	0	4.05	-
0	0	0	0	4.05	-
0	0	0	0	4.05	-
0	0	0	0	4.05	-
0	0	0	0	4.05	-
0	0	0	0	4.05	-



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1 in 1 Year Storm 15 Mins Duration
Outflow based on Hydraulic Curves

i=50 mm/hr, as the Wallingford Rational Method coefficients are not applicable for T < 5 Years

Area **0.0191** ha

Storage profile described on adjoining sheet

Out Flow fron Hydraulic Tables for Head
Head based on Stored Volume of previous line.

D	i	Q_{peak}	Run Off	Head	Out Flow	Disch.	Stored Volume
mins	*mm/hr*	*l/sec*	*cu m*		*l/s*	*cu m*	*cu m*
1	50.00	2.65	0.16	0.00	0.00	0.01	**0.15**
2	50.00	2.65	0.32	0.01	0.03	0.01	**0.31**
3	50.00	2.65	0.48	0.02	0.04	0.01	**0.46**
4	50.00	2.65	0.64	0.03	0.05	0.02	**0.62**
5	50.00	2.65	0.80	0.05	0.06	0.02	**0.78**
6	50.00	2.65	0.96	0.06	0.07	0.02	**0.93**
7	50.00	2.65	1.12	0.07	0.07	0.03	**1.09**
8	50.00	2.65	1.27	0.08	0.08	0.03	**1.24**
9	50.00	2.65	1.43	0.09	0.08	0.04	**1.39**
10	50.00	2.65	1.59	0.10	0.09	0.04	**1.55**
11	50.00	2.65	1.75	0.11	0.09	0.05	**1.70**
12	50.00	2.65	1.91	0.12	0.10	0.06	**1.86**
13	50.00	2.65	2.07	0.12	0.10	0.06	**2.01**
14	50.00	2.65	2.23	0.12	0.10	0.07	**2.16**
15	50.00	2.65	2.39	0.12	0.10	0.07	**2.32**
20	50.00	2.65	3.19	0.12	0.65	0.27	**2.92**
25	50.00	2.65	3.98	0.12	0.65	0.46	**3.52**
30	50.00	2.65	4.78	0.12	0.65	0.66	**4.12**
35	50.00	2.65	5.58	0.12	0.65	0.86	**4.72**
40	50.00	2.65	6.37	0.12	0.65	1.05	**5.32**
45	50.00	2.65	7.17	0.12	0.65	1.25	**5.92**
						Max Volume to be Stored	**2.32** *cu m*

Mean Outflow **0.081** *l/sec*

D Duration in minutes
T Return Period in Years
I Rainfall Intensity in mm/hour

Q_{peak} Peak Flow l/s =2.78 Cv.Cr.i.A
CvCr=1
A Area in hectares
(10,000sq m = 1ha)

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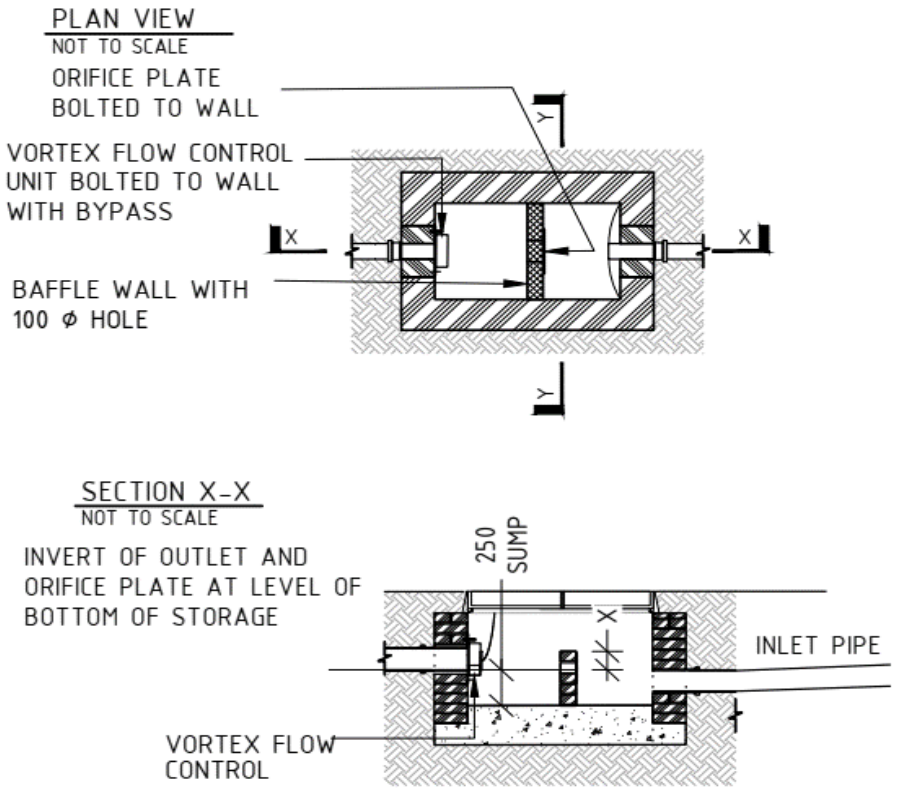
DETAILS OF BAFFLE WITH ORIFICE PLATE.

Project Name	**39-41 London Road**
Location	**Enfield**

RECTANGULAR MANHOLE DRAWN BUT CIRCULAR SIMILAR
FOR DIMENSIONS X AND Y REFER TO PREVIOUS SHEETS

X - height of baffle Y -diameter of orifice



Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	0.300	1.000
Flush-Flo™	0.089	0.995
Kick-Flo®	0.214	0.862
Mean Flow		0.827

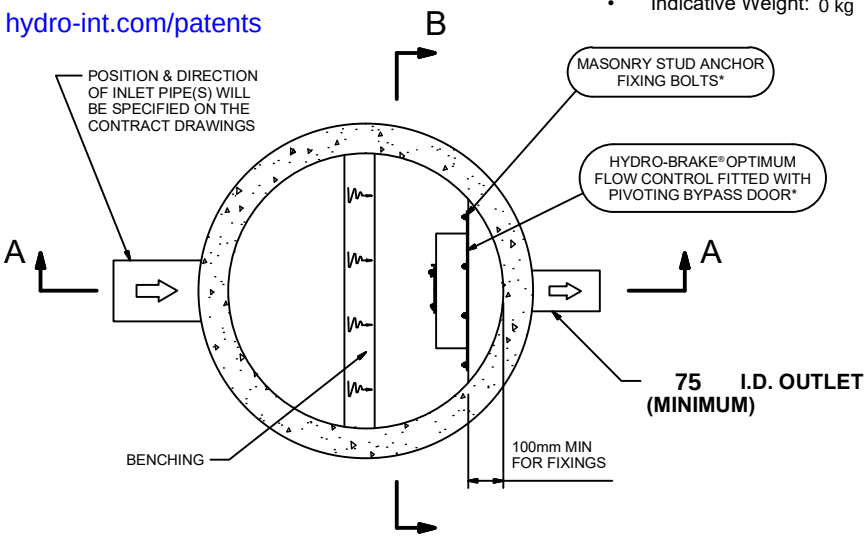
Hydro-Brake® Optimum Flow Control including:

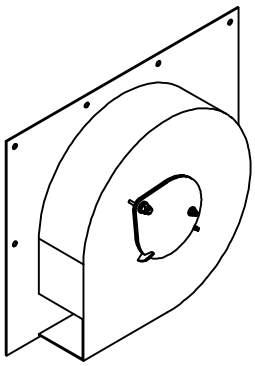
- 3 mm grade 304L stainless steel
- Integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Beed blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet
- Indicative Weight: 0 kg

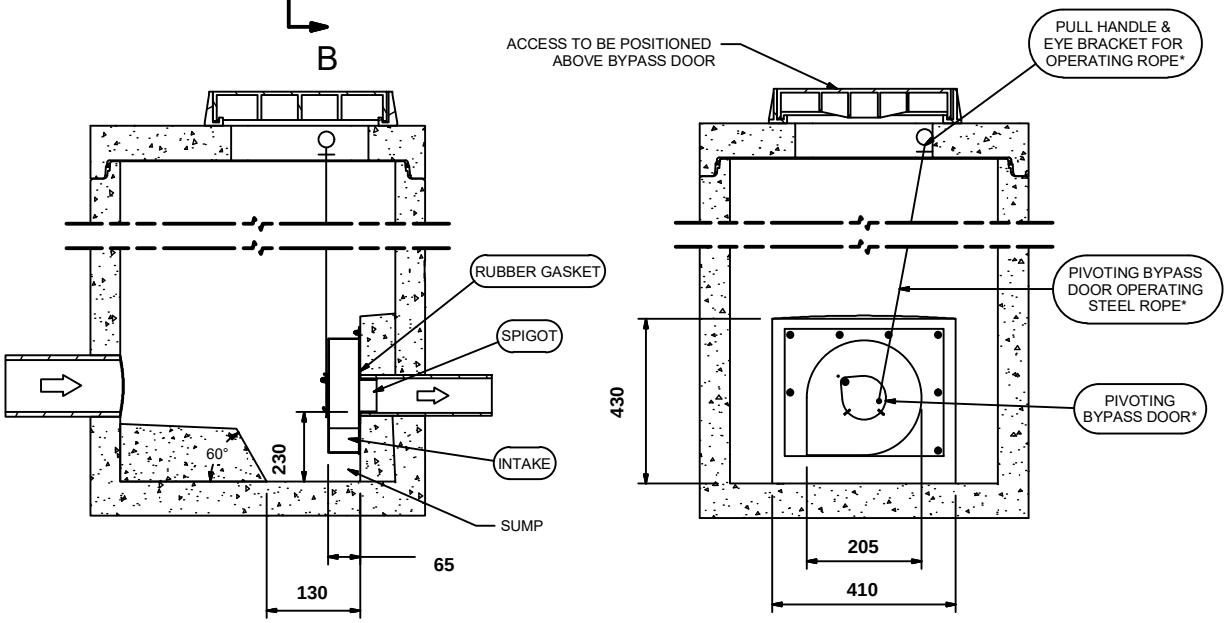
BBA APPROVAL INSPECTION TESTING CERTIFICATION CERTIFICATE 08/4596

wrc approved PT/503/0422 Valid: 01/04/2022 - 31/03/2027

hydro-int.com/patents







SECTION A-A

SECTION B-B

IMPORTANT:

LIMIT OF HYDRO INTERNATIONAL SUPPLY
THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS
FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
ALL CIVIL AND INSTALLATION WORK BY OTHERS
* WHERE SUPPLIED
HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE® OPTIMUM FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

DESIGN ADVICE

The head/flow characteristics of this SHE-0056-1000-0300-1000 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro International A CRH COMPANY

DATE	14/11/2023 17:07
SITE	London Rd
DESIGNER	Nick Kramer
REF	23107 A / 23_21_6403

SHE-0056-1000-0300-1000
Hydro-Brake® Optimum

Hydro International Ltd • Unit 2, Rivermead Court • Kenn Business Park • Windmill Road • Kenn • Clevedon • BS21 6FT • Tel: 01275 878371 • www.hydro-int.com • Email: Enquiries@hydro-int.com

nick.kramer@amacl.co.uk

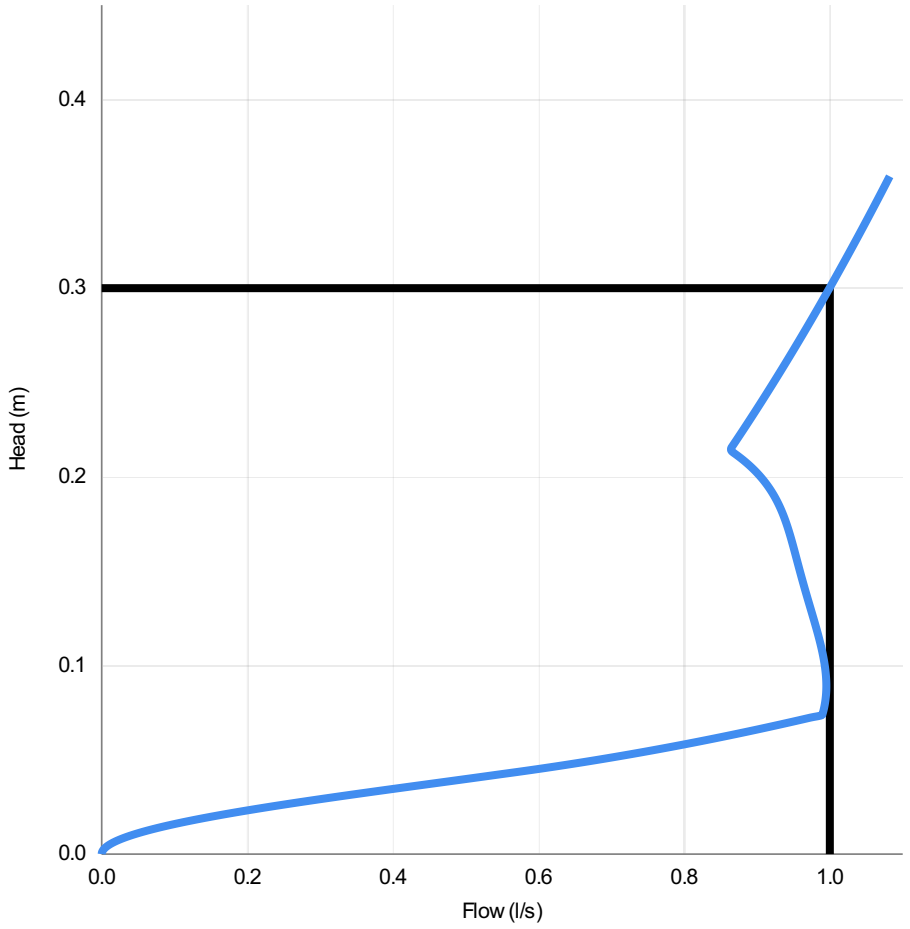
Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	0.300	1.000
Flush-Flo	0.089	0.995
Kick-Flo®	0.214	0.862
Mean Flow		0.827

BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4596

wrc approved™
PT/503/0422
Valid: 01/04/2022 - 31/03/2027

hydro-int.com/patents



Head (m)	Flow (l/s)
0.000	0.000
0.010	0.044
0.021	0.163
0.031	0.334
0.041	0.530
0.052	0.708
0.062	0.851
0.072	0.974
0.083	0.994
0.093	0.995
0.103	0.992
0.114	0.986
0.124	0.978
0.134	0.970
0.145	0.963
0.155	0.955
0.166	0.948
0.176	0.940
0.186	0.929
0.197	0.912
0.207	0.887
0.217	0.868
0.228	0.886
0.238	0.903
0.248	0.920
0.259	0.937
0.269	0.953
0.279	0.969
0.290	0.984
0.300	1.000

DESIGN ADVICE

The head/flow characteristics of this SHE-0056-1000-0300-1000 Hydro-Brake Optimum® Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.

! **The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.**

Hydro International
A CRH COMPANY

DATE	14/11/2023 17:07
Site	London Rd
DESIGNER	Nick Kramer
Ref	23107 A / 23_21_6403

SHE-0056-1000-0300-1000

Hydro-Brake Optimum®

AMA Consulting Engineers
3 Marconi Place
London EN4 8RE
Tel 020 8361 6827

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	17/11/2023

SURF1 - SURFACE WATER; HYDRAULIC CALCULATIONS

i

Project Name 39-41 London Rd

Location Enfield

This calculation is for the lower blue roof looking at the 100 Year + CC attenuation.
The roof is drained through a bauder variable outlet at its minimum setting

1. Schedule of Areas

1.1	Area of Site	A_{site}	233	m^2
1.2	Impermeable Area Before Developr	A_{dbd}	233	m^2

Area of two blue roofs are combined

1.3	Impermeable Area After Developme	A_{dad}	109	m^2

2. Location Specific Hydological Data

2.1	*Wallingford Coefficients*	M5-60	20	*mm*
		r	0.4	

2.2 *Flood Esimate for small catchment areas*

		SAAR	678 *mm*
WRAP Soil type	4	SOIL	4.7

Increase for Climate Change NPPF Guidance Table 2 50-95 Yr Life

2.3

Central	20%
High (Upper)	40%
None	0%

%age increase on i: High (Upper) 40%

Urban Drift

2.4 Uplift on storage: N/A

Applies to developments with houses only.

WRAP - Winter Rain Acceptance Potential

Flow Control Method: Orifice Pl

Hydraulic Data for Orifice Plater

h m	Q l/s	h m	Q l/s
0.00	0.00	0.06	0.05
0.00	0.01	0.06	0.05
0.00	0.01	0.06	0.05
0.00	0.01	0.06	0.05
0.00	0.01	0.06	0.05
0.01	0.01	0.06	0.05
0.01	0.02	0.06	0.05
0.01	0.02	0.06	0.05
0.01	0.02	0.06	0.05
0.01	0.02	0.06	0.05
0.01	0.02	0.07	0.05
0.01	0.02	0.07	0.05
0.01	0.02	0.07	0.05
0.01	0.02	0.07	0.05
0.01	0.02	0.07	0.06
0.02	0.03	0.07	0.06
0.02	0.03	0.07	0.06
0.02	0.03	0.07	0.06
0.02	0.03	0.07	0.06
0.02	0.03	0.07	0.06
0.02	0.03	0.08	0.06
0.02	0.03	0.08	0.06
0.02	0.03	0.08	0.06
0.02	0.03	0.08	0.06
0.02	0.03	0.08	0.06
0.03	0.03	0.08	0.06
0.03	0.03	0.08	0.06
0.03	0.03	0.08	0.06
0.03	0.04	0.08	0.06
0.03	0.04	0.08	0.06
0.03	0.04	0.09	0.06
0.03	0.04	0.09	0.06
0.03	0.04	0.09	0.06
0.03	0.04	0.09	0.06
0.03	0.04	0.09	0.06
0.04	0.04	0.09	0.06
0.04	0.04	0.09	0.06
0.04	0.04	0.09	0.06
0.04	0.04	0.09	0.06
0.04	0.04	0.10	0.06
0.04	0.04	0.10	0.06
0.04	0.04	0.10	0.07
0.04	0.04	0.10	0.07
0.04	0.04	0.10	0.07
0.05	0.04	0.10	0.07
0.05	0.04	0.10	0.07
0.05	0.05	0.10	0.07
0.05	0.05	0.10	0.07
0.05	0.05	0.11	0.07
0.05	0.05	0.11	0.07
0.05	0.05	0.11	0.07
0.05	0.05	0.11	0.07
0.05	0.05	0.11	0.07
0.05	0.05	0.11	0.07

TECHNICAL SPECIFICATION		
Q Max	0.0660	l/sec
Diameter	10	mm
No of Holes		1
Max Head	0.1	m

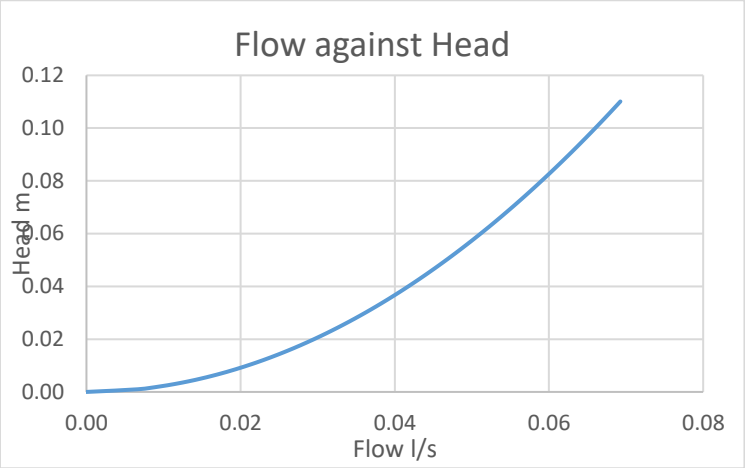
Eqn 28.1 SuDS Manual

EQ. 28.1 Standard orifice equation

$$Q = C_d A_o \sqrt{2gh}$$

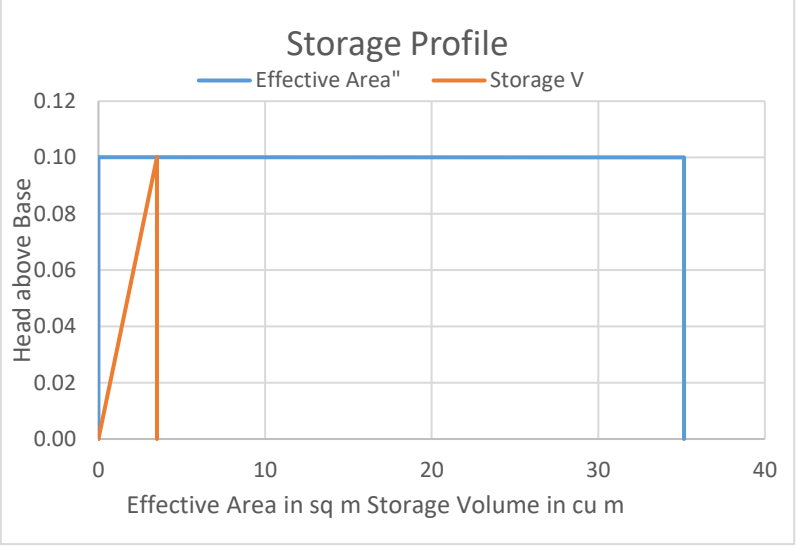
C_d = 0.6

Note this is the minimum flow from roof



Storage Profile

Head m	Area sq m	Voids Ratio	Aeff=A.VR	Storage V	Type
0	37	0.95	35.15	0	Geocell
0.1	37	0.95	35.15	3.515	Geocell
0.1001	0	0	0	3.515	-
0	0	0	0	3.515	-
0	0	0	0	3.515	-
0	0	0	0	3.515	-
0	0	0	0	3.515	-
0	0	0	0	3.515	-
0	0	0	0	3.515	-
0	0	0	0	3.515	-
0	0	0	0	3.515	-



AMA Consulting Engineers

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6 Hour Event

Outflow based on Hydraulic Curves

Return Period T	100	*Years*
M5-60	20	*mm*
r	0.4	
Area	0.0092	*ha*

Allowance for Climate Change

High (Upper)	**40%**	Refer NPPF Table 2

Out Flow fron supplier data based on Head
Head based on Storage Volume of previous line.

D	Z1	M5-D	Z2	M100-D	i	i + %age	Q_{peak}	Run Off	Head	Out Flow	Allow. Disch.	Stor. Vol.
mins		*mm*		*mm*	*mm/hr*	*mm/hr*	*l/sec*	*cu m*			*cu m*	*cu m*
5	0.37	7.41	1.84	13.66	163.91	229.48	5.87	1.76	0.00	0.00	0.01	**1.75**
10	0.53	10.59	1.93	20.40	122.40	171.36	4.38	2.63	0.05	0.05	0.02	**2.60**
15	0.63	12.59	1.96	24.67	98.68	138.15	3.53	3.18	0.07	0.06	0.04	**3.14**
20	0.70	14.06	1.98	27.82	83.46	116.85	2.99	3.59	0.09	0.06	0.06	**3.53**
25	0.76	15.22	1.99	30.32	72.77	101.88	2.60	3.91	0.11	0.07	0.08	**3.83**
30	0.81	16.18	2.00	32.39	64.79	90.70	2.32	4.17	0.11	0.07	0.10	**4.07**
35	0.85	17.01	2.01	34.17	58.57	82.00	2.10	4.40	0.11	0.07	0.12	**4.28**
40	0.89	17.73	2.01	35.72	53.58	75.01	1.92	4.60	0.11	0.07	0.14	**4.46**
45	0.92	18.38	2.02	37.10	49.47	69.25	1.77	4.78	0.11	0.07	0.16	**4.62**
50	0.95	18.97	2.02	38.34	46.01	64.41	1.65	4.94	0.11	0.07	0.18	**4.76**
55	0.98	19.50	2.02	39.47	43.06	60.28	1.54	5.09	0.11	0.07	0.20	**4.88**
60	1.00	20.00	2.03	40.51	40.51	56.71	1.45	5.22	0.11	0.07	0.22	**5.00**
90	1.12	22.39	2.03	45.40	30.27	42.38	1.08	5.85	0.11	0.07	0.35	**5.50**
120	1.21	24.19	2.02	48.92	24.46	34.25	0.88	6.30	0.11	0.07	0.47	**5.83**
180	1.34	26.87	2.01	53.89	17.96	25.15	0.64	6.94	0.11	0.07	0.72	**6.22**
240	1.45	28.91	1.98	57.37	14.34	20.08	0.51	7.39	0.11	0.07	0.97	**6.42**
270	1.49	29.77	1.97	58.76	13.06	18.28	0.47	7.57	0.11	0.07	1.09	**6.48**
300	1.53	30.57	1.97	60.11	12.02	16.83	0.43	7.75	0.11	0.07	1.22	**6.53**
330	1.57	31.30	1.96	61.36	11.16	15.62	0.40	7.91	0.11	0.07	1.34	**6.56**
360	1.60	31.98	1.95	62.51	10.42	14.58	0.37	8.05	0.11	0.07	1.47	**6.59**
											Max Volume to be Stored	**6.59**

Storage profile described on adjoining sheet Volume : 3.52 cu m Storage **NOT OK**

1] T= Return Period of Storm (Years)
2] D= Duration of Storm (Mins)
3] i =[MT-D]*60/D
4] Q = 2.78 * Area * i
5] Run Off = Q *D *60/1000
6] Allowable Discharge = Va * D / 1000
Valid Range for T is 5 to 100 Years

7] M5-D=Z1 * M5-60
8] MT-D=Z2 * M5-D
9]Z1 & Z2 Wallingford Procedure Vols 1 and 4

NPPF/EA UPLIFT FOR CC

Central	**0.2**
High (Upper)	**0.4**
None	**0**

This calculation uses a hydrograph described in the Wallingford Modified Rational Method. Whilst more advanced methods exist based on the Flood Estimation Handbook (1999), the Revitalised Flood Hydrograph (ReFH)(2007) and the Revitalised Flood Hydrograph rainfall-runoff method version 2 (ReFH 2)(2015). As at May 2020 ReFH 2.3 which incorporates urban modelling is currant.
It should be noted that ReFH was rural only and only for catchments > 0.5 sq km or 50 hectares which is a much larger than any project for which these calculations apply.
A calibration study of ReFH2 considered a 40 sq km catchment (4,000 hectares) small, the FEH method has only been calibrated for catchments of over 200 ha, whilst the typical catchment for which these calculations are made is less than 5 ha and frequently less than 1.
Bearing in mind the small catchments and that ReFH and FEH are proprietary, the Wallingford Modified Rational method does not appear inappropriate.

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SURF1 - SURFACE WATER; HYDRAULIC CALCULATIONS

i

Project Name 39-41 London Rd

Location Enfield

This calculation is for the upper blue roof looking at the 100 Year + CC attenuation.
The roof is drained through a bauder variable outlet at its minimum setting

1. Schedule of Areas

1.1	Area of Site	A_{site}	233	m^2
1.2	Impermeable Area Before Developr	A_{dbd}	233	m^2
1.3	Impermeable Area After Developme	A_{dad}	66	m^2

2. Location Specific Hydological Data

2.1	*Wallingford Coefficients*	M5-60	20	mm
		r	0.4	

2.2 *Flood Esimate for small catchment areas*

WRAP Soil type 4 → SAAR 678 mm; SOIL 4.7

Increase for Climate Change — NPPF Guidance Table 2 50-95 Yr Life

2.3

Central	20%
High (Upper)	40%
None	0%

%age increase on i: High (Upper) 40%

Urban Drift

2.4 Uplift on storage: N/A

Applies to developments with houses only.

WRAP - Winter Rain Acceptance Potential

Flow Control Method: Orifice Pl

Hydraulic Data for Orifice Plater

h m	Q l/s	h m	Q l/s
0.00	0.00	0.06	0.05
0.00	0.01	0.06	0.05
0.00	0.01	0.06	0.05
0.00	0.01	0.06	0.05
0.00	0.01	0.06	0.05
0.01	0.01	0.06	0.05
0.01	0.02	0.06	0.05
0.01	0.02	0.06	0.05
0.01	0.02	0.06	0.05
0.01	0.02	0.06	0.05
0.01	0.02	0.07	0.05
0.01	0.02	0.07	0.05
0.01	0.02	0.07	0.05
0.01	0.02	0.07	0.05
0.01	0.02	0.07	0.06
0.02	0.03	0.07	0.06
0.02	0.03	0.07	0.06
0.02	0.03	0.07	0.06
0.02	0.03	0.07	0.06
0.02	0.03	0.07	0.06
0.02	0.03	0.08	0.06
0.02	0.03	0.08	0.06
0.02	0.03	0.08	0.06
0.02	0.03	0.08	0.06
0.02	0.03	0.08	0.06
0.03	0.03	0.08	0.06
0.03	0.03	0.08	0.06
0.03	0.03	0.08	0.06
0.03	0.04	0.08	0.06
0.03	0.04	0.08	0.06
0.03	0.04	0.09	0.06
0.03	0.04	0.09	0.06
0.03	0.04	0.09	0.06
0.03	0.04	0.09	0.06
0.03	0.04	0.09	0.06
0.04	0.04	0.09	0.06
0.04	0.04	0.09	0.06
0.04	0.04	0.09	0.06
0.04	0.04	0.09	0.06
0.04	0.04	0.10	0.06
0.04	0.04	0.10	0.06
0.04	0.04	0.10	0.07
0.04	0.04	0.10	0.07
0.04	0.04	0.10	0.07
0.05	0.04	0.10	0.07
0.05	0.04	0.10	0.07
0.05	0.05	0.10	0.07
0.05	0.05	0.10	0.07
0.05	0.05	0.11	0.07
0.05	0.05	0.11	0.07
0.05	0.05	0.11	0.07
0.05	0.05	0.11	0.07
0.05	0.05	0.11	0.07
0.05	0.05	0.11	0.07

TECHNICAL SPECIFICATION		
Q Max	0.0660	l/sec
Diameter	10	mm
No of Holes		1
Max Head	0.1	m

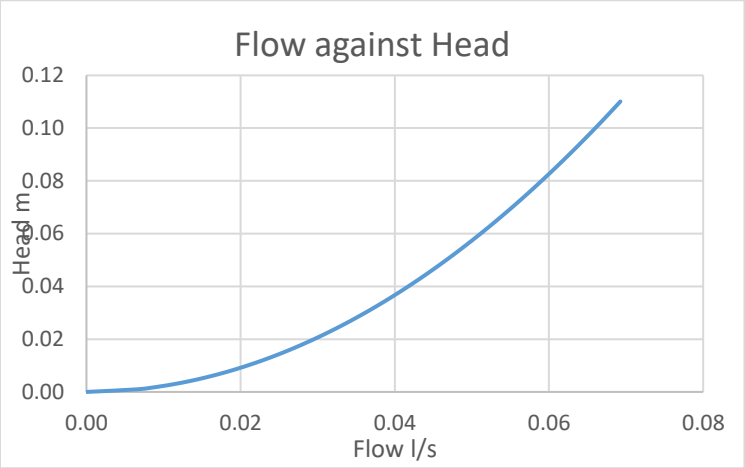
Eqn 28.1 SuDS Manual

EQ. 28.1 Standard orifice equation

$$Q = C_d A_o \sqrt{2gh}$$

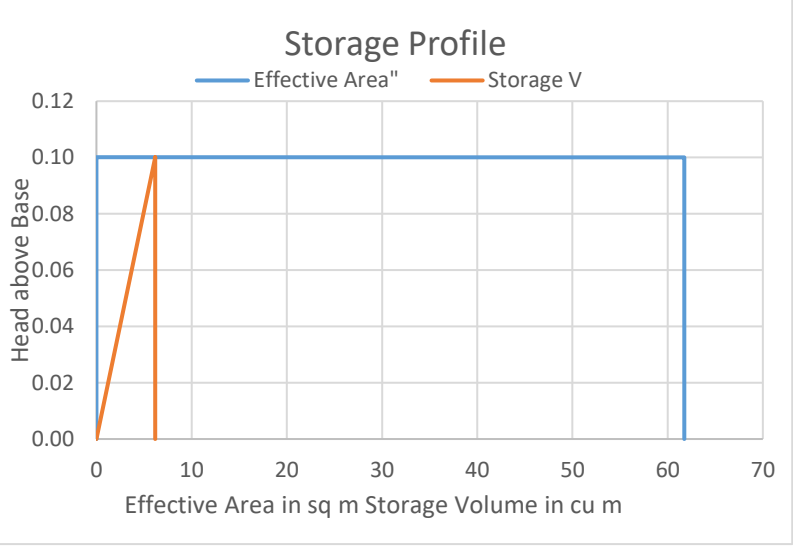
C_d = 0.6

Note this is the minimum flow from roof



Storage Profile

Head m	Area sq m	Voids Ratio	Aeff=A.VR	Storage V	Type
0	65	0.95	61.75	0	Geocell
0.1	65	0.95	61.75	6.175	Geocell
0.1001	0	0	0	6.175	-
0	0	0	0	6.175	-
0	0	0	0	6.175	-
0	0	0	0	6.175	-
0	0	0	0	6.175	-
0	0	0	0	6.175	-
0	0	0	0	6.175	-
0	0	0	0	6.175	-
0	0	0	0	6.175	-



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6 Hour Event

Outflow based on Hydraulic Curves

Return Period T	100	*Years*
M5-60	20	*mm*
r	0.4	
Area	0.0065	*ha*

Allowance for Climate Change

High (Upper)	**40%**	Refer NPPF Table 2

Out Flow fron supplier data based on Head
Head based on Storage Volume of previous line.

D	Z1	M5-D	Z2	M100-D	i	i + %age	Q_{peak}	Run Off	Head	Out Flow	Allow. Disch.	Stor. Vol.
mins		*mm*		*mm*	*mm/hr*	*mm/hr*	*l/sec*	*cu m*			*cu m*	*cu m*
5	0.37	7.41	1.84	13.66	163.91	229.48	4.14	1.24	0.00	0.00	0.01	**1.23**
10	0.53	10.59	1.93	20.40	122.40	171.36	3.09	1.85	0.02	0.03	0.02	**1.84**
15	0.63	12.59	1.96	24.67	98.68	138.15	2.49	2.24	0.03	0.04	0.03	**2.21**
20	0.70	14.06	1.98	27.82	83.46	116.85	2.11	2.53	0.04	0.04	0.04	**2.49**
25	0.76	15.22	1.99	30.32	72.77	101.88	1.84	2.76	0.04	0.04	0.05	**2.70**
30	0.81	16.18	2.00	32.39	64.79	90.70	1.64	2.94	0.04	0.04	0.07	**2.88**
35	0.85	17.01	2.01	34.17	58.57	82.00	1.48	3.11	0.05	0.04	0.08	**3.03**
40	0.89	17.73	2.01	35.72	53.58	75.01	1.35	3.25	0.05	0.05	0.09	**3.15**
45	0.92	18.38	2.02	37.10	49.47	69.25	1.25	3.37	0.05	0.05	0.11	**3.27**
50	0.95	18.97	2.02	38.34	46.01	64.41	1.16	3.49	0.05	0.05	0.12	**3.36**
55	0.98	19.50	2.02	39.47	43.06	60.28	1.09	3.59	0.05	0.05	0.14	**3.45**
60	1.00	20.00	2.03	40.51	40.51	56.71	1.02	3.68	0.06	0.05	0.15	**3.53**
90	1.12	22.39	2.03	45.40	30.27	42.38	0.76	4.13	0.06	0.05	0.24	**3.89**
120	1.21	24.19	2.02	48.92	24.46	34.25	0.62	4.45	0.06	0.05	0.33	**4.11**
180	1.34	26.87	2.01	53.89	17.96	25.15	0.45	4.90	0.07	0.05	0.52	**4.37**
240	1.45	28.91	1.98	57.37	14.34	20.08	0.36	5.21	0.07	0.06	0.72	**4.49**
270	1.49	29.77	1.97	58.76	13.06	18.28	0.33	5.34	0.07	0.06	0.82	**4.52**
300	1.53	30.57	1.97	60.11	12.02	16.83	0.30	5.46	0.07	0.06	0.92	**4.54**
330	1.57	31.30	1.96	61.36	11.16	15.62	0.28	5.58	0.07	0.06	1.03	**4.55**
360	1.60	31.98	1.95	62.51	10.42	14.58	0.26	5.68	0.07	0.06	1.13	**4.56**
										Max Volume to be Stored		**4.56**

Storage profile described on adjoining sheet Volume : 6.18 cu m Storage **OK < Provided**

1] T= Return Period of Storm (Years)
2] D= Duration of Storm (Mins)
3] i =[MT-D]*60/D
4] Q = 2.78 * Area * i
5] Run Off = Q *D *60/1000
6] Allowable Discharge = Va * D / 1000
Valid Range for T is 5 to 100 Years

7] M5-D=Z1 * M5-60
8] MT-D=Z2 * M5-D
9]Z1 & Z2 Wallingford Procedure Vols 1 and 4

NPPF/EA UPLIFT FOR CC

Central	**0.2**
High (Upper)	**0.4**
None	**0**

This calculation uses a hydrograph described in the Wallingford Modified Rational Method. Whilst more advanced methods exist based on the Flood Estimation Handbook (1999), the Revitalised Flood Hydrograph (ReFH)(2007) and the Revitalised Flood Hydrograph rainfall-runoff method version 2 (ReFH 2)(2015). As at May 2020 ReFH 2.3 which incorporates urban modelling is currant.
It should be noted that ReFH was rural only and only for catchments > 0.5 sq km or 50 hectares which is a much larger than any project for which these calculations apply.
A calibration study of ReFH2 considered a 40 sq km catchment (4,000 hectares) small, the FEH method has only been calibrated for catchments of over 200 ha, whilst the typical catchment for which these calculations are made is less than 5 ha and frequently less than 1.
Bearing in mind the small catchments and that ReFH and FEH are proprietary, the Wallingford Modified Rational method does not appear inappropriate.

Annex D Existing & Proposed Plans

Existing and Proposed Architect's Plans.

519822-1 Existing Site Survey and Location Plan

519822-2 Proposed Roofs and Site Plan

519822-3 Proposed Floor plans and Elevations

AMA Consulting Engineers | 6a Nesbitts Alley, Barnet EN5 5XG | e: ama@amacl.co.uk | t: +44(0)208 361 6827

SOUTHBURY ROAD

GENOTIN ROAD

LONDON ROAD

SEE DRAWING 519822-4

SEE DRAWING 519822-4

HOARDING 2.3 H

TMAC

TOSU

DRAINAGE CHANNEL

STEPS

1

2

3

4

5

6

7

8-12

36

37

38

39

41

2

4

6

8

LOCATION PLAN 1.1250

SCALE AT 1.100

No.	Date	By	Revisions

Site Address

LAND TO REAR OF
39/41 LONDON ROAD
ENFIELD
EN26LX

Job Title

DEVELOPMENT OF SITE

Drawing Title

EXG SITE SURVEY

Scale	Date	Drawn by
1:100 @ A1	10/22	AJC

Alan Cox associates
Architectural & Planning Consultants
TEL : 020 - 8440 - 7777
www.coxassociates.co.uk

Dwg.No.	Rev.
519822-1	

SOUTHBURY ROAD

ACCESS ROAD

SEE DRAWING 519822-4

B

GENOTIN ROAD

LONDON ROAD

37

38

39

41

4

6

8

1

2

3

4

5

6

7

8-12

5

6

3

7

SEE DRAWING 519822-4

C

SEE DRAWING 519822-4

ACCESS TO EXTERNAL STAIRS

SEE DRAWING 519822-4

B

LOCATION PLAN 1.1250

KEY

	ACCESS INTO SITE
	SOLAR PANELS
	SEDUM GREEN ROOF
	CGI
	TIMBER ENCLOSURE FOR BIKES/REFUSE/RECYCLING
	LANDSCAPING TBC
	1.8M HIGH FENCE

1 2 3 4 5 6 7 8 9 10

SCALE AT 1.100

No.	Date	By	Contents

Revisions

Site Address

LAND TO REAR OF
39/41 LONDON ROAD
ENFIELD
EN26LX

Job Title

DEVELOPMENT OF SITE

Drawing Title

PROPOSED SITE PLAN

Scale	Date	Drawn by
1.100 @ A1	10/22	AJC

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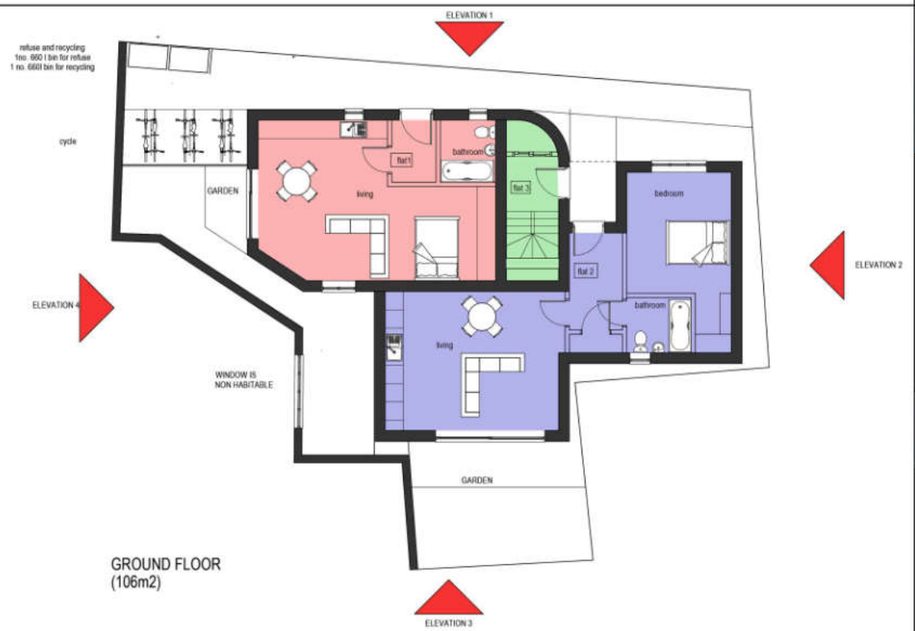
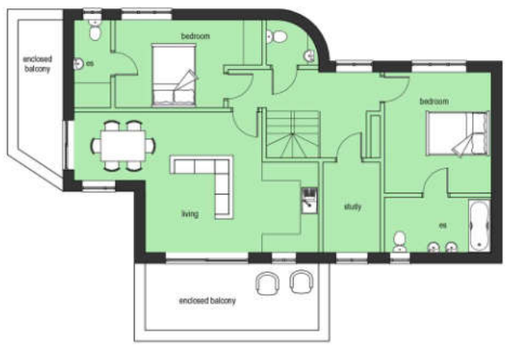
Drg.No.	Rev.
519822-2	

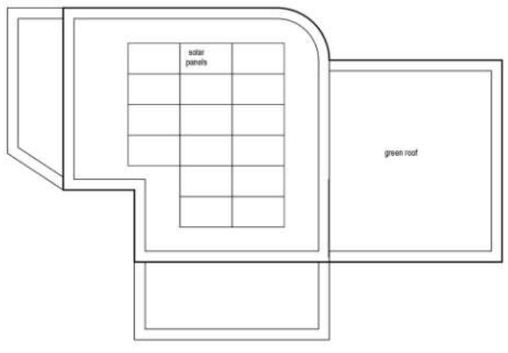
PLANS



GROUND FLOOR
(106m2)



FIRST FLOOR (87m2)



ROOF PLAN

FLAT 1
STUDIO 40M2
AMENITY
(27M2)

FLAT 2
1 BED 2 PERSONS 54M2
AMENITY
(23M2)

FLAT 3- 2 BED 4 PERSONS
96m2
AMENITY
(18M2)

ELEVATIONS

PROFILE OF 1.8M FENCE SHOWN DOTTED

PROFILE OF BUILDINGS BEHIND SHOWN WITH DOTTED LINE AND GREY INFILL

1 2 3 4 5 6 7 8 9 10

SCALE AT 1.100

No.	Date	By	Contents

Revisions

Site Address

LAND TO REAR OF
39/41 LONDON ROAD
ENFIELD
EN26LX

Job Title

DEVELOPMENT OF SITE
TO FORM 3 SELF CONTAINED
FLATS

Drawing Title

PROPOSED PLANS AND ELEVATIONS

Scale	Date	Drawn By
1.100 @ a1	10/22	AJC

Alan Cox associates
Architectural & Planning Consultants
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www.coxassociates.co.uk

Drg.No.	Rev.
519822-3	

Annex E - Site Data

LB Enfield & Environment Agency and Thames Water

i. Abstract from LB Enfield Watercourse, Geology Maps and Critical Drainage Areas Map

ii. EA Surface Water, Reservoir, and River Flood Maps

iii. Abstract Thames Water Asset Plans

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Flood map for planning

Your reference	Location (easting/northing)	Created
REAR 39-41 LR	**532901/196537**	**20 Nov 2023 13:02**

Your selected location is in flood zone 1, an area with a low probability of flooding.

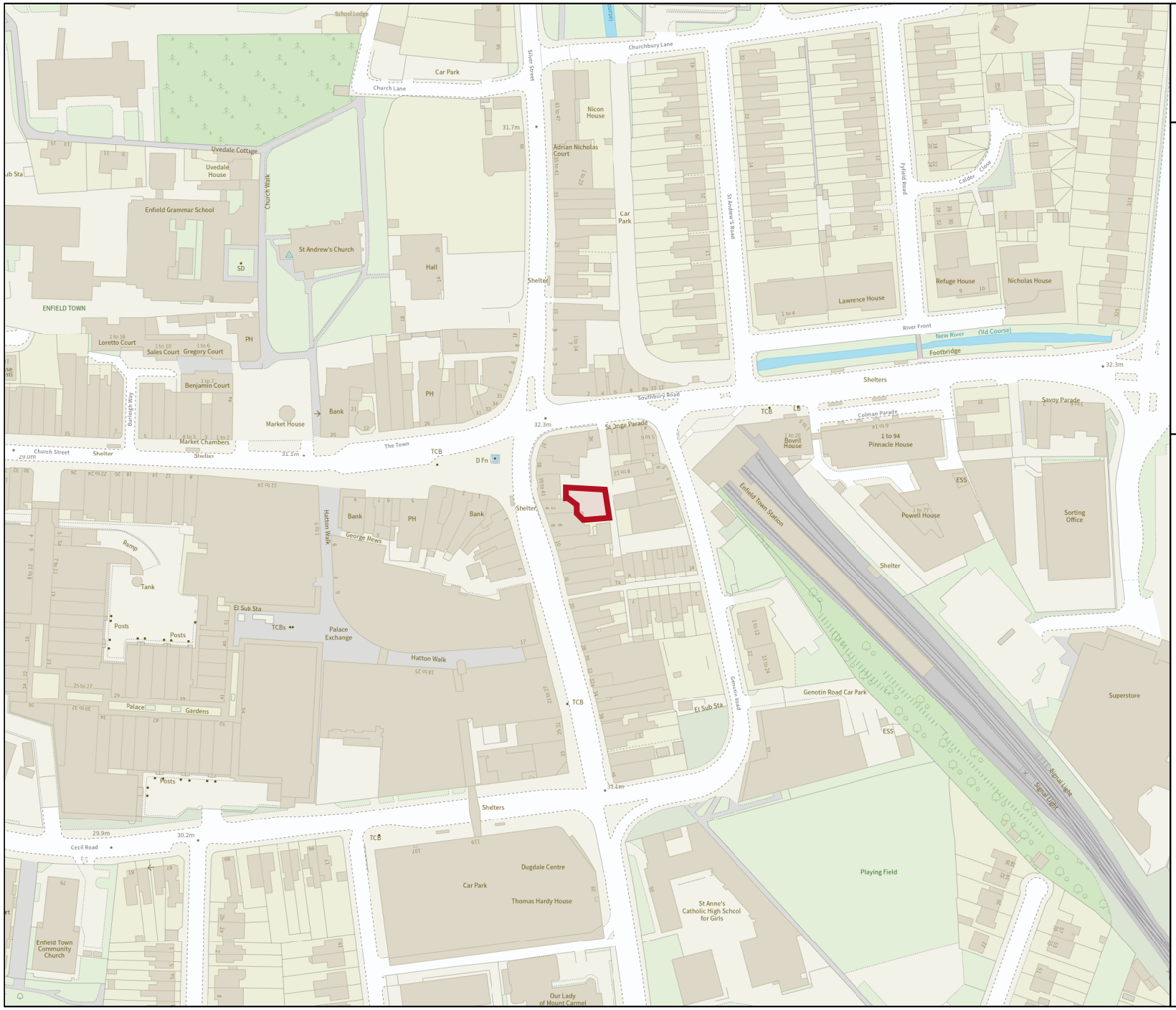
You will need to do a flood risk assessment if your site is **any of the following:**

- bigger that 1 hectare (ha)
- In an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.



Environment Agency

Flood map for planning

Your reference
REAR 39-41 LR

Location (easting/northing)
532901/196537

Scale
1:2500

Created
20 Nov 2023 13:02

- Selected area
- Flood zone 3
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Water storage area

0 20 40 60m

Back

Learn more about this area's flood risk

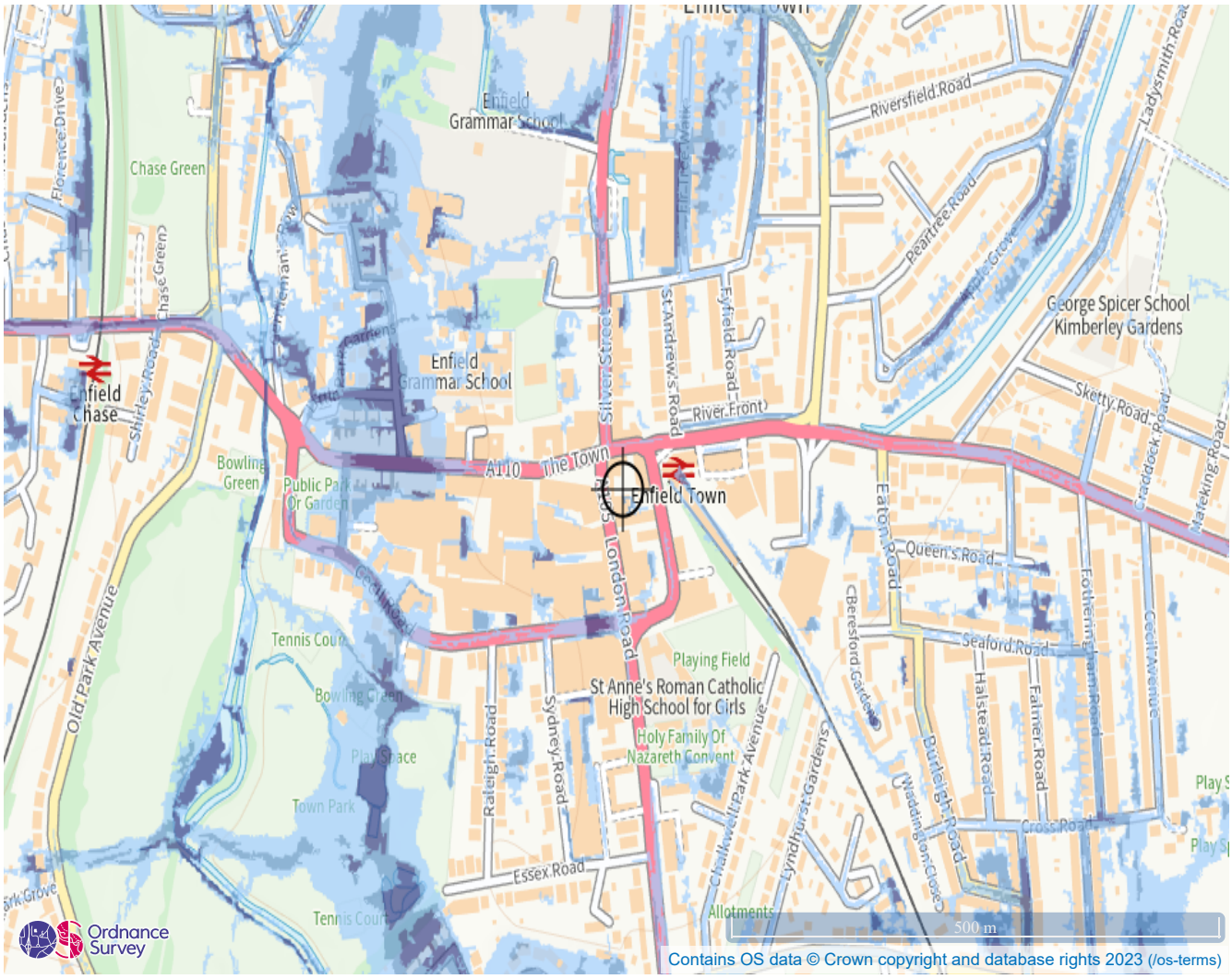
Select the type of flood risk information you're interested in. The map will then update.

Flood risk

Extent of flooding

Location

EN2 6LZ Enfield Town C



Extent of flooding from surface water

High Medium Low Very low Location you selected

View the flood risk information for another location (/postcode)

< Back

Learn more about this area's flood risk

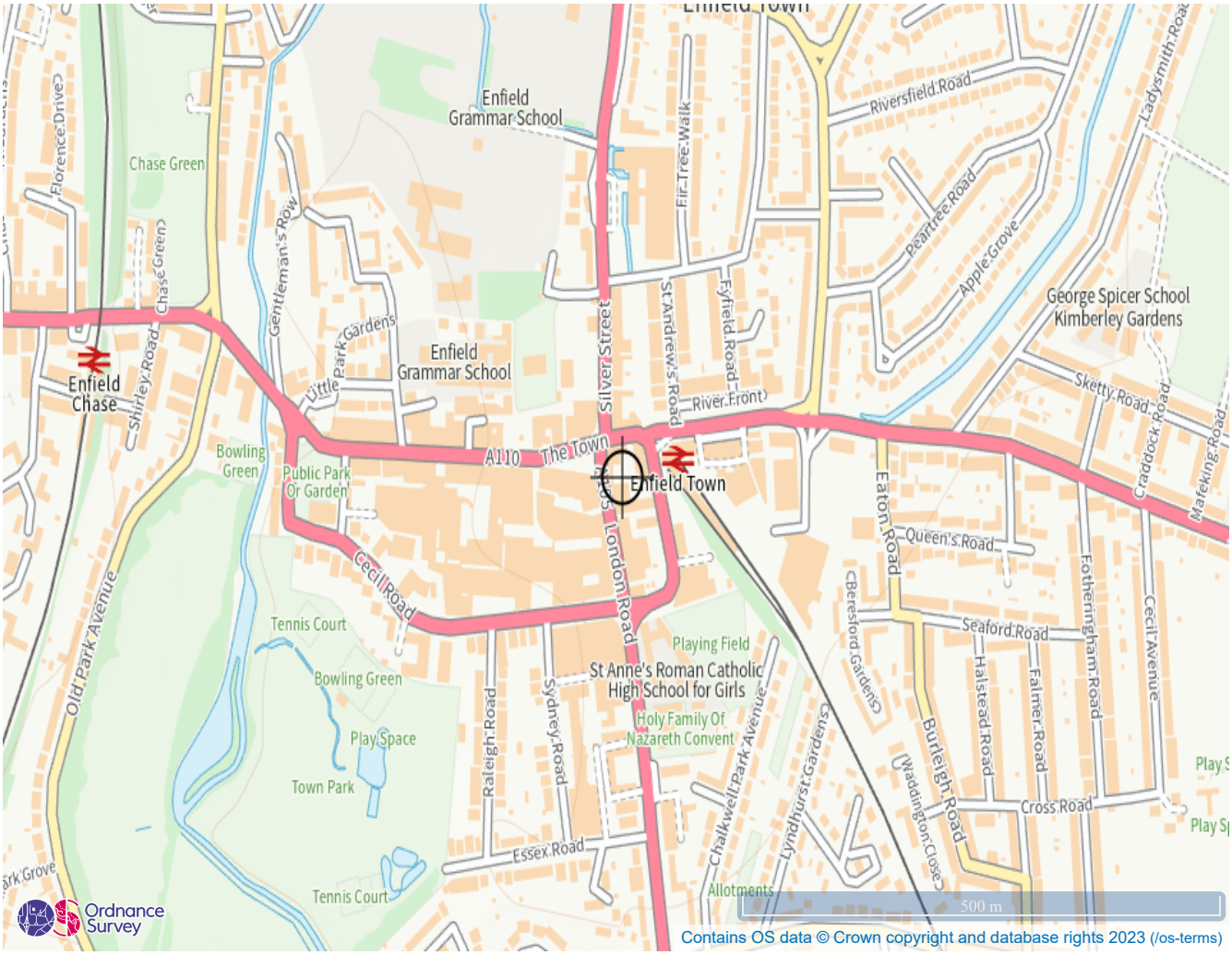
Select the type of flood risk information you're interested in. The map will then update.

Flood risk

Extent of flooding

Location

EN2 6LZ Enfield Town Ce



Maximum extent of flooding from reservoirs:

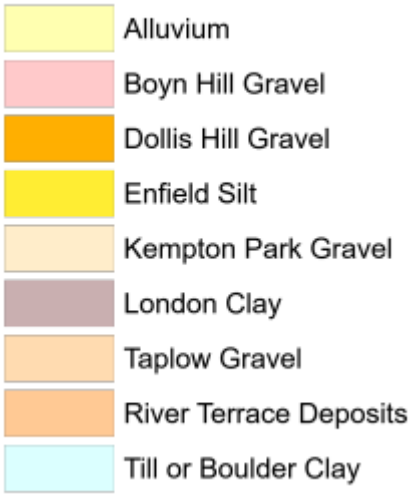
when river levels are normal when there is also flooding from rivers Location you selected

View the flood risk information for another location (/postcode)

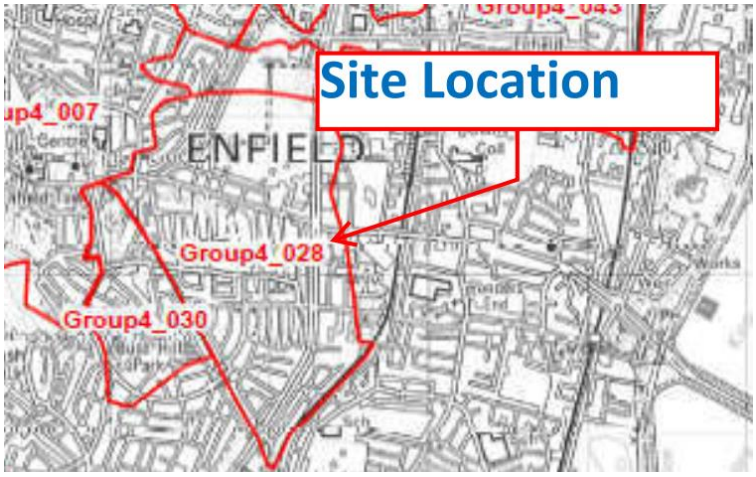
39-41 London Road Enfield

Enfield Council Maps

Geological Part Plan



Critical Drainage Areas Site is in Group4 028



Borough Watercourse Map Site is surrounded by buildings so no direct access to culverted watercourse under Southbury Road.

Asset location search

Property Searches

AMA Consulting Engineers
6a

BARNET
EN5 5XG

Search address supplied

Halifax Plc
39-41
The Town
Enfield
EN2 6LX

Your reference 39-41 London Road

Our reference ALS/ALS Standard/2023_4898647

Search date 17 October 2023

Notification of Price Changes

From 1st April 2023 Thames water Property Searches will be increasing the prices of its CON29DW, CommercialDW Drainage & Water Enquiries and Asset Location Searches. Historically costs would rise in line with RPI but as this currently sits at 14.2%, we are capping it at 10%.

Customers will be emailed with the new prices by January 1st 2023.

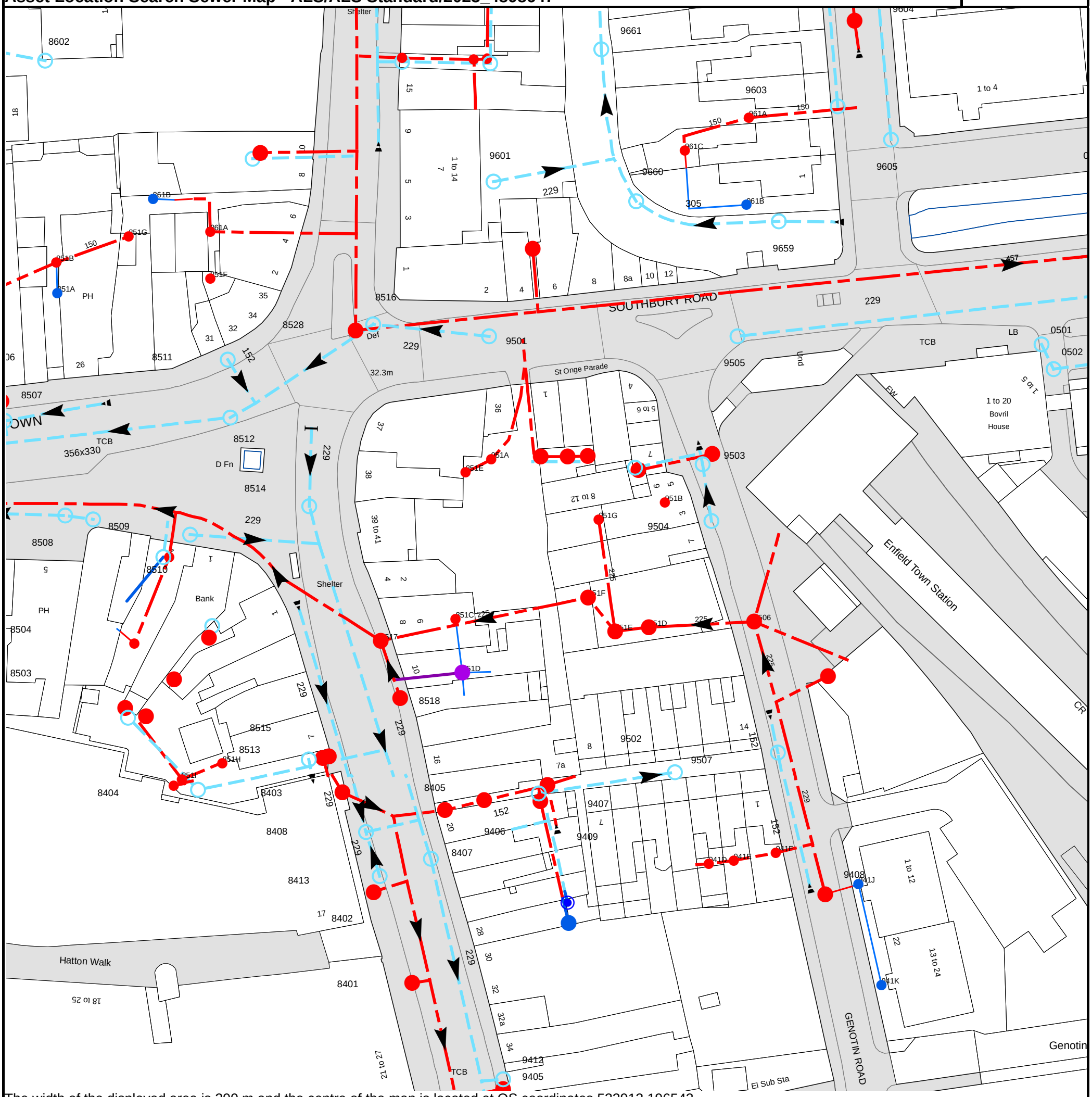
Any orders received with a higher payment prior to the 1st April 2023 will be non-refundable. For further details on the price increase please visit our website at www.thameswater-propertysearches.co.uk

Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW

searches@thameswater.co.uk
www.thameswater-propertysearches.co.uk

0800 009 4540

Asset Location Search Sewer Map - ALS/ALS Standard/2023_4898647



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 532913,196542

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
8508	31.82	30.9
8509	31.99	31.3
85GI	n/a	n/a
85GH	n/a	n/a
85FE	n/a	n/a
85HC	n/a	n/a
85FI	n/a	n/a
85FF	n/a	n/a
8404	31.82	30.93
85HE	n/a	n/a
851I	n/a	n/a
8510	32.06	31.3
84BH	n/a	n/a
85HD	n/a	n/a
85HB	n/a	n/a
851H	n/a	n/a
8513	31.8	30.82
8514	32.25	30.93
8515	31.81	30.5
85GG	n/a	n/a
8403	31.75	30.36
8408	31.62	30.66
8517	31.88	29.16
8518	33.09	32.34
8405	31.62	30.5
851C	n/a	n/a
851D	n/a	n/a
851E	n/a	n/a
9406	31.76	30.55
951A	n/a	n/a
9409	n/a	n/a
94CC	n/a	n/a
95CB	n/a	n/a
9407	n/a	n/a
95CA	n/a	n/a
95BJ	n/a	n/a
951F	n/a	n/a
951G	n/a	n/a
951E	n/a	n/a
95CI	n/a	n/a
95CE	n/a	n/a
951D	n/a	n/a
951B	n/a	n/a
9502	32.44	31.8
9503	33	32.19
9504	33.08	32.35
95CF	n/a	n/a
9506	32.93	30.39
941F	n/a	n/a
9507	32.64	31.87
95BF	n/a	n/a
8402	31.66	30.22
8413	31.96	30.96
8401	31.38	29.42
8407	31.47	29.85
9405	31.09	29.6
9412	31.3	30.11
94BJ	n/a	n/a
941D	n/a	n/a
941E	n/a	n/a
9408	32.3	30.63
941J	n/a	n/a
941K	n/a	n/a
9515	n/a	n/a
9661	32.43	31.27
9660	32.28	31.31
961C	n/a	n/a
9505	32.62	31.33
961B	n/a	n/a
961A	n/a	n/a
9659	32.72	31.36
9603	32.75	32.02
9604	n/a	n/a
9605	32.77	31.8
0501	32.68	31.79
0502	32.69	31.73
8507	31.61	30.63
8602	n/a	n/a
851B	n/a	n/a
851A	n/a	n/a
851G	n/a	n/a
861B	n/a	n/a
851F	n/a	n/a
861A	n/a	n/a
8511	31.94	31.05
8512	32.18	30.9
86BH	n/a	n/a
86BF	n/a	n/a
8528	30.22	27.42
8516	32.17	31.11
86BB	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
86BD	n/a	n/a
86BA	n/a	n/a
96GE	n/a	n/a
9501	32.47	31.21
96GH	n/a	n/a
9601	32.75	31.51

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Asset Location Search - Sewer Key

Public Sewer Types (Operated and maintained by Thames Water)

Foul Sewer: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water Sewer: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined Sewer: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

- Storm Sewer
- Sludge Sewer
- Foul Trunk Sewer
- Surface Trunk Sewer
- Combined Trunk Sewer
- Foul Rising Main
- Surface Water Rising Main
- Combined Rising Main
- Vacuum
- Thames Water Proposed
- Vent Pipe
- Gallery

Other Sewer Types (Not operated and maintained by Thames Water)

- Sewer
- Culverted Watercourse
- Proposed
- Decommissioned Sewer
- Content of this drainage network is currently unknown
- Ownership of this drainage network is currently unknown

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

- Air Valve
- Meter
- Dam Chase
- Vent
- Fitting

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

- Ancillary
- Drop Pipe
- Control Valve
- Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol. Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

- Inlet
- Outfall
- Undefined End

Other Symbols

Symbols used on maps which do not fall under other general categories.

- Change of Characteristic Indicator
- Public / Private Pumping Station
- Invert Level
- Summit

Areas

Lines denoting areas of underground surveys, etc.

- Agreement
- Chamber
- Operational Site

Ducts or Crossings

- Casement

Ducts may contain high voltage cables. Please check with Thames Water.

- Conduit Bridge
- Subway
- Tunnel

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.
2) All measurements on the plan are metric.
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate the direction of flow.
4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.
5) 'na' or '0' on a manhole indicates that data is unavailable.
6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimeters. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology, please contact Property Searches on 0800 009 4540.