2423 - 100 and 88 Grays Inn Road, SUDs Strategy

Contents

Appendices

Status: Planning
Date: 29th September 2022
Revision: P01
Job no: 2423
Prepared by: Thomas O'Hara
Approved by: Alex O'Hare

1. Introduction

This SuDS Strategy Report has been prepared by Heyne Tillett Steel on behalf of the client, Lawnmist Limited, to support the proposed Grays Inn Road development in Farringdon, London Borough of Camden (LBC).

This SuDS strategy has been prepared in consultation with Thames Water (TW).

The report aims to incorporate and demonstrate compliance with the following regional and local guidance such as:

+ National Planning Policy Framework, 2021
+ The London Plan, 2021
+ Sustainable Design and Construction Supplementary Planning Guidance (SPG), 2014
+ LBC Local Plan 2017
+ LBC SuDS Advice Note

2. Existing Drainage Arrangements

2.1 Public Drainage Network

There is a Thames Water trunk combined sewer along Clerkenwell Road in the vicinity of the site of at 100 Grays Inn Road. This trunk sewer drains from west to east along Clerkenwell Road. There are 2no. direct connections from this site to this sewer.

There is also one Thames Water public sewer in the vicinity of 88 Grays Inn Road. Within Grays Inn Road there is a 1245mm dia. combined sewer draining south to north that joins a 3200mm dia. combined trunk sewer draining west to east along Clerkenwell Road. There is also a direct connect from the site at 88 Grays Inn Road to the 1245mm combined sewer within Grays Inn Road.

An extract of the sewer records is shown in Image 5. Refer to Appendix A for the full asset map.

Image 1 - Thames Water Sewer Records

2.2 Existing On-site Drainage

The site at 100 Grays Inn Road has an area of approximately 0.1709 ha (1709 m^2), and the site at 88 Grays Inn Road has an area of approximately 0.051 ha (510m^2). Approximately all of this area is impermeable in the existing situation. The existing peak run-off for the impermeable area has been calculated using the Modified Rational Method in accordance with the following formula:

$Q = 3.61\ C_v \times i \times A$

where Cv is the volumetric runoff coefficient, A is the impermeable catchment area in hectares and i is the peak rainfall intensity in mm/hr which was obtained using Microdrainage software.

Table 1 summarises the existing peak run-off rate for the 1 in 2 years, 1 in 30 years, 1 in 100 years and 1 in 100 years with 40% climate change rainfall events, using FEH 2013 data.

Rainfall event	Rainfall Intensity (mm/hr)	Existing rate (l/s)	
		100 Grays Inn Road	88 Grays Inn road
Q_2^*	42.52	26.2	7.8
Q_{30}	80.83	49.9	14.9
Q_{100}	105.12	64.9	19.4
$Q_{100+40\%}$	147.17	90.8	27.1

*FEH data cannot be used to generate a 1 in 1 year rainfall profile

Table 1 - Existing Surface Water Run-off Rates

3. Proposed Drainage Arrangements

It is proposed to tie into the existing combined sewers in the vicinity of the site for proposed foul and surface water drainage. Separated foul and surface water networks will be provided to serve the buildings as far as possible, and will be designed in accordance with Building Regulations Part H.

3.1 Surface Water Drainage Proposals

In accordance with the London Plan and LBC policy the surface water drainage network for both buildings has been designed in coordination with the architect and landscape architect and aims to incorporate SuDS into the fabric of the new buildings and landscaped areas.

A SuDS Assessment has been carried out using guidance set out in the London Plan. Priority was given to SuDS which provide multi-functional benefits and coordination was undertaken to ensure that SuDS are incorporated into the building fabric and the landscaping. The LBC SuDS proforma has been completed and is included in Appendix B.

Table 2 presents the drainage hierarchy, taken from Policy SI13 of the London Plan, which shows which SuDS are proposed to be incorporated into the development.

SuDS Technique		Included	Examples	
			100 Grays Inn Road	88 Grays Inn Road
1	Rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation)	✓	Blue-green roofs are proposed at plant roof, roof level and Levels 8, 5, 4, 3 & 2 to provide attenuation and passive irrigation of the soft landscaping above.	Blue-green roofs are proposed at roof level and Level 1 to provide attenuation and passive irrigation of the soft landscaping above.
2	Rainwater infiltration to ground at or close to source	×	From a review of the site investigation borehole logs, the permeability of the site is deemed to be unsuitable for infiltration due to being underlain by London Clay Formation. It is therefore concluded that infiltration is not viable across the site.	From a review of the site investigation borehole logs, the permeability of the site is deemed to be unsuitable for infiltration due to being underlain by London Clay Formation. It is therefore concluded that infiltration is not viable across the site.
3	Rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens)	✓	The proposed blue-green roof will drain slowly into the existing combined sewer along Clerkenwell Road via the existing connections to the site.	The proposed blue-green roof will drain into a proposed sub-surface attenuation tank, which will drain slowly into the existing combined sewers in the immediate vicinity of the site.
4	Rainwater discharge direct to a watercourse (unless not appropriate)	×	The River Thames is located 1.1km south of the site. Discharge to the Thames is not considered feasible due to the distance. It is therefore concluded that discharge to a watercourse is not practical.	The River Thames is located 1.1km south of the site. Discharge to the Thames is not considered feasible due to the distance. It is therefore concluded that discharge to a watercourse is not practical.
5	Controlled rainwater discharge to a surface water sewer or drain	×	There are no public surface water sewers within the vicinity of the site.	There are no public surface water sewers within the vicinity of the site.
6	Controlled rainwater discharge to a combined sewer	✓	It is proposed to discharge surface water from SuDS features to the combined public sewers via existing connections where possible.	It is proposed to discharge surface water from SuDS features to the combined public sewers via existing connections where possible.

Table 2 - Surface Water Drainage Hierarchy (Policy SI13 London Plan)

The aim for this development is to use the combination of the attenuation techniques described in Table 4 to reduce the peak run-off for the 1 in 100-year rainfall event (+40% climate change) as close as possible to Greenfield run-off rates.

Greenfield run-off rate has been calculated using the calculation tool available on www.uksuds.com. This established that the greenfield run-off for the site at 100 Grays Inn Road (not including adoptable highway area) is 0.23 l/s for Q_{BAR} and 0.74 l/s for the 1 in 100-year rainfall event, see Appendix C.

It is proposed to reduce the peak surface water run-off rate to as close to the greenfield rates as feasible whilst omitting the need for below ground attenuation tanks and pumping systems for 100 Grays Inn Road.

For 88 Grays Inn Road greenfield run-off rate has also been calculated using the same calculation tool available on www.uksuds.com. This established that the greenfield run-off for the site at 88 Grays Inn Road (not including adoptable highway area) is 0.07 l/s for Q_{BAR} and 0.22 l/s for the 1 in 100-year rainfall event, see Appendix C.

100 Grays Inn Road

The proposals are to provide blue-green roofs at all flat roofs & terraces for 100 Grays Inn Road. All run-off from the site is routed to a form of sustainable drainage. The proposed SuDS Strategy layout is included in Appendix E.

Building Drainage

Blue-green roofs are proposed at levels 2 to 5, 8, roof level and plant roof level. A blue roof system with a depth of 165mm is proposed at roof level north, 125mm is proposed at all other levels apart from levels 3 & 4 which will be at a depth of 85mm.

Blue roof specialists (ACO) were engaged and provided preliminary calculations based on blue roof build-ups of each blue roof system. This gives a total discharge rate from the blue roofs of 3.58 l/s for the 1 in 100-year rainfall event (+40% climate change). A breakdown of depths and run-off rates for each level is in Appendix D. The reduced run-off from the blue roofs will be achieved using restricted outlets. A copy of the detailed calculations is contained in Appendix D.

A request for consultation and comment from Thames Water on the proposed SuDS strategy for 100 Grays Inn Road has been issued, and their responses will be incorporated within the next revision of this report once they have been received.

Multi-Functional Benefits

In accordance with the NPPF and the London Plan, the aim of the SuDS design has been to provide multi-functional benefits with a focus on water quality, biodiversity and amenity as well as reducing the peak run-off.

The inclusion of blue-green roofs at the site will provide biodiversity benefits and the blue roofs will also provide irrigation for the green roof above.

Roof No.	Blue Roof Depth (mm)	Catchment Area (m^2)	Blue Roof Area (m^2)	Run-off Rate (l/s)	Storage Volume (m^3)
Plant Roof	125	445.6	265.4	1.40	29.86
Roof Level North	165	253	220.2	0.18	32.70
Roof Level South	125	144.2	120	0.18	13.50
Roof Level West	125	262.5	218.3	0.35	24.56
8th Floor North	125	93.2	50.8	0.37	5.72
8th Floor West	125	51.8	32.7	0.14	3.68
8th Floor South	125	145	79.7	0.55	8.97
5th Floor East	125	21.1	17.3	0.09	1.32
5th Floor South	125	13.2	7.9	0.09	0.60
4th Floor	85	32.3	23.1	0.16	1.77
3rd Floor	85	37.5	28.1	0.17	2.15
2nd Floor	125	125.4	102.5	0.17	11.53
Total		**1624.8**	**1166**	**3.85**	**136.36**

Table 3 - Blue Roof Run-off Rates

Discharge rates

Table 4 compares the existing discharge with the proposed discharge rate betterment for 100 Grays Inn Road.

Table 4 shows with the introduction of blue roofs, it provides an 90% improvement on the existing situation. This strategy ensures that the discharge rate was restricted as far as possible without the need to provide a pump.

Year	Existing Discharge Rate	Proposed Discharge Rate Betterment			Betterment %
	Existing Runoff Rate (l/s)	Restricted Blue Roof Runoff Rate (l/s)	Unrestricted Runoff Rate (l/s)	Total Proposed Runoff Rate (l/s)	
Q_{2*}	26.2	3.85	1.60	5.55	79%
Q_{30}	49.9	3.85	3.03	6.88	86%
Q_{100}	64.9	3.85	3.95	7.80	88%
$Q_{100+40\%}$	90.8	3.85	5.53	9.38	90%

Table 4 - Summary of Discharge Rates

88 Grays Inn Road

The proposals are to provide 2 blue roofs and an attenuation tank at basement level for 88 Grays Inn Road to provide attenuation at both sites. All run-off from the site is routed to a form of sustainable drainage. The proposed SuDS Strategy layout is included in Appendix E.

Building Drainage

Blue-green roofs are proposed at level 1, and roof level. A blue roof system with a depth of 165mm is proposed at roof level, and 125mm is proposed at level 1.

Blue roof specialists (ACO) were engaged and provided preliminary calculations based on blue roof build-ups of each blue roof system. This gives a total discharge rate from the blue roofs of 0.52 l/s for the 1 in 100-year rainfall event (+40% climate change). A breakdown of depths and run-off rates for each level is in Appendix D. The reduced run-off from the blue roofs will be achieved using restricted outlets. A copy of the detailed calculations is contained in Appendix

Roof No.	Blue Roof Depth (mm)	Catchment Area (m^2)	Blue Roof Area (m^2)	Run-off Rate (I/s)	Storage Volume (m^3)
Roof Level	165	203	105.8	0.45	15.31
1st Floor	125	28.7	22.6	0.07	2.07
Total		231.7	128.4	0.52	15.38

Table 5 - Blue Roof Run-off rates

External Drainage

For 88 Grays inn Road approximately 145m^2 hard landscaping areas are proposed to be geocellular storage.

Table 6 shows the sub-base storage depth and area for the Above Ground Tank system. The volume of this system is constrained by the available area within the existing basement to locate a tank. The tank is located above ground to allow gravity discharge from the site. Microdrainage calculations are included in Appendix D.

A request for consultation and comment from Thames Water on the proposed SuDS strategy for 88 Grays Inn Road has been issued, and their responses will be incorporated within the next revision of this report once they have been received.

SuDS Component	Storage Depth (mm)	Area (m^2)
Attenuation Tank	1600	9.63

Table 6 - SuDS Component Area and Depth

Multi-Functional Benefits

Table 7 compares the existing discharge with the proposed discharge rate betterment for 88 Grays Inn Road.

Table 7 shows with the introduction of blue roofs, a Geocellular tank and the remaining unrestricted area, it provides a 72% improvement on the existing situation. Even with the unrestricted area that is open to the atmosphere and cannot be routed to the below ground tank, this strategy ensures that the discharge rate was restricted as far as possible without the need to provide a pump.

Year	Existing Discharge Rate	Proposed Discharge Rate Betterment				Betterment %
	Existing Runoff Rate (l/s)	Restricted Blue Roof Runoff Rate (l/s)	Restricted Geocellular Tank Runoff Rate (l/s)	Unrestricted Runoff Rate (l/s)	Total Proposed Runoff Rate (l/s)	
Q_{2*}	7.83	0.52	0.2	2.04	2.58	67%
Q_{30}	14.9	0.52	0.2	3.88	4.42	70%
Q_{100}	19.4	0.52	0.2	5.05	5.59	72%
$Q_{100+40\%}$	27.1	0.52	0.2	7.07	7.61	72%

Table 7 - Summary of Discharge Rates

3.2 Proposed Foul Water Drainage Strategy

Foul water drainage from ground floor level and above is proposed to be discharged by gravity to the existing outfall to the Thames Water sewer. Drainage at basement level will employ appropriate surcharge protection measures.

3.3 Drainage Inspection and Maintenance Strategy

The surface water network will route the rainwater downpipes from the blue-green roofs and remaining areas towards the outfall manhole via gravity.

In accordance with CIRIA C625 it is recommended that a private SuDS maintenance agreement is agreed as a simple contract between the property owner/ tenant (customer) and the maintenance provider (the maintainer). It is mainly to facilitate continuing maintenance of the SuDS that are in private ownership. The maintenance requirements have been set out in accordance with the CIRIA C753 SuDS Manual 2015 in Appendix G.

3.4 Summary

SuDS have been proposed in the form of blue and blue-green roofs and an attenuation tank which allow the peak discharge rate from the total development to be reduced to as close to the Greenfield run-off rates (Q_{BAR}) as possible, taking into consideration the constraints of the existing building at 88 Grays Inn Road.

Multi-functional benefits are being achieved with the blue-green roofs both facilitating rainwater reuse and enhancing biodiversity.

4. Conclusion

This SuDS Strategy report has been prepared in accordance with local, regional and national planning policy and guidance documents including the London Plan (2021) and the NPPF (2021).

Surface water from all new development will be restricted to 9.38l/s for the 1 in 100 year + 40% Climate Change storm event for 100 Grays Inn Road, and 7.61l/s for 88 Grays Inn Road.

The suitability of different SuDS techniques was assessed in accordance with the constraints of the existing site. Surface water attenuation will be provided in the form of blue-green roofs and an attenuation tank.

The proposed development complies with local, regional, and national planning policy on sustainable drainage.

Appendix A

TW Asset Map and Existing Drainage Layout

Asset location search

Property Searches

Heyne Tillett Steel Limited
LONDON
EC1R 0DS

Search address supplied
100
Gray's Inn Road
London
WC1X 8AL

Your reference 2423

Our reference ALS/ALS Standard/2020_4260372

Search date 22 September 2020

Knowledge of features below the surface is essential for every development

The benefits of this knowledge not only include ensuring due diligence and avoiding risk, but also being able to ascertain the feasibility of any development.

Did you know that Thames Water Property Searches can also provide a variety of utility searches including a more comprehensive view of utility providers' assets (across up to 35-45 different providers), as well as more focused searches relating to specific major utility companies such as National Grid (gas and electric).

Contact us to find out more.

Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW
DX 151280 Slough 13

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

0845 070 9148

Asset location search

Property Searches

Search address supplied: 100, Gray's Inn Road, London, WC1X 8AL

Dear Sir / Madam

An Asset Location Search is recommended when undertaking a site development. It is essential to obtain information on the size and location of clean water and sewerage assets to safeguard against expensive damage and allow cost-effective service design.

The following records were searched in compiling this report: - the map of public sewers & the map of waterworks. Thames Water Utilities Ltd (TWUL) holds all of these.

This searchprovides maps showing the position, size of Thames Water assets close to the proposed development and also manhole cover and invert levels, where available.

Please note that none of the charges made for this report relate to the provision of Ordnance Survey mapping information. The replies contained in this letter are given following inspection of the public service records available to this company. No responsibility can be accepted for any error or omission in the replies.

You should be aware that the information contained on these plans is current only on the day that the plans are issued. The plans should only be used for the duration of the work that is being carried out at the present time. Under no circumstances should this data be copied or transmitted to parties other than those for whom the current work is being carried out.

Thames Water do update these service plans on a regular basis and failure to observe the above conditions could lead to damage arising to new or diverted services at a later date.

Contact Us

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0845 070 9148, or use the address below:

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

Email: searches@thameswater.co.uk
Web: www.thameswater-propertysearches.co.uk

Waste Water Services

Please provide a copy extract from the public sewer map.

Enclosed is a map showing the approximate lines of our sewers. Our plans do not show sewer connections from individual properties or any sewers not owned by Thames Water unless specifically annotated otherwise. Records such as "private" pipework are in some cases available from the Building Control Department of the relevant Local Authority.

Where the Local Authority does not hold such plans it might be advisable to consult the property deeds for the site or contact neighbouring landowners.

This report relates only to sewerage apparatus of Thames Water Utilities Ltd, it does not disclose details of cables and or communications equipment that may be running through or around such apparatus.

The sewer level information contained in this response represents all of the level data available in our existing records. Should you require any further Information, please refer to the relevant section within the 'Further Contacts' page found later in this document.

For your guidance:

- The Company is not generally responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only.
- Any private sewers or lateral drains which are indicated on the extract of the public sewer map as being subject to an agreement under Section 104 of the Water Industry Act 1991 are not an ‘as constructed’ record. It is recommended these details be checked with the developer.

Clean Water Services

Please provide a copy extract from the public water main map.

Enclosed is a map showing the approximate positions of our water mains and associated apparatus. Please note that records are not kept of the positions of individual domestic supplies.

For your information, there will be a pressure of at least 10m head at the outside stop valve. If you would like to know the static pressure, please contact our Customer Centre on 0800 316 9800. The Customer Centre can also arrange for a full flow and pressure test to be carried out for a fee.

Asset location search

Property Searches

For your guidance:

- Assets other than vested water mains may be shown on the plan, for information only.
- If an extract of the public water main record is enclosed, this will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

Payment for this Search

A charge will be added to your suppliers account.

Asset location search

Property Searches

Further contacts:

Waste Water queries

Should you require verification of the invert levels of public sewers, by site measurement, you will need to approach the relevant Thames Water Area Network Office for permission to lift the appropriate covers. This permission will usually involve you completing a TWOSA form. For further information please contact our Customer Centre on Tel: 0845 920 0800. Alternatively, a survey can be arranged, for a fee, through our Customer Centre on the above number.

If you have any questions regarding sewer connections, budget estimates, diversions, building over issues or any other questions regarding operational issues please direct them to our service desk. Which can be contacted by writing to:

Developer Services (Waste Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

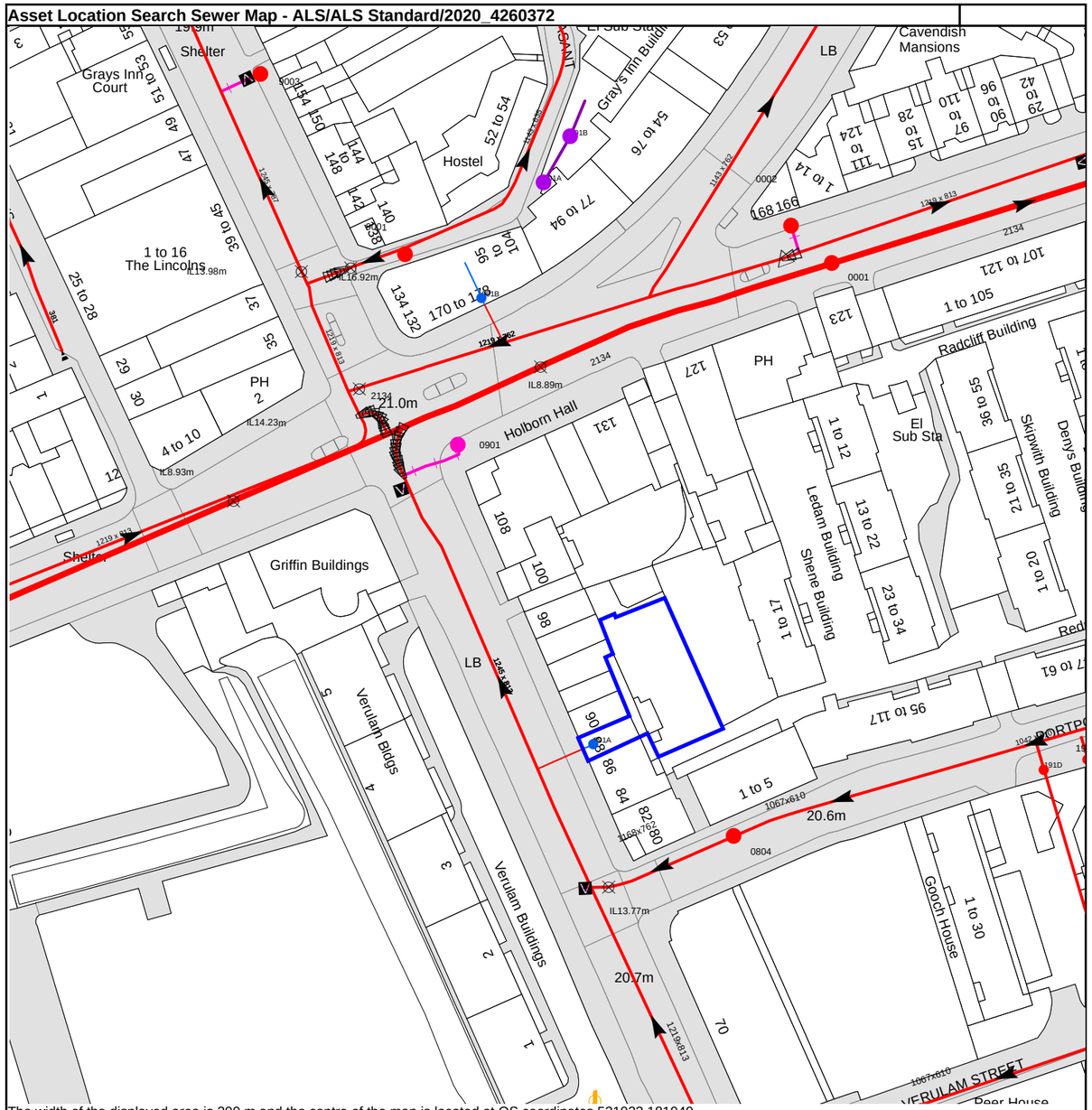
Clean Water queries

Should you require any advice concerning clean water operational issues or clean water connections, please contact:

Developer Services (Clean Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

Asset Location Search Sewer Map - ALS/ALS Standard/2020_4260372



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 531023,181949

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.

Based on the Ordnance Survey Map with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.

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
191D	n/a	n/a
9003	n/a	n/a
9001	20.62	n/a
0901	n/a	n/a
091B	n/a	n/a
001A	n/a	n/a
001B	n/a	n/a
091A	n/a	n/a
0002	n/a	n/a
0001	n/a	8.87
191A	n/a	n/a
0804	n/a	n/a

ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

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

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

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

Trunk Surface Water

Trunk Foul

Storm Relief

Trunk Combined

Vent Pipe

Bio-solids (Sludge)

Proposed Thames Surface Water Sewer

Proposed Thames Water Foul Sewer

Gallery

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Sludge Rising Main

Proposed Thames Water Rising Main

Vacuum

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

Dam Chase

Fitting

Meter

Vent Column

Operational Controls

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

Control Valve

Drop Pipe

Ancillary

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.

Outfall

Undefined End

Inlet

Other Symbols

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

Public/Private Pumping Station

Change of characteristic indicator (C.O.C.I.)

Invert Level

Summit

Areas

Lines denoting areas of underground surveys, etc.

Agreement

Operational Site

Chamber

Tunnel

Conduit Bridge

Other Sewer Types (Not Operated or Maintained by Thames Water)

Foul Sewer

Surface Water Sewer

Combined Sewer

Gulley

Culverted Watercourse

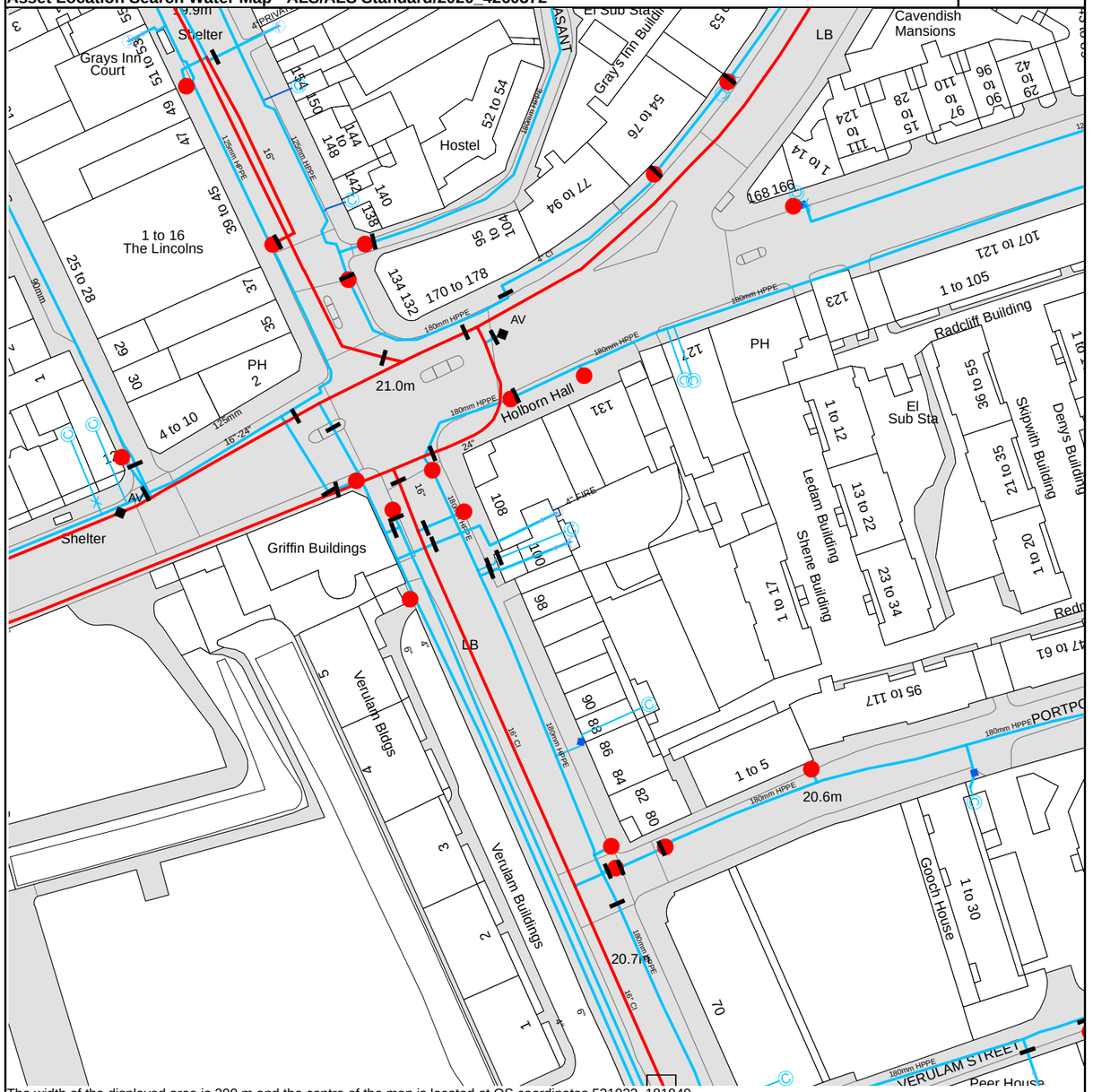
Proposed

Abandoned Sewer

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.
2) All measurements on the plans are metric.
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate 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 level indicates that data is unavailable.
6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. 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 present on the plan, please contact a member of Property Insight on 0845 070 9148.

Asset Location Search Water Map - ALS/ALS Standard/2020_4260372



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 531023, 181949.

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ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)

4"

Distribution Main: The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.

16"

Trunk Main: A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.

3" SUPPLY

Supply Main: A supply main indicates that the water main is used as a supply for a single property or group of properties.

3" FIRE

Fire Main: Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.

3" METERED

Metered Pipe: A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.

Transmission Tunnel: A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.

Proposed Main: A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

PIPE DIAMETER	DEPTH BELOW GROUND
Up to 300mm (12")	900mm (3')
300mm - 600mm (12" - 24")	1100mm (3' 8")
600mm and bigger (24" plus)	1200mm (4')

Valves

- General Purpose Valve
- Air Valve
- Pressure Control Valve
- Customer Valve

Hydrants

- Single Hydrant

Meters

- Meter

End Items

Symbol indicating what happens at the end of a water main.

- Blank Flange
- Capped End
- Emptying Pit
- Undefined End
- Manifold
- Customer Supply
- Fire Supply

Operational Sites

- Booster Station
- Other
- Other (Proposed)
- Pumping Station
- Service Reservoir
- Shaft Inspection
- Treatment Works
- Unknown
- Water Tower

Other Symbols

- Data Logger

Other Water Pipes (Not Operated or Maintained by Thames Water)

Other Water Company Main: Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.

Private Main: Indiates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

Terms and Conditions

All sales are made in accordance with Thames Water Utilities Limited (TWUL) standard terms and conditions unless previously agreed in writing.

1. All goods remain in the property of Thames Water Utilities Ltd until full payment is received.
2. Provision of service will be in accordance with all legal requirements and published TWUL policies.
3. All invoices are strictly due for payment 14 days from due date of the invoice. Any other terms must be accepted/agreed in writing prior to provision of goods or service, or will be held to be invalid.
4. Thames Water does not accept post-dated cheques-any cheques received will be processed for payment on date of receipt.
5. In case of dispute TWUL`s terms and conditions shall apply.
6. Penalty interest may be invoked by TWUL in the event of unjustifiable payment delay. Interest charges will be in line with UK Statute Law 'The Late Payment of Commercial Debts (Interest) Act 1998'.
7. Interest will be charged in line with current Court Interest Charges, if legal action is taken.
8. A charge may be made at the discretion of the company for increased administration costs.

A copy of Thames Water's standard terms and conditions are available from the Commercial Billing Team (cashoperations@thameswater.co.uk).

We publish several Codes of Practice including a guaranteed standards scheme. You can obtain copies of these leaflets by calling us on 0800 316 9800

If you are unhappy with our service you can speak to your original goods or customer service provider. If you are not satisfied with the response, your complaint will be reviewed by the Customer Services Director. You can write to her at: Thames Water Utilities Ltd. PO Box 492, Swindon, SN38 8TU.

If the Goods or Services covered by this invoice falls under the regulation of the 1991 Water Industry Act, and you remain dissatisfied you can refer your complaint to Consumer Council for Water on 0121 345 1000 or write to them at Consumer Council for Water, 1st Floor, Victoria Square House, Victoria Square, Birmingham, B2 4AJ.

Ways to pay your bill

Credit Card	**BACS Payment**	**Telephone Banking**	**Cheque**
Call **0845 070 9148** quoting your invoice number starting CBA or ADS / OSS	Account number **90478703** Sort code **60-00-01** A remittance advice must be sent to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW.** or email **ps.billing@thameswater.co.uk**	By calling your bank and quoting: Account number **90478703** Sort code **60-00-01** and your invoice number	Made payable to '**Thames Water Utilities Ltd**' Write your Thames Water account number on the back. Send to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW** or by DX to **151280 Slough 13**

Appendix B

London Borough of Camden SuDS Proforma

1. Project & Site Details

Project / Site Name (including sub-catchment / stage / phase where appropriate)	Grays Inn Road
Address & post code	100 Grays Inn Road, London WC1X 8AL
OS Grid ref. (Easting, Northing)	E 531023
	N 181948
LPA reference (if applicable)	
Brief description of proposed work	100 Grays Inn Road will consist of the refurbishment of a 10 storey commercial building containing office space and a basement floor level.
Total site Area	1709 m^2
Total existing impervious area	1709 m^2
Total proposed impervious area	1709 m^2
Is the site in a surface water flood risk catchment (ref. local Surface Water Management Plan)?	
Existing drainage connection type and location	
Designer Name	Thomas O'Hara
Designer Position	Engineer
Designer Company	Heyne Tillet Steel

2. Proposed Discharge Arrangements

2a. Infiltration Feasibility

Superficial geology classification	
Bedrock geology classification	
Site infiltration rate	m/s
Depth to groundwater level	m below ground level
Is infiltration feasible?	

2b. Drainage Hierarchy

	Feasible (Y/N)	*Proposed (Y/N)*
1 store rainwater for later use	Y	Y
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	Y	Y
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	N	N
7 discharge rainwater to the combined sewer.	Y	Y

2c. Proposed Discharge Details

Proposed discharge location	bined sewer along Clerkenwell Road for 100
Has the owner/regulator of the discharge location been consulted?	Yes

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				
1 in 1				
1 in 30				
1 in 100				
1 in 100 + CC				
Climate change allowance used		40%		
3b. Principal Method of 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	0	0	0
Blue roofs	1624.8	1166	0
Filter strips	0	0	0
Filter drains	0	0	0
Bioretention / tree pits	0	0	0
Pervious pavements	0	0	0
Swales	0	0	0
Basins/ponds	0	0	0
Attenuation tanks	0		0
Total	**1624.8**	**1166**	**0**

4. Supporting Information

4a. Discharge & Drainage Strategy	*Page/section of drainage report*
Infiltration feasibility (2a) – geotechnical factual and interpretive reports, including infiltration results	
Drainage hierarchy (2b)	
Proposed discharge details (2c) – utility plans, correspondence / approval from owner/regulator of discharge location	
Discharge rates & storage (3a) – detailed hydrologic and hydraulic calculations	
Proposed SuDS measures & specifications (3b)	

4b. Other Supporting Details	*Page/section of drainage report*
Detailed Development Layout	
Detailed drainage design drawings, including exceedance flow routes	
Detailed landscaping plans	
Maintenance strategy	
Demonstration of how the proposed SuDS measures improve:	
a) water quality of the runoff?	
b) biodiversity?	
c) amenity?	

1. Project & Site Details

Project / Site Name (including sub-catchment / stage / phase where appropriate)	Grays Inn Road
Address & post code	88 Grays Inn Road, London WC1X 8AL
OS Grid ref. (Easting, Northing)	E 531023
	N 181948
LPA reference (if applicable)	
Brief description of proposed work	88 Grays Inn Road will consist of the refurbishment of a 4 storey commercial & residential building containing 6 residential units, as well as office space at ground and a basement floor levels.
Total site Area	510 m^2
Total existing impervious area	510 m^2
Total proposed impervious area	510 m^2
Is the site in a surface water flood risk catchment (ref. local Surface Water Management Plan)?	
Existing drainage connection type and location	
Designer Name	Thomas O'Hara
Designer Position	Engineer
Designer Company	Heyne Tillet Steel

2. Proposed Discharge Arrangements

2a. Infiltration Feasibility

Superficial geology classification	
Bedrock geology classification	
Site infiltration rate	m/s
Depth to groundwater level	m below ground level
Is infiltration feasible?	

2b. Drainage Hierarchy

	Feasible (Y/N)	*Proposed (Y/N)*
1 store rainwater for later use	Y	Y
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	Y	Y
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	N	N
7 discharge rainwater to the combined sewer.	Y	Y

2c. Proposed Discharge Details

Proposed discharge location	nwell Road for 100 GIR & combined sewer a
Has the owner/regulator of the discharge location been consulted?	Yes

Camden GREATERLONDONAUTHORITY LoDEG

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				
1 in 1				
1 in 30				
1 in 100				
1 in 100 + CC				
Climate change allowance used		40%		
3b. Principal Method of 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	0	0	0
Blue roofs	231.7	128.4	0
Filter strips	0	0	0
Filter drains	0	0	0
Bioretention / tree pits	0	0	0
Pervious pavements	0	0	0
Swales	0	0	0
Basins/ponds	0	0	0
Attenuation tanks	145		15
Total	**376.7**	**128.4**	**15**

4. Supporting Information

4a. Discharge & Drainage Strategy	*Page/section of drainage report*
Infiltration feasibility (2a) – geotechnical factual and interpretive reports, including infiltration results	
Drainage hierarchy (2b)	
Proposed discharge details (2c) – utility plans, correspondence / approval from owner/regulator of discharge location	
Discharge rates & storage (3a) – detailed hydrologic and hydraulic calculations	
Proposed SuDS measures & specifications (3b)	

4b. Other Supporting Details	*Page/section of drainage report*
Detailed Development Layout	
Detailed drainage design drawings, including exceedance flow routes	
Detailed landscaping plans	
Maintenance strategy	
Demonstration of how the proposed SuDS measures improve:	
a) water quality of the runoff?	
b) biodiversity?	
c) amenity?	

Appendix C

Greenfield Run-off Rate Calculations

Print | Close Report

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Thomas O'Hara
Site name:	100 Grays Inn Road
Site location:	Camden

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	51.52125° N
Longitude:	0.11268° W
Reference:	2101694773
Date:	Sep 20 2022 12:01

Runoff estimation approach FEH Statistical

Site characteristics

Total site area (ha): 0.1709

Methodology

Q_{MED} estimation method:	Calculate from BFI and SAAR
BFI and SPR method:	Specify BFI manually
HOST class:	N/A
BFI / BFIHOST:	0.641
Q_{MED} (l/s):	
Q_{BAR} / Q_{MED} factor:	1.14

Hydrological characteristics	Default	Edited
SAAR (mm):	608	608
Hydrological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):		0.23
1 in 1 year (l/s):		0.2
1 in 30 years (l/s):		0.53
1 in 100 year (l/s):		0.74
1 in 200 years (l/s):		0.87

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Thomas O'Hara
Site name:	88 Grays Inn Road
Site location:	Camden

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	51.52125° N
Longitude:	0.11268° W
Reference:	4201486267
Date:	Sep 20 2022 12:03

Runoff estimation approach FEH Statistical

Site characteristics

Total site area (ha):	0.051

Methodology

Q_{MED} estimation method:	Calculate from BFI and SAAR
BFI and SPR method:	Specify BFI manually
HOST class:	N/A
BFI / BFIHOST:	0.641
Q_{MED} (l/s):	
Q_{BAR} / Q_{MED} factor:	1.14

Hydrological characteristics	Default	Edited
SAAR (mm):	608	608
Hydrological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):		0.07
1 in 1 year (l/s):		0.06
1 in 30 years (l/s):		0.16
1 in 100 year (l/s):		0.22
1 in 200 years (l/s):		0.26

Appendix D

SuDS Calculations

ACO Blue Roof Calculator Version 1.0.0.36

Project Title: 100 Grays Inn Rd

Design Number:

Notes / Reference: Roof Level West

Design Storm Event	1:100
Climate Change %	40%
Location	London
Roof Area m²	262.5
Additional Contributing Areas (m²)	
Total Catchment Area (m²)	**262.5**
Net Roof Area (m²)	218.3
Permitted Outflow (l/s)	0.350
Blue or Blue/Green Roof	Blue / Green
If B/G, Green Roof Type	Extensive
a. Permanent reservoir above or in storage void	None
b. Required Reservoir Depth (mm)	

Required Net Storm Storage Volume (m³)	23.80
Total Net Volume Required (m³)	23.80
Void Ratio	0.90
Selected depth of storage tank (mm)	125

R: l/s

M5-60: mm/h

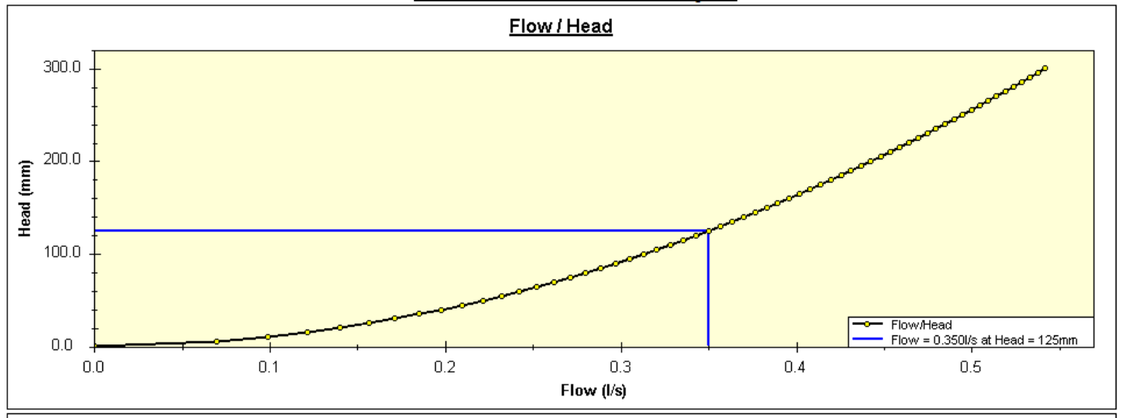
DURATION (mins)	INTENSITY (mm/h)	REQUIRED STORAGE VOLUME (m³)
5 mins	439.50	9.51
10 mins	261.51	11.23
15 mins	175.78	11.22
30 mins	113.09	14.21
1 hour	63.70	15.46
2 hours	44.10	20.63
4 hours	27.19	23.51
6 hours	19.91	23.80
10 hours	13.09	21.76
24 hours	6.08	8.04
48 hours	3.25	0.00

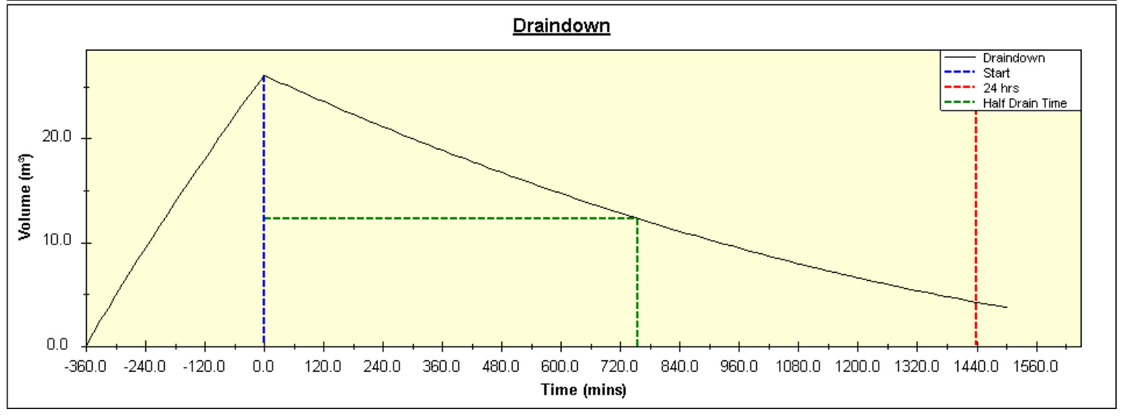
Structural Load Calculations

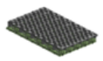
Item	kN/m²
Weight of Product (Tank / Cell)	0.154
Weight of Product (Tray)	0.000
Geotextile	0.004
Weight of Permanent Storage	0.000
Weight of Stormwater Storage	1.103

Half Draindown time: 755 mins

Level & Draindown Graphs





	Required (m²)	Depth (mm)	Gross Volume (m³)	Net Volume (m³)	Layers Required	Product No.	Description	Qty	Unit
	218.3	125	27.29	24.56	1	110002	RoofBloxx Tank 125	874	pcs
	218.3	30	6.55	6.22	1	110008	RoofBloxx Cell 30	873	pcs
	0	0	0	0	0			0	pcs
	0					110011	Capilliary Wicking Rope	0	Rolls
	230					27041	ACOTex Plus Protection Fleece (300gsm) 100 x 4.0m	1	Rolls
	230					27038	ACOTex Filter geotextile (125gsm) 100 x 4.0m	1	Rolls

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ACO Business Park, Hitchin Road, Shefford, Bedfordshire SG17 5TE
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email: technologies@aco.co.uk website: www.aco.co.uk

For our dedicated stormwater management team, please contact:
uk-swc@aco.co.uk Tel: 01462 816666

ACO Blue Roof Calculator Version 1.0.0.36

Project Title: 88 Grays Inn Rd

Design Number:

Notes / Reference: Level 1

Design Storm Event	1:100
Climate Change %	40%
Location	London
Roof Area m²	28.7
Additional Contributing Areas (m²)	
Total Catchment Area (m²)	**28.7**
Net Roof Area (m²)	22.6
Permitted Outflow (l/s)	0.070
Blue or Blue/Green Roof	Blue / Green
If B/G, Green Roof Type	Extensive
a. Permanent reservoir above or in storage void	None
b. Required Reservoir Depth (mm)	

Required Net Storm Storage Volume (m³)	2.07
Total Net Volume Required (m³)	2.07
Void Ratio	0.90
Selected depth of storage tank (mm)	125

R: l/s

M5-60: mm/h

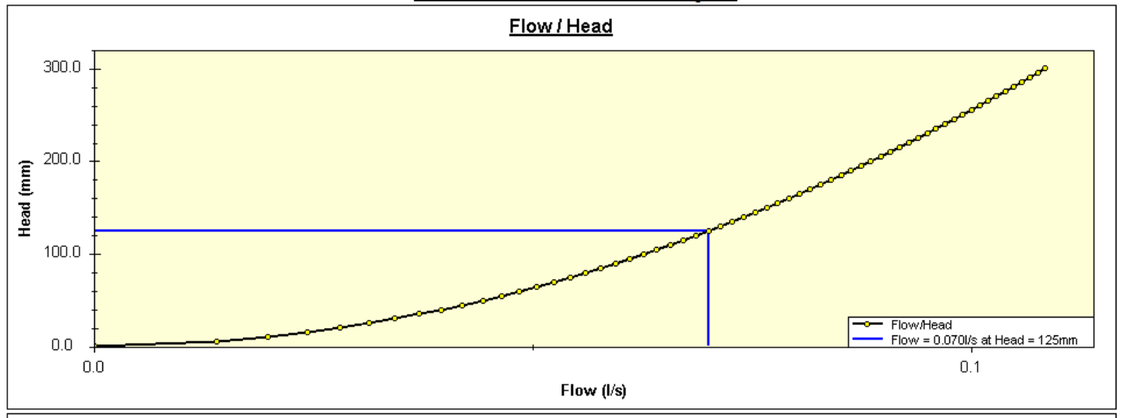
DURATION (mins)	INTENSITY (mm/h)	REQUIRED STORAGE VOLUME (m³)
5 mins	448.78	1.05
10 mins	265.76	1.23
15 mins	173.54	1.18
30 mins	111.89	1.48
1 hour	68.45	1.71
2 hours	43.76	2.01
4 hours	26.84	2.07
6 hours	19.61	1.87
10 hours	12.87	1.17
24 hours	5.94	0.00
48 hours	3.16	0.00

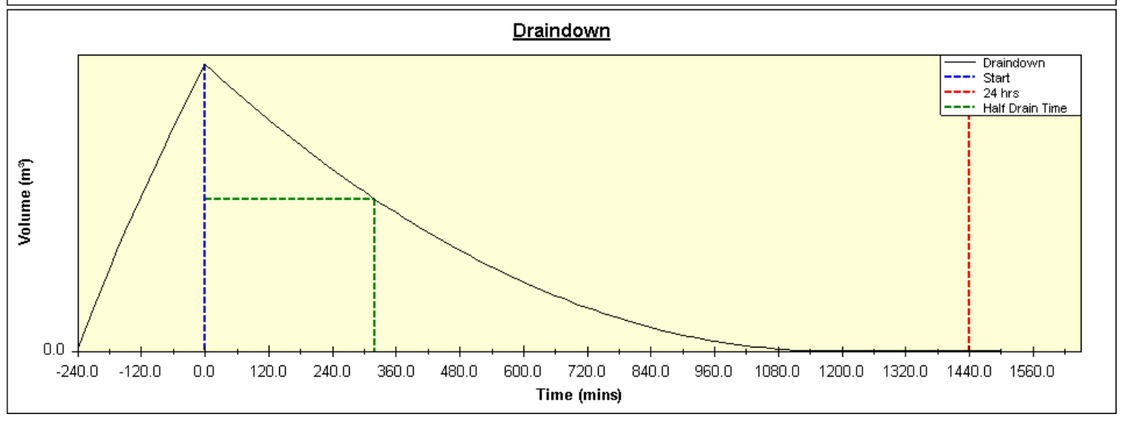
Structural Load Calculations

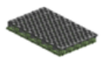
Item	kN/m²
Weight of Product (Tank / Cell)	0.155
Weight of Product (Tray)	0.000
Geotextile	0.004
Weight of Permanent Storage	0.000
Weight of Stormwater Storage	1.103

Half Draindown time: 322 mins

Level & Draindown Graphs





	Required (m²)	Depth (mm)	Gross Volume (m³)	Net Volume (m³)	Layers Required	Product No.	Description	Qty	Unit
	22.6	125	2.83	2.54	1	110002	RoofBloxx Tank 125	91	pcs
	22.6	30	0.68	0.64	1	110008	RoofBloxx Cell 30	90	pcs
	0	0	0	0	0			0	pcs
	0					110011	Capilliary Wicking Rope	0	Rolls
	24					27041	ACOTex Plus Protection Fleece (300gsm) 100 x 4.0m	1	Rolls
	24					27038	ACOTex Filter geotextile (125gsm) 100 x 4.0m	1	Rolls

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For our dedicated stormwater management team, please contact:
uk-swc@aco.co.uk Tel: 01462 816666

ACO Blue Roof Calculator Version 1.0.0.36

Project Title: 88 Grays Inn Rd

Design Number:

Notes / Reference: Roof Level

Design Storm Event	1:100
Climate Change %	40%
Location	London
Roof Area m²	203.0
Additional Contributing Areas (m²)	
Total Catchment Area (m²)	**203.0**
Net Roof Area (m²)	105.8
Permitted Outflow (l/s)	0.450
Blue or Blue/Green Roof	Blue / Green
If B/G, Green Roof Type	Extensive
a. Permanent reservoir above or in storage void	None
b. Required Reservoir Depth (mm)	

Required Net Storm Storage Volume (m³)	15.31
Total Net Volume Required (m³)	15.31
Void Ratio	0.90
Selected depth of storage tank (mm)	165

R: l/s

M5-60: mm/h

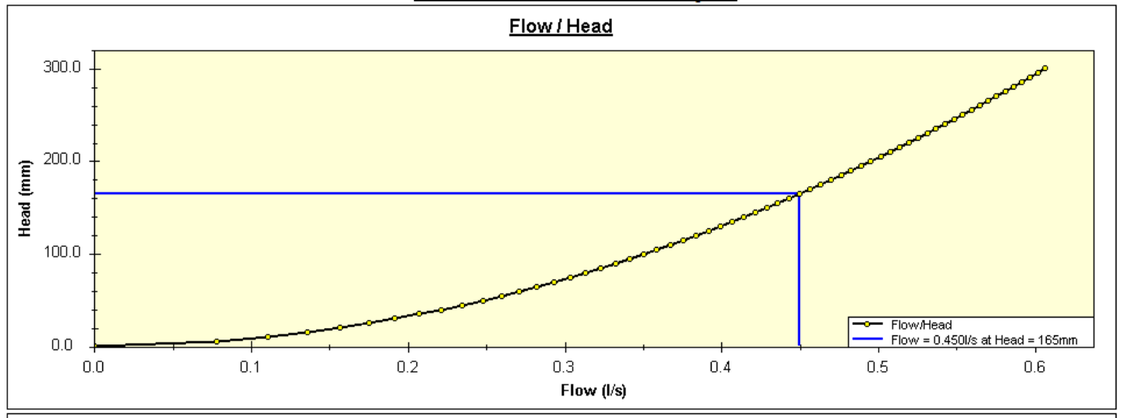
DURATION (mins)	INTENSITY (mm/h)	REQUIRED STORAGE VOLUME (m³)
5 mins	448.78	7.46
10 mins	265.76	8.72
15 mins	173.54	8.40
30 mins	111.89	10.55
1 hour	68.45	12.27
2 hours	43.76	14.53
4 hours	26.84	15.31
6 hours	19.61	14.17
10 hours	12.87	9.92
24 hours	5.94	0.00
48 hours	3.16	0.00

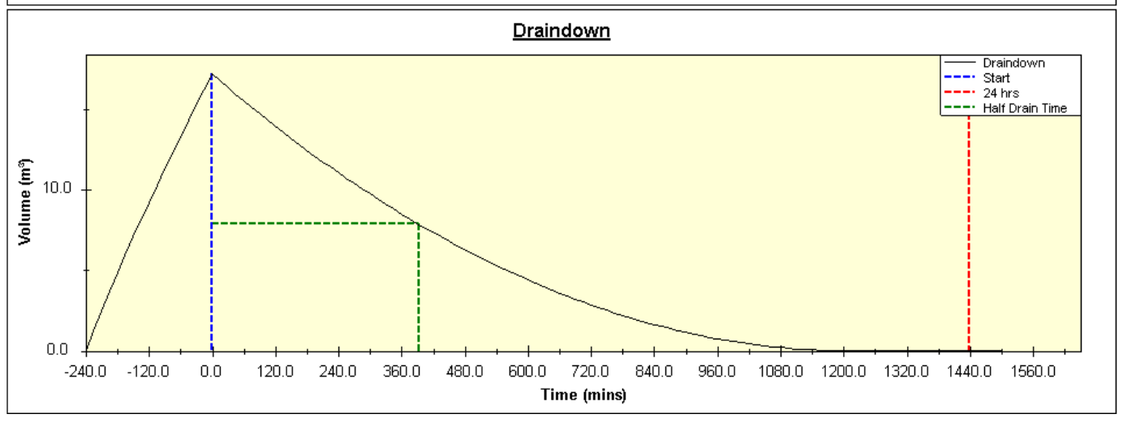
Structural Load Calculations

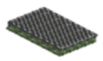
Item	kN/m²
Weight of Product (Tank / Cell)	0.197
Weight of Product (Tray)	0.000
Geotextile	0.004
Weight of Permanent Storage	0.000
Weight of Stormwater Storage	1.456

Half Draindown time: 393 mins

Level & Draindown Graphs





	Required (m²)	Depth (mm)	Gross Volume (m³)	Net Volume (m³)	Layers Required	Product No.	Description	Qty	Unit
	105.8	165	17.46	15.71	1	110003	RoofBloxx Tank 165	424	pcs
	105.8	30	3.17	3.02	1	110008	RoofBloxx Cell 30	423	pcs
	0	0	0	0	0			0	pcs
	0					110011	Capilliary Wicking Rope	0	Rolls
	112					27041	ACOTex Plus Protection Fleece (300gsm) 100 x 4.0m	1	Rolls
	112					27038	ACOTex Filter geotextile (125gsm) 100 x 4.0m	1	Rolls

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For our dedicated stormwater management team, please contact:
uk-swc@aco.co.uk Tel: 01462 816666

ACO Blue Roof Calculator Version 1.0.0.36

Project Title 100 Grays Inn Rd

Design Number

Notes / Reference

Level 02

Design Storm Event	1:100
Climate Change %	40%
Location	London
Roof Area m²	125.4
Additional Contributing Areas (m²)	
Total Catchment Area (m²)	**125.4**
Net Roof Area (m²)	102.5
Permitted Outflow (l/s)	0.170
Blue or Blue/Green Roof	Blue / Green
If B/G, Green Roof Type	Extensive
a. Permanent reservoir above or in storage void	None
b. Required Reservoir Depth (mm)	

Required Net Storm Storage Volume (m³)	11.31
Total Net Volume Required (m³)	11.31
Void Ratio	0.90
Selected depth of storage tank (mm)	125

R: l/s

M5-60: mm/h

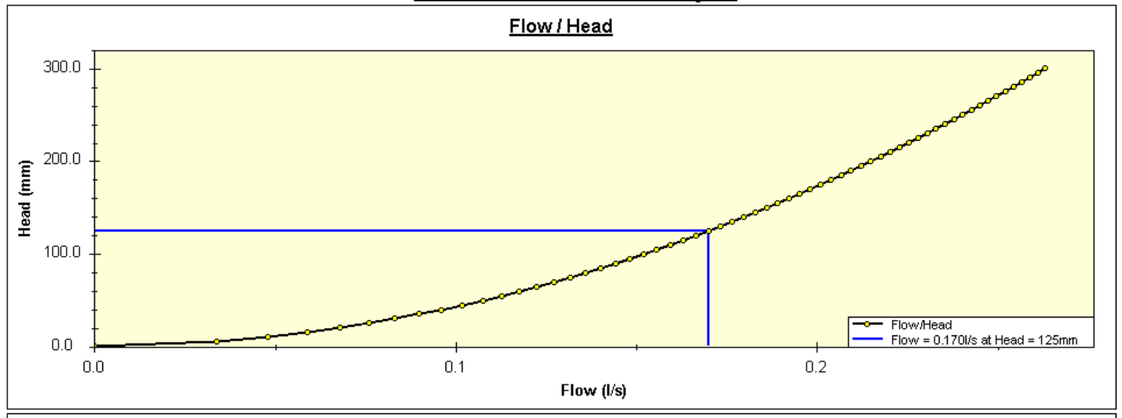
DURATION (mins)	INTENSITY (mm/h)	REQUIRED STORAGE VOLUME (m³)
5 mins	439.50	4.54
10 mins	261.51	5.36
15 mins	175.78	5.36
30 mins	113.09	6.78
1 hour	63.70	7.38
2 hours	44.10	9.84
4 hours	27.19	11.19
6 hours	19.91	11.31
10 hours	13.09	10.29
24 hours	6.08	3.60
48 hours	3.25	0.00

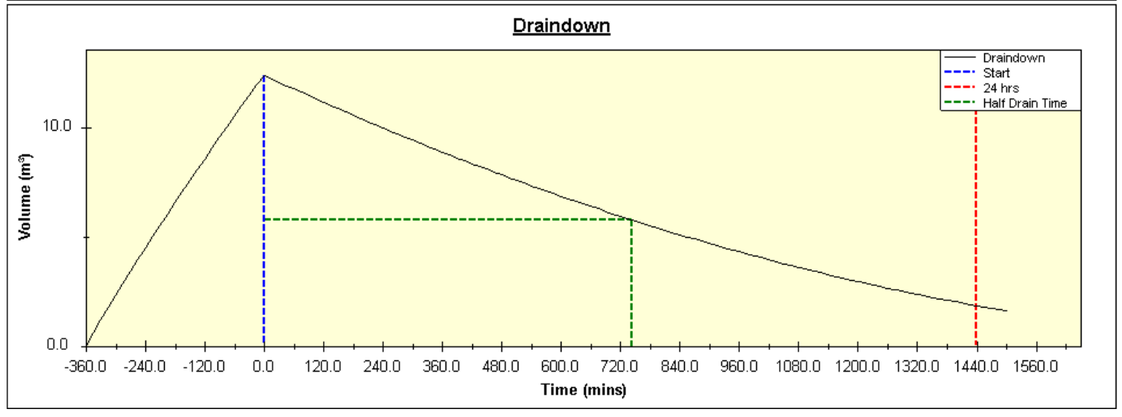
Structural Load Calculations

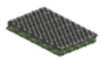
Item	kN/m²
Weight of Product (Tank / Cell)	0.154
Weight of Product (Tray)	0.000
Geotextile	0.004
Weight of Permanent Storage	0.000
Weight of Stormwater Storage	1.103

Half Draindown time: 744 mins

Level & Draindown Graphs





	Required (m²)	Depth (mm)	Gross Volume (m³)	Net Volume (m³)	Layers Required	Product No.	Description	Qty	Unit
	102.5	125	12.81	11.53	1	110002	RoofBloxx Tank 125	410	pcs
	102.5	30	3.08	2.92	1	110008	RoofBloxx Cell 30	410	pcs
	0	0	0	0	0			0	pcs
	0					110011	Capilliary Wicking Rope	0	Rolls
	108					27041	ACOTex Plus Protection Fleece (300gsm) 100 x 4.0m	1	Rolls
	108					27038	ACOTex Filter geotextile (125gsm) 100 x 4.0m	1	Rolls

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ACO Blue Roof Calculator Version 1.0.0.36

Project Title: 100 Grays Inn Rd

Design Number:

Notes / Reference: Level 03

Design Storm Event	1:100
Climate Change %	40%
Location	London
Roof Area m²	37.5
Additional Contributing Areas (m²)	
Total Catchment Area (m²)	**37.5**
Net Roof Area (m²)	28.1
Permitted Outflow (l/s)	0.170
Blue or Blue/Green Roof	Blue / Green
If B/G, Green Roof Type	Extensive
a. Permanent reservoir above or in storage void	None
b. Required Reservoir Depth (mm)	

Required Net Storm Storage Volume (m³)	2.08
Total Net Volume Required (m³)	2.08
Void Ratio	0.90
Selected depth of storage tank (mm)	85

R: l/s

M5-60: mm/h

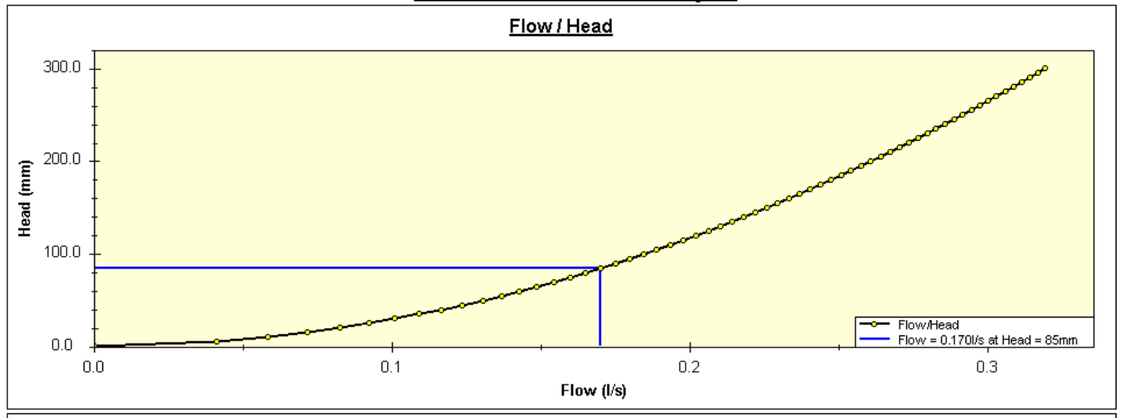
DURATION (mins)	INTENSITY (mm/h)	REQUIRED STORAGE VOLUME (m³)
5 mins	439.50	1.32
10 mins	261.51	1.53
15 mins	175.78	1.49
30 mins	113.09	1.81
1 hour	63.70	1.78
2 hours	44.10	2.08
4 hours	27.19	1.63
6 hours	19.91	0.81
10 hours	13.09	0.00
24 hours	6.08	0.00
48 hours	3.25	0.00

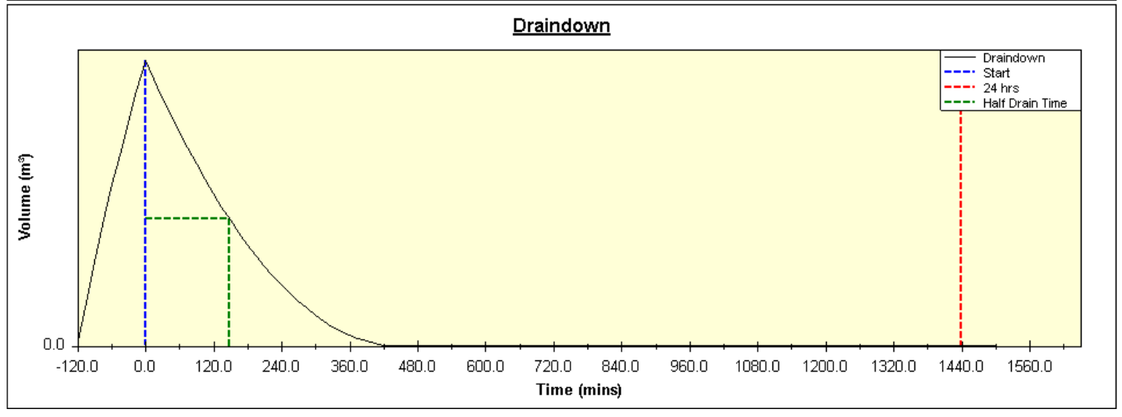
Structural Load Calculations

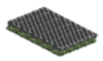
Item	kN/m²
Weight of Product (Tank / Cell)	0.111
Weight of Product (Tray)	0.000
Geotextile	0.004
Weight of Permanent Storage	0.000
Weight of Stormwater Storage	0.750

Half Draindown time: 148 mins

Level & Draindown Graphs





	Required (m²)	Depth (mm)	Gross Volume (m³)	Net Volume (m³)	Layers Required	Product No.	Description	Qty	Unit
	28.1	85	2.39	2.15	1	110001	RoofBloxx Tank 85	113	pcs
	28.1	30	0.84	0.80	1	110008	RoofBloxx Cell 30	112	pcs
	0	0	0	0	0			0	pcs
	0					110011	Capilliary Wicking Rope	0	Rolls
	30					27041	ACOTex Plus Protection Fleece (300gsm) 100 x 4.0m	1	Rolls
	30					27038	ACOTex Filter geotextile (125gsm) 100 x 4.0m	1	Rolls

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ACO Blue Roof Calculator Version 1.0.0.36

Project Title: 100 Grays Inn Rd

Design Number:

Notes / Reference: Level 5 East

Design Storm Event	1:100
Climate Change %	40%
Location	London
Roof Area m²	21.1
Additional Contributing Areas (m²)	
Total Catchment Area (m²)	**21.1**
Net Roof Area (m²)	17.3
Permitted Outflow (l/s)	0.090
Blue or Blue/Green Roof	Blue / Green
If B/G, Green Roof Type	Extensive
a. Permanent reservoir above or in storage void	None
b. Required Reservoir Depth (mm)	

Required Net Storm Storage Volume (m³)	1.21
Total Net Volume Required (m³)	1.21
Void Ratio	0.90
Selected depth of storage tank (mm)	85

R: l/s

M5-60: mm/h

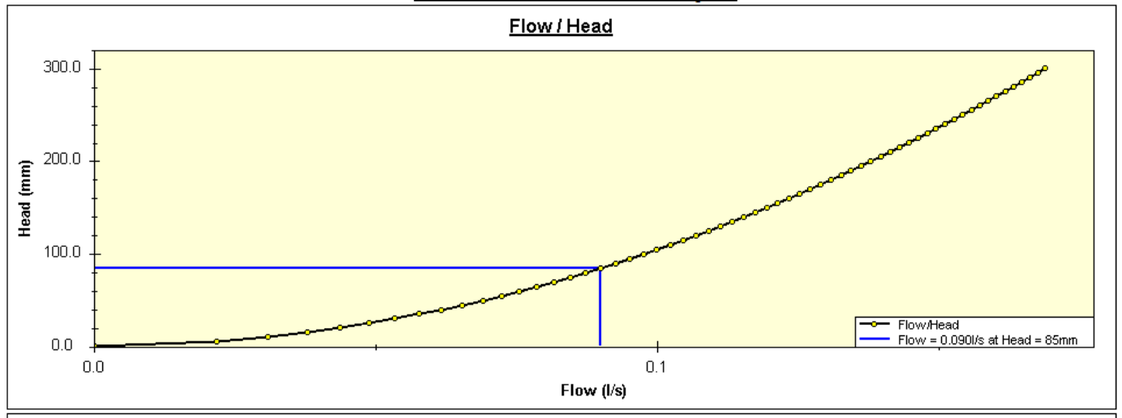
DURATION (mins)	INTENSITY (mm/h)	REQUIRED STORAGE VOLUME (m³)
5 mins	439.50	0.75
10 mins	261.51	0.87
15 mins	175.78	0.85
30 mins	113.09	1.03
1 hour	63.70	1.02
2 hours	44.10	1.21
4 hours	27.19	1.00
6 hours	19.91	0.58
10 hours	13.09	0.00
24 hours	6.08	0.00
48 hours	3.25	0.00

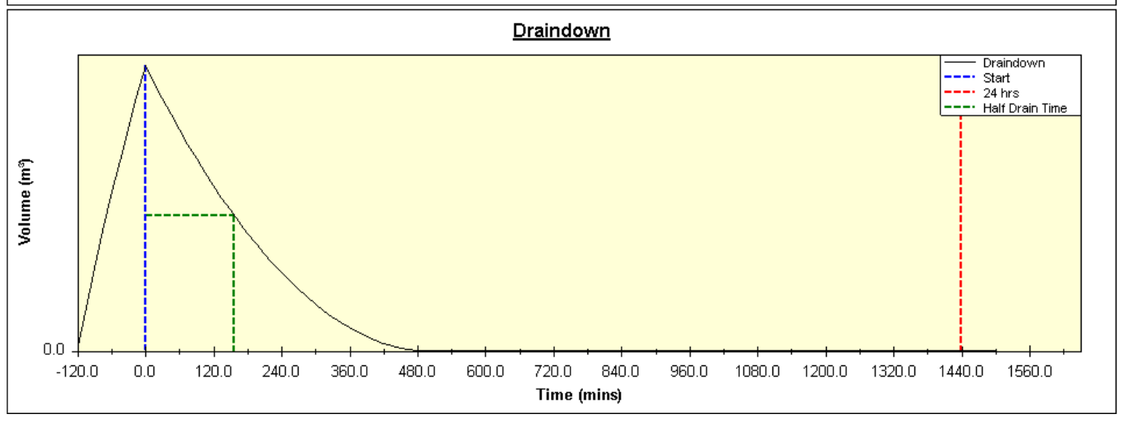
Structural Load Calculations

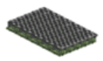
Item	kN/m²
Weight of Product (Tank / Cell)	0.112
Weight of Product (Tray)	0.000
Geotextile	0.005
Weight of Permanent Storage	0.000
Weight of Stormwater Storage	0.750

Half Draindown time: 158 mins

Level & Draindown Graphs





	Required (m²)	Depth (mm)	Gross Volume (m³)	Net Volume (m³)	Layers Required	Product No.	Description	Qty	Unit
	17.3	85	1.47	1.32	1	110001	RoofBloxx Tank 85	70	pcs
	17.3	30	0.52	0.49	1	110008	RoofBloxx Cell 30	69	pcs
	0	0	0	0	0			0	pcs
	0					110011	Capilliary Wicking Rope	0	Rolls
	19					27041	ACOTex Plus Protection Fleece (300gsm) 100 x 4.0m	1	Rolls
	19					27038	ACOTex Filter geotextile (125gsm) 100 x 4.0m	1	Rolls

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ACO Blue Roof Calculator Version 1.0.0.36

Project Title: 100 Grays Inn Rd

Design Number:

Notes / Reference: Level 5 West

Design Storm Event	1:100
Climate Change %	40%
Location	London
Roof Area m²	13.2
Additional Contributing Areas (m²)	
Total Catchment Area (m²)	**13.2**
Net Roof Area (m²)	7.9
Permitted Outflow (l/s)	0.090
Blue or Blue/Green Roof	Blue / Green
If B/G, Green Roof Type	Extensive
a. Permanent reservoir above or in storage void	None
b. Required Reservoir Depth (mm)	

Required Net Storm Storage Volume (m³)	0.58
Total Net Volume Required (m³)	0.58
Void Ratio	0.90
Selected depth of storage tank (mm)	85

R: l/s

M5-60: mm/h

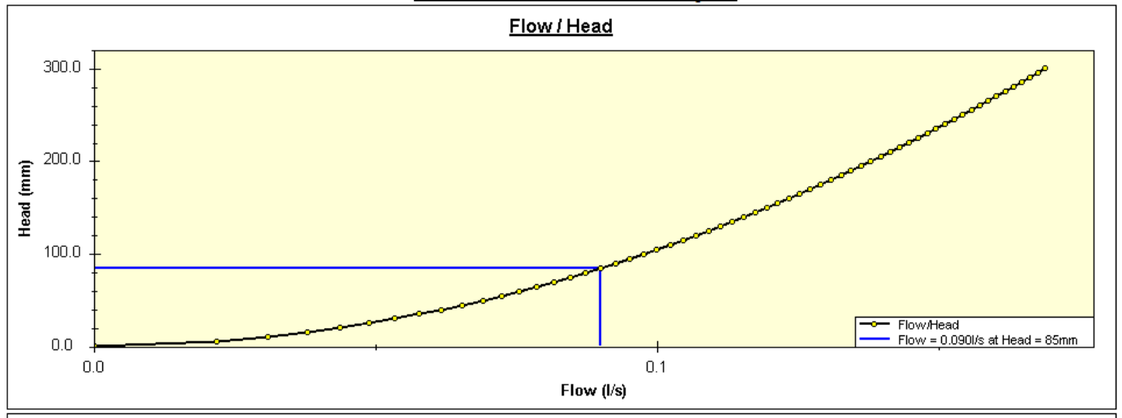
DURATION (mins)	INTENSITY (mm/h)	REQUIRED STORAGE VOLUME (m³)
5 mins	439.50	0.46
10 mins	261.51	0.52
15 mins	175.78	0.50
30 mins	113.09	0.58
1 hour	63.70	0.52
2 hours	44.10	0.52
4 hours	27.19	0.14
6 hours	19.91	0.00
10 hours	13.09	0.00
24 hours	6.08	0.00
48 hours	3.25	0.00

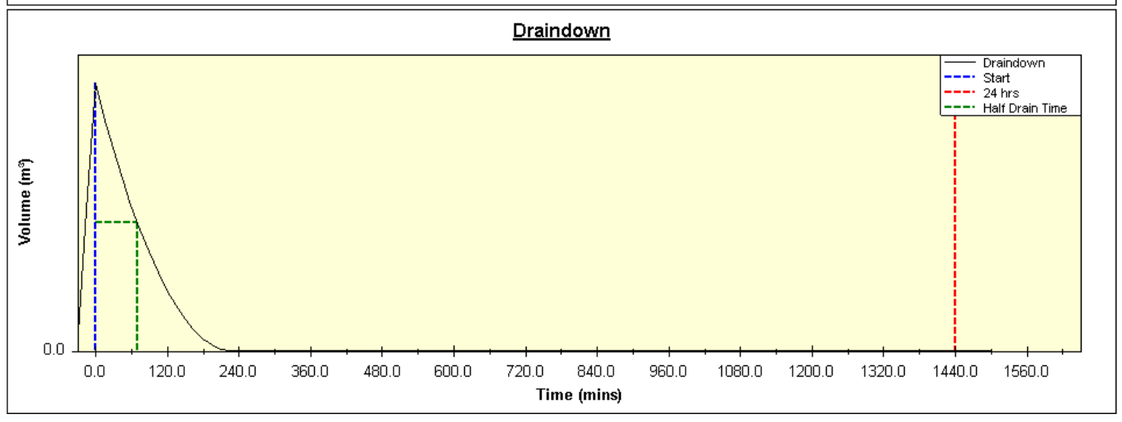
Structural Load Calculations

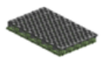
Item	kN/m²
Weight of Product (Tank / Cell)	0.111
Weight of Product (Tray)	0.000
Geotextile	0.005
Weight of Permanent Storage	0.000
Weight of Stormwater Storage	0.750

Half Draindown time: 71 mins

Level & Draindown Graphs





	Required (m²)	Depth (mm)	Gross Volume (m³)	Net Volume (m³)	Layers Required	Product No.	Description	Qty	Unit
	7.9	85	0.67	0.60	1	110001	RoofBloxx Tank 85	32	pcs
	7.9	30	0.24	0.23	1	110008	RoofBloxx Cell 30	31	pcs
	0	0	0	0	0			0	pcs
	0					110011	Capilliary Wicking Rope	0	Rolls
	9					27041	ACOTex Plus Protection Fleece (300gsm) 100 x 4.0m	1	Rolls
	9					27038	ACOTex Filter geotextile (125gsm) 100 x 4.0m	1	Rolls

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ACO Blue Roof Calculator Version 1.0.0.36

Project Title: 100 Grays Inn Rd

Design Number:

Notes / Reference: Level 8 North

Design Storm Event	1:100
Climate Change %	40%
Location	London
Roof Area m²	93.2
Additional Contributing Areas (m²)	
Total Catchment Area (m²)	**93.2**
Net Roof Area (m²)	50.8
Permitted Outflow (l/s)	0.370
Blue or Blue/Green Roof	Blue / Green
If B/G, Green Roof Type	Extensive
a. Permanent reservoir above or in storage void	None
b. Required Reservoir Depth (mm)	

Required Net Storm Storage Volume (m³)	5.56
Total Net Volume Required (m³)	5.56
Void Ratio	0.90
Selected depth of storage tank (mm)	125

R: l/s

M5-60: mm/h

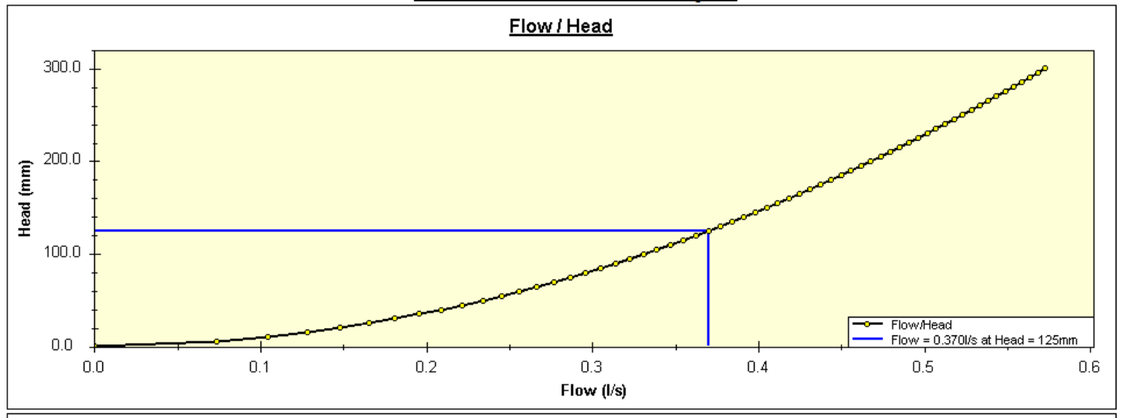
DURATION (mins)	INTENSITY (mm/h)	REQUIRED STORAGE VOLUME (m³)
5 mins	439.50	3.30
10 mins	261.51	3.84
15 mins	175.78	3.76
30 mins	113.09	4.60
1 hour	63.70	4.60
2 hours	44.10	5.56
4 hours	27.19	4.81
6 hours	19.91	3.14
10 hours	13.09	0.00
24 hours	6.08	0.00
48 hours	3.25	0.00

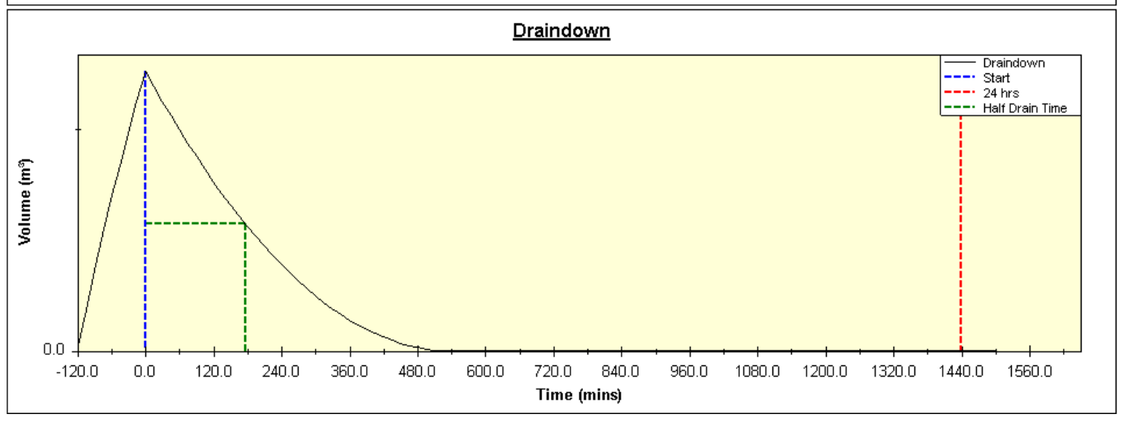
Structural Load Calculations

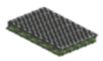
Item	kN/m²
Weight of Product (Tank / Cell)	0.154
Weight of Product (Tray)	0.000
Geotextile	0.004
Weight of Permanent Storage	0.000
Weight of Stormwater Storage	1.103

Half Draindown time: 176 mins

Level & Draindown Graphs





	Required (m²)	Depth (mm)	Gross Volume (m³)	Net Volume (m³)	Layers Required	Product No.	Description	Qty	Unit
	50.8	125	6.35	5.72	1	110002	RoofBloxx Tank 125	204	pcs
	50.8	30	1.52	1.45	1	110008	RoofBloxx Cell 30	203	pcs
	0	0	0	0	0			0	pcs
	0					110011	Capilliary Wicking Rope	0	Rolls
	54					27041	ACOTex Plus Protection Fleece (300gsm) 100 x 4.0m	1	Rolls
	54					27038	ACOTex Filter geotextile (125gsm) 100 x 4.0m	1	Rolls

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ACO Blue Roof Calculator Version 1.0.0.36

Project Title: 100 Grays Inn Rd

Design Number:

Notes / Reference: Level 8 South

Design Storm Event	1:100
Climate Change %	40%
Location	London
Roof Area m²	145.0
Additional Contributing Areas (m²)	
Total Catchment Area (m²)	**145.0**
Net Roof Area (m²)	79.7
Permitted Outflow (l/s)	0.550
Blue or Blue/Green Roof	Blue / Green
If B/G, Green Roof Type	Extensive
a. Permanent reservoir above or in storage void	None
b. Required Reservoir Depth (mm)	

Required Net Storm Storage Volume (m³)	8.83
Total Net Volume Required (m³)	8.83
Void Ratio	0.90
Selected depth of storage tank (mm)	125

R: l/s

M5-60: mm/h

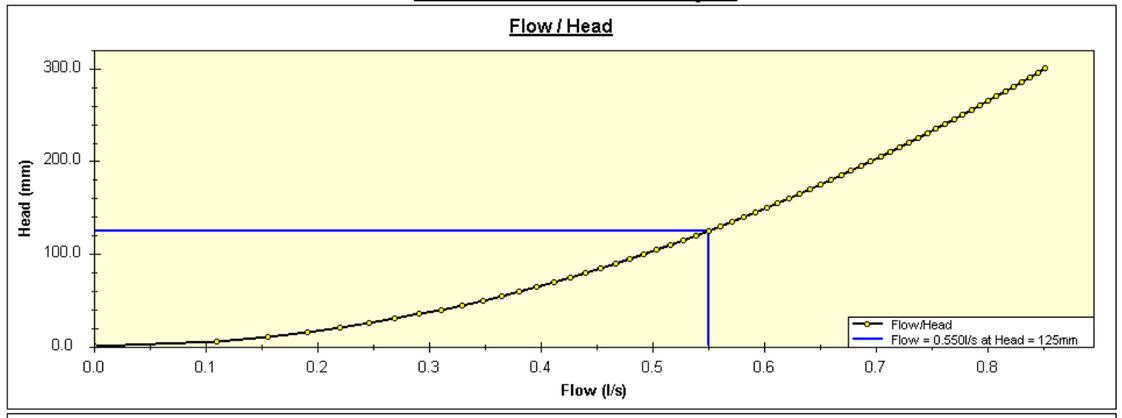
DURATION (mins)	INTENSITY (mm/h)	REQUIRED STORAGE VOLUME (m³)
5 mins	439.50	5.15
10 mins	261.51	5.99
15 mins	175.78	5.88
30 mins	113.09	7.21
1 hour	63.70	7.26
2 hours	44.10	8.83
4 hours	27.19	7.85
6 hours	19.91	5.44
10 hours	13.09	0.00
24 hours	6.08	0.00
48 hours	3.25	0.00

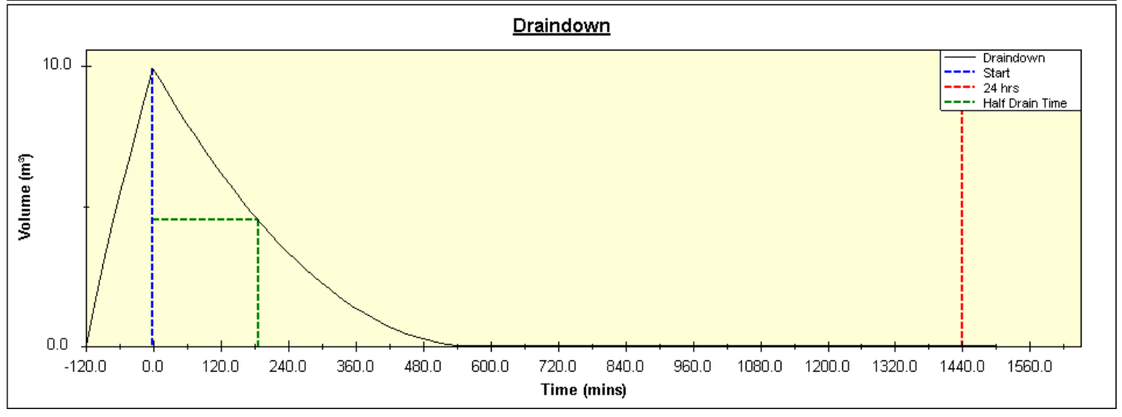
Structural Load Calculations

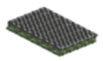
Item	kN/m²
Weight of Product (Tank / Cell)	0.154
Weight of Product (Tray)	0.000
Geotextile	0.004
Weight of Permanent Storage	0.000
Weight of Stormwater Storage	1.103

Half Draindown time: 187 mins

Level & Draindown Graphs





	Required (m²)	Depth (mm)	Gross Volume (m³)	Net Volume (m³)	Layers Required	Product No.	Description	Qty	Unit
	79.7	125	9.96	8.97	1	110002	RoofBloxx Tank 125	319	pcs
	79.7	30	2.39	2.27	1	110008	RoofBloxx Cell 30	318	pcs
	0	0	0	0	0			0	pcs
	0					110011	Capilliary Wicking Rope	0	Rolls
	84					27041	ACOTex Plus Protection Fleece (300gsm) 100 x 4.0m	1	Rolls
	84					27038	ACOTex Filter geotextile (125gsm) 100 x 4.0m	1	Rolls

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ACO Blue Roof Calculator Version 1.0.0.36

Project Title: 100 Grays Inn Rd

Design Number:

Notes / Reference: Level 8 West

Design Storm Event	1:100
Climate Change %	40%
Location	London
Roof Area m²	51.8
Additional Contributing Areas (m²)	
Total Catchment Area (m²)	**51.8**
Net Roof Area (m²)	32.7
Permitted Outflow (l/s)	0.140
Blue or Blue/Green Roof	Blue / Green
If B/G, Green Roof Type	Extensive
a. Permanent reservoir above or in storage void	None
b. Required Reservoir Depth (mm)	

Required Net Storm Storage Volume (m³)	3.62
Total Net Volume Required (m³)	3.62
Void Ratio	0.90
Selected depth of storage tank (mm)	125

R: l/s

M5-60: mm/h

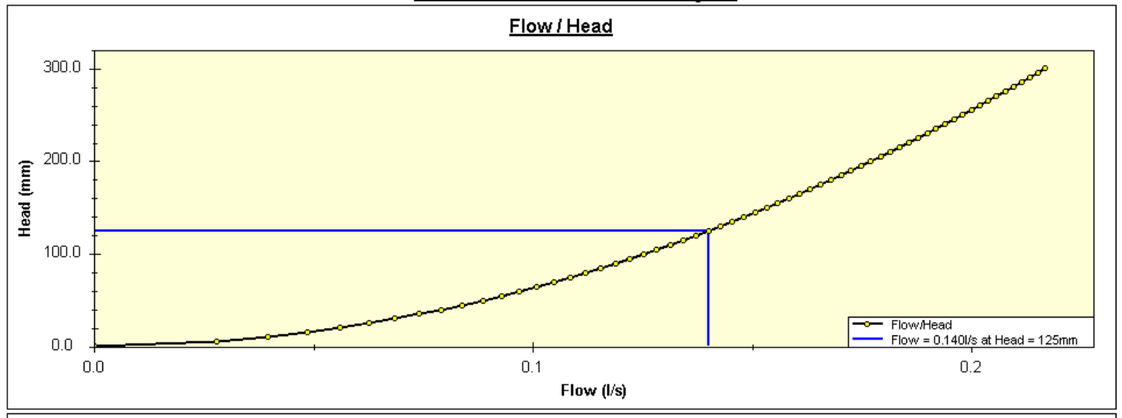
DURATION (mins)	INTENSITY (mm/h)	REQUIRED STORAGE VOLUME (m³)
5 mins	439.50	1.86
10 mins	261.51	2.17
15 mins	175.78	2.15
30 mins	113.09	2.68
1 hour	63.70	2.80
2 hours	44.10	3.56
4 hours	27.19	3.62
6 hours	19.91	3.16
10 hours	13.09	1.74
24 hours	6.08	0.00
48 hours	3.25	0.00

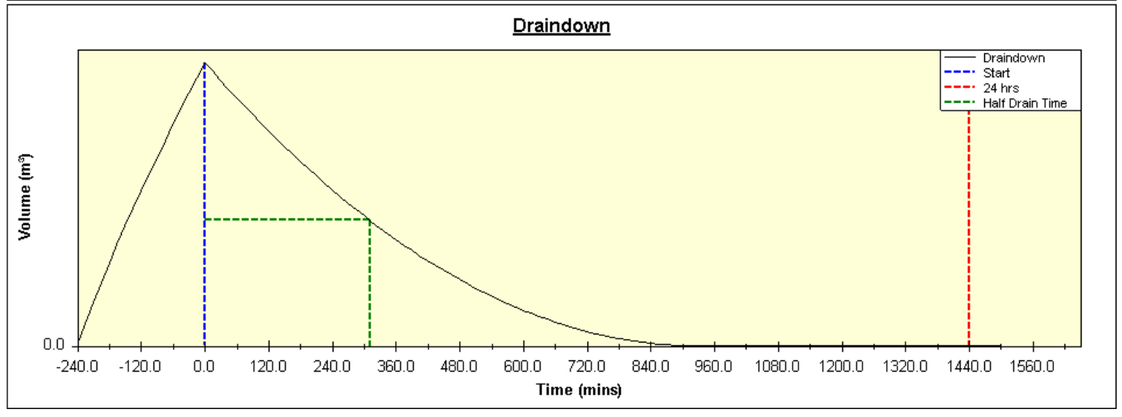
Structural Load Calculations

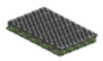
Item	kN/m²
Weight of Product (Tank / Cell)	0.154
Weight of Product (Tray)	0.000
Geotextile	0.004
Weight of Permanent Storage	0.000
Weight of Stormwater Storage	1.103

Half Draindown time: 311 mins

Level & Draindown Graphs





	Required (m²)	Depth (mm)	Gross Volume (m³)	Net Volume (m³)	Layers Required	Product No.	Description	Qty	Unit
	32.7	125	4.09	3.68	1	110002	RoofBloxx Tank 125	131	pcs
	32.7	30	0.98	0.93	1	110008	RoofBloxx Cell 30	130	pcs
	0	0	0	0	0			0	pcs
	0					110011	Capilliary Wicking Rope	0	Rolls
	35					27041	ACOTex Plus Protection Fleece (300gsm) 100 x 4.0m	1	Rolls
	35					27038	ACOTex Filter geotextile (125gsm) 100 x 4.0m	1	Rolls

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ACO Blue Roof Calculator Version 1.0.0.36

Project Title: 100 Grays Inn Rd

Design Number:

Notes / Reference: Plant Roof

Design Storm Event	1:100
Climate Change %	40%
Location	London
Roof Area m²	445.6
Additional Contributing Areas (m²)	
Total Catchment Area (m²)	**445.6**
Net Roof Area (m²)	265.4
Permitted Outflow (l/s)	1.400
Blue or Blue/Green Roof	Blue / Green
If B/G, Green Roof Type	Extensive
a. Permanent reservoir above or in storage void	None
b. Required Reservoir Depth (mm)	

Required Net Storm Storage Volume (m³)	29.22
Total Net Volume Required (m³)	29.22
Void Ratio	0.90
Selected depth of storage tank (mm)	125

R: l/s

M5-60: mm/h

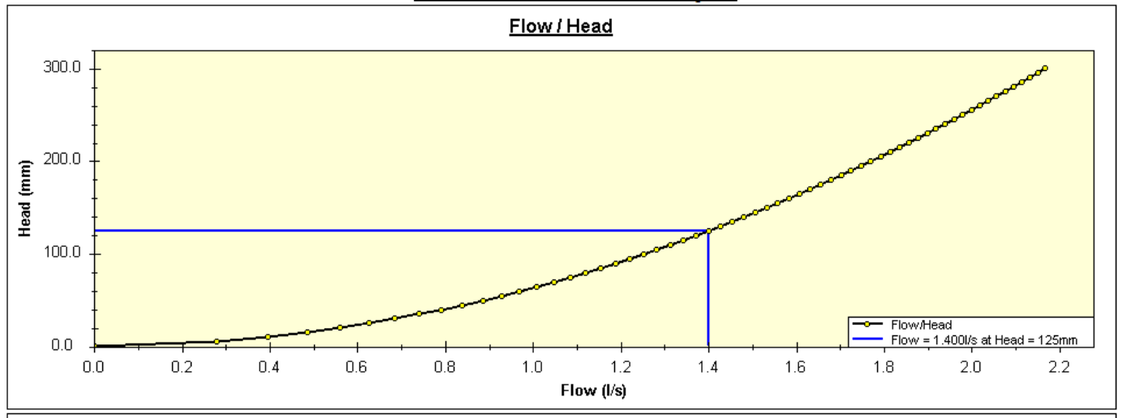
DURATION (mins)	INTENSITY (mm/h)	REQUIRED STORAGE VOLUME (m³)
5 mins	439.50	15.90
10 mins	261.51	18.58
15 mins	175.78	18.32
30 mins	113.09	22.68
1 hour	63.70	23.34
2 hours	44.10	29.22
4 hours	27.19	28.30
6 hours	19.91	22.99
10 hours	13.09	7.93
24 hours	6.08	0.00
48 hours	3.25	0.00

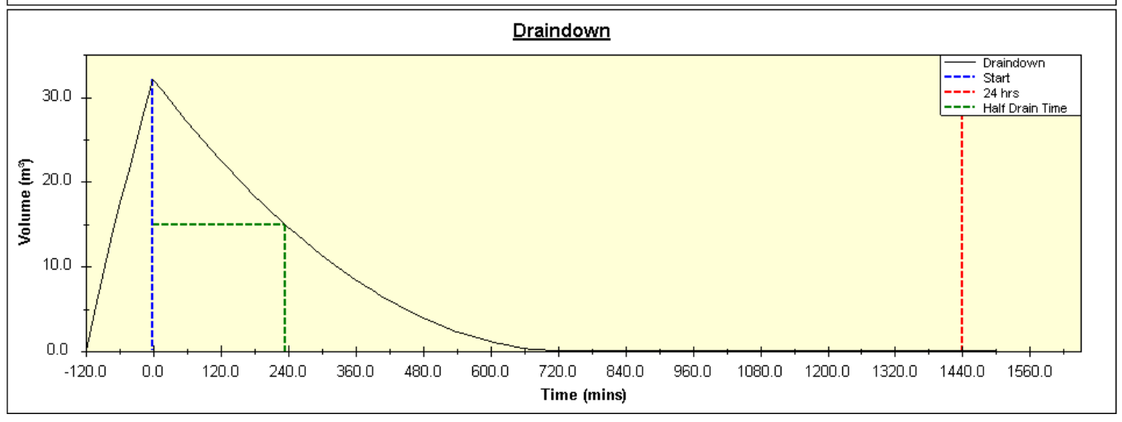
Structural Load Calculations

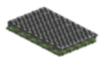
Item	kN/m²
Weight of Product (Tank / Cell)	0.154
Weight of Product (Tray)	0.000
Geotextile	0.004
Weight of Permanent Storage	0.000
Weight of Stormwater Storage	1.103

Half Draindown time: 235 mins

Level & Draindown Graphs





	Required (m²)	Depth (mm)	Gross Volume (m³)	Net Volume (m³)	Layers Required	Product No.	Description	Qty	Unit
	265.4	125	33.18	29.86	1	110002	RoofBloxx Tank 125	1062	pcs
	265.4	30	7.96	7.56	1	110008	RoofBloxx Cell 30	1061	pcs
	0	0	0	0	0			0	pcs
	0					110011	Capilliary Wicking Rope	0	Rolls
	279					27041	ACOTex Plus Protection Fleece (300gsm) 100 x 4.0m	1	Rolls
	279					27038	ACOTex Filter geotextile (125gsm) 100 x 4.0m	1	Rolls

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uk-swc@aco.co.uk Tel: 01462 816666

ACO Blue Roof Calculator Version 1.0.0.36

Project Title: 100 Grays Inn Rd

Design Number:

Notes / Reference: Roof Level North

Design Storm Event	1:100
Climate Change %	40%
Location	London
Roof Area m²	253.0
Additional Contributing Areas (m²)	
Total Catchment Area (m²)	**253.0**
Net Roof Area (m²)	220.2
Permitted Outflow (l/s)	0.180
Blue or Blue/Green Roof	Blue / Green
If B/G, Green Roof Type	Extensive
a. Permanent reservoir above or in storage void	None
b. Required Reservoir Depth (mm)	

Required Net Storm Storage Volume (m³)	26.64
Total Net Volume Required (m³)	26.64
Void Ratio	0.90
Selected depth of storage tank (mm)	165

R: l/s

M5-60: mm/h

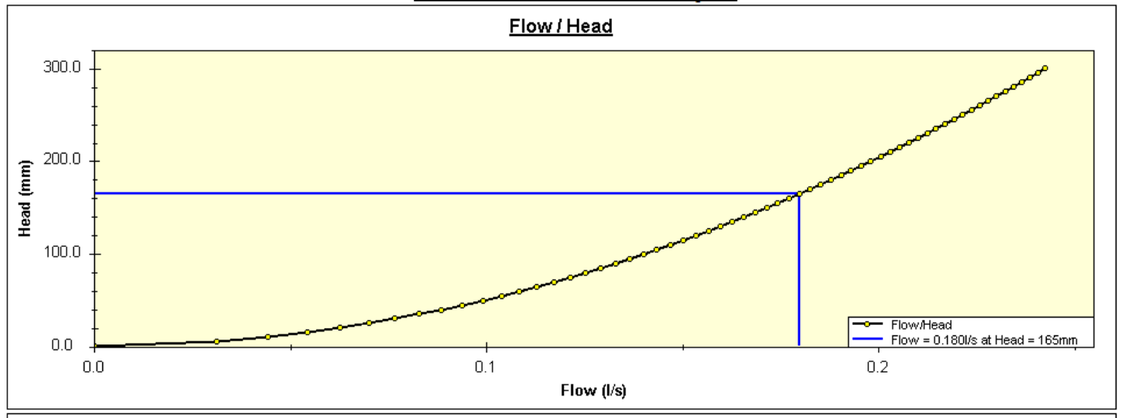
DURATION (mins)	INTENSITY (mm/h)	REQUIRED STORAGE VOLUME (m³)
5 mins	439.50	9.21
10 mins	261.51	10.92
15 mins	175.78	10.96
30 mins	113.09	13.98
1 hour	63.70	15.47
2 hours	44.10	21.02
4 hours	27.19	24.92
6 hours	19.91	26.33
10 hours	13.09	26.64
24 hours	6.08	21.34
48 hours	3.25	8.34

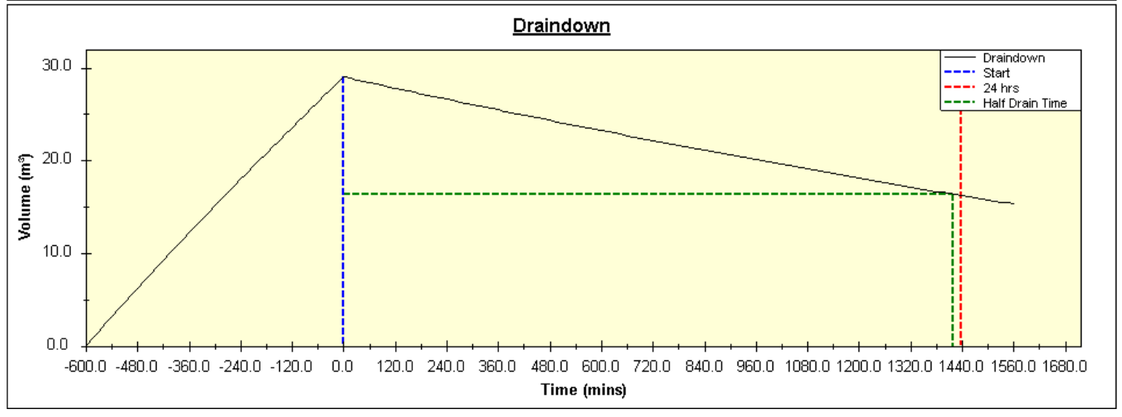
Structural Load Calculations

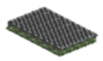
Item	kN/m²
Weight of Product (Tank / Cell)	0.197
Weight of Product (Tray)	0.000
Geotextile	0.004
Weight of Permanent Storage	0.000
Weight of Stormwater Storage	1.456

Half Draindown time: 1419 mins

Level & Draindown Graphs





	Required (m²)	Depth (mm)	Gross Volume (m³)	Net Volume (m³)	Layers Required	Product No.	Description	Qty	Unit
	220.2	165	36.33	32.70	1	110003	RoofBloxx Tank 165	881	pcs
	220.2	30	6.61	6.28	1	110008	RoofBloxx Cell 30	880	pcs
	0	0	0	0	0			0	pcs
	0					110011	Capilliary Wicking Rope	0	Rolls
	232					27041	ACOTex Plus Protection Fleece (300gsm) 100 x 4.0m	1	Rolls
	232					27038	ACOTex Filter geotextile (125gsm) 100 x 4.0m	1	Rolls

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ACO Blue Roof Calculator Version 1.0.0.36

Project Title: 100 Grays Inn Rd

Design Number:

Notes / Reference: Roof Level South

Design Storm Event	1:100
Climate Change %	40%
Location	London
Roof Area m²	144.2
Additional Contributing Areas (m²)	
Total Catchment Area (m²)	**144.2**
Net Roof Area (m²)	120.0
Permitted Outflow (l/s)	0.180
Blue or Blue/Green Roof	Blue / Green
If B/G, Green Roof Type	Extensive
a. Permanent reservoir above or in storage void	None
b. Required Reservoir Depth (mm)	

Required Net Storm Storage Volume (m³)	13.34
Total Net Volume Required (m³)	13.34
Void Ratio	0.90
Selected depth of storage tank (mm)	125

R: l/s

M5-60: mm/h

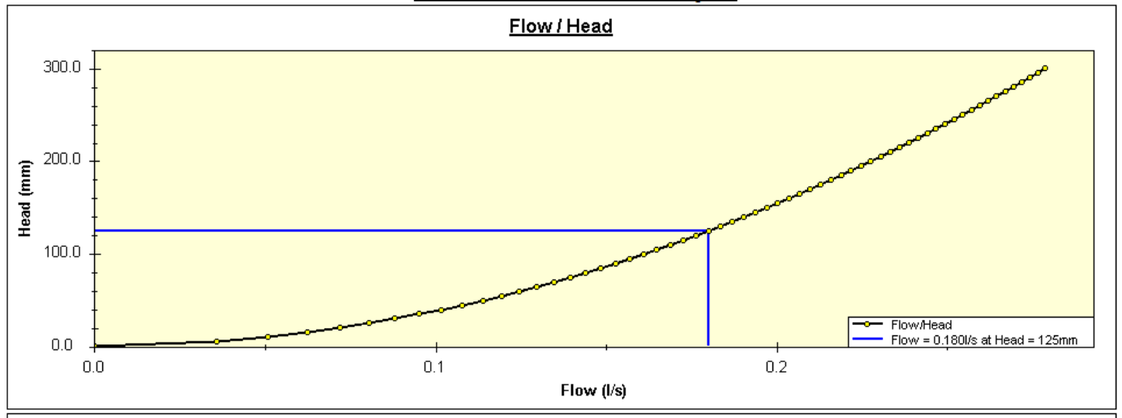
DURATION (mins)	INTENSITY (mm/h)	REQUIRED STORAGE VOLUME (m³)
5 mins	439.50	5.23
10 mins	261.51	6.18
15 mins	175.78	6.18
30 mins	113.09	7.83
1 hour	63.70	8.54
2 hours	44.10	11.42
4 hours	27.19	13.09
6 hours	19.91	13.34
10 hours	13.09	12.40
24 hours	6.08	5.48
48 hours	3.25	0.00

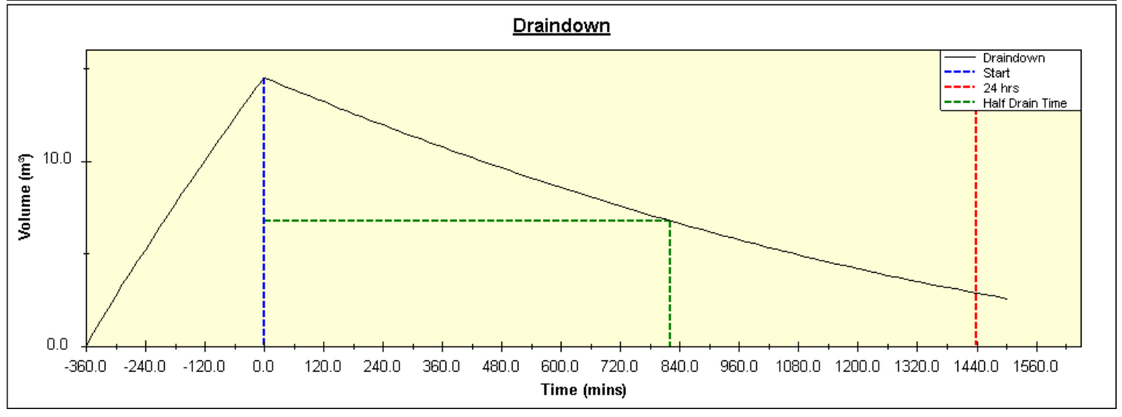
Structural Load Calculations

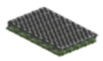
Item	kN/m²
Weight of Product (Tank / Cell)	0.154
Weight of Product (Tray)	0.000
Geotextile	0.004
Weight of Permanent Storage	0.000
Weight of Stormwater Storage	1.103

Half Draindown time: 822 mins

Level & Draindown Graphs





	Required (m²)	Depth (mm)	Gross Volume (m³)	Net Volume (m³)	Layers Required	Product No.	Description	Qty	Unit
	120.0	125	15.00	13.50	1	110002	RoofBloxx Tank 125	480	pcs
	120.0	30	3.60	3.42	1	110008	RoofBloxx Cell 30	480	pcs
	0	0	0	0	0			0	pcs
	0					110011	Capilliary Wicking Rope	0	Rolls
	126					27041	ACOTex Plus Protection Fleece (300gsm) 100 x 4.0m	1	Rolls
	126					27038	ACOTex Filter geotextile (125gsm) 100 x 4.0m	1	Rolls

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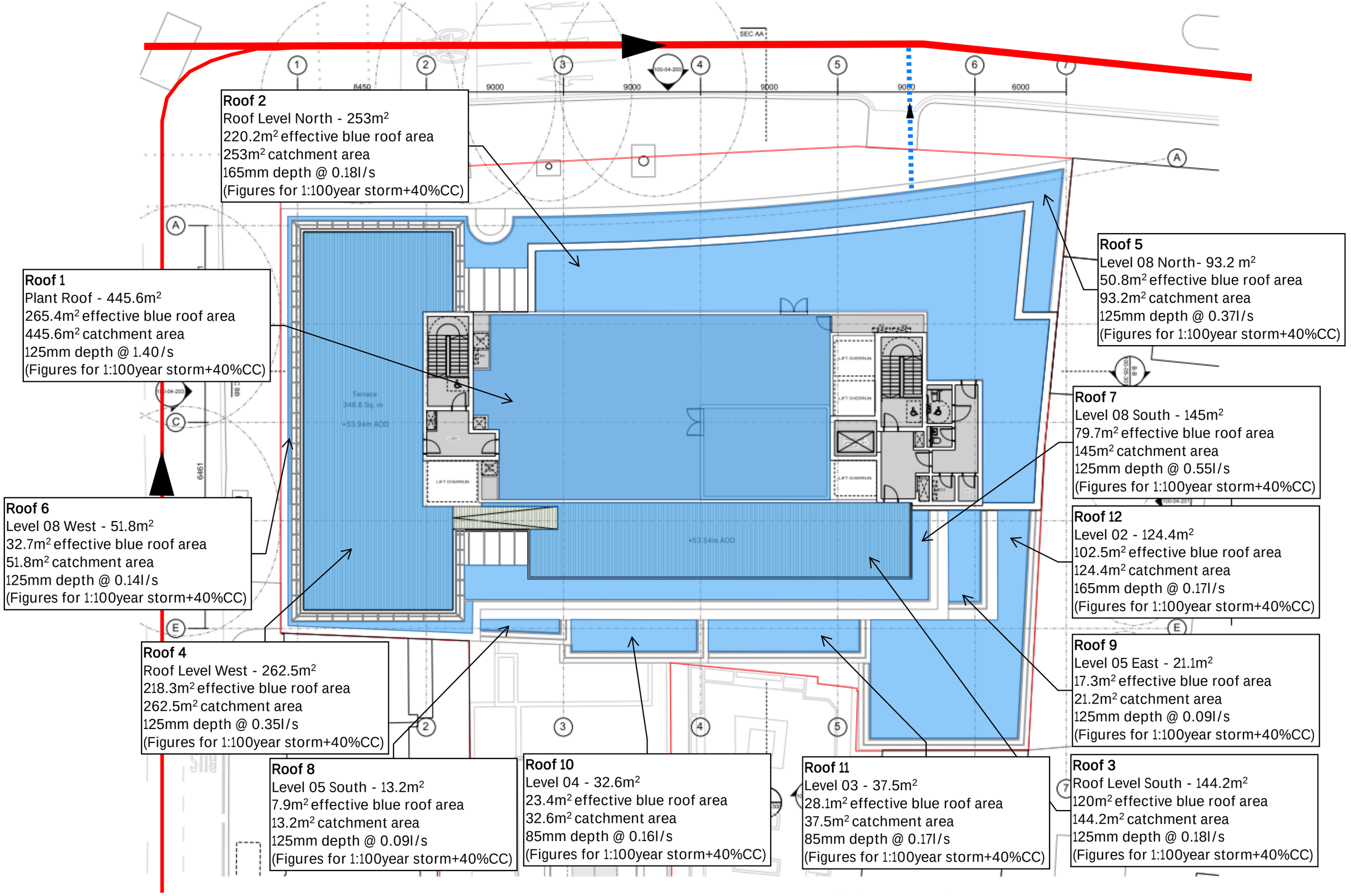
Appendix E

The proposed SuDS Strategy Layout



Roof 2
Roof Level North - 253m²
220.2m² effective blue roof area
253m² catchment area
165mm depth @ 0.18l/s
(Figures for 1:100year storm+40%CC)

Roof 1
Plant Roof - 445.6m²
265.4m² effective blue roof area
445.6m² catchment area
125mm depth @ 1.40/s
(Figures for 1:100year storm+40%CC)

Roof 5
Level 08 North- 93.2 m²
50.8m² effective blue roof area
93.2m² catchment area
125mm depth @ 0.37l/s
(Figures for 1:100year storm+40%CC)

Roof 7
Level 08 South - 145m²
79.7m² effective blue roof area
145m² catchment area
125mm depth @ 0.55l/s
(Figures for 1:100year storm+40%CC)

Roof 6
Level 08 West - 51.8m²
32.7m² effective blue roof area
51.8m² catchment area
125mm depth @ 0.14l/s
(Figures for 1:100year storm+40%CC)

Roof 12
Level 02 - 124.4m²
102.5m² effective blue roof area
124.4m² catchment area
165mm depth @ 0.17l/s
(Figures for 1:100year storm+40%CC)

Roof 4
Roof Level West - 262.5m²
218.3m² effective blue roof area
262.5m² catchment area
125mm depth @ 0.35l/s
(Figures for 1:100year storm+40%CC)

Roof 9
Level 05 East - 21.1m²
17.3m² effective blue roof area
21.2m² catchment area
125mm depth @ 0.09l/s
(Figures for 1:100year storm+40%CC)

Roof 8
Level 05 South - 13.2m²
7.9m² effective blue roof area
13.2m² catchment area
125mm depth @ 0.09l/s
(Figures for 1:100year storm+40%CC)

Roof 10
Level 04 - 32.6m²
23.4m² effective blue roof area
32.6m² catchment area
85mm depth @ 0.16l/s
(Figures for 1:100year storm+40%CC)

Roof 11
Level 03 - 37.5m²
28.1m² effective blue roof area
37.5m² catchment area
85mm depth @ 0.17l/s
(Figures for 1:100year storm+40%CC)

Roof 3
Roof Level South - 144.2m²
120m² effective blue roof area
144.2m² catchment area
125mm depth @ 0.18l/s
(Figures for 1:100year storm+40%CC)

Job	100 Grays Inn Road	Date	12.09.2022
Title	Drainage Strategy Plan	Eng.	TO'H
Job No.	2423	Sheet SK01	Rev. P1

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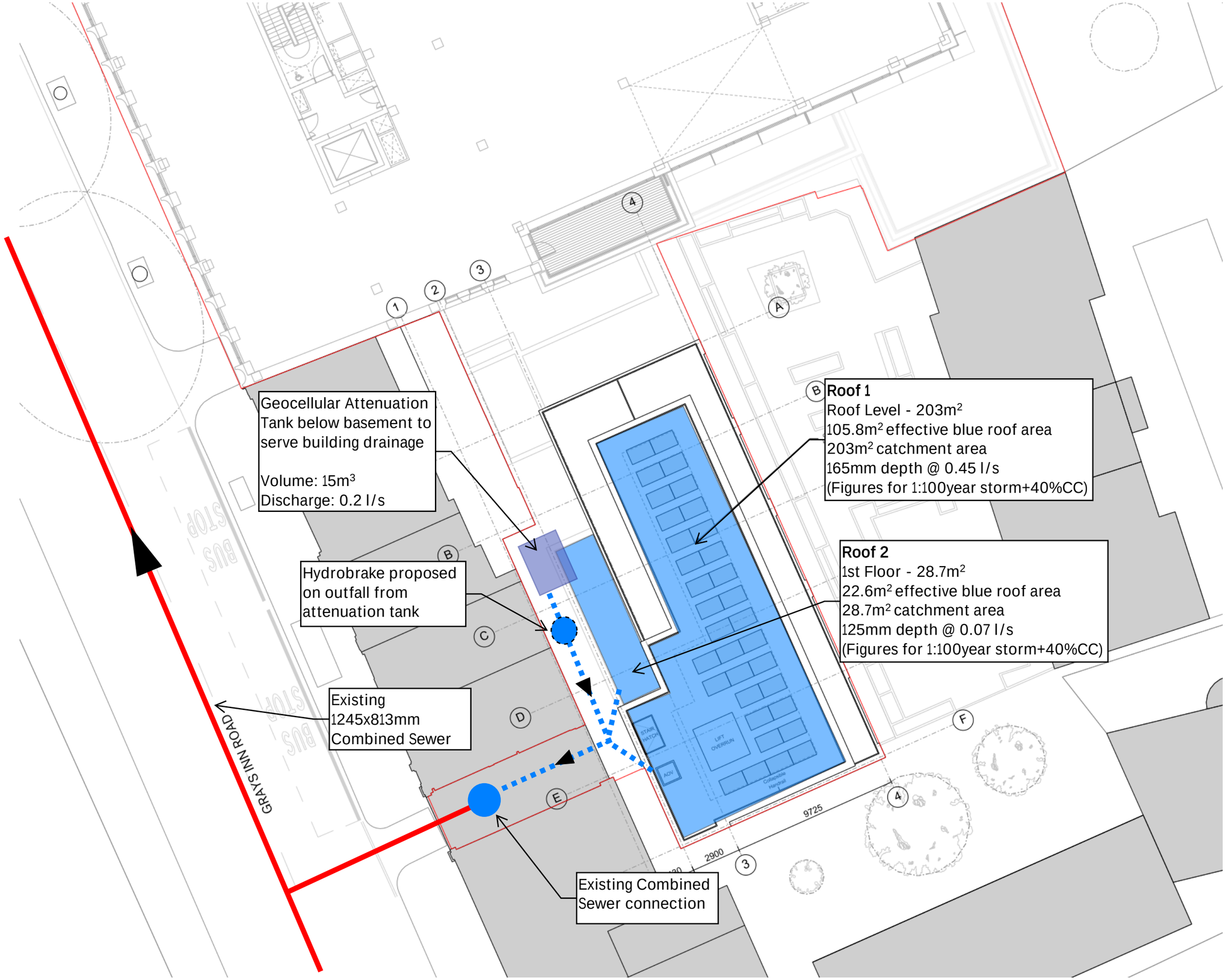

Job	88 Grays Inn Road			Date	09.09.2022
Title	Drainage Strategy Plan			Eng.	TO'H
Job No.	22423	Sheet	SK01	Rev.	P1

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Appendix F

Consultation with Thames Water

Appendix G

Drainage Maintenance Schedule

2423 – 88 Grays Inn Road
Date: September 2022
Prepared by: Thomas O'Hara

Drainage Inspection and Maintenance Strategy

This document has been prepared to support the inspection and maintenance of the proposed below ground drainage of the 100 & 88 Grays Inn Road site. The drainage network comprises surface and foul water drainage systems:

- Surface water network will route all the rainwater towards the existing combined sewer in Grays Inn Road. Blue/blue-green roofs surface water will also be routed towards the existing combined sewer in Grays Inn Road.
- Foul water network from above ground level will be routed towards the outfall manhole via gravity.

In accordance with CIRIA C625 it is recommended that a private SuDS maintenance agreement is undertaken as a simple contract between the property owner and the maintenance provider (the maintainer). It is mainly to facilitate continuing maintenance of the SuDS that are in private ownership. The maintenance requirements are in accordance with the CIRIA C753 SuDS Manual 2015 and product manufacturer's requirements.

The following Drainage / SuDS measures are proposed within the development:

- General Drainage:

Maintenance Period	Maintenance Task	Frequency
Regular maintenance	Inspect and identify areas that are not operating correctly. If required, take remedial action.	Monthly
	Inspect surface structures and covers removing obstructions and silt as necessary.	Monthly or as required
	Top-up traps to floor gullies and internal channel drains.	
	Check there is no physical damage.	
	Remove overgrown vegetation 1m min. around structures and keep hard aprons free from silt and debris.	
Occasional Maintenance	Remove sediment from pre-treatment structures (e.g. gullies, channels silt traps) and non-return valves.	Six-monthly or as required after large storm events
	Remove cover and inspect inside, ensuring water is flowing freely and that the exit route for water is unobstructed.	Annually or as required after large storm events.
	Remove debris and silt.	
	Undertake inspection after leaf fall in autumn.	
Remedial Actions	Repair/rehabilitation of inlets, outlets, overflows and vents.	As required
Monitoring	Inspect all manholes, inspection chambers, inlets, outlets, overflows and vents to ensure they are in good condition and operating as designed.	Annually or after large storms.

- Inlets, Outlets and Inspection Chambers:

Maintenance Period	Maintenance Task	Frequency
Regular Maintenance	Inspect surface structures and covers removing obstructions and silt as necessary.	Monthly or as required
	Check there is no physical damage. Remove overgrown vegetation 1m min. around structures and keep hard aprons free from silt and debris.	
	Remove cover and inspect inside, ensuring water is flowing freely and that the exit route for water is unobstructed. Remove debris and silt. Undertake inspection after leaf fall in autumn.	Annually
Occasional Maintenance	Check topsoil levels are 20mm above edges off baskets and chambers to avoid mower damage.	As necessary
Remedial Work	Unpack stone in basket features and unblock or repair and repack stone as design detail as necessary.	As required
	Repair physical damage is necessary.	

- Flow control Structures:

Maintenance Period	Maintenance Task	Frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action (for 3 months following installation).	Monthly
	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Six Monthly
	Remove sediment from pre-treatment structures.	
Monitoring	Inspect and carry out essential recovery works to return the feature to full working order.	Following all significant storm events

- Green / Blue / Brown Roofs:

Maintenance Period	Maintenance Task	Frequency
Regular Maintenance	During establishment, replace dead plants as required (for 12 months following installation).	Monthly
	Mow grasses (where required) and remove resultant clippings.	
	Remove fallen leaves and debris from deciduous plant foliage.	Six Monthly
	Remove nuisance and invasive vegetation, including weeds.	
	Remove debris & litter to prevent clogging of inlet drains and interference with plant growth.	
	Noxious weed treatment (3 times a year).	
Occasional Maintenance	Replace dead plants as required (typically in the Autumn).	Annually
	Inspect all components including soil substrate, vegetation, drains, irrigation systems (if applicable), membranes, and roof structure for proper operation, integrity of waterproofing and structural stability, act where required.	
	Inspect soil substrate for evidence of erosion channels and identify any sediment sources, act where required.	

	Inspect drain inlets to ensure unrestricted runoff from the drainage layer to the conveyance or roof drain system, act where required.	
	Inspect underside of roof for evidence of leakage, act where required.	
	Inspect and document the presence of wildlife.	
Remedial Action	Inspect and carry out essential recovery works to return the feature to full working order.	Following all significant storm events

- Permeable paving system:

Maintenance Period	Maintenance Task	Frequency
Regular maintenance	Inspect for sediment and debris in the inlet chambers and trim any roots that may be causing blockages.	Annually or as required based on inspections
	Cleaning of gutters and any filters on downpipes	
	Brushing and vacuuming (standard cosmetic sweep over whole surface).	Once a year, after autumn leaf fall, or as required,
Occasional maintenance	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying.	As required, based on inspections
Remedial Actions	Remedial work to any depressions, rutting, cracked or broken blocks considered detrimental to the permeable paving performance.	As required
	Rehabilitation of surface and upper substructure by remedial sweeping.	Every 10 to 15 years or as required
	Jet washing and suction cleaning will substantially reinstate pavement to 90% efficiency (CIRIA RP992).	As required
Monitoring	Initial inspection.	Monthly for three months after installation
	Inspect inspection chambers and note rate of sediment accumulation and establish appropriate brushing frequencies.	Monthly in the first year and then annually
	Inspect for evidence of poor operation and/or week growth – if required, take remedial action.	Annually
	Monitor effectiveness of permeable pavement and when water does not infiltrate immediately advise Client of possible need for reinstatement of top layers or specialist cleaning.	As required

Reference shall be made to CIRIA publication C753 (The SuDS Manual) and to the relevant maintenance guidance from the products manufacturers.

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FS 592987