

Planning ref: 51175/APP/2019/187,
51175/APP/2018/4260

RE: Officer Response to SuDS Amendment

Appendices:

Appendix A – HCC comments
Appendix B – TW confirmation of discharge rates
Appendix C – Updated Layouts
Appendix D – Blue Roof Specialist Calculations
Appendix E – MicroDrainage Calculations

1 Introduction

This report is in response to comments raised by Vicky Boorman, Flood and Water Specialist at London Borough of Hillingdon (LBH), regarding the drainage strategy for a development at 9 Nestles Avenue, Hayes. Full document with comments can be found in Appendix A of this report.

2. Water Efficiency and reuse

LBH Comment:

"The proposals state only: " There is potential to utilise an active rainwater harvesting system to minimise potable water usage for the building. However, its viability and technical feasibility will be further assessed at the detailed design stage".

This is not acceptable the proposals should establish the principles for the detailed design to work within. Without clear undertaking to deliver a smart system that can work by holding water back for reuse whilst discharging in advance of storms, this is often an element later dismissed."

HTS Response:

The M&E confirmed that the rainwater harvesting will not be possible due to lack of space at ground floor to accommodate the filtration plant, pumps and storage tank required for such a system (even if the tank is part of the below ground attenuation – using the smart system mentioned). The development will utilise green roofs with blue roof storage below, which will re-use the rainwater collected for irrigation. There is further opportunity to provide watering butts on balconies, but this method will need to be evaluated at detailed design.

3. Drainage Design

LBH Comment:

"A range of methods sustainable methods for drainage has been considered although the proposal still continues to include a substantial amount of storage provided for in the least favored option of tanks."

HTS Response:

In response to the comments, the design will now include additional blue roofs located at 4th, 5th, 7th and roof level. The permeable paving depth has also increased to provide additional attenuation, set at approximately 0.5m depth of storage (+ 0.25m for finishes) – to align invert levels with the tank. Please refer to HTS response to point 5 for summary of storage volumes used.

The below ground storage is proposed to help with reduction of the runoff rates. If the preference is to remove the tank from the design, then the discharge rate for the site will need to increase.

The additional blue roofs and permeable storage will allow the development to discharge at a rate of 1.5 l/s, which is significantly lower than the previous discharge rate of 3.7 l/s. The greenfield rate is unachievable due to depth of the sewers in the road.

4. Rates

LBH Comment:

"A 2ls discharge rate was initially indicated to require 125m³ in Rev A. Which was considered large and consultants indicated that a 2ls limiting discharge rate was not possible. So, 3.8 ls was chosen.

A flow limit of 2ls/ha is considered feasible and has been met by other applicants within Hillingdon.

The Thames Water response in Appendix J Dated 10 Sept 2018 also refers to not accepting a rate of 25l/s/ha. All rates should be considered per ha, and so the rate requested by Thames Water is actually lower than that indicated will be provided, as the site is approx. a quarter of a ha."

HTS Response:

Thames Water confirmed the rates specified by them refer to this site specifically and are in l/s, not l/s/ha. Please see correspondence attached in Appendix B.

The revised design will reduce the rates to 1.5 l/s. As the design utilized all available space for storage, no further reduction can be achieved, unless pumping solution is introduced.

See revised plans in Appendix C.

5. SuDs

LBH Comment:

"This storage was proposed to be provided through the provision of variety of methods:

- *A blue roof of 260m² attenuating 25m³ by ABG.*
- *Plus, 468m² of Green Roof Attenuation volume n/a*
- *As well as a shallow attenuation tank of 300mm depth providing 106m³ volume to accommodate Thames Water invert Levels.*
- *Permeable Paving across the site of 0.195m depth across 257m² 15m³ volume.*

It was noted that there was little resilience in this green roof actually increasing the dependence on watering of planter proposal by introducing raised planters. These areas could also be blue roof attenuation providing the additional storage the applicant appears to not be able to provide.

In Rev C, a table has been introduced summarising the proposals. Comparing these: Blue Roof remains the same size, the tank has reduced in size from 106 to 86m³. Permeable paving has remained the same.

The overall attenuation volume 126m³ is provided which was stated was not possible to be accommodated in rev A.

Appendix G However of Rev C still shows the Tank provision at the same rate as rev A of 106m³ and provides limited information on the overflows required to ensure the blue roof operates safely and is designed in detail appropriately.

Appendix H contains the Hillingdon proforma. This suggests that a storage volume of 246m³ is required to provide the adequate government standards to design for the 1 in 100 year plus 40% allowance for climate change. It is not provided in this application."

HTS Response:

The table within the report had a typo, which was missed during the issue of the report, hence the volumes may not have lined up with what was being proposed.

As suggested, blue roof attenuation on additional floors will be introduced which will increase the volume of storage provided onsite. The blue roof will be used to restrict the flow from its' own footprint.

As the design relies on various forms of attenuation, the efficiency of the system reduces. Hence even though the 146m³ of storage indicated to theoretically reduce the runoff to greenfield runoff rates could be achieved – as demonstrated below the site provides 189m³ of attenuation – the discharge rate from site continues to be above the QMED of 0.9 l/s.

Medium	Catchment Area	Attenuation Volume	Discharge Rate
Blue Roofs	695 m ²	67 m ³	1.8 l/s (4 x roofs @ 0.4-0.5 l/s each), routed towards the attenuation tank / permeable paving.
Geocellular Tank	1085 m ² (combined with permeable paving) + blue roofs from above	86 m ³	1.5 l/s – limited via hydrobrake.
Permeable Paving	1085 m ² (combined with attenuation tank) + blue roofs from above	36 m ³	
Green roofs	630 m ²	N/A	N / A
Total	1,780 m ²	189 m ³	1.5 l/s

The revised drainage system will route the blue roof discharges towards the hydrobrake manhole, which will restrict the flow further – utilising the below ground storage provided. This allows for a much more efficient design which is able to reduce the total site discharge to 1.5 l/s.

Calculations from Blue Roof manufacturer and MicroDrainage calculations can be seen in Appendices D and E of this report.

6. Summary

LBH Comment:

"It is not clear why blue roof cannot be expanded to be incorporated within with rest of the roof area, particularly providing resilience for raised planters and re use of water for these landscaped areas allowing them to draw up the water needed.

Clarification of the Thames Water requirement should be provided.

Further revision and clarification to be undertaken which could allow a statement of common ground to be agreed."

HTS Response:

As recommended, additional blue roof storage will be provided below landscaped areas.

Thames water confirmed that the rate referred specifically to this site, taking consideration of the site area, hence the rate of 2.0–3.7 l/s is acceptable. The updated design – due to increase in permeable paving and blue roof attenuation reduces the runoff to 1.5 l/s. Hence the discharge rate is acceptable.

7. Landscaping to the front of the site

LBH Comment:

"A 5 m buffer has not been incorporated within the drainage design for the site, as it is presumed that this is anticipated to be handed over to LBH. However, this remains part of the site.

The frontage of the development must be drained sustainably through as indicated rain garden type arrangement. However the landscaping arrangement of section 2.4 is not acceptable as design of this whole area of frontage needs to take into account best practice and other environmental factors which require a green buffer zone alongside the road way prior to any footway and cycleway and so proposals for this area will need to be revised significantly and the footway cycleway integrated within the development which also links with the wider developments either side and may mean amendments to the landscaping proposals in this area.

As there are still details to be finalised particularly to the frontage area and if permitted an appropriate sustainable drainage condition should be implemented and a separate landscaping condition requested specifically integrating highways and landscaping and drainage for the frontage area.

If this appear is to be allowed, a separate condition must be required to isolate any landscaping required within the plot to secure the required need for appropriate pedestrian and cycle ways which may need to be included within the landscaping rather than alongside Nestle avenue to meet best practice.

This is particularly important where cycle and pedestrian routes are expected to be hardstanding at the front of the site and the landscaped area will need to incorporate the drainage arrangement appropriate to deal with the additional hardstanding.

As previously indicated the proposed layby, within that area will impact on the provision of any cycling and pedestrian route required along Nestle Avenue and should not be allowed, and hence the need for the front of site to be separated as a phase with its only landscaping and drainage condition attached."

HTS Response:

HTS report does not have section 2.4, believe comment is directed towards the Landscape Architect. As suggested, a planning condition could be added to ensure these requirements are met.

8. Conclusions

LBH Comment:

"There is still a confused provision of calculations and sizing of storage contradicting each other through the revised application. With a few further revisions it is achievable for these to be refined so that a Statement of common ground could be entered into and an appropriate condition agreed for detailed design stage.

As detailed design evolves as the applicant acknowledges the design may need to change. So, to give the applicant the opportunity to refine these details and ensure that it continues to meet current standards and it maximises the opportunity to include SuDs, therefore the following condition would be requested:

Prior to commencement, (excluding demolition and site clearance) a scheme for the provision of sustainable water management shall be submitted to, and approved in writing by the Local Planning Authority.

The scheme shall follow the strategy set out in 'Flood Risk Assessment' and 'Surface Water Drainage Strategy', produced by XXXdated XXXRef or Revision XXX

The scheme shall clearly demonstrate how it, Manages Water and demonstrate ways of controlling the surface water on site by providing information on:

a) Suds features

- I. incorporating sustainable urban drainage (SuDs) in accordance with the hierarchy set out in Policy 5.13 of the London Plan. Where the proposal does not utilise the most sustainable solution, justification must be provided,*
- II. calculations showing storm period and intensity and volume of storage required to control surface water and size of features to control that volume to Greenfield run off rates at a variety of return periods including 1 in 1 year, 1 in 30, 1 in 100, and 1 in 100 plus Climate change,*
- III. where identified in an area at risk of surface water flooding, include additional provision within calculations for surface water from off site,*
- IV. where it is intended to have above ground storage, overland flooding should be mapped, both designed and exceedance routes above the 100, plus climate change, including flow paths depths and velocities identified as well as any hazards, (safe access and egress must be demonstrated).*

b) Capacity of Receptors

- I. Demonstration that the proposals connect into a proper and functioning Thames Water network, ie that the point a proposal connects into is part of a wider network, and the applicant provides details of the approval and any appropriate upgrades will be undertaken from Thames Waters free pre-planning service,*
- II. Where infiltration techniques (soakaway) or a basement are proposed a site investigation must be provided to establish the level of groundwater on the site, and to demonstrate the suitability of infiltration techniques proposed on the site. (This should be undertaken at the appropriate time of year as groundwater levels fluctuate),*
- III. Where groundwater is found within the site and a basement is proposed suitable mitigation methods must be provided to ensure the risk to others is not increased.*
- IV. identify vulnerable receptors, i.e. WFD status and prevent pollution of the receiving groundwater and/or surface waters through appropriate methods,*

c) Minimise water use

- I. incorporate water saving measures and equipment*
- II. provide details of how rain and or grey water will be recycled and reused in the development.*

Thereafter the development shall be implemented and retained/maintained in accordance with these details for as long as the development remains in existence."

HTS Response:

Ai. Hierarchy evaluated within the FRA.

Aii. Calculations supplied as part of the FRA, additional calculations (addressing the changes in design) included as part of this response.

Aiii. Site not at risk of surface water flooding.

Aiv. Overland flows included as part of this response. – See Appendix C.

Bi. TW approved discharge rates for the site.

Bii. N/A

Biii. N/A

Biv. N/A.

Ci. Blue roof & green roofs will be implemented to utilize the water for irrigation, additionally potential to use rainwater butts will be evaluated at the detailed stages of the design.

Cii. As point Ci. above.

APPENDIX A – Comments from Hillingdon CC



Planning Specialist Observations			
Specialism(s)	Water and Blue Ribbon		
Officer	Vicky Boorman		
Site	STANFORD HOUSE, 9 NESTLES AVENUE HAYES		
Proposal	Demolition of existing buildings and redevelopment to provide a building up to 10 storeys, comprising 84 (44 x 1 bed, 28 x 2 bed and 12 x 3 bed) Build to Rent residential units, associated landscaping, access, car parking and cycle parking Appealed Demolition of existing building and redevelopment to provide a building up to 10 storeys, with 868 sq.m of commercial or community space (Use Class B1 or D1) at ground floor level and 81 (44 x 1-bed, 28 x 2-bed and 9 x 3-bed) residential units to the upper floors, with associated landscaping, access, car parking and cycle parking. Not appealed		
Planning Ref	51175/APP/2019/187 51175/APP/2018/4260	Date	31/07/2019

Objection	Condition	Informative	No Comments	Discharge of Condition

Observations

The Flood Risk Assessment produce by **Heyne Tillet Steel** dated **19 Dec 2018 Rev A** Job no 20106 was provided with the application.

A revised FRA has now been submitted dated **17th July 2019 Rev C**

There is no summary of the changes that have been made so it the two plans have been compared to find the changes made:

The site is approximately 0.25 ha.

Both FRA referred to as Rev A and Rev C proposed to control surface water to 3.8ls from the site which is 0.25 ha for the 1 in 100 year plus climate change allowance.

The QMED Urban Greenfield rate for the site was calculated to be 0.9 l/sec, using MicroDrainage software. Extract can be seen in Appendix H.



Water Efficiency and reuse

The proposals state only : *There is potential to utilise an active rainwater harvesting system to minimise potable water usage for the building. However, its viability and technical feasibility will be further assessed at the detailed design stage.*

This is not acceptable the proposals should establish the principles for the detailed design to work within. Without clear undertaking to deliver a smart system that can work by holding water back for reuse whilst discharging in advance of storms, this is often an element later dismissed.

Drainage Design

A range of methods sustainable methods for drainage has been considered although the proposal still continue to include a substantial amount of storage provided for in the least favoured option of tanks.

Rates

A 2ls discharge rate was initially indicated to require 125m³ in Rev A. Which was considered large and consultants indicated that a 2ls limiting discharge rate was not possible. So 3.8 ls was chosen.

A flow limit of 2ls/ha is considered feasible and has been met by other applicants within Hillingdon.

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SuDs

This storage was proposed to be provided through the provision of variety of methods:

- A blue roof of 260m² attenuating **25m³** by ABG.
- Plus 468m² of Green Roof Attenuation volume n/a
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It was noted that there was little resilience in this green roof actually increasing the the dependence on watering of planter proposal by introducing raised planters - These areas could also be blue roof attenuation providing the additional storage the applicant appears to not be able to provide.

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The overall attenuation volume 126m³ is provided which was stated was not possible to be accommodated in rev A.

Appendix G However of Rev C still shows the Tank provision at the same rate as rev A of 106m³ and provides limited information on the overflows required to ensure the blue roof operates safely and is designed in detail appropriately.

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Summary

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Clarification of the Thames Water requirement should be provided.

Further revision and clarification to be undertaken which could allow a statement of common ground to be agreed.

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Conclusions

There is still a confused provision of calculations and sizing of storage contradicting each other through the revised application. With a few further revisions it is achievable for these to be refined so that a Statement of common ground could be entered into and an appropriate condition agreed for detailed design stage.

As detailed design evolves as the applicant acknowledges the design may need to change. So to give the applicant the opportunity to refine these details and ensure that it continues to meet current standards and it maximises the opportunity to include SuDs, therefore the following condition would be requested:

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The scheme shall clearly demonstrate how it manages water and demonstrate ways of controlling the surface water on site by providing information on:

a) SuDs features:

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- ii. calculations showing storm period and intensity and volume of storage required to control surface water and size of features to control that volume to **Greenfield runoff rates** at a variety of return periods including 1 in 1 year, 1 in 30, 1 in 100, and 1 in 100 plus Climate change,
- iii. where identified in an area at risk of surface water flooding, include additional provision within calculations for surface water from off site
- iv. where it is intended to have above ground storage, overland flooding should be mapped, both designed and exceedance routes above the 100, plus climate change, including flow paths depths and velocities identified as well as any hazards, (safe access and egress must be demonstrated).



b) Capacity of Receptors

- i. Demonstration that the proposals connect into a proper and functioning **Thames Water network**, ie ie that the point a proposal connects into is part of a wider network, and the applicant provides details of the approval and any appropriate upgrades will be undertaken from Thames Waters free [pre planning service](#).
- ii. Where infiltration techniques (soakaway) or a basement are proposed a site investigation must be provided to establish the level of groundwater on the site, and to demonstrate the suitability of infiltration techniques proposed on the site. (This should be undertaken at the appropriate time of year as groundwater levels fluctuate).
- iii. Where groundwater is found within the site and a basement is proposed suitable mitigation methods must be provided to ensure the risk to others is not increased.
- iv. identify vulnerable receptors, ie WFD status and prevent pollution of the receiving groundwater and/or surface waters through appropriate methods;

c) Minimise water use.

- i. incorporate water saving measures and equipment.
- ii. provide details of how rain and or grey water will be recycled and reused in the development.

Thereafter the development shall be implemented and retained/maintained in accordance with these details for as long as the development remains in existence.

REASON

To ensure that surface water run off is controlled to ensure the development does not increase the risk of flooding contrary to:

- Policy EM6 Flood Risk Management in Hillingdon Local Plan: Part 1- Strategic Policies (Nov 2012),
- *Policy DME1 10 Water Management, Efficiency and Quality in emerging Hillingdon Local Plan Part 2 Development Management Policies (with modifications March 2019)*
- Policy 5.12 Flood Risk Management of the London Plan (March 2016) and
- London Plan Policy 5.13 Sustainable Drainage (March 2016), and
- London Plan Policy 5.15 Water use and supplies. (March 2016).
- National Planning Policy Framework (June 2019), and the
- Planning Practice Guidance (Flood Risk and Coastal Change March 2014).

Landscaping and drainage to the front of Stanford House: To be recommended by Landscape Architect.

Name Vicky Boorman

Title Flood and Water Specialist

APPENDIX B – Confirmation from Thames Water

Karol Gyba

From: Siva Sivarajan <Siva.Sivarajan@thameswater.co.uk>
Sent: 07 August 2019 10:09
To: Karol Gyba; Developer Services
Cc: Carmel Lennon
Subject: RE: RE: 9 Nestles Avenue - Pre-development Enquiry

Dear Karol

I refer to your query;

As stated in the consent letter the permissible discharge rate is in l/s; ie 3.8 l/s in total;

Regds

Siva Sivarajan

Developer Services- Wastewater Adoptions Engineer
Office: 0203 577 7752 Mobile: 07747642603
siva.sivarajan@thameswater.co.uk

Get advice on making your sewer connection correctly at connectright.org.uk

Thames Water Utilities Ltd, Clearwater Court, Vastern Road, Reading, Berkshire, RG1 8DB
Find us online at developers.thameswater.co.uk

Find us online at developers.thameswater.co.uk



From: Karol Gyba <KGyba@hts.uk.com>
Sent: 06 August 2019 15:09
To: Developer Services <developer.services@thameswater.co.uk>
Cc: Siva Sivarajan <Siva.Sivarajan@thameswater.co.uk>; Carmel Lennon <CLennon@hts.uk.com>
Subject: RE: RE: 9 Nestles Avenue - Pre-development Enquiry

Good afternoon Siva,

I tried calling to discuss, but could not get through. We are working on the development with the attached pre-planning approval.

As you suggested in the letter, we are aiming to limit the surface water runoff rate to up to 3.8 l/sec for the site (site measures 0.224Ha). To clarify a confusion during the planning process, could you please confirm that the rate suggested is in l/sec specifically for this site, not in l/sec/ha, and that the sewer in the road will have capacity for this discharge rate.

Regards,
Karol Gyba

HEYNE TILLET STEEL

4 Pear Tree Court, T: 020 7870 8050
London, EC1R 0DS
hts.uk.com

From: DEVELOPER.SERVICES@THAMESWATER.CO.U <DEVELOPER.SERVICES@THAMESWATER.CO.UK>
Sent: 11 September 2018 11:28
To: Karol Gyba <KGyba@hts.uk.com>
Subject: RE: 9 Nestles Avenue - Pre-development Enquiry [Filed 12 Oct 2018 15:45]

response attached; for your perusal and consideration

regds

Siva Sivarajan

Developer Services- Wastewater Adoptions Engineer
[Office:0203 577 7752](tel:02035777752) Mobile: 07747642603
siva.sivarajan@thameswater.co.uk

Thames Water Utilities Ltd, Clearwater Court, Vastern Road, Reading, Berkshire, RG1 8DB
Find us online at developers.thameswater.co.uk



Original Text

From: Karol Gyba <KGyba@hts.uk.com>
To: developer.services@thameswater.co.uk <developer.services@thameswater.co.uk>
CC:
Sent: 30.08.18 10:42:06
Subject: 9 Nestles Avenue - Pre-development Enquiry

Good morning,

Please see attached pre-development enquiry form for a site located at 9 Nestles Avenue, Hayes, UB3 4SA.

Attached are also associated proposed architectural layouts and topographical survey of the existing site. Please let me know if there's any more information you require.

Kind regards,

Karol Gyba

HEYNE TILLET STEEL

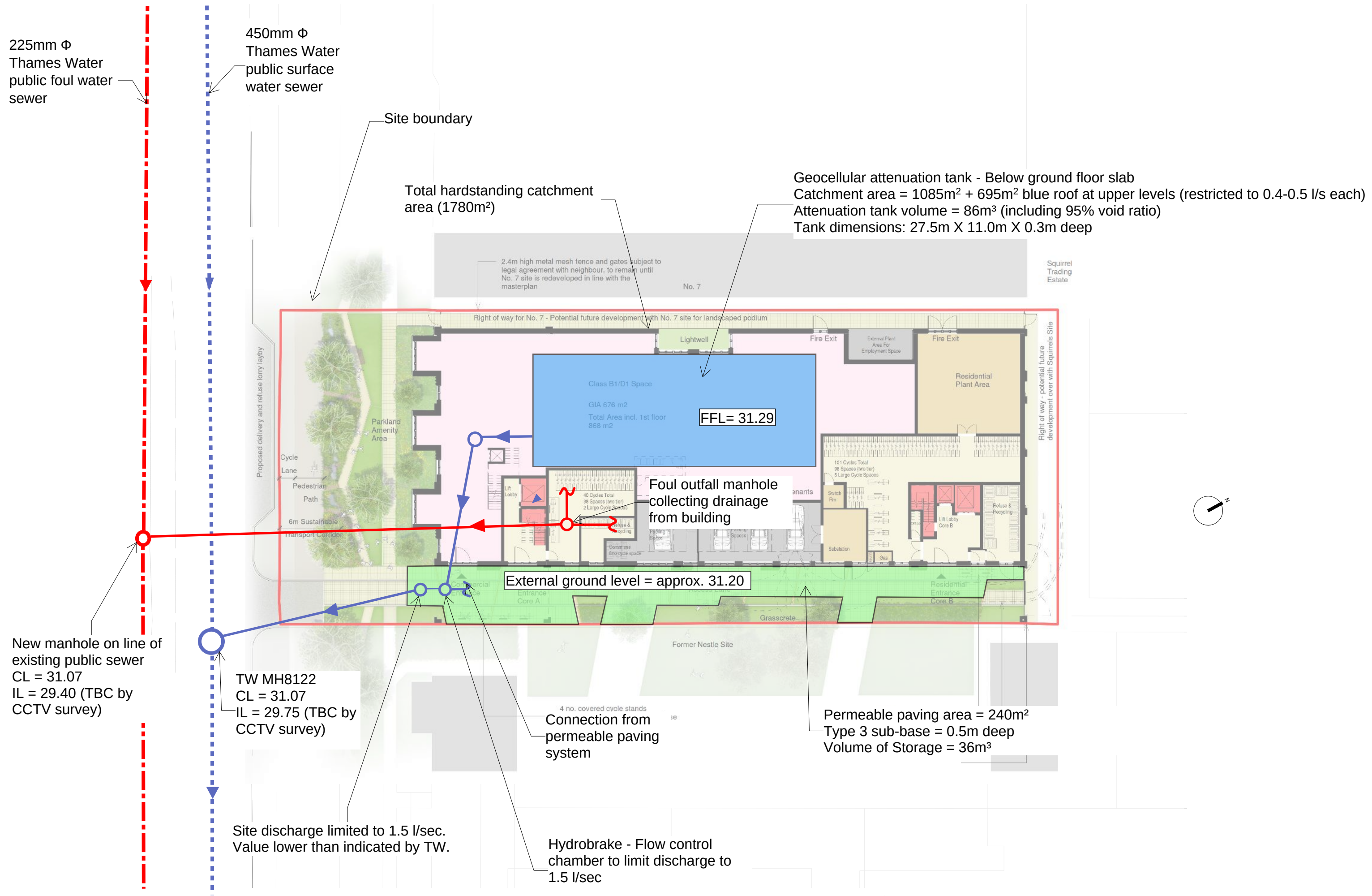
4 Pear Tree Court, T: 020 7870 8050
London, EC1R 0DS
hts.uk.com

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Visit us online www.thameswater.co.uk , follow us on twitter www.twitter.com/thameswater or find us on www.facebook.com/thameswater. We're happy to help you 24/7.

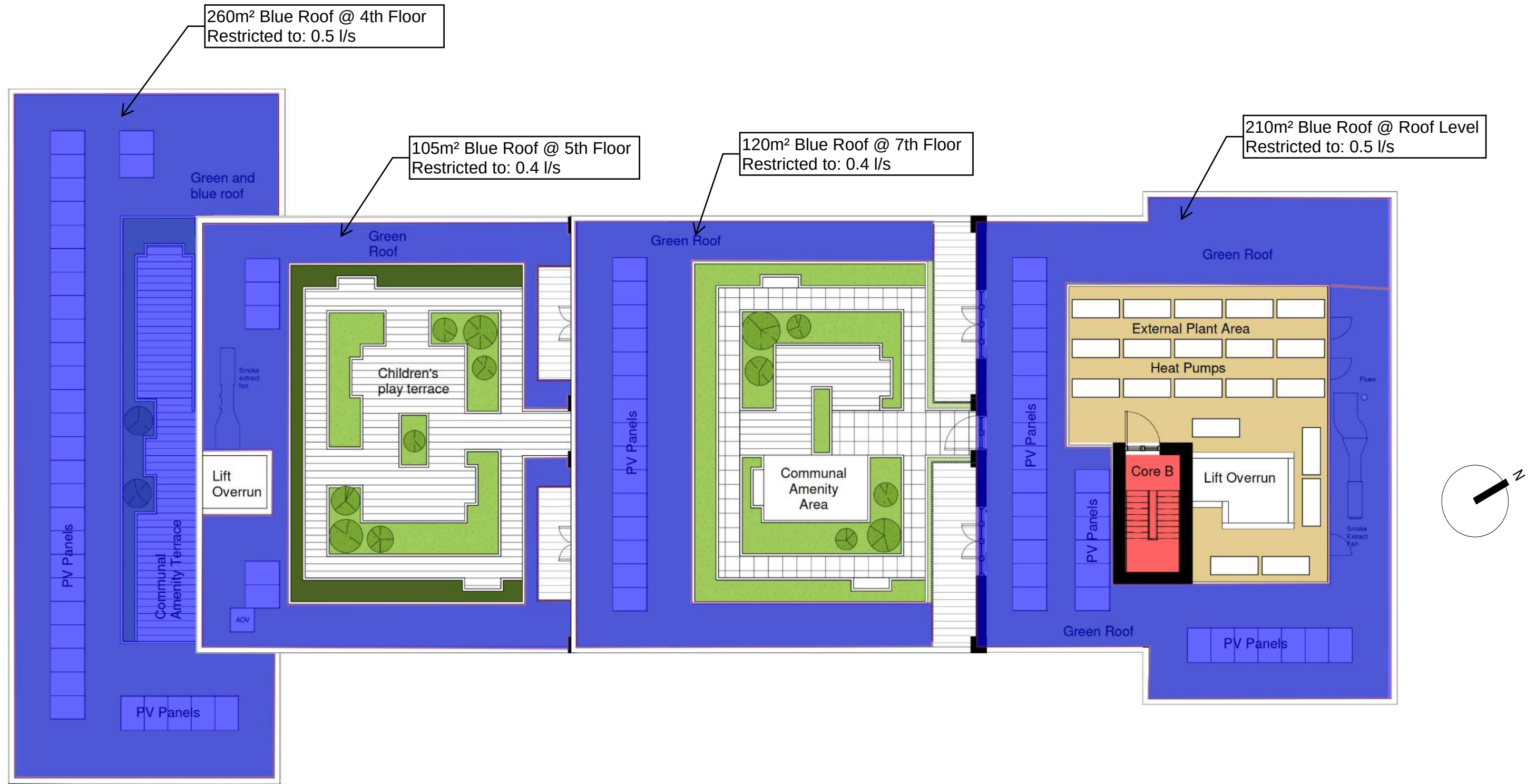
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APPENDIX C – Revised Layouts



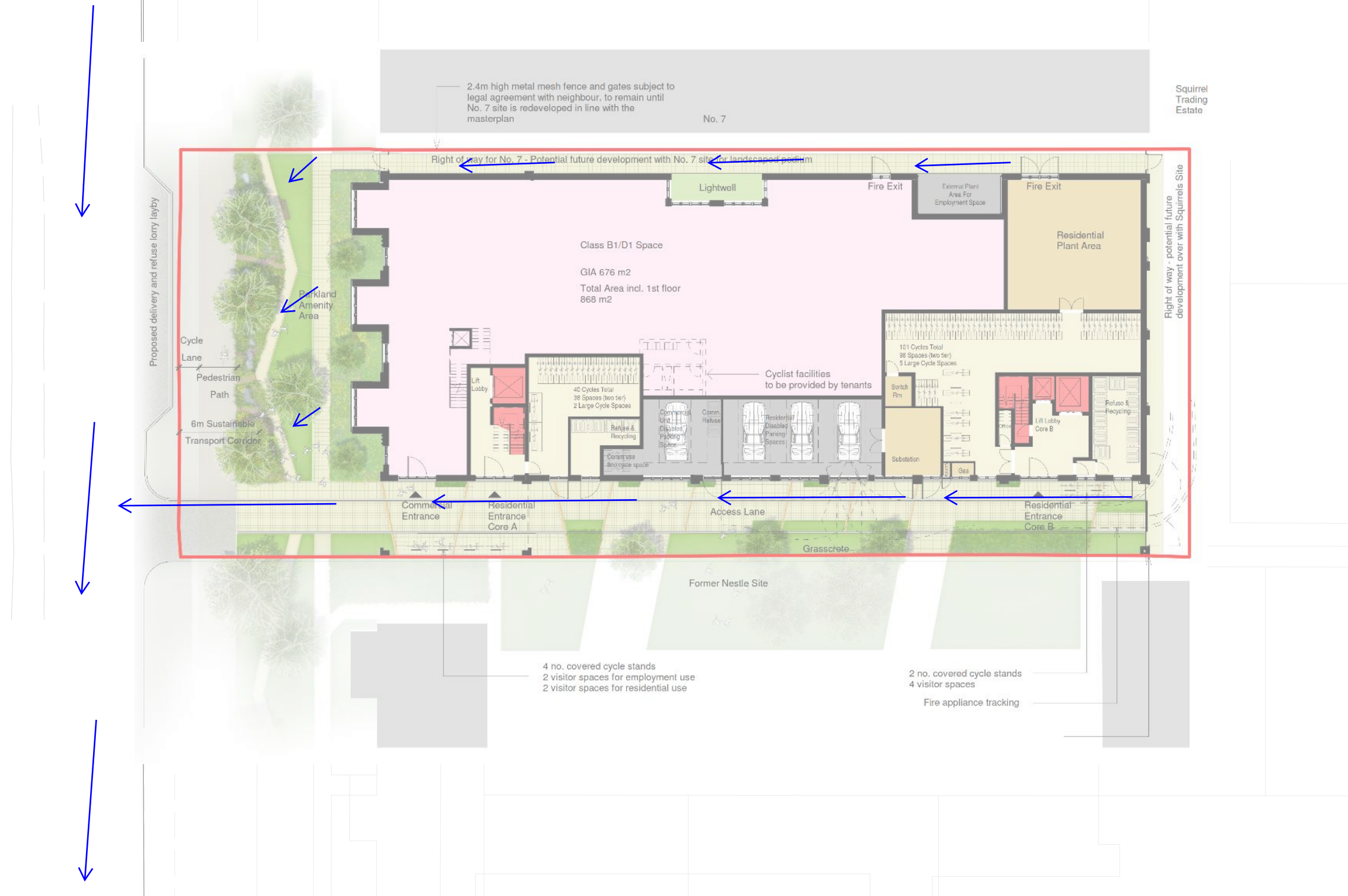
Job	9 Nestles Avenue	Date	03.09.2019
Title	Preliminary drainage strategy-Below ground drainage	Eng.	KG
Job No.	2006	Sheet	SK001
		Rev.	P4





KEY

← Direction of Iflow



Job 9 Nestles Avenue

Date 03.09.2019

Title Overland Flows

Eng. KG

Job No. 2006

Sheet SK003

Rev. P2

APPENDIX D – Blue Roof Calculations

BLUE ROOF STORAGE AND OUTFLOW SUMMARY

PRIVATE & CONFIDENTIAL - NOT FOR DISTRIBUTION

Project Name:	9 Nestles Avenue, Hayes, UB3 4SA - Roof 1		
Prepared for:	Heyne Tillett Steel, London		
Date:	29/11/2018		
ABG Project ID:	16080	Calculator version:	1.18
Prepared by:	Andrew Keer, andrew@abgltd.com, 07525-808700		
Notes/description:	Combined amenity terrace & green roof/lawn, surface finish - sedum mat/lawn turf - TBC. Pedestrian/amenity access only. Warm/inverted roof construction, with zero falls - TBC.		

Input Parameters - Rainfall Information (Flood Estimation Handbook 2013)

Return period:	100 years	As supplied by Client
Allowance for Climate Change:	40 %	As supplied by Client
OS grid reference selected for FEH data:	TQ 10400 78800	

Input Parameters - Roof Information

Catchment area:	260 m ²	As supplied by Client
Storage area:	260 m ²	As supplied by Client
Maximum allowable runoff:	0.5 l/s	As supplied by Client

Output - Rainfall Calculation

Duration	Time to Empty	Restricted Outflow (l/s)
15 mins	9 hours and 0 minutes	0.3
30 mins	11 hours and 40 minutes	0.4
1 hour	13 hours and 50 minutes	0.4
2 hours	16 hours and 0 minutes	0.4
4 hours	17 hours and 30 minutes	0.5
6 hours	17 hours and 40 minutes	0.5
10 hours	16 hours and 40 minutes	0.5
24 hours	11 hours and 10 minutes	0.3
48 hours	2 hours and 40 minutes	0.1

Total storage required: 21.3 m³
Half empty time: 5 hours and 40 minutes.

Output - Recommended Blue Roof System

System Name:	ABG bluroof VF HD 108mm/129mm
Description:	The blue roof depth of 129mm, includes for a 25mm reservoir board. 2 no. control positions TBC by design team, and also with the structural engineer's deflection analysis.

Total storage capacity:	25.2 m ³
Number of Blue Roof outlets:	2

- Notes:
1. This document contains an estimate which has been prepared by ABG Ltd and is illustrative only and not a detailed design.
 2. Further details on the theories used in this estimate are available upon request from ABG. The values given are indicative and correspond to nominal results obtained in our laboratories and testing institutes. In line with our policy of continuous improvement the right is reserved to make changes without notice at any time.
 3. This estimate is specific to the characteristics of ABG products and is not applicable to other products.
 4. The copyright in this document belongs to ABG Ltd.
 5. The estimate given in this report is based on the stated parameters as per the brief. If these parameters are not correct or have changed, ABG should be contacted to provide a revised estimate.
 6. No guarantee or liability can be drawn from the information in this report.
 7. Final determination of the suitability of any information is the sole responsibility of the user. ABG will be pleased to discuss the use of this or any other product but responsibility for selection of a material and its application in any specific project remains with the user.

BLUE ROOF STORAGE AND OUTFLOW SUMMARY

PRIVATE & CONFIDENTIAL - NOT FOR DISTRIBUTION

Project Name:	9 Nestles Avenue, Hayes, UB3 4SA - 5th floor		
Prepared for:	Heyne Tillett Steel, London		
Date:	23/08/2019		
ABG Project ID:	16080	Calculator version:	1.18
Prepared by:	Kirstin, 01484 354844, kirstin@abgltd.com		
Notes/description:	Combined amenity terrace & green roof/lawn, surface finish - sedum mat/lawn turf - TBC. Pedestrian/amenity access only. Warm/inverted roof construction, with zero falls - TBC.		

Input Parameters - Rainfall Information (Flood Estimation Handbook 2013)

Return period:	100 years	As supplied by Client
Allowance for Climate Change:	40 %	As supplied by Client
OS grid reference selected for FEH data:	TQ 10400 78800	

Input Parameters - Roof Information

Catchment area:	106 m ²	As supplied by Client
Storage area:	106 m ²	As supplied by Client
Maximum allowable runoff:	0.5 l/s	As supplied by Client

Output - Rainfall Calculation

Duration	Time to Empty	Restricted Outflow (l/s)
15 mins	3 hours and 40 minutes	0.3
30 mins	4 hours and 40 minutes	0.3
1 hour	5 hours and 20 minutes	0.4
2 hours	5 hours and 50 minutes	0.4
4 hours	5 hours and 50 minutes	0.4
6 hours	5 hours and 20 minutes	0.4
10 hours	3 hours and 50 minutes	0.3
24 hours	0 hours and 10 minutes	0.1
48 hours	0 hours and 0 minutes	0.0

Total storage required: 6.5 m³
Half empty time: 1 hours and 0 minutes.

Output - Recommended Blue Roof System

System Name:	ABG bluroof VF HD 108mm/129mm
Description:	The blue roof depth of 129mm, includes for a 25mm reservoir board. 2 no. control positions TBC by design team, and also with the structural engineer's deflection analysis.

Total storage capacity:	10.2 m ³
Number of Blue Roof outlets:	2

Notes:

1. This document contains an estimate which has been prepared by ABG Ltd and is illustrative only and not a detailed design.
2. Further details on the theories used in this estimate are available upon request from ABG. The values given are indicative and correspond to nominal results obtained in our laboratories and testing institutes. In line with our policy of continuous improvement the right is reserved to make changes without notice at any time.
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6. No guarantee or liability can be drawn from the information in this report.
7. Final determination of the suitability of any information is the sole responsibility of the user. ABG will be pleased to discuss the use of this or any other product but responsibility for selection of a material and its application in any specific project remains with the user.



BLUE ROOF STORAGE AND OUTFLOW SUMMARY

PRIVATE & CONFIDENTIAL - NOT FOR DISTRIBUTION

Project Name:	9 Nestles Avenue, Hayes, UB3 4SA - 5th floor		
Prepared for:	Heyne Tillett Steel, London		
Date:	23/08/2019		
ABG Project ID:	16080	Calculator version:	1.18
Prepared by:	Kirstin, 01484 354844, kirstin@abgltd.com		
Notes/description:	Combined amenity terrace & green roof/lawn, surface finish - sedum mat/lawn turf - TBC. Pedestrian/amenity access only. Warm/inverted roof construction, with zero falls - TBC.		

Input Parameters - Rainfall Information (Flood Estimation Handbook 2013)

Return period:	100 years	As supplied by Client
Allowance for Climate Change:	40 %	As supplied by Client
OS grid reference selected for FEH data:	TQ 10400 78800	

Input Parameters - Roof Information

Catchment area:	120 m ²	As supplied by Client
Storage area:	120 m ²	As supplied by Client
Maximum allowable runoff:	0.5 l/s	As supplied by Client

Output - Rainfall Calculation

Duration	Time to Empty	Restricted Outflow (l/s)
15 mins	4 hours and 10 minutes	0.3
30 mins	5 hours and 10 minutes	0.3
1 hour	6 hours and 10 minutes	0.4
2 hours	6 hours and 50 minutes	0.4
4 hours	6 hours and 50 minutes	0.4
6 hours	6 hours and 20 minutes	0.4
10 hours	5 hours and 0 minutes	0.3
24 hours	0 hours and 30 minutes	0.1
48 hours	0 hours and 0 minutes	0.0

Total storage required: 7.7 m³
Half empty time: 1 hours and 20 minutes.

Output - Recommended Blue Roof System

System Name:	ABG bluroof VF HD 108mm/129mm
Description:	The blue roof depth of 129mm, includes for a 25mm reservoir board. 2 no. control positions TBC by design team, and also with the structural engineer's deflection analysis.

Total storage capacity:	11.6 m ³
Number of Blue Roof outlets:	2

Notes:

1. This document contains an estimate which has been prepared by ABG Ltd and is illustrative only and not a detailed design.
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BLUE ROOF STORAGE AND OUTFLOW SUMMARY

PRIVATE & CONFIDENTIAL - NOT FOR DISTRIBUTION

Project Name:	9 Nestles Avenue, Hayes, UB3 4SA - Roof		
Prepared for:	Heyne Tillett Steel, London		
Date:	23/08/2019		
ABG Project ID:	16080	Calculator version:	1.18
Prepared by:	Kirstin, 01484 354844, kirstin@abgltd.com		
Notes/description:	Combined amenity terrace & green roof/lawn, surface finish - sedum mat/lawn turf - TBC. Pedestrian/amenity access only. Warm/inverted roof construction, with zero falls - TBC.		

Input Parameters - Rainfall Information (Flood Estimation Handbook 2013)

Return period:	100 years	As supplied by Client
Allowance for Climate Change:	40 %	As supplied by Client
OS grid reference selected for FEH data:	TQ 10400 78800	

Input Parameters - Roof Information

Catchment area:	210 m ²	As supplied by Client
Storage area:	210 m ²	As supplied by Client
Maximum allowable runoff:	0.5 l/s	As supplied by Client

Output - Rainfall Calculation

Duration	Time to Empty	Restricted Outflow (l/s)
15 mins	7 hours and 20 minutes	0.3
30 mins	9 hours and 20 minutes	0.3
1 hour	11 hours and 0 minutes	0.4
2 hours	12 hours and 40 minutes	0.4
4 hours	13 hours and 40 minutes	0.5
6 hours	13 hours and 40 minutes	0.5
10 hours	12 hours and 30 minutes	0.4
24 hours	6 hours and 50 minutes	0.3
48 hours	0 hours and 20 minutes	0.1

Total storage required: 16.2 m³
Half empty time: 4 hours and 0 minutes.

Output - Recommended Blue Roof System

System Name:	ABG bluroof VF HD 108mm/129mm
Description:	The blue roof depth of 129mm, includes for a 25mm reservoir board. 2 no. control positions TBC by design team, and also with the structural engineer's deflection analysis.

Total storage capacity:	20.3 m ³
Number of Blue Roof outlets:	2

Notes:

1. This document contains an estimate which has been prepared by ABG Ltd and is illustrative only and not a detailed design.
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APPENDIX E – MicroDrainage Calculations

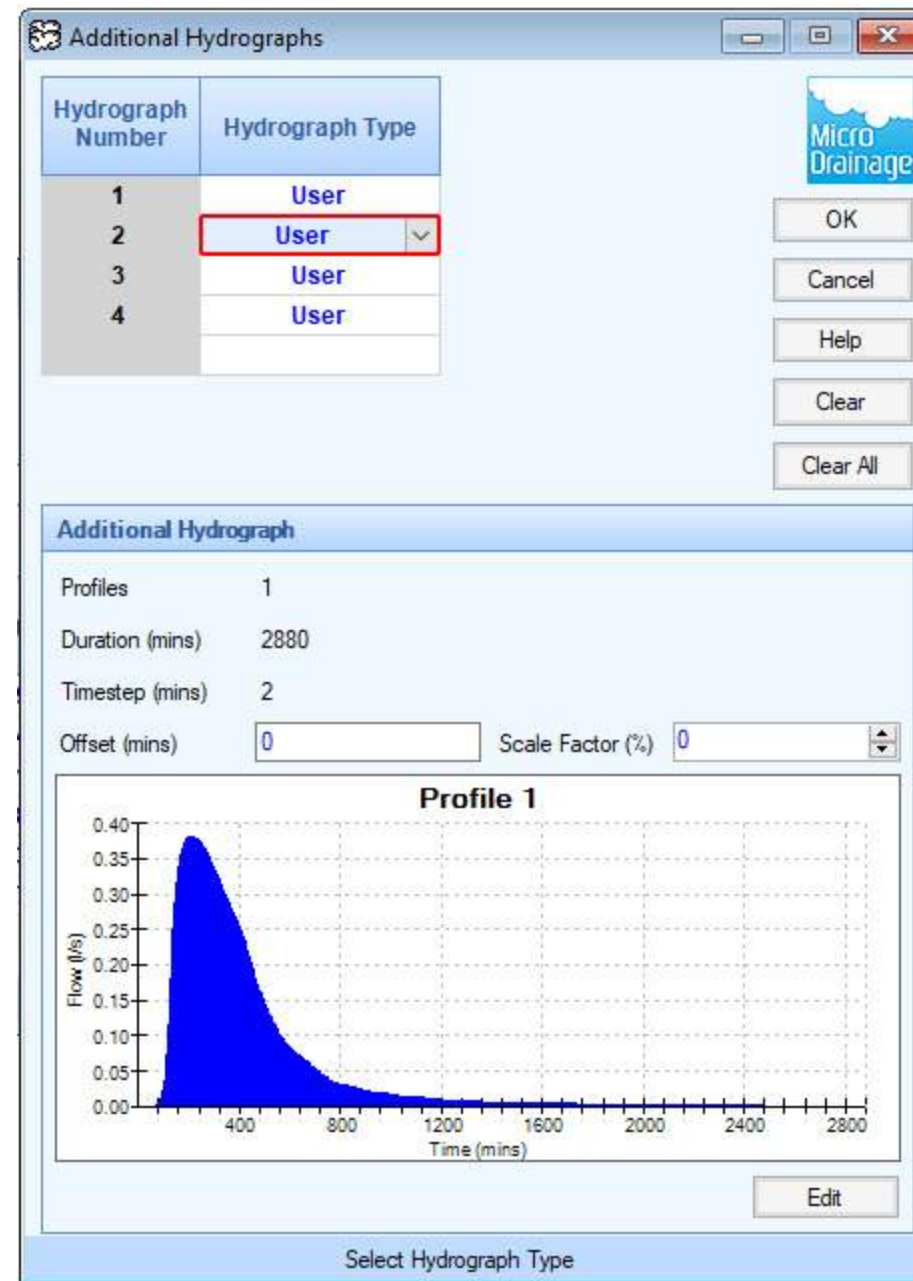
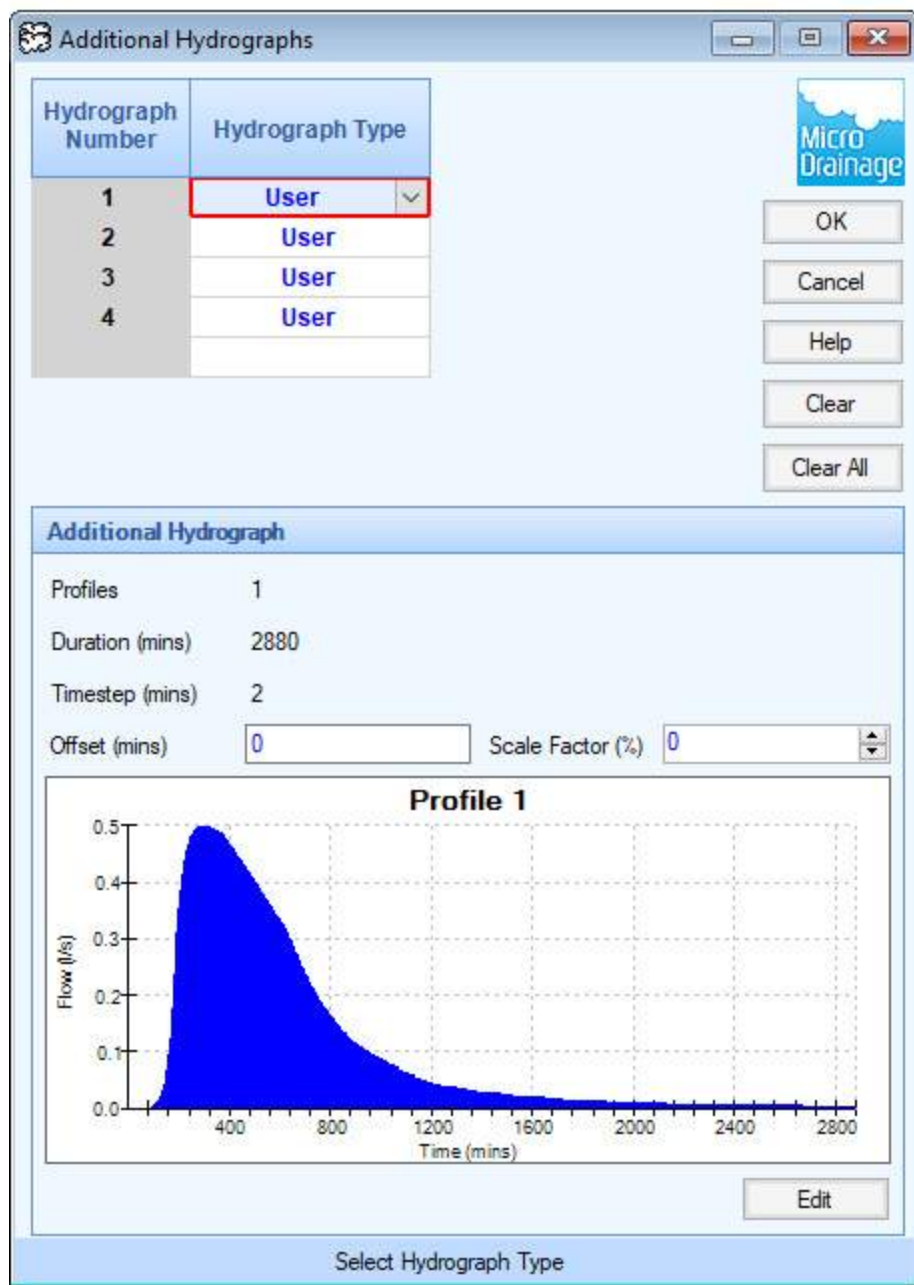
Heyne Tillett Steel			Page 1				
4 Pear Tree Court London EC1R 0DS			2006 - 9 Nestles Avenue Proposed Surface Water Drainage Network				
Date 29/08/2019 11:02 File 2006 - Combined Model - ...			Designed by AGH Checked by CL				
XP Solutions			Source Control 2019.1				
<u>Summary of Results for 100 year Return Period (+40%)</u>							
Half Drain Time : 646 minutes.							
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	30.551	0.111	0.0	1.5	1.5	39.9	O K
30 min Summer	30.582	0.142	0.0	1.5	1.5	51.1	O K
60 min Summer	30.611	0.171	0.0	1.5	1.5	61.6	O K
120 min Summer	30.648	0.208	0.0	1.5	1.5	74.9	O K
180 min Summer	30.679	0.239	0.0	1.5	1.5	86.1	O K
240 min Summer	30.701	0.261	0.0	1.5	1.5	94.0	O K
360 min Summer	30.731	0.291	0.0	1.5	1.5	104.7	O K
480 min Summer	30.786	0.346	0.0	1.5	1.5	111.5	O K
600 min Summer	30.829	0.389	0.0	1.5	1.5	114.5	O K
720 min Summer	30.830	0.390	0.0	1.5	1.5	114.6	O K
960 min Summer	30.752	0.312	0.0	1.5	1.5	109.0	O K
1440 min Summer	30.701	0.261	0.0	1.5	1.5	94.0	O K
2160 min Summer	30.624	0.184	0.0	1.5	1.5	66.3	O K
2880 min Summer	30.554	0.114	0.0	1.5	1.5	41.0	O K
4320 min Summer	30.498	0.058	0.0	1.4	1.4	20.9	O K
5760 min Summer	30.475	0.035	0.0	1.4	1.4	12.6	O K
15 min Winter	30.551	0.111	0.0	1.5	1.5	39.9	O K
30 min Winter	30.582	0.142	0.0	1.5	1.5	51.1	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
15 min Summer	159.600	0.0	100.4	19			
30 min Summer	103.600	0.0	112.7	33			
60 min Summer	64.260	0.0	129.0	64			
120 min Summer	40.530	0.0	146.4	420			
180 min Summer	30.343	0.0	156.7	428			
240 min Summer	24.465	0.0	163.7	436			
360 min Summer	17.780	0.0	172.9	458			
480 min Summer	14.023	0.0	178.6	484			
600 min Summer	11.606	0.0	182.6	602			
720 min Summer	9.917	0.0	185.6	722			
960 min Summer	7.702	0.0	190.1	882			
1440 min Summer	5.372	0.0	195.9	1004			
2160 min Summer	3.735	0.0	201.6	1344			
2880 min Summer	2.890	0.0	206.1	1704			
4320 min Summer	2.028	0.0	213.4	2420			
5760 min Summer	1.588	0.0	220.2	3064			
15 min Winter	159.600	0.0	100.4	18			
30 min Winter	103.600	0.0	112.7	33			
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Heyne Tillett Steel			Page 2				
4 Pear Tree Court London EC1R 0DS		2006 - 9 Nestles Avenue Proposed Surface Water Drainage Network					
Date 29/08/2019 11:02 File 2006 - Combined Model - ...		Designed by AGH Checked by CL					
XP Solutions		Source Control 2019.1					
<u>Summary of Results for 100 year Return Period (+40%)</u>							
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
60 min Winter	30.611	0.171	0.0	1.5	1.5	61.7	O K
120 min Winter	30.648	0.208	0.0	1.5	1.5	74.9	O K
180 min Winter	30.679	0.239	0.0	1.5	1.5	86.2	O K
240 min Winter	30.701	0.261	0.0	1.5	1.5	94.1	O K
360 min Winter	30.731	0.291	0.0	1.5	1.5	104.7	O K
480 min Winter	30.787	0.347	0.0	1.5	1.5	111.5	O K
600 min Winter	30.831	0.391	0.0	1.5	1.5	114.7	O K
720 min Winter	30.836	0.396	0.0	1.5	1.5	115.0	O K
960 min Winter	30.769	0.329	0.0	1.5	1.5	110.2	O K
1440 min Winter	30.699	0.259	0.0	1.5	1.5	93.2	O K
2160 min Winter	30.612	0.172	0.0	1.5	1.5	61.9	O K
2880 min Winter	30.529	0.089	0.0	1.5	1.5	32.2	O K
4320 min Winter	30.474	0.034	0.0	1.4	1.4	12.1	O K
5760 min Winter	30.471	0.031	0.0	1.3	1.3	11.1	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
60 min Winter	64.260	0.0	129.0	62			
120 min Winter	40.530	0.0	146.4	420			
180 min Winter	30.343	0.0	156.7	428			
240 min Winter	24.465	0.0	163.8	436			
360 min Winter	17.780	0.0	173.0	458			
480 min Winter	14.023	0.0	178.6	484			
600 min Winter	11.606	0.0	182.6	594			
720 min Winter	9.917	0.0	185.7	702			
960 min Winter	7.702	0.0	190.0	906			
1440 min Winter	5.372	0.0	196.0	1054			
2160 min Winter	3.735	0.0	201.6	1424			
2880 min Winter	2.890	0.0	206.1	1760			
4320 min Winter	2.028	0.0	213.5	528			
5760 min Winter	1.588	0.0	220.3	520			
©1982-2019 Innovyze							

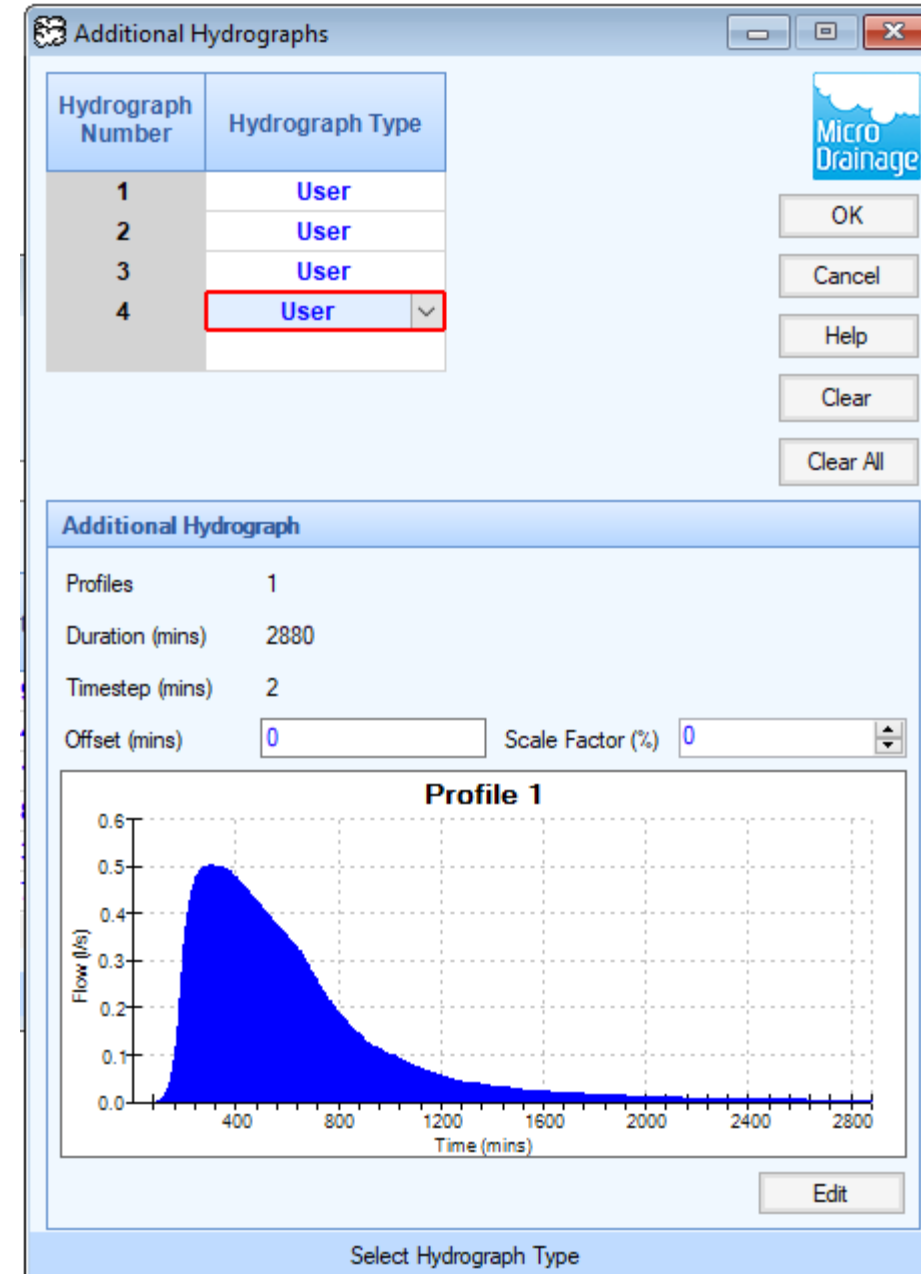
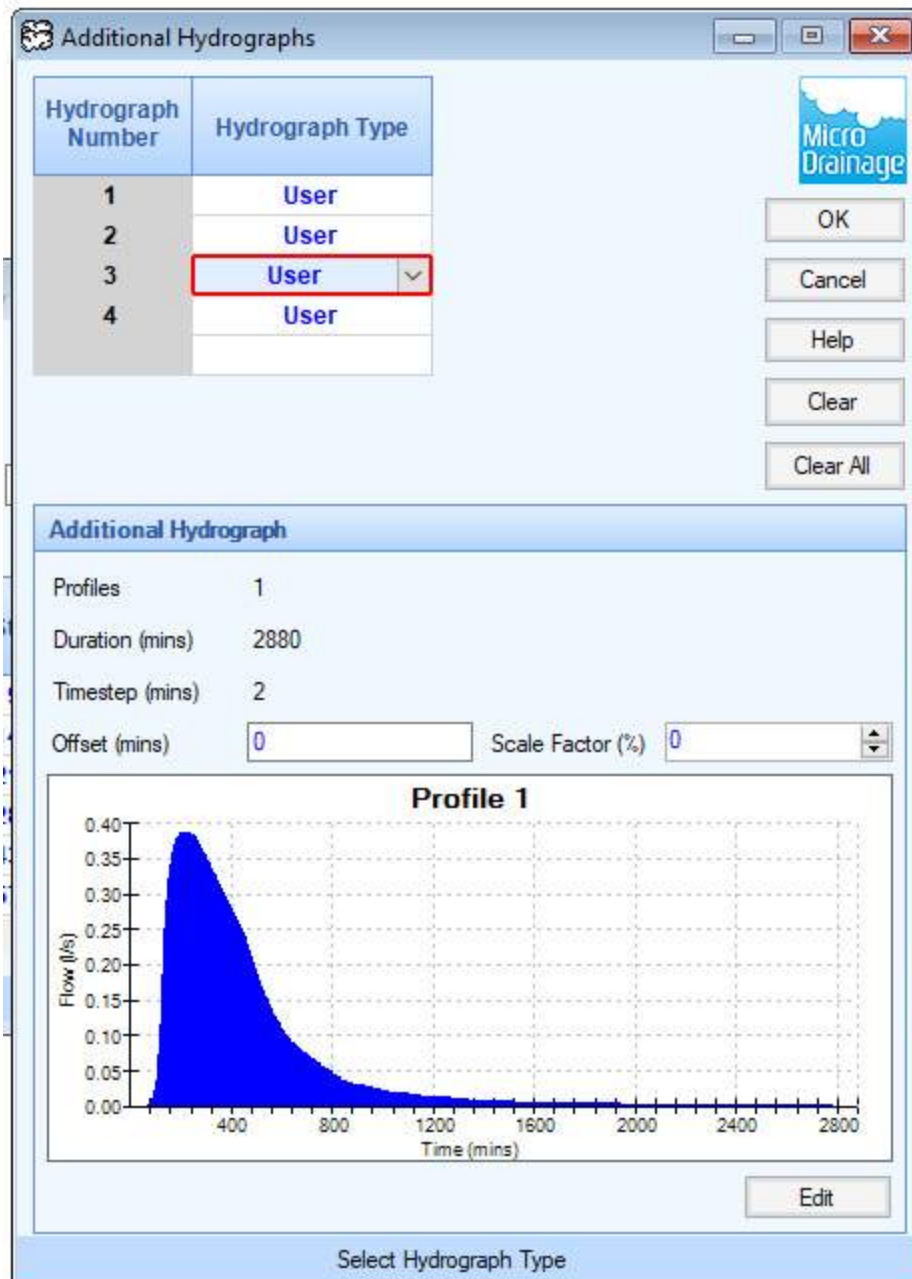
Heyne Tillett Steel		Page 3
4 Pear Tree Court London EC1R 0DS	2006 - 9 Nestles Avenue Proposed Surface Water Drainage Network	
Date 29/08/2019 11:02 File 2006 - Combined Model - ...	Designed by AGH Checked by CL	
XP SolutionsSource Control 2019.1		

Heyne Tillett Steel		Page 4																																																																								
4 Pear Tree Court London EC1R 0DS	2006 - 9 Nestles Avenue Proposed Surface Water Drainage Network																																																																									
Date 29/08/2019 11:02 File 2006 - Combined Model - ...	Designed by AGH Checked by CL																																																																									
XP SolutionsSource Control 2019.1																																																																										
Model Details Storage is Online Cover Level (m) 31.200 Cellular Storage Structure Invert Level (m)30.440 Safety Factor2.0 Infiltration Coefficient Base (m/hr)0.00000 Porosity1.00 Infiltration Coefficient Side (m/hr)0.00000																																																																										
<table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>360.0</td><td>0.0</td><td>0.510</td><td>72.0</td><td>0.0</td></tr><tr><td>0.300</td><td>360.0</td><td>0.0</td><td>0.511</td><td>0.0</td><td>0.0</td></tr><tr><td>0.301</td><td>72.0</td><td>0.0</td><td></td><td></td><td></td></tr></table>			Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	360.0	0.0	0.510	72.0	0.0	0.300	360.0	0.0	0.511	0.0	0.0	0.301	72.0	0.0																																																			
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0.300	360.0	0.0	0.511	0.0	0.0																																																																					
0.301	72.0	0.0																																																																								
Hydro-Brake® Optimum Outflow Control Unit ReferenceMD-SHE-0064-1500-0560-1500 Design Head (m)0.560 Design Flow (l/s)1.5 Flush-Flo™Calculated ObjectiveMinimise upstream storage ApplicationSurface Sump AvailableYes Diameter (mm)64 Invert Level (m)30.390 Minimum Outlet Pipe Diameter (mm)100 Suggested Manhole Diameter (mm)1200																																																																										
<table><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>0.560</td><td>1.5</td><td>Kick-Flo®</td><td>0.369</td><td>1.2</td></tr><tr><td>Flush-Flo™</td><td>0.167</td><td>1.5</td><td>Mean Flow over Head Range</td><td>-</td><td>1.3</td></tr></table>			Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	0.560	1.5	Kick-Flo®	0.369	1.2	Flush-Flo™	0.167	1.5	Mean Flow over Head Range	-	1.3																																																						
Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)																																																																					
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Flush-Flo™	0.167	1.5	Mean Flow over Head Range	-	1.3																																																																					
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated																																																																										
<table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>1.4</td><td>1.200</td><td>2.1</td><td>3.000</td><td>3.2</td><td>7.000</td><td>4.8</td></tr><tr><td>0.200</td><td>1.5</td><td>1.400</td><td>2.3</td><td>3.500</td><td>3.5</td><td>7.500</td><td>5.0</td></tr><tr><td>0.300</td><td>1.4</td><td>1.600</td><td>2.4</td><td>4.000</td><td>3.7</td><td>8.000</td><td>5.2</td></tr><tr><td>0.400</td><td>1.3</td><td>1.800</td><td>2.5</td><td>4.500</td><td>3.9</td><td>8.500</td><td>5.3</td></tr><tr><td>0.500</td><td>1.4</td><td>2.000</td><td>2.7</td><td>5.000</td><td>4.1</td><td>9.000</td><td>5.5</td></tr><tr><td>0.600</td><td>1.5</td><td>2.200</td><td>2.8</td><td>5.500</td><td>4.3</td><td>9.500</td><td>5.6</td></tr><tr><td>0.800</td><td>1.8</td><td>2.400</td><td>2.9</td><td>6.000</td><td>4.5</td><td></td><td></td></tr><tr><td>1.000</td><td>1.9</td><td>2.600</td><td>3.0</td><td>6.500</td><td>4.6</td><td></td><td></td></tr></table>			Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	1.4	1.200	2.1	3.000	3.2	7.000	4.8	0.200	1.5	1.400	2.3	3.500	3.5	7.500	5.0	0.300	1.4	1.600	2.4	4.000	3.7	8.000	5.2	0.400	1.3	1.800	2.5	4.500	3.9	8.500	5.3	0.500	1.4	2.000	2.7	5.000	4.1	9.000	5.5	0.600	1.5	2.200	2.8	5.500	4.3	9.500	5.6	0.800	1.8	2.400	2.9	6.000	4.5			1.000	1.9	2.600	3.0	6.500	4.6		
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)																																																																			
0.100	1.4	1.200	2.1	3.000	3.2	7.000	4.8																																																																			
0.200	1.5	1.400	2.3	3.500	3.5	7.500	5.0																																																																			
0.300	1.4	1.600	2.4	4.000	3.7	8.000	5.2																																																																			
0.400	1.3	1.800	2.5	4.500	3.9	8.500	5.3																																																																			
0.500	1.4	2.000	2.7	5.000	4.1	9.000	5.5																																																																			
0.600	1.5	2.200	2.8	5.500	4.3	9.500	5.6																																																																			
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The Blue Roofs have been added to the model as 'Additional Hydrographs'



The Blue Roofs have been added to the model as 'Additional Hydrographs'



Calculations of Individual Blue Roofs

Heyne Tillett Steel		Page 1	
4 Pear Tree Court		2006 - 9 Nestles Avenue	
London		Proposed Surface Water	
EC1R ODS		Drainage Network	
Date 29/08/2019 10:58		Designed by AGH	
File 4th floor - 260m2 - 0_5...		Checked by CL	
XP Solutions		Source Control 2019.1	

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 390 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	35.047	0.047	0.0	0.3	0.3	7.4	O K
30 min Summer	35.064	0.064	0.0	0.3	0.3	10.0	O K
60 min Summer	35.081	0.081	0.0	0.4	0.4	12.7	O K
120 min Summer	35.104	0.104	0.0	0.5	0.5	16.2	O K
180 min Summer	35.115	0.115	0.0	0.5	0.5	17.9	O K
240 min Summer	35.120	0.120	0.0	0.5	0.5	18.7	O K
360 min Summer	35.122	0.122	0.0	0.5	0.5	19.0	O K
480 min Summer	35.121	0.121	0.0	0.5	0.5	18.8	O K
600 min Summer	35.119	0.119	0.0	0.5	0.5	18.6	O K
720 min Summer	35.117	0.117	0.0	0.5	0.5	18.2	O K
960 min Summer	35.112	0.112	0.0	0.5	0.5	17.4	O K
1440 min Summer	35.101	0.101	0.0	0.5	0.5	15.8	O K
2160 min Summer	35.088	0.088	0.0	0.4	0.4	13.7	O K
2880 min Summer	35.077	0.077	0.0	0.4	0.4	12.0	O K
4320 min Summer	35.061	0.061	0.0	0.3	0.3	9.6	O K
5760 min Summer	35.052	0.052	0.0	0.3	0.3	8.0	O K
15 min Winter	35.047	0.047	0.0	0.3	0.3	7.4	O K
30 min Winter	35.064	0.064	0.0	0.3	0.3	10.0	O K
60 min Winter	35.081	0.081	0.0	0.4	0.4	12.7	O K
120 min Winter	35.104	0.104	0.0	0.5	0.5	16.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	159.600	0.0	7.3	75
30 min Summer	103.600	0.0	10.2	84
60 min Summer	64.260	0.0	13.9	104
120 min Summer	40.530	0.0	17.9	146
180 min Summer	30.343	0.0	20.3	192
240 min Summer	24.465	0.0	22.0	244
360 min Summer	17.780	0.0	24.0	326
480 min Summer	14.023	0.0	25.3	388
600 min Summer	11.606	0.0	26.2	452
720 min Summer	9.917	0.0	26.8	518
960 min Summer	7.702	0.0	27.6	652
1440 min Summer	5.372	0.0	28.6	920
2160 min Summer	3.735	0.0	30.3	1312
2880 min Summer	2.890	0.0	30.9	1692
4320 min Summer	2.028	0.0	31.7	2428
5760 min Summer	1.588	0.0	33.0	3136
15 min Winter	159.600	0.0	7.3	75
30 min Winter	103.600	0.0	10.2	84
60 min Winter	64.260	0.0	13.9	104
120 min Winter	40.530	0.0	17.9	146

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Heyne Tillett Steel			Page 2				
4 Pear Tree Court		2006 - 9 Nestles Avenue					
London		Proposed Surface Water					
EC1R ODS		Drainage Network					
Date 29/08/2019 10:58		Designed by AGH					
File 4th floor - 260m2 - 0_5...		Checked by CL					
XP Solutions		Source Control 2019.1					
Summary of Results for 100 year Return Period (+40%)							
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
180 min Winter	35.115	0.115	0.0	0.5	0.5	17.9	O K
240 min Winter	35.120	0.120	0.0	0.5	0.5	18.7	O K
360 min Winter	35.122	0.122	0.0	0.5	0.5	19.0	O K
480 min Winter	35.120	0.120	0.0	0.5	0.5	18.7	O K
600 min Winter	35.117	0.117	0.0	0.5	0.5	18.3	O K
720 min Winter	35.114	0.114	0.0	0.5	0.5	17.8	O K
960 min Winter	35.107	0.107	0.0	0.5	0.5	16.7	O K
1440 min Winter	35.094	0.094	0.0	0.4	0.4	14.6	O K
2160 min Winter	35.077	0.077	0.0	0.4	0.4	12.0	O K
2880 min Winter	35.064	0.064	0.0	0.3	0.3	10.1	O K
4320 min Winter	35.048	0.048	0.0	0.3	0.3	7.5	O K
5760 min Winter	35.039	0.039	0.0	0.2	0.2	6.1	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
180 min Winter	30.343	0.0	20.3	192			
240 min Winter	24.465	0.0	22.0	244			
360 min Winter	17.780	0.0	24.0	346			
480 min Winter	14.023	0.0	25.3	402			
600 min Winter	11.606	0.0	26.2	474			
720 min Winter	9.917	0.0	26.8	548			
960 min Winter	7.702	0.0	27.6	696			
1440 min Winter	5.372	0.0	28.6	980			
2160 min Winter	3.735	0.0	30.3	1384			
2880 min Winter	2.890	0.0	30.9	1764			
4320 min Winter	2.028	0.0	31.7	2484			
5760 min Winter	1.588	0.0	33.0	3168			
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Calculations of Individual Blue Roofs

Heyne Tillett Steel		Page 3	
4 Pear Tree Court London EC1R 0DS		2006 - 9 Nestles Avenue Proposed Surface Water Drainage Network	
Date 29/08/2019 10:58		Designed by AGH	
File 4th floor - 260m2 - 0_5...		Checked by CL	
XP Solutions		Source Control 2019.1	

Rainfall Details

Rainfall Model

FEH

Return Period (years)

100

FEH Rainfall Version

2013

Site Location

GB 510000 179000 TQ 10000 79000

Data Type

Summer Storms

Yes

Winter Storms

Yes

Cv (Summer)

0.950

Cv (Winter)

0.950

Shortest Storm (mins)

15

Longest Storm (mins)

5760

Climate Change %

+40

Green Roof

Area (m³)

260

Evaporation (mm/day)

3

Depression Storage (mm)

5

Decay Coefficient

0.050

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From:	To:	From:	To:	From:	To:	From:	To:
	(ha)		(ha)		(ha)		(ha)
0	4 0.004725	32	36 0.000954	64	68 0.000193	96	100 0.000039
4	8 0.003868	36	40 0.000781	68	72 0.000158	100	104 0.000032
8	12 0.003167	40	44 0.000639	72	76 0.000129	104	108 0.000026
12	16 0.002593	44	48 0.000524	76	80 0.000106	108	112 0.000021
16	20 0.002123	48	52 0.000429	80	84 0.000087	112	116 0.000017
20	24 0.001738	52	56 0.000351	84	88 0.000071	116	120 0.000014
24	28 0.001423	56	60 0.000287	88	92 0.000058		
28	32 0.001165	60	64 0.000235	92	96 0.000047		

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Heyne Tillett Steel		Page 4
4 Pear Tree Court London EC1R 0DS	2006 - 9 Nestles Avenue Proposed Surface Water Drainage Network	
Date 29/08/2019 10:58	Designed by AGH	
File 4th floor - 260m2 - 0_5...	Checked by CL	
XP Solutions		
Source Control 2019.1		

Model Details

Storage is Online Cover Level (m) 35.500

Cellular Storage Structure

Invert Level (m) 35.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.80
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	195.0	0.0	0.131	0.0	0.0
0.130	195.0	0.0			

Orifice Outflow Control

Diameter (m) 0.027 Discharge Coefficient 0.600 Invert Level (m) 35.000

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Calculations of Individual Blue Roofs

Heyne Tillett Steel							Page 1
4 Pear Tree Court		2006 - 9 Nestles Avenue					
London		Proposed Surface Water					
EC1R 0DS		Drainage Network					
Date 23/08/2019 17:08		Designed by AGH					
File 5th floor - 106m2 - 0_4...		Checked by CL					
XP Solutions		Source Control 2019.1					
Summary of Results for 100 year Return Period (+40%)							
Half Drain Time : 188 minutes.							
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	35.033	0.033	0.0	0.2	0.2	2.8	O K
30 min Summer	35.044	0.044	0.0	0.3	0.3	3.7	O K
60 min Summer	35.056	0.056	0.0	0.3	0.3	4.7	O K
120 min Summer	35.070	0.070	0.0	0.4	0.4	5.9	O K
180 min Summer	35.075	0.075	0.0	0.4	0.4	6.4	O K
240 min Summer	35.077	0.077	0.0	0.4	0.4	6.5	O K
360 min Summer	35.077	0.077	0.0	0.4	0.4	6.5	O K
480 min Summer	35.075	0.075	0.0	0.4	0.4	6.4	O K
600 min Summer	35.073	0.073	0.0	0.4	0.4	6.2	O K
720 min Summer	35.070	0.070	0.0	0.4	0.4	5.9	O K
960 min Summer	35.064	0.064	0.0	0.3	0.3	5.4	O K
1440 min Summer	35.055	0.055	0.0	0.3	0.3	4.6	O K
2160 min Summer	35.045	0.045	0.0	0.3	0.3	3.8	O K
2880 min Summer	35.038	0.038	0.0	0.2	0.2	3.2	O K
4320 min Summer	35.032	0.032	0.0	0.2	0.2	2.7	O K
5760 min Summer	35.028	0.028	0.0	0.1	0.1	2.4	O K
15 min Winter	35.033	0.033	0.0	0.2	0.2	2.8	O K
30 min Winter	35.044	0.044	0.0	0.3	0.3	3.7	O K
60 min Winter	35.056	0.056	0.0	0.3	0.3	4.7	O K
120 min Winter	35.070	0.070	0.0	0.4	0.4	5.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
15 min Summer	159.600	0.0	3.1	64			
30 min Summer	103.600	0.0	4.3	71			
60 min Summer	64.260	0.0	5.7	90			
120 min Summer	40.530	0.0	7.4	132			
180 min Summer	30.343	0.0	8.4	180			
240 min Summer	24.465	0.0	9.1	210			
360 min Summer	17.780	0.0	9.9	272			
480 min Summer	14.023	0.0	10.5	336			
600 min Summer	11.606	0.0	10.8	402			
720 min Summer	9.917	0.0	11.1	468			
960 min Summer	7.702	0.0	11.4	598			
1440 min Summer	5.372	0.0	11.8	848			
2160 min Summer	3.735	0.0	12.4	1212			
2880 min Summer	2.890	0.0	12.7	1560			
4320 min Summer	2.028	0.0	13.0	2292			
5760 min Summer	1.588	0.0	13.5	3016			
15 min Winter	159.600	0.0	3.1	64			
30 min Winter	103.600	0.0	4.3	72			
60 min Winter	64.260	0.0	5.7	90			
120 min Winter	40.530	0.0	7.4	132			
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Heyne Tillett Steel		Page 2					
4 Pear Tree Court		2006 - 9 Nestles Avenue					
London		Proposed Surface Water					
EC1R 0DS		Drainage Network					
Date 23/08/2019 17:08		Designed by AGH					
File 5th floor - 106m2 - 0_4...		Checked by CL					
XP Solutions		Source Control 2019.1					
Summary of Results for 100 year Return Period (+40%)							
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
180 min Winter	35.075	0.075	0.0	0.4	0.4	6.4	O K
240 min Winter	35.076	0.076	0.0	0.4	0.4	6.5	O K
360 min Winter	35.075	0.075	0.0	0.4	0.4	6.4	O K
480 min Winter	35.072	0.072	0.0	0.4	0.4	6.1	O K
600 min Winter	35.069	0.069	0.0	0.4	0.4	5.8	O K
720 min Winter	35.065	0.065	0.0	0.3	0.3	5.5	O K
960 min Winter	35.058	0.058	0.0	0.3	0.3	4.9	O K
1440 min Winter	35.046	0.046	0.0	0.3	0.3	3.9	O K
2160 min Winter	35.037	0.037	0.0	0.2	0.2	3.1	O K
2880 min Winter	35.032	0.032	0.0	0.2	0.2	2.7	O K
4320 min Winter	35.026	0.026	0.0	0.1	0.1	2.2	O K
5760 min Winter	35.022	0.022	0.0	0.1	0.1	1.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
180 min Winter	30.343	0.0	8.4	180			
240 min Winter	24.465	0.0	9.1	218			
360 min Winter	17.780	0.0	9.9	284			
480 min Winter	14.023	0.0	10.5	356			
600 min Winter	11.606	0.0	10.8	426			
720 min Winter	9.917	0.0	11.1	494			
960 min Winter	7.702	0.0	11.4	628			
1440 min Winter	5.372	0.0	11.9	880			
2160 min Winter	3.735	0.0	12.4	1232			
2880 min Winter	2.890	0.0	12.7	1596			
4320 min Winter	2.028	0.0	13.0	2336			
5760 min Winter	1.588	0.0	13.5	3088			
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Calculations of Individual Blue Roofs

Heyne Tillett Steel		Page 3	
4 Pear Tree Court		2006 - 9 Nestles Avenue	
London		Proposed Surface Water	
EC1R 0DS		Drainage Network	
Date 23/08/2019 17:08		Designed by AGH	
File 5th floor - 106m2 - 0_4...		Checked by CL	
XP Solutions		Source Control 2019.1	

Rainfall Details

Rainfall ModelFEH

Return Period (years)100

FEH Rainfall Version2013

Site Location GB 510000 179000 TQ 10000 79000

Data Type

Summer StormsYes

Winter StormsYes

Cv (Summer)0.950

Cv (Winter)0.950

Shortest Storm (mins)15

Longest Storm (mins)5760

Climate Change % +40

Green Roof

Area (m³) 106

Evaporation (mm/day) 3

Depression Storage (mm) 5

Decay Coefficient 0.050

Time (mins)			Time (mins)			Time (mins)			Time (mins)		
From:	To:	Area (ha)	From:	To:	Area (ha)	From:	To:	Area (ha)	From:	To:	Area (ha)
0	4	0.001926	32	36	0.000389	64	68	0.000079	96	100	0.000016
4	8	0.001577	36	40	0.000318	68	72	0.000064	100	104	0.000013
8	12	0.001291	40	44	0.000261	72	76	0.000053	104	108	0.000011
12	16	0.001057	44	48	0.000213	76	80	0.000043	108	112	0.000009
16	20	0.000866	48	52	0.000175	80	84	0.000035	112	116	0.000007
20	24	0.000709	52	56	0.000143	84	88	0.000029	116	120	0.000006
24	28	0.000580	56	60	0.000117	88	92	0.000024			
28	32	0.000475	60	64	0.000096	92	96	0.000019			

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Heyne Tillett Steel		Page 4
4 Pear Tree Court	2006 - 9 Nestles Avenue	
London	Proposed Surface Water	
EC1R 0DS	Drainage Network	
Date 23/08/2019 17:08	Designed by AGH	
File 5th floor - 106m2 - 0_4...	Checked by CL	
XP Solutions		Source Control 2019.1

Model Details

Storage is Online Cover Level (m) 35.500

Cellular Storage Structure

Invert Level (m) 35.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.80
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	106.0	0.0	0.131	0.0	0.0
0.130	106.0	0.0			

Orifice Outflow Control

Diameter (m) 0.027 Discharge Coefficient 0.600 Invert Level (m) 35.000

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Calculations of Individual Blue Roofs

Heyne Tillett Steel							Page 1
4 Pear Tree Court			2006 - 9 Nestles Avenue				
London			Proposed Surface Water				
EC1R ODS			Drainage Network				
Date 23/08/2019 17:09			Designed by AGH				
File 8th floor - 120m2 - 0_4...			Checked by CL				
XP Solutions			Source Control 2019.1				
Summary of Results for 100 year Return Period (+40%)							
Half Drain Time : 203 minutes.							
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	35.034	0.034	0.0	0.2	0.2	3.2	O K
30 min Summer	35.045	0.045	0.0	0.3	0.3	4.3	O K
60 min Summer	35.057	0.057	0.0	0.3	0.3	5.5	O K
120 min Summer	35.072	0.072	0.0	0.4	0.4	6.9	O K
180 min Summer	35.077	0.077	0.0	0.4	0.4	7.4	O K
240 min Summer	35.079	0.079	0.0	0.4	0.4	7.6	O K
360 min Summer	35.079	0.079	0.0	0.4	0.4	7.6	O K
480 min Summer	35.078	0.078	0.0	0.4	0.4	7.5	O K
600 min Summer	35.076	0.076	0.0	0.4	0.4	7.3	O K
720 min Summer	35.073	0.073	0.0	0.4	0.4	7.0	O K
960 min Summer	35.068	0.068	0.0	0.4	0.4	6.5	O K
1440 min Summer	35.059	0.059	0.0	0.3	0.3	5.6	O K
2160 min Summer	35.048	0.048	0.0	0.3	0.3	4.6	O K
2880 min Summer	35.041	0.041	0.0	0.3	0.3	4.0	O K
4320 min Summer	35.034	0.034	0.0	0.2	0.2	3.3	O K
5760 min Summer	35.030	0.030	0.0	0.2	0.2	2.9	O K
15 min Winter	35.034	0.034	0.0	0.2	0.2	3.2	O K
30 min Winter	35.045	0.045	0.0	0.3	0.3	4.3	O K
60 min Winter	35.057	0.057	0.0	0.3	0.3	5.5	O K
120 min Winter	35.071	0.071	0.0	0.4	0.4	6.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
15 min Summer	159.600	0.0	3.5	66			
30 min Summer	103.600	0.0	4.8	74			
60 min Summer	64.260	0.0	6.5	92			
120 min Summer	40.530	0.0	8.4	134			
180 min Summer	30.343	0.0	9.5	182			
240 min Summer	24.465	0.0	10.2	216			
360 min Summer	17.780	0.0	11.2	278			
480 min Summer	14.023	0.0	11.8	344			
600 min Summer	11.606	0.0	12.2	408			
720 min Summer	9.917	0.0	12.5	474			
960 min Summer	7.702	0.0	12.9	606			
1440 min Summer	5.372	0.0	13.4	860			
2160 min Summer	3.735	0.0	14.0	1224			
2880 min Summer	2.890	0.0	14.3	1584			
4320 min Summer	2.028	0.0	14.7	2300			
5760 min Summer	1.588	0.0	15.2	3024			
15 min Winter	159.600	0.0	3.5	66			
30 min Winter	103.600	0.0	4.8	74			
60 min Winter	64.260	0.0	6.5	92			
120 min Winter	40.530	0.0	8.4	134			
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Heyne Tillett Steel			Page 2				
4 Pear Tree Court		2006 - 9 Nestles Avenue					
London		Proposed Surface Water					
EC1R ODS		Drainage Network					
Date 23/08/2019 17:09		Designed by AGH					
File 8th floor - 120m2 - 0_4...		Checked by CL					
XP Solutions		Source Control 2019.1					
Summary of Results for 100 year Return Period (+40%)							
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
180 min Winter	35.077	0.077	0.0	0.4	0.4	7.4	O K
240 min Winter	35.079	0.079	0.0	0.4	0.4	7.6	O K
360 min Winter	35.078	0.078	0.0	0.4	0.4	7.5	O K
480 min Winter	35.076	0.076	0.0	0.4	0.4	7.3	O K
600 min Winter	35.072	0.072	0.0	0.4	0.4	6.9	O K
720 min Winter	35.069	0.069	0.0	0.4	0.4	6.6	O K
960 min Winter	35.062	0.062	0.0	0.3	0.3	5.9	O K
1440 min Winter	35.051	0.051	0.0	0.3	0.3	4.9	O K
2160 min Winter	35.040	0.040	0.0	0.2	0.2	3.8	O K
2880 min Winter	35.034	0.034	0.0	0.2	0.2	3.3	O K
4320 min Winter	35.028	0.028	0.0	0.1	0.1	2.7	O K
5760 min Winter	35.024	0.024	0.0	0.1	0.1	2.3	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
180 min Winter	30.343	0.0	9.5	182			
240 min Winter	24.465	0.0	10.2	226			
360 min Winter	17.780	0.0	11.2	290			
480 min Winter	14.023	0.0	11.8	362			
600 min Winter	11.606	0.0	12.2	434			
720 min Winter	9.917	0.0	12.5	504			
960 min Winter	7.702	0.0	12.9	638			
1440 min Winter	5.372	0.0	13.4	896			
2160 min Winter	3.735	0.0	14.0	1248			
2880 min Winter	2.890	0.0	14.3	1608			
4320 min Winter	2.028	0.0	14.7	2340			
5760 min Winter	1.588	0.0	15.3	3040			
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Calculations of Individual Blue Roofs

Heyne Tillett Steel		Page 3	
4 Pear Tree Court London EC1R 0DS		2006 - 9 Nestles Avenue Proposed Surface Water Drainage Network	
Date 23/08/2019 17:09 File 8th floor - 120m2 - 0_4...		Designed by AGH Checked by CL	
XP Solutions		Source Control 2019.1	

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 510000 179000 TQ 10000 79000
Data Type	
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	5760
Climate Change %	+40

Green Roof

Area (m³)	120	Evaporation (mm/day)	3
Depression Storage (mm)	5	Decay Coefficient	0.050

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From:	To:	From:	To:	From:	To:	From:	To:
0	4 0.002181	32	36 0.000440	64	68 0.000089	96	100 0.000018
4	8 0.001785	36	40 0.000360	68	72 0.000073	100	104 0.000015
8	12 0.001462	40	44 0.000295	72	76 0.000060	104	108 0.000012
12	16 0.001197	44	48 0.000242	76	80 0.000049	108	112 0.000010
16	20 0.000980	48	52 0.000198	80	84 0.000040	112	116 0.000008
20	24 0.000802	52	56 0.000162	84	88 0.000033	116	120 0.000007
24	28 0.000657	56	60 0.000133	88	92 0.000027		
28	32 0.000538	60	64 0.000109	92	96 0.000022		

Heyne Tillett Steel		Page 4																		
4 Pear Tree Court London EC1R 0DS	2006 - 9 Nestles Avenue Proposed Surface Water Drainage Network																			
Date 23/08/2019 17:09 File 8th floor - 120m2 - 0_4...	Designed by AGH Checked by CL																			
XP Solutions		Source Control 2019.1																		
Model Details Storage is Online Cover Level (m) 35.500 Cellular Storage Structure Invert Level (m) 35.000 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.80 Infiltration Coefficient Side (m/hr) 0.00000 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>120.0</td><td>0.0</td><td>0.131</td><td>0.0</td><td>0.0</td></tr><tr><td>0.130</td><td>120.0</td><td>0.0</td><td></td><td></td><td></td></tr></tbody></table> Orifice Outflow Control Diameter (m) 0.027 Discharge Coefficient 0.600 Invert Level (m) 35.000			Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	120.0	0.0	0.131	0.0	0.0	0.130	120.0	0.0			
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)															
0.000	120.0	0.0	0.131	0.0	0.0															
0.130	120.0	0.0																		
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Calculations of Individual Blue Roofs

Heyne Tillett Steel		Page 1					
4 Pear Tree Court London EC1R 0DS		2006 - 9 Nestles Avenue Proposed Surface Water Drainage Network					
Date 23/08/2019 17:06 File Top floor - 210m2 - 0_5...		Designed by AGH Checked by CL					
XP Solutions		Source Control 2019.1					
Summary of Results for 100 year Return Period (+40%)							
Half Drain Time : 304 minutes.							
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	35.036	0.036	0.0	0.2	0.2	6.0	O K
30 min Summer	35.047	0.047	0.0	0.3	0.3	7.9	O K
60 min Summer	35.060	0.060	0.0	0.4	0.4	10.1	O K
120 min Summer	35.076	0.076	0.0	0.5	0.5	12.7	O K
180 min Summer	35.083	0.083	0.0	0.5	0.5	14.0	O K
240 min Summer	35.086	0.086	0.0	0.5	0.5	14.5	O K
360 min Summer	35.087	0.087	0.0	0.5	0.5	14.6	O K
480 min Summer	35.086	0.086	0.0	0.5	0.5	14.5	O K
600 min Summer	35.085	0.085	0.0	0.5	0.5	14.3	O K
720 min Summer	35.083	0.083	0.0	0.5	0.5	14.0	O K
960 min Summer	35.079	0.079	0.0	0.5	0.5	13.3	O K
1440 min Summer	35.071	0.071	0.0	0.4	0.4	11.9	O K
2160 min Summer	35.061	0.061	0.0	0.4	0.4	10.2	O K
2880 min Summer	35.053	0.053	0.0	0.4	0.4	8.9	O K
4320 min Summer	35.043	0.043	0.0	0.3	0.3	7.3	O K
5760 min Summer	35.038	0.038	0.0	0.3	0.3	6.4	O K
15 min Winter	35.036	0.036	0.0	0.2	0.2	6.0	O K
30 min Winter	35.047	0.047	0.0	0.3	0.3	7.9	O K
60 min Winter	35.060	0.060	0.0	0.4	0.4	10.1	O K
120 min Winter	35.076	0.076	0.0	0.5	0.5	12.7	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
15 min Summer	159.600	0.0	5.7	73			
30 min Summer	103.600	0.0	8.0	80			
60 min Summer	64.260	0.0	11.1	98			
120 min Summer	40.530	0.0	14.4	140			
180 min Summer	30.343	0.0	16.3	188			
240 min Summer	24.465	0.0	17.6	240			
360 min Summer	17.780	0.0	19.3	302			
480 min Summer	14.023	0.0	20.3	364			
600 min Summer	11.606	0.0	21.0	430			
720 min Summer	9.917	0.0	21.5	496			
960 min Summer	7.702	0.0	22.2	630			
1440 min Summer	5.372	0.0	23.0	894			
2160 min Summer	3.735	0.0	24.4	1276			
2880 min Summer	2.890	0.0	24.9	1640			
4320 min Summer	2.028	0.0	25.4	2348			
5760 min Summer	1.588	0.0	26.6	3072			
15 min Winter	159.600	0.0	5.7	73			
30 min Winter	103.600	0.0	8.0	80			
60 min Winter	64.260	0.0	11.1	100			
120 min Winter	40.530	0.0	14.4	140			
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4 Pear Tree Court London EC1R 0DS		2006 - 9 Nestles Avenue Proposed Surface Water Drainage Network					
Date 23/08/2019 17:06 File Top floor - 210m2 - 0_5...		Designed by AGH Checked by CL					
XP Solutions		Source Control 2019.1					
Summary of Results for 100 year Return Period (+40%)							
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
180 min Winter	35.083	0.083	0.0	0.5	0.5	14.0	O K
240 min Winter	35.086	0.086	0.0	0.5	0.5	14.5	O K
360 min Winter	35.087	0.087	0.0	0.5	0.5	14.6	O K
480 min Winter	35.085	0.085	0.0	0.5	0.5	14.3	O K
600 min Winter	35.083	0.083	0.0	0.5	0.5	14.0	O K
720 min Winter	35.080	0.080	0.0	0.5	0.5	13.5	O K
960 min Winter	35.075	0.075	0.0	0.5	0.5	12.5	O K
1440 min Winter	35.064	0.064	0.0	0.4	0.4	10.8	O K
2160 min Winter	35.052	0.052	0.0	0.4	0.4	8.8	O K
2880 min Winter	35.044	0.044	0.0	0.3	0.3	7.4	O K
4320 min Winter	35.036	0.036	0.0	0.2	0.2	6.1	O K
5760 min Winter	35.031	0.031	0.0	0.2	0.2	5.3	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
180 min Winter	30.343	0.0	16.3	188			
240 min Winter	24.465	0.0	17.6	238			
360 min Winter	17.780	0.0	19.3	314			
480 min Winter	14.023	0.0	20.3	382			
600 min Winter	11.606	0.0	21.0	456			
720 min Winter	9.917	0.0	21.5	528			
960 min Winter	7.702	0.0	22.2	672			
1440 min Winter	5.372	0.0	23.0	942			
2160 min Winter	3.735	0.0	24.4	1324			
2880 min Winter	2.890	0.0	24.9	1680			
4320 min Winter	2.028	0.0	25.4	2404			
5760 min Winter	1.588	0.0	26.6	3168			
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Calculations of Individual Blue Roofs

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4 Pear Tree Court London EC1R 0DS		2006 - 9 Nestles Avenue Proposed Surface Water Drainage Network	
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File Top floor - 210m2 - 0_5...		Checked by CL	
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4 Pear Tree Court London EC1R 0DS	2006 - 9 Nestles Avenue Proposed Surface Water Drainage Network	
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File Top floor - 210m2 - 0_5...	Checked by CL	
XP Solutions		
Source Control 2019.1		

Model Details

Storage is Online Cover Level (m) 35.500

Cellular Storage Structure

Invert Level (m) 35.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.80
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	210.0	0.0	0.131	0.0	0.0
0.130	210.0	0.0			

Orifice Outflow Control

Diameter (m) 0.030 Discharge Coefficient 0.600 Invert Level (m) 35.000

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