

Drainage Strategy Report

J2740 373-375 Euston Road Cambridge House, London

> Ref: J2740-Doc-06 Revision: 01

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GENERAL NOTES

Only construction status documentation is to be constructed from. If you do not have a construction issue document and you are about to build something, please contact Webb Yates Engineers. Ensure that you have the latest revision prior to construction.

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REVISION HISTORY

Revisions indicated with line in margin.

Revision status: P = Preliminary, T = Tender, C = Construction, X = For Information

Revision	Status	Date	Author	Reviewer	Description
00	Information	07/12/17	MJ	GP-D	Issued for Comment
01	Stage 3	15/12/17	GP-D	GP-D	Stage 3 issue

I INTRODUCTION

Webb Yates Engineers have been appointed by Birkbeck College Cambridge house Ltd. to undertake civil and structural engineering design services for the proposed redevelopment at 373-375 Euston Road.

The proposal is a refurbishment and extension to the existing building. The site is currently occupied by a four storey building, plus basement. The development consists of a refurbishment of the existing building including new stair and lift cores as well as minor lowering of the existing basement floor level. The new extension is a 1-2 storey extension including a new lecture theatre, lounge area and plant areas internally and externally.

The purpose of this report is to consider the various drainage strategy options and determine the preferred option for the new development.

The site is bounded by; Euston Road to the North; Cleveland Street to the West and Warren Street to the South. An existing building occupies the site immediately to the East, sharing a party wall with the existing build on site.

This document has been prepared with reference to:

- London Borough of Camden Strategic Flood Risk Assessment (SFRA) July 2014.
- Camden Core Strategy November 2010
- National Planning Policy Framework (NPPF) March 2012.
- Sewers for Adoption 7th Edition (October 2012)
- Environment Agency Flood Maps (http://maps.environment-agency.gov.uk/)
- Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems April 2015.
- The London Plan (www.london.gov.uk) 2011.
- The London Supplementary Planning Guidance (SPG) Sustainable Design and Construction (www.london.gov.uk) 2014.
- Sustainable Drainage Systems (SuDS) Manual, Ciria 2015.
- Rainfall Runnoff Management for Developments Report SC030219, Environment Agency 2013

2 SITE DESCRIPTORS

373-375 Euston Road's approximate National Grid reference is TQ 28956 82178. Located in North West London, within the Borough of Camden. The site's postal code is NWI 3AR.

To the north of the site is Euston Road. Cleveland Street bounds the site to the west and Warren Street bounds the site to the south. An existing building occupies the site immediately to the east, which shares a party wall with the existing building.

A London Underground tunnel servicing the Circle, Metropolitan and Hammersmith & City lines is located beneath Euston Road, adjacent to the site. Great Portland Street Station is situated on Euston Road and the underground platform extends to the North-West corner of the site.

The proposed building occupies the entire footprint of the site. New piled foundations are to be set back a minimum of 3 m from the London Underground tunnel and platform in accordance with London Underground requirements.

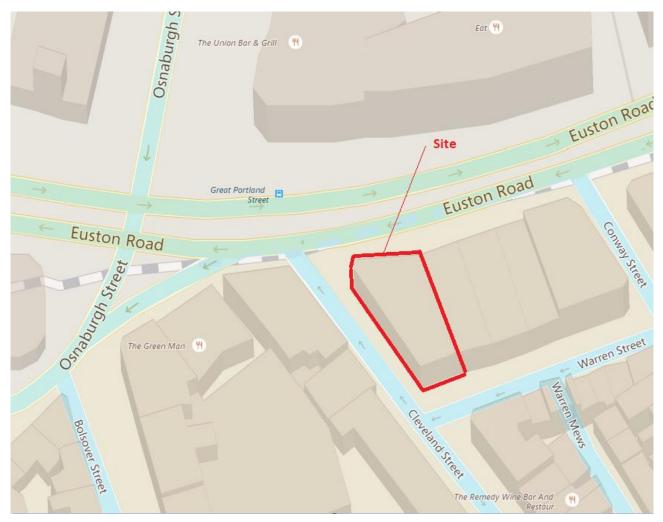


Figure 1: Map of Local Area with site boundary marked in red





Figure 2: Satellite view of local area with the site location marked in red

3 SITE CONTEXT

3.1 TOPOGRAPHY

The site topography is gently sloped from South to North in the upward direction. The highest topographic point, on site, is found on Euston Road at 10.13 mAOD. The lowest topographic point is found on the Southern along Warren Street and is 9.92mAOD. This gives a slope of 1 in 143.

3.2 GEOLOGY

British Geological Society maps and nearby boreholes indicate that the site is underlain by Lynch Hill Gravel over London Clay. A geotechnical investigation, Phase I and 2, was undertaken by BRD Environmental in September 2016. Geotechnical Reports from the Desk-Study and Site Investigation is found in Appendix B.

The typical ground stratum at the site, as identified during the Site Investigation is described in Table I. Geotechnical boreholes and trial pits were carried out at basement level and ground strata is identified in depth below basement level. Basement level is located approximately 3.0m below ground level.

Stratum	Depth Range (mBBL)	Strength/Consistency
Made Ground	0.5m-1.0m below basement level	Slightly gravelly, slightly sandy clay or clayey sand
Lynch Hill Gravel	3.40m-3.80m bbl.	Medium dense to dense, very sandy gravel of fine to coarse,
London Clay	Between 28.80m and >29.00m bbl.	Generally recorded as very stiff, fissured, dark grey silty clay.

Table I- Ground strata identified in the BRD Geo-Environmental Site Investigation Ref: BRD2742-OR2-B

3.3 GROUNDWATER

The Site Investigation identified ground water in both boreholes at approximately 2.8m below basement level in the Lynch Hill Gravel Formation. In borehole BH01, resting water was also struck in the London Clay formation at approximately 8.17m below existing basement level.

The ground water levels were recorded in one single visit at 01. September 2016.

3.4 HYDROLOGY

There are no nearby waterbodies which effect the site. The nearest water bodies include Boating Lake found in Regents Park (1km) and the Regents Canal (1.62km) which runs North of the site. The site lies within a Flood Risk Zone 1 (low risk). The site lies between two sub terrain rivers; the River Tyburn; and the River Fleet. These sub terrain Rivers do not affect the site. The River Thames lies South of the site 2.5 km away.

3.5 HYDROLOGEOLOGY

The bedrock geology (London Clay Formation) is an aquiclude. An aquiclude is a geological formation that absorbs and holds water but does not allow transmission of water. It is classified by the Environment Agency as "unproductive strata".

The Superficial Deposits (Lynch Hill Gravel Member) have an ability to act as a perched aquifer. It is classified by the Environment Agency as a "Secondary A" whereby permeable layers are capable of supporting water supplies at a local rather a strategic scale. These can also form an important source of base flow to rivers.

3.6 EXISTING SURFACE WATER DRAINAGE

The existing drainage within the local vicinity of the site includes a combined sewer for both surface water and foul water.

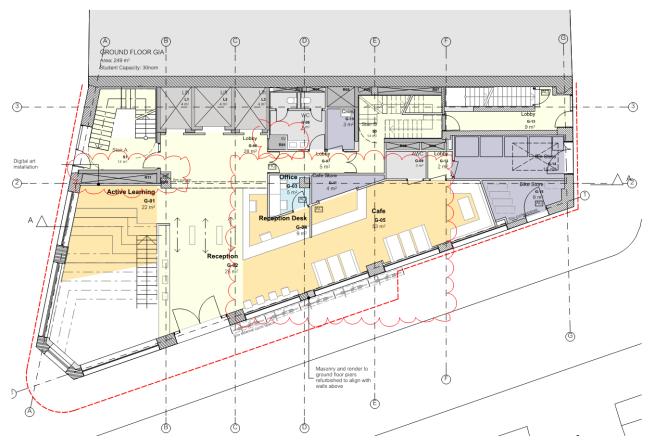


Figure 3: Layout of the proposed development Ground Floor.

4 DESIGN ASSUMPTIONS, CONSTRAINTS AND PARAMETERS

4.1 SPATIAL CONSTRAINTS

Onsite above ground drainage storage options such as swales, ponds and detention basins are not considered a viable solution due to spatial constraints inhibiting for open water features with sufficient capacity.

4.2 CLIMATE CHANGE EFFECTS

In accordance with the National Planning Policy Framework (NPPF) 2012, the effects of climate change are included within the assessment to reduce future flood risk. Following the recommended contingency allowances from the 19th February 2016, the following allowances should be made for the proposed development:

- Peak Rainfall Intensity: +40% (Upper End Allowance) for 2070 to 2115
- Peak Rainfall Intensity: +20% (Central Allowance) for 2070 to 2115

The new surface water drainage systems for the site will include SUDS and will be designed to accommodate increases in peak rainfall intensity.

4.3 ASSUMED IMPERMEABLE AREAS

The table below identifies the total area of the site and the respective surface areas belonging to hard and soft landscaping.

Table 2	: Table	of	impermeable areas
---------	---------	----	-------------------

		Existing Area (m²)	Proposed Area (m²)	Differenc (m²)
Hard Landscaping	Building Footprint	340	367	0
	External Hardstanding	0	0	0
	Total	340	367	0
Soft Landscaping	Total	0	0	0
Site Area	Total	340	367	+27

The Building footprint has not changed and governs the entire site. Part of the building does cantilever over the existing street but as the existing street is impermeable there is no change to the overall hardstanding area.

4.4 INFILTRATION RATES

Borehole investigations taken on site have identified that the site is underlain by made ground, which sits on London Clay. Due to the presence of London Clay and the fact the existing building footprint occupies the entire site, soakaways and other infiltration approaches are not likely to be appropriate or sustainable methods to drain surface water runoff from the site.

4.5 HYDROLOGICAL PARAMETERS

The drainage design has assumed the following hydrological parameters found in table 3.

Table 3: Hydrological Parameters

Hydrological Character	Parameter	Unit	Value
Rainfall Model			FSR Rainfall
Hydrological Region		-	6
M5-60		mm	20.700
Ratio	R	-	0.438
Summer Volumetric Run-	-	-	0.750
off Coefficient			
Winter Volumetric Run-off	-	-	0.840
Coefficient			

5 DRAINAGE DESIGN CRITERIA AND PRINCIPLES

5.1 EXISTING DRAINAGE

Figure 5 below shows the surrounding Thames Water Public sewers that serve the site. From the extract below it appears the site is served by a combined sewer.

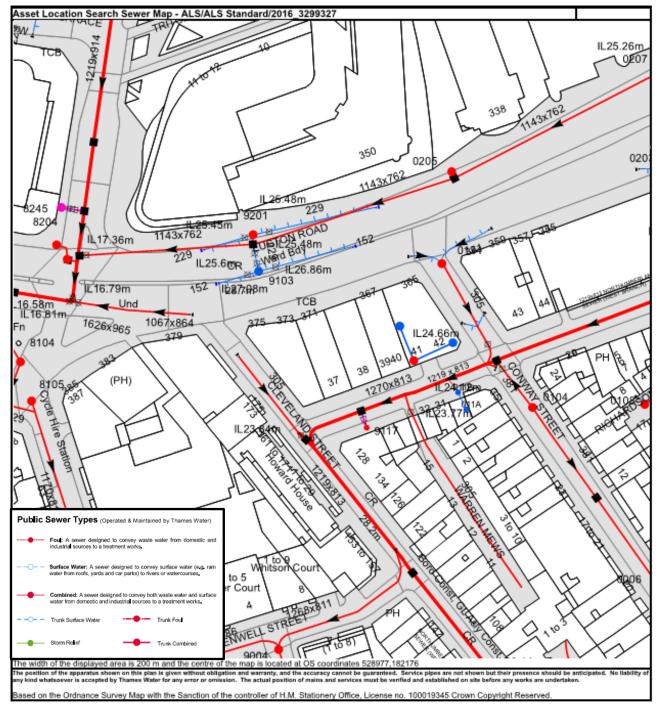


Figure 4: Thames Water Asset Search Map

The existing peak surface water flow draining into the Thames Water system has been calculated to be 20.9 l/s for the 100-year rainfall event plus 40% climate change.

5.2 PROPOSED DRAINAGE SYSTEM DESIGN

The proposed drainage system will provide separate foul and surface water systems that will confluence at the last manhole on-site within a demarcation chamber before entering the Thames Water Combined Sewer on Cleveland Street. This will allow ease to mutually exclude the surface water from the foul system if a separate surface water sewer was to be constructed by Thames Water within the vicinity of the site.

5.3 SURFACE WATER DESIGN

The surface water disposal system has been designed to ensure the drainage hierarchy has been implemented in the most practical and viable approach to benefit to the site; as per the SuDS Manual 2015. Furthermore, the design has considered the Non-Statutory Technical standards for sustainable drainage systems, and ensured these standards have been addressed.

Table	4:	Discharge	Rates

Return Period	Greenfield Runoff (l/s)	Existing Rates (I/s)	Proposed Unmitigated Rates (I/s)	Proposed Mitigated Rates (I/s)	Difference (I/s) (Proposed Mitigated – Existing)
Greenfield QBAR	0.14	N/A	N/A	N/A	N/A
l in l	0.12	4.7	4.9	4.9	0.2
l in 30	0.32	11.5	12.2	12.2	0.7
l in 100	0.44	15.0	15.8	15.8	0.8
l in 100 plus Climate change (20%)	N/A	17.9	19.0	19.0	1.1
l in 100 plus Climate change (40%)	N/A	20.9	22.2	22.2	1.3

As the existing site is currently all taken up by the building footprint and is 100% hardstanding and this is mainly a refurbishment of the existing building with a minor extension on the upper floors which cantilever over the public footpath (which is currently also all hardstanding).

As a result, there is no overall net increase in the surface water runoff being discharged into the public sewer because of this development. If one was to reduce the surface water runoff from the existing site it would result in having an attenuation tank below the basement slab (due to space constraints) which would result in the surface water discharge from the site needing to be pumped to reuse the existing drainage connection. This would add to the maintenance requirements and flood risk for the site.

As the only change to the external footprint of the building is the minor extension at the upper levels and the surface water discharge from the extension is due to be around II/s it is not possible to reduce the surface water runoff from this area. II/s is the minimum recommended flowrate for flow controls in the SuDS tool for maintenance and practical reasons

To mitigate the low risk of flooding drainage from the basement will be fitted with non-return valves to prevent any surcharge from the public sewer backing up into the building drainage.

An infiltration-based system has not been considered due to the sites geological restrains and spatial constraints. Surface water control bodies have not been considered due to the sites spatial limitations.

5.4 FOUL WATER DESIGN

It is proposed that the new foul drainage connects to the existing Thames Water combined sewer. The foul water system will provide for educational and office premises of Birbeck College. The foul system will require a pump chamber due to the depth of the double basement for the development and the positioning of the Thames Water combined sewer.

The waste water flow rate has been calculated using the Discharge Unit (DU) Method for both the existing site and the proposed development. The equation is as follow:

$$P_{PP} = P \sqrt{\sum PP}$$

 Q_{ww} = Waste Water flow rate (I/s) K = Frequency Factor $\sum \mathbb{PP}$ = Sum of discharge units

A frequency factor (K) of 0.7 has been used to represent appliances in frequent use in places such as hospitals, schools, restaurants and hotels. Birkbeck College is an Academic Institution and therefore best fits under the "School" category.

	Existing	Proposed
Discharge Units (DU)	38	44.6
Waste Water Flow Rate (Q _{ww})	4.31	4.67
(l/s)		

The results show that the Waste Water Flow Rate increases very slightly however the increase less than a 10% increase in the flow rate.

6 MAINTENANCE

The drainage system will be designed to minimise maintenance requirements; however, a full maintenance scheme will be established for those elements not being offered for adoption. The private storm and foul drains, attenuation tank and pump chamber will be maintained by Birkbeck College Cambridge house Ltd. to the manufacturer's recommendations as part of their property maintenance programme. The downstream public sewer will be maintained by Thames Water as part of their maintenance works.

6.1 BELOW GROUND DRAINAGE PIPED SYSTEMS

The below ground piped system (based on assessed flood risk) should be inspected every 10 years as a minimum and repaired and cleansed where necessary.

6.2 GULLIES AND CHANNEL DRAINS

Gullies and channel drains should be cleaned out very six months or when required.



7 DESIGN STANDARDS AND REFERENCES

The works are to be designed to the requirements of the following British Standards and documents:

- BS EN 752:2008 Drain and Sewer Systems Outside Buildings
- The Wallingford Procedure: Design and Analysis of Urban Storm Drainage
- Building Regulations 2010 Part H: Drainage and Waste Disposal.
- CIRIA Report C697: The SUDS Manual
- National Planning Policy Framework
- Volume 7 of Design Manual for Roads and Bridges.
- BS EN 1997 Eurocode 7- Geotechnical Design of Structures
- Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems April 2015.

8 CONCULSION

To conclude the designed proposal is for a separated surface water and foul system that confluences at the ultimate manhole on site before entering the Thames Water combined sewer found on Cleveland Street.

As this is mainly a refurbishment of an existing building with a minor extension of 27metres squared at the upper levels it is not practical to reduce the runoff from the extension to 50% of the existing as this is already at the minimum recommended flowrate of II/s (as recommended on the SuDS tool).

To mitigate the low risk of flooding drainage from the basement will be fitted with non-return valves to prevent any surcharge from the public sewer backing up into the building drainage. There will also be a building maintenance schedule put in place for the below ground drainage system. Surrounding proposed ground levels will also be made to slope away from the building to prevent surface water flows entering the building due to the the unlikely event of the drainage system failing.



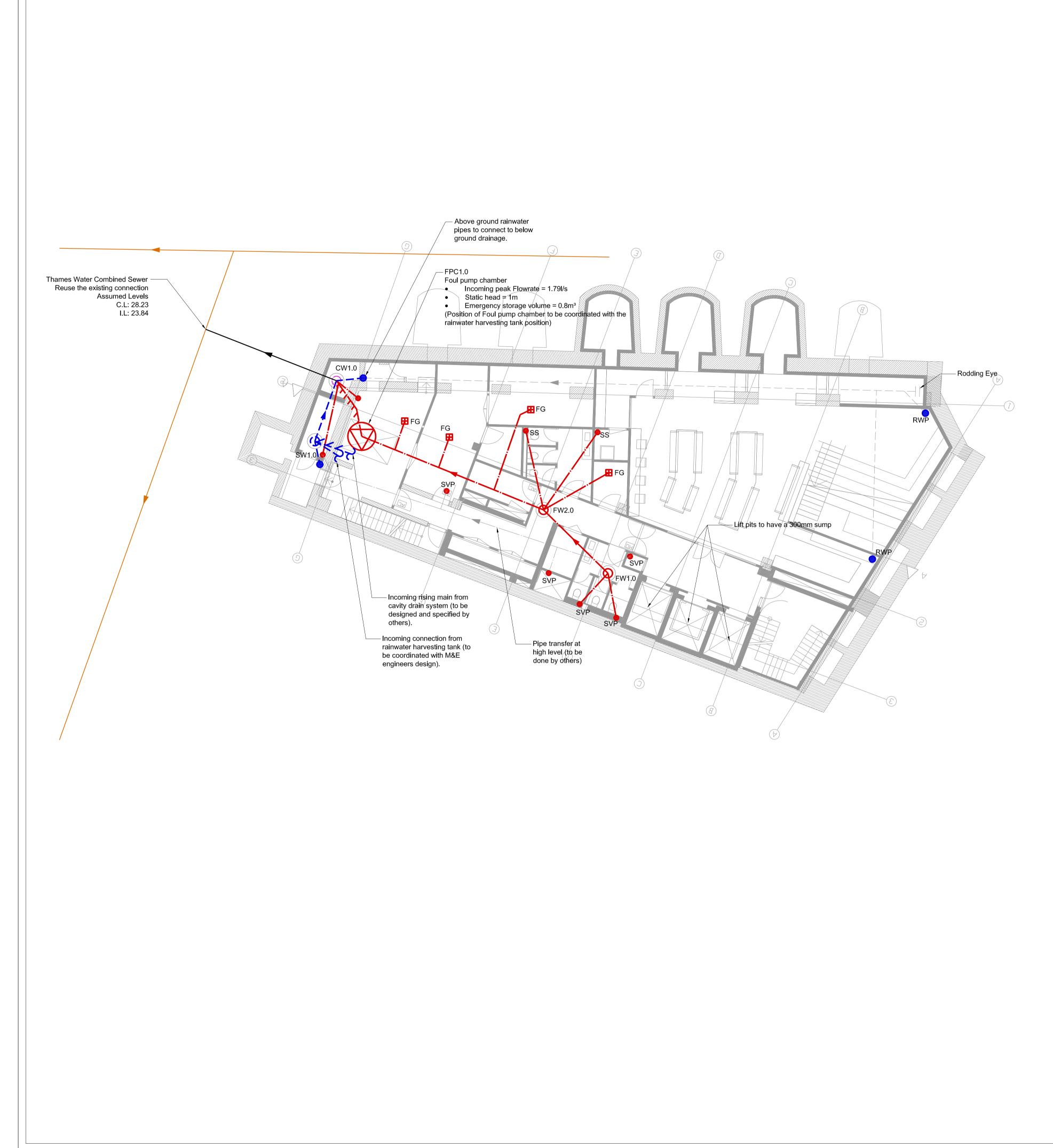
9 APPENDIX A: EXISTING TOPOGRAPHIC SURVEY

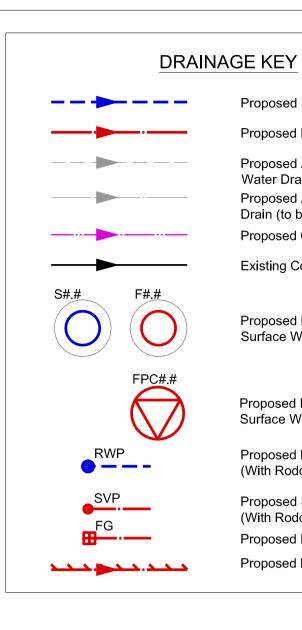




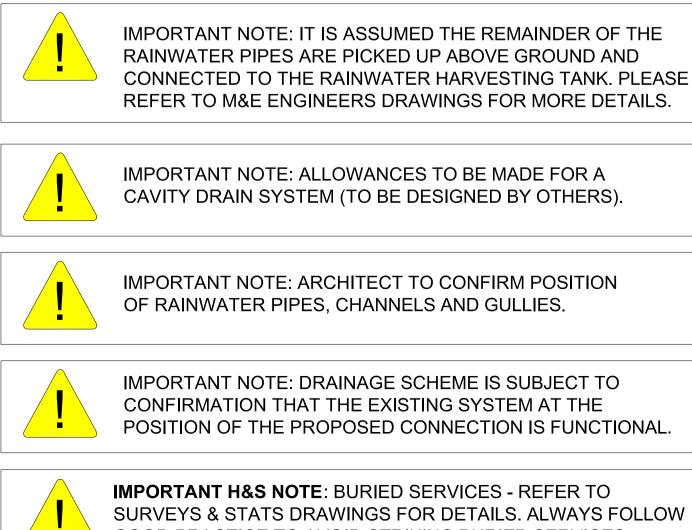


10 APPENDIX B -CIVIL DRAINAGE DRAWING





Ν



Notes

Proposed Surface Water Drain

Proposed Above Ground Surface

Proposed Above Ground Foul

Proposed Combined Drain

Existing Combined Drain

Proposed Manhole

Surface Water / Foul

Surface Water / Foul

Proposed Pumping Chamber

Proposed Rainwater Pipe

(With Roddable access)

Proposed Soil Vent Pipe

(With Roddable Access)

Proposed Pressurised Main

Proposed Foul Gully

Drain (to be designed by others)

Water Drain (to be designed by others)

Proposed Foul Drain

1. Do not scale the drawing

- 2. All dimensions are in millimetres unless noted otherwise 3. Any discrepancies between structural and architectural setting out dimensions must be brought to the attention of the Architect and Engineers
- 4. This drawing is to be read in conjunction with the drainage details and other relevant Architects and Engineers drawings and specifications.
- 5. Design and setting out of above ground drainage by Architect/M&E engineer. All soil pipes, rainwater downpipes, channels and gullies are shown indicatively.
- 6. Any part of the existing drainage system retained as part of the new scheme shall be cleaned and inspected. Any defects shall be reported to the Engineer.
- 7. Existing drainage connectivity & condition to be confirmed by Contractor. Before starting work, check invert levels & positions of existing drains, sewers, inspection chambers & manholes against drawings. Report discrepancies.
- 8. Any drains proposed to be removed, the Contractor is to confirm the drain is no longer live prior to removal/capping. 9. Existing drainage to be removed is to be broken out to bed level
- and void backfilled with granular material, compacted in layers not exceeding 250mm. 10. Private foul water and surface water drainage is to be constructed in accordance with the building regulations part H (2002), BS EN
- 12056-2:2002 (inside buildings), BS EN 752:2008 (outside buildings) and all relevant agreement certificates. 11. Any Statutory Authority (eg Section 106 Water Industry Act)
- connection approvals or new drain adoption approvals to be undertaken by Client / Contractor. 12. Relevant drains to be built to adoptable standard as per "Sewers
- for Adoption, 7th Edition". 13. Drain connections to be soffit to soffit unless noted otherwise.
- 14. UNO Gravity drains up to and including DN300 are to be constructed using flexibly jointed vitrified day pipes to BS EN 295-1:1995 (Hepworth "Supersleve" or similar approved), drains bedded and back filled in accordance with the manufacturer's instructions, all tested in accordance with BS EN 1610:1998.
- 15. UNO Gravity drains over DN300 jointed concrete pipes to BS EN 5911-1:2002 & BS EN 1916:2002 (Stanton-Bonna Integrated Gasket or similar approved), drains bedded and back filled in accordance with the manufacturer's instructions. all tested in accordance with BS EN 1610:1998.
- 16. Where drains run at shallow depths under basements and foundations, allow for Cast Iron pipes to BS EN 877 (Saint-Gobain "Timesaver" or similar approved).
- 17. All Foul Drains are DN100mm at 1:40 gradient UNO. 18. All Storm Drains are DN100mm at 1:100 gradient UNO. 19. Pipes with cover less than 1200mm under paved areas and 900mm under soft areas to be laid with concrete surround
- (Class Z or similar). 20. Concrete surround to pipes below slab to be monolithic with slab, allow for nominal re-bar to be cast into surround and tie
- into slab. Double-rocker detail required at all interfaces. 21. All pipes passing through foundations to be fitted with double rocker pipe connections on each side and/or sleeved through ground beams/walls subject to confirmation with structural engineer
- 22. Surface water from private areas is not to be discharged onto public highway.
- 23. All internal manhole covers and rodding eyes shall be of 'double-seal' type. All external foul drainage manholes shall have double seal covers and all storm drainage manholes shall have single seal cover as a minimum.
- 24. Manhole covers and frames shall be BS EN 124 and shall be Kitemarked. Covers and frames shall be heavy duty C250 in carriageways and vehicular areas and medium duty B125 in footways and soft landscaping. In blocked/concrete paved areas covers shall be recessed fabricated steel. All recessed covers shall be in accordance with the FACTA association gradings and shall match the Architects finishes.
- 25. Cover levels are to be adjusted locally to suit finished ground levels 26. Access panels are to be provided to all rainwater pipes, max
- 600 above finished ground level. 27. All drains to be tested before backfilling the trench and again
- after back filling this may need to be witnessed by the local building control officer - contractor to confirm. Contractor to agree preferred method of testing (Water or Air test) with building control/engineer.
- 28. HEALTH AND SAFETY: The works shall be carried out by specialist competent and experienced contractors who are members of a recognised national organisation. Operatives shall have received full and appropriate training for the operations they are to undertake. All work shall be carried out in accordance with all pertinent Health and Safety Regulations. 29. HEALTH AND SAFETY: Care should be taken to locate
- services prior to any excavation.

Rev	Date	Description	Drn App
00	06.12.17	Issued for comments	GP-D GP-D
01	15.12.17	Issued for Stage 3	GP-D GP-D



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Project

Cambridge House

Drawing Title

Below Ground Drainage Layout

Drawing Status

Detailed Design

Drawn by	Checked by	Sheet size	Scale	REV
MJ	GP-D	A1	1:50	S3
Drawing Number	Revision			
Jź	01			

GOOD PRACTICE TO AVOID STRIKING BURIED SERVICES.

D THE REMAINDER OF THE	
JP ABOVE GROUND AND	
R HARVESTING TANK. PLEASE	
WINGS FOR MORE DETAILS.	



11 APPENDIX C -SUPPORTING CALCULATIONS



Calculated by:	Guy Parker-Dennison
Site name:	Cambridge House
Site location:	Euston

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Greenfield runoff estimation for sites

www.uksuds.com | Greenfield runoff tool

Site coordinates

Latitude:	51.52348° N
Longitude:	0.14215° W
Reference:	6195390
Date:	2017-12-06T12:40:39

Methodology	IH12	4		
Site characteristics				
Total site area (ha)			0.1	
Methodology				
Qbar estimation metho	bc	Calculate fro	om SPR ar	nd SAAR
SPR estimation metho	bd	Calculate fro	om SOIL ty	/pe
			Default	Edited
SOIL type			4	4
HOST class				
SPR/SPRHOST			0.47	0.47
Hydrological charact	eristic	s	Default	Edited
SAAR (mm)			619	619
Hydrological region			6	6
Growth curve factor: 1	year		0.85	0.85
Growth curve factor: 3	80 yea	r	2.3	2.3
Growth curve factor: 1	00 ye	ar	3.19	3.19

Notes:

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

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

Where flow rates are less than 5.0 l/s consents are usually set at 5.0l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set in which case blockage work must be addressed by using appropriate drainage elements (3) Is SPR/SPRHOST \leq 0.3?

Greenfield runoff rates	Default	Edited
Qbar (l/s)	0.42	0.42
1 in 1 year (l/s)	0.36	0.36
1 in 30 years (l/s)	0.96	0.96
1 in 100 years (l/s)	1.33	1.33

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at http://uksuds.com/terms-and-conditions.htm. The outputs from this tool have been used to estimate storage volume requirements. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for use of this data in the design or operational characteristics of any drainage scheme.

Webb Yates Engineers		Page 1
44-46 Scrutton Street		
London	Existing Surface Water	4
EC2A 4HH	Runoff Rate Calculations	Micco
Date 06/12/2017 17:42	Designed by guy	
File SURFACE RUNOFF.MDX	Checked by	Drainage
XP Solutions	Network 2015.1	
	by the Modified Rational Method	
<u>Design</u>	<u>Criteria for Storm</u>	
Pipe Sizes STA	NDARD Manhole Sizes STANDARD	
Return Period (years) M5-60 (mm) Ratio R	20.700Minimum Backdrop Heig0.438Maximum Backdrop Heig50Min Design Depth for Optimisati30Min Vel for Auto Design only0.000Min Slope for Optimisation	ht (m) 0.200 ht (m) 1.500 on (m) 1.200 (m/s) 1.00
Design	ed with Level Soffits	

Webb Yates Engineers		Page 2
44-46 Scrutton Street	Existing Surface Water	
London	Runoff Rate Calculations	<u> </u>
EC2A 4HH	Runon Rate Calculations	Micco
Date 06/12/2017 17:42	Designed by guy	
File SURFACE RUNOFF.MDX	Checked by	Drainage
XP Solutions	Network 2015.1	

Area Summary for Storm

Pipe Number		PIMP Name		Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.034	0.034	0.034
1.001	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.034	0.034	0.034

4-46 Sc.		-		,				Page 3
	rutto	n Stree	t		Existing Surfac	e Wate	r	,
ondon					Runoff Rate Ca			Mr.
EC2A 4HH				ſ	NUTION RALE CA	liculatio	115	Micro
Date 06/	12/20	17 17:4	2	De	signed by guy			
Tile SUR	FACE	RUNOFF.	MDX	Ch	ecked by			Drainag
KP Solut	ions			Ne	twork 2015.1			
Manho	A ole He ul Sew N	real Redu Hot Stan adloss Co age per H Number of Number o Rain	Start (min Start (min rt Level (n beff (Globa hectare (l. Input Hyd of Online f Offline f Offline Sall Model Region M5-60 (mm) br Flood R	<u>1)</u> <u>Simula</u> tor 1.00 hs) mm) al) 0.50 /s) 0.00 rograph Control Control Control Control Control	00 Flow per Perso 00 s 0 Number of St s 0 Number of Ti s 0 Number of Re <u>Rainfall Detail</u>	Flow - % of ctor * 10 Inlet on per Da corage Str me/Area D eal Time C Sal Time C Satio R ((Summer) ((Winter) (DVD S	of Total Flo m ³ /ha Storad Coeffiecies y (1/per/day cuctures 0 Diagrams 0 Controls 0 0.438 0.750 0.840 tatus OFF	ow 0.000 ge 2.000 nt 0.800
		Durati	Profile on(s) (mir	is) 15,	30, 60, 120, 240			
	Reti US/MH		d(s) (year e Change (Return ((%)	First (X) First	(Y) First	1, 30, 10 0, 0, t (Z) Overf:	0 0 Water
PN			e Change ((%) Climate	First (X) First Surcharge Floc		0, 0,	00 0 Water low Level
	US/MH Name	Climat	Return C Period	(%) Climate			0, 0, t (Z) Overf:	00 0 Water low Level
PN	US/MH Name 1	Climat Storm	Return C Period	(%) Climate Change			0, 0, t (Z) Overf:	00 0 Water low Level . (m)

ondon C2A 4HH ate 06/12 ile SURFA P Solutio 30 year R Manhole	eturn Perio Areal Redu Hot Star Headloss Co Sewage per h Number of Number of	2 MDX od Summan start (min start (min st Level (n peff (Globa	R Des Che Net Cy of C. 1) Simula cor 1.00 nm) al) 0.50 (s) 0.00 rographs	for Stor tion Crite 0 Addit. 0 M 0 0 Flow pe: 0	eria ADD Fact	ow - % c or * 10n Inlet	ns aximum of Total n³/ha St Coeffie	Flow orage : cient	0.000
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	Return Perio	Profile(on(s) (mir d(s) (year e Change (is) 15, 3 is)	30, 60, 12	20, 240,		1, 30,	1440	Water
	/MH ame Storm			First (X) Surcharge				erflow Act.	Level (m)
1.000	1 15 Winte	r 30	+0%						99.076
1.001	2 15 Winter		+0%						98.362
	S US/MH PN Name	urcharged Depth (m)		Flow / Ov Cap.	verflow		I atus Ex	Level ceeded	
1	.000 1	-0.149	0.000	0.24		12.0	OK		
	.001 2	-0.151	0.000	0.23		11.5	OK		

IC2A 4HH Runoff Rate Calculations mate 06/12/2017 17:42 Designed by guy Checked by Designed by guy Checked by P. Solutions Network 2015.1 100 year Return Period Summary of Critical Results by Maximum Outflow (R 1) for Storm Simulation Criteria Areal Reduction Forteria Areal Reduction 1000 Additional Flow - % of Total Flow 0.000 Hot Start (mins) Manbol Headloss Coeff (Global) 0.500 Flow per Person per Day (1/per/day) 0.000 Number of Input Hydrographs 0 Number of Storage Structures 0 Number of Online Controls 0 Number of Time/Area Diagrams 0 Number of Online Controls 0 Number of Real Time Controls 0 Synthetic Rainfall Details Rainfall Model FSR Ratio R 0.438 Region England and Wales Cv (Summer) 0.750 M5-60 (mm) Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF DIS Status Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440 Return Period(s) (years) 1, 30, 100 (1) 30, 00 Climate Change (%) 0, 0, 0 Name Storm Period Change Surcharge Flood Overflow Act. PN Name Storm Period Change Surcharge Flood Overflow Act. N.000 115 Winter 100			gineers							P	age 5
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Provided for the second of the	Date 06/	12/20	17 17 : 42		De	esigned	by guy				
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1.001 2 15 Winter 100 +0% 98.373 Surcharged Flooded Pipe US/MH Depth Volume Flow / Overflow Flow Level PN Name (m) (m³) Cap. (1/s) Status Exceeded 1.000 1 -0.137 0.000 0.31 15.6 OK	PN		Storm								
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,	crutto	n Street			Existing S	Surface V	Vater		
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Manh	A: hole Hea bul Sewa N	real Redu Hot Star adloss Co age per he umber of Number of Rainf	ction Fac Start (mi t Level (eff (Glob ectare (1 Input Hyr f Online Offline Sall Mode: Region (5-60 (mm) r Flood R	Simul. tor 1.00 ns) mm) al) 0.50 /s) 0.00 drograph Control Control Control Control control isk Warn	ation Crite 00 Addit 0 M 00 Flow pe 00 s 0 Number s 0 Number s 0 Number s 0 Number s 0 Aumber s 0 Addit s 0 Mumber s 0 Addit s 0 Addit s 0 Mumber s 0 Addit s 0 Addit s 0 Mumber s 0 Addit s 0 Mumber s 0 Addit s 0 Addit s 0 Addit s 0 Mumber s 0 Addit s 0 Addit 0 Addit s 0 Ad	eria ional Flow ADD Factor r Person p c of Stora c of Time/. c of Real <u>Details</u> R Rat s Cv (Sum 0 Cv (Win 300.0	w (Rank 1 - % of To * 10m ³ /ha Inlet Coef per Day (1/) ge Structur Area Diagra Time Contro io R 0.438 mer) 0.750 ter) 0.840 DVD Status ctia Status	tal Flow Storage fiecient per/day) es 0 ms 0 ls 0 OFF	0.000 2.000 0.800
			Profile	(s)			Summer and	Winter	
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1.000	US/MH Name 1	Storm Storm 15 Winter	Return of Period	rs) (%) Climate Change +20% +20% Flooded	First (X) Surcharge Flow / Ot	First (Y) Flood P: verflow F:	First (Z) Overflow	100 20 Overflow Act.	<pre>w Level (m) 99.097 98.382</pre>
1.000	US/MH Name 1 2	storm Climate Storm 15 Winter 15 Winter Su US/MH Name	Return (Period 100 100 rcharged Depth	rs) (%) Climate Change +20% +20% Flooded Volume (m ³)	First (X) Surcharge I Flow / Ov Cap.	First (Y) Flood P: verflow F: (1/s) (1	First (Z) Overflow ipe Low	100 20 Overflow Act.	<pre>w Level (m) 99.097 98.382</pre>

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					Runoff Ra				Mr.
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Date 06/	12/203	17 17 : 39		De	esigned b	oy guy			Drainac
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Manh	An nole Hea bul Sewa N	real Reduc Hot Start adloss Coe age per he umber of Number of Number of	ction Fact Start (mir E Level (n eff (Globa ectare (1/ Input Hyd f Online Offline	Simula cor 1.00 mm) al) 0.50 ('s) 0.00 rograph Control Control	ation Crit 0 Addit 0 N 0 00 Flow pe 00 s 0 Numbe s 0 Numbe s 0 Numbe s 0 Numbe s 0 Numbe	eria MADD Facto Pr Person r of Stora r of Time r of Real Details	w - % of r * 10m³ Inlet C per Day age Struc /Area Dia Time Cor	agrams O ntrols O	w 0.000 e 2.000 t 0.800
	Ν	М	5-60 (mm) r Flood Ri	Englan .sk Warr nalysis	d and Wale	00 Cv (Win 300.0 Fine Ine	nmer) 0.7 hter) 0.8 DVD Sta	750 340 tus OFF	
		Duratio		s) 15,	30, 60, 1	20, 240, 3		and Winter 960, 1440	
	US/MH	rn Period Climate	Change (Return C	limate				100 40 (Z) Overfl	Water ow Level
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Webb Yates Engineers		Page 1
44-46 Scrutton Street	Bronocod Surface Weter	
London	Proposed Surface Water Runoff Rates Calculations	4
EC2A 4HH	Runom Rates Calculations	Micco
Date 06/12/2017 17:49	Designed by guy	
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XP Solutions	Network 2015.1	
	by the Modified Rational Method Criteria for Storm	
Pipe Sizes STA	NDARD Manhole Sizes STANDARD	
Return Period (years) M5-60 (mm) Ratio R Maximum Rainfall (mm/hr) Maximum Time of Concentration (mins) Foul Sewage (l/s/ha) Volumetric Runoff Coeff.	0.438 Maximum Backdrop Heig 50 Min Design Depth for Optimisati 30 Min Vel for Auto Design only 0.000 Min Slope for Optimisation	ht (m) 0.200 ht (m) 1.500 on (m) 1.200 (m/s) 1.00

Webb Yates Engineers		Page 2
44-46 Scrutton Street	Proposed Surface Water	
London	Runoff Rates Calculations	L.
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XP Solutions	Network 2015.1	

Area Summary for Storm

Pipe Number		PIMP Name		Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.036	0.036	0.036
1.001	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.036	0.036	0.036

44-46 Sc		gineers							Pa	ge 3
	rutto	n Street		P	ronoser	l Surface	Wate	r		
London						ates Calo			4	
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XP Solut	ions			Ne	twork 2	015.1				
<u>l year</u>	<u>Retur</u>	<u>n Perioc</u>	<u>l Summar</u>		<u>ritical</u> for Sto	<u>Results</u> rm	by Max	<u>imum (</u>	Dutflo	w (Rank
	nole Hea bul Sewa	Hot S Hot Start adloss Coe age per he Jumber of	Start (mi z Level (eff (Glob ectare (1 Input Hyc	tor 1.00 ns) mm) al) 0.50 /s) 0.00 drographs	0 1 0 00 Flow po 00 s 0 Numbe	tional Flo MADD Facto er Person er of Stora	or * 10m Inlet per Day age Stru	³ /ha St Coeffie (l/per actures	orage 2 cient (/day) (0	2.000
						er of Time, er of Real		2		
		Rainf	<u>S</u> all Model		Rainfall F	Details SR Ra	tio R N	.438		
		Matilt				es Cv (Sui				
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PN	US/MH Name	Storm		Change	Surcharge) First Overf		erflow Act.	Level (m)
PN 1.000 1.001	Name 1	Storm 15 Winter 15 Winter	Period	Change +0응 +0응	Surcharge					
1.000	Name 1	15 Winter 15 Winter	Period	+0% +0% Flooded Volume	-	Flood I Verflow F	Overf Pipe Flow	low	Act. Level	(m) 99.049
1.000	Name 1	15 Winter 15 Winter Su	Period 1 1 rcharged	+0% +0% Flooded	-	Flood I Verflow F	Overf Pipe	low	Act. Level	(m) 99.049
1.000	Name 1 2	15 Winter 15 Winter Su US/MH Name 1	Period 1 1 rcharged Depth	+0% +0% Flooded Volume	Flow / C Cap. 0.10	Flood I Verflow F	Overf Pipe Flow	low	Act. Level	(m) 99.049
1.000	Name 1 2 PN 1.000	15 Winter 15 Winter Su US/MH Name 1	Period 1 1 rcharged Depth (m) -0.176	+0% +0% Flooded Volume (m ³) 0.000	Flow / C Cap. 0.10	Flood I Verflow F	Overf Pipe Flow 1/s) St 5.2	low atus Ex OK	Act. Level	(m) 99.049
1.000	Name 1 2 PN 1.000	15 Winter 15 Winter Su US/MH Name 1	Period 1 1 rcharged Depth (m) -0.176	+0% +0% Flooded Volume (m ³) 0.000	Flow / C Cap. 0.10	Flood I Verflow F	Overf Pipe Flow 1/s) St 5.2	low atus Ex OK	Act. Level	(m) 99.049
1.000	Name 1 2 PN 1.000	15 Winter 15 Winter Su US/MH Name 1	Period 1 1 rcharged Depth (m) -0.176	+0% +0% Flooded Volume (m ³) 0.000	Flow / C Cap. 0.10	Flood I Verflow F	Overf Pipe Flow 1/s) St 5.2	low atus Ex OK	Act. Level	(m) 99.049

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ondon	rutto	n Street		P	ronose	d Surfac		ter		
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C2A 4HH	1					ales Cai	Cuiat	ions	N	Aicro
ate 06/	12/20	17 17:49	3	De	esigned	by guy				
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