elliottwood

The Network Building
97 Tottenham Court Road
London W1T 4TP

Outline Application: Surface Water Drainage Statement

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		Remarks:	**Issued for Planning**				
Revision	P1	Prepared by:	Will Hudson MEng (Hons)	Checked by:	Paul Davis BEng (Hons) MSc CEng MICE	Approved by:	Paul Davis BEng (Hons) MSc CEng MICE
Date:	19/11/2020	Signature:		Signature:		Signature:	

Contents

Appendices

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One

Introduction

1.1

Elliott Wood Partnership Ltd have been appointed to provide a Surface Water Drainage Statement to support an outline planning application for the proposed development at The Network Building, 97 Tottenham Court Road, London W1T 4TP.

1.2

The purpose of this report is to explain the approach taken with regards to the below ground drainage strategy. It evaluates the selection of SuDS devices and highlights how the drainage disposal hierarchy has been followed.

1.3

This report has been prepared in accordance with the GOV.UK *Sustainable Drainage Systems: Non-statutory Technical Standards, The New London Plan* and the *London Borough of Camden (LBC) Advice Note on contents of a Surface Water Drainage Statement* and LBC's *Strategic Flood Risk Assessment (SFRA) 2014.*

1.4

This proposal seeks outline planning permission for "Demolition of the existing building and construction of a new building to provide for a maximum of 17275 sqm (GIA) of E class use floorspace along with details of access, scale and landscaping and other works incidental to the application (layout and appearance reserved)."

1.5

This Surface Water Drainage Statement is supported by an Outline Structural Engineering Report. As detailed matters of layout and appearance are reserved, further supporting documents will be required with assessing the detail of the different structural proposals and basement impact assessments.

Two

Existing Site

2.1

The development site is located within the London Borough of Camden (LBC). The site is located on the corner of Tottenham Court Road and Howland Street. The site is bound to the west by Whitfield Street, with Cyprus Place running through the centre of the site. The site sits approximately 250m northwest of Goodge Street London Underground Station. The total site area is approximately 2,070m^2 (0.207ha) and is considered to be 100% hardstanding drained area.

2.2

The existing building located on the site is 6-storey mixed use building, with a double height retail space fronting Tottenham Court Road with office space occupying the rest of the building.

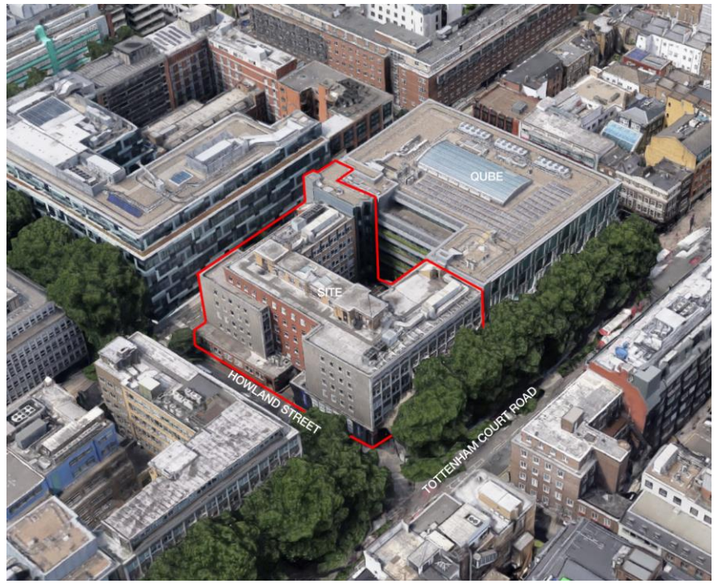

Figure 1: Site Location

2.3

A topographical survey of the site was completed by Point 2 Surveyors Ltd in December 2017. The survey shows very little level change along the Tottenham Court Road and Whitfield Street elevations and a slight fall from west to east along Howland Street of approximately 100mm over the width of the building. The topographic survey has been included in **Appendix A.**

Three

Underlying Geology

Site specific investigations have not yet been carried out, however a Ground Investigation report carried out by Ove Arup & Partners Ltd (Arup) for the neighbouring 80 Charlotte Street development has been made available.

The geotechnical information indicate that the soil conditions comprise of varying depths of Made Ground underlain by River Terrace Deposits that is then underlain by London Clay.

Four

Existing Drainage

4.1

Public sewer records have been obtained from Thames Water. An extract of the asset plan is shown in **Figure 2** below. Refer to **Appendix B** for the full records.

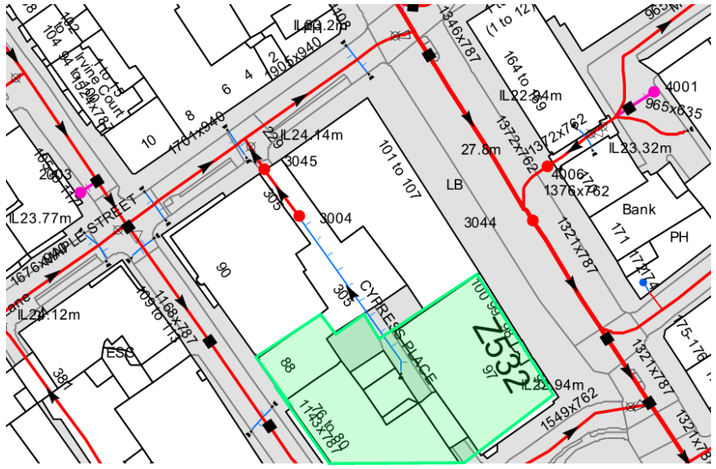

Figure 2: Extract from Thames Water sewer records

4.2

The records show a 1321x787mm combined water trunk sewer running south beneath Tottenham Court Road, 1168x787mm combined water sewer running south in Whitfield Street, and a 1549x762 combined water sewer running east in Howland Street which connects to the trunk sewer in Tottenham Court Road.

4.3

A CCTV Drainage Survey has been undertaken by WJ Shirley to confirm the location, size, depth and condition of the existing network on site, and principally to the located the existing outfall positions to review the possibility for reuse.

The survey indicates that the site has two existing foul water sewer connections to the combined water sewer Howland Street and a separate surface water outfall.

Refer to **Appendix C** for the report prepared by WJ Shirley Ltd.

4.4

The surface water runoff rates for the existing site have been calculated using the Modified Rational Method equation below (based on CIRIA C697) and are shown in **Table 1**:

Q = 2.78C.i.A

Where

Q = Existing peak runoff (l/s),

C = non-dimensional runoff coefficient=1.0,

i = Rainfall intensity (see table 1) and

A = total catchment area being drained =0.207ha

Table 1 Existing Surface Water Run-off rates

Return Period	Rainfall Intensity (mm/hr)	Existing run-off (l/s)
1yr	33.6	19.4
30yr	82.6	47.5
100yr	107.5	61.9

Note that the rainfall intensities used in the above calculations have been based on average rainfall intensities for a 15-minute storm using Micro Drainage software.

Five

Proposed Development

5.1

The proposed works involve the demolition of the existing building and construction of a new building on the site.

Please refer to the Reserved Matters documents submitted as part of the planning application for further details on the proposed development.

Six

Proposed Drainage

6.1

The surface water drainage system has been designed in accordance with the requirements of the National Planning Policy Framework (NPPF) and relevant Planning Practice Guidance (PPG) and the LBC Advice Note on contents of a Surface Water Drainage Statement. The following drainage hierarchy has therefore been considered:

1) Store rainwater for later use
2) Use infiltration techniques, such as porous surfaces in non-clay areas
3) Attenuate rainwater in ponds or open water features for gradual release
4) attenuate rainwater by storing in tanks or sealed water features for gradual release
5) Discharge rainwater direct to a watercourse
6) Discharge rainwater to a surface water sewer/drain
7) Discharge rainwater to the combined sewer.

6.2 Appraising the use of Rainwater Harvesting

It is not proposed to use rainwater harvesting techniques for the scheme due to the required space for an appropriately sized tank, and the additional complexity involved with the routing of mains water supply within the proposed building.

The demand on the potable water supply will be reduced as much as possible through the use of low flow appliances

6.3 Appraising the use of Infiltration Techniques

In order to comply with building regulations, infiltration techniques such as soakaways must not be installed within 5m of a building or highway. As the building occupies the entirety of the site, it is not possible to comply with this requirement from building regulations.

Due to the limited external areas, which are located above the basement slab, it will not be feasible to make use of permeable paving for the development.

6.4 Appraising the use of Open Water Feature

As the site has no associated external area at ground floor proposed as part of the development, it will not be possible to use open water features to provide attenuation

.

6.5 Appraising the use of above and below ground attenuation

The current proposals include a combination of green/blue roofs as indicated on the architect's drawings. This will help to improve the thermal performance of the building, reduce the urban heat island effect, reduce both the total and peak surface water discharge and enhance biodiversity in the surrounding area.

6.6

The development proposes to achieve attenuation of surface water through above ground blue roof systems only in order to avoid the need for below ground attenuation or attenuation in the basement.

6.7

The evaluation of SuDS is demonstrated in **Table 2** below.

Table 2 Evaluation of SuDS techniques

SuDS Technique	Y/N	Comment
Blue Roofs	**Y**	**Blue roofs will be incorporated within the scheme. Refer to the architects drawings for location and details.**
Rainwater reuse	N	Rainwater reuse is not proposed for the scheme as it is proposed to reduce water usage rather than recycle rainwater.
Open Water features	N	There is limited external space for open water features and the nature of the development makes open water features unfeasible.
Infiltration devices (i.e. Soakaways)	N	Soakaways are not deemed feasible for this site due to restricted space on site not allowing a minimum of 5m from buildings or roads.
Permeable surfaces	N	There are no external areas at ground floor associated with the site, therefore permeable surfaces are not possible
Tanked systems	N	It is proposed to avoid tanked systems by utilising an above ground attenuation system via the blue roof.

6.8

There are no nearby accessible water courses, therefore surface water generated from site areas of the development will discharge at a restricted rate to the Thames Water combined water sewers in Howland Street and Whitfield Street.

6.9

The LBC Advice Note on contents of a Surface Water Drainage Statement states that developments should aim to achieve greenfield runoff rates. The greenfield runoff for the site has been calculated using Micro Drainage and are shown in **Table 3**.

Table 3 Greenfield Runoff Rates (from Micro Drainage)

Return Period	Greenfield Runoff Rate (l/s)
QBar	0.8
1 in 1 year	0.6
1 in 30 year	1.7
1 in 100 year	2.4

As can be seen, the greenfield run-off rates for the site are very low, and it is not considered feasible to restrict a site of this size to 0.8l/s due to the increased risk of blockages associated with the low flows and small orifice size required.

6.10

The LBC advice states that for sites where it is not feasible to achieve Greenfield Runoff rates, “a minimum 50% reduction in run off rate across the development is required”.

It is therefore proposed to utilise a blue roof system to reduce the runoff from the proposed building. ABG Ltd have been contacted and provided calculations for the proposed blue roof systems to be located at the upper roof level and the Level 5 terrace area. The ABG Ltd Calculations have been included within **Appendix D.**

A total of 900m^2 will be routed to the blue roof system which will cover 660m^2 of the roof. The total runoff achieve from the blue roof has been calculated to be a peak discharge of **1.4l/s** for the 1 in 100-year return + 40% climate change. The peak run-off for the 1 in 1-year, 1 in 30-year and 1 in 100-year return have been shown in the **Table 4** below.

Table 4 Blue Roof Runoff Rates (from ABG Ltd)

Return Period	Blue Roof Runoff Rate (l/s)
1 in 1 year	0.6
1 in 30 years	1.0
1 in 100 years	1.1
1 in 100 years + 40% Climate Change	1.4

6.11

Due to the build-up depth available on the roof terrace areas, it is not possible to use a blue roof system in these areas. It is however proposed to use a green roof system in some of these areas. Although a green roof does not attenuate surface water, it does help reduce the peak runoff rate by slowing the rate of rainwater through the percolation through the soil and through evapotranspiration. A minimum of 529m^2 of green roof is proposed on Levels 08 and 09.

6.12

Using Micro Drainage, it is possible to calculate the peak runoff from the 529m^2 of green roof for the various storm events, as shown in the **Table 5** below. Refer to **Appendix E** for the green roof runoff calculations.

Table 5 Green Roof Area Runoff Rates

Return Period	Unrestricted area Runoff Rate (l/s)
1 in 1 year	2.2
1 in 30 years	5.9
1 in 100 years	7.8
1 in 100 years + 40%	10.9

6.13

There is approximately 641m^2 that is within the red line boundary but cannot be routed to an attenuation device or used for green roof. In order to avoid the need for pumping surface water from an attenuation tank in or below the basement, it is proposed to allow this area to drain freely. Based on the rainfall profiles detailed earlier in this report (**Table 1**), the runoff from this area has been calculated as shown in **Table 6**.

Table 6 Unrestricted Area Runoff Rates

Return Period	Unrestricted area Runoff Rate (l/s)
1 in 1 year	6.0
1 in 30 years	14.7
1 in 100 years	19.2
1 in 100 years + 40%	25.1

6.14

The total runoff from the proposed development site, and the percentage improvement over the existing runoff can be seen in **Table 7**.

Table 7 Total proposed runoff

Return Period	Existing Runoff Rate (l/s)	Proposed Runoff Rate (l/s)	Percentage betterment (%)
1 in 1 year	19.4	8.8	54%
1 in 30 years	47.5	21.6	55%
1 in 100 years	61.9	28.1	55%
1 in 100 years + 40% Climate Change	N/A	37.4	>55%

6.15

Please refer to **Appendix F** for the proposed below ground drainage strategy. The London Borough of Camden Surface Water Drainage Pro-forma for new developments has been completed and included within **Appendix G**.

Seven

Maintenance Requirements

7.1

All SuDS will be maintained by the building management company for the lifetime of the development in accordance with the SuDS Manual as summarised below. Maintenance requirements for the blue/green roof will be supplied by the specialist designer.

Green/Blue Roofs:

Maintenance Schedule	Required Action	Recommended Frequency
Regular inspections	Inspect all components including soil substrate, vegetation, drains, irrigation systems (if applicable), membranes and roof structure for proper operation, integrity of waterproofing and structural stability	Annually and after severe storms
	Inspect soil substrate for evidence of erosion channels and identify any sediment sources	Annually and after severe storms
	Inspect drain inlets to ensure unrestricted runoff from the drainage layer to the conveyance or roof drain system	Annually and after severe storms
	Inspect underside of roof for evidence of leakage	Annually and after severe storms
Regular maintenance	Remove debris and litter to prevent clogging of inlet drains and interference with plant growth	Six monthly and annually or as required
	During establishment (ie year one), replace dead plants as required	Monthly (but usually responsibility of manufacturer)
	Post establishment, replace dead plants as required (where > 5% of coverage)	Annually (in autumn)
	Remove fallen leaves and debris from deciduous plant foliage	Six monthly or as required
	Remove nuisance and invasive vegetation, including weeds	Six monthly or as required
	Mow grasses, prune shrubs and manage other planting	Six monthly or as required
	(if appropriate) as required – clippings should be removed and not allowed to accumulate	
Remedial actions	If erosion channels are evident, these should be stabilised with extra soil substrate similar to the original material, and sources of erosion damage should be identified and controlled	As required
	If drain inlet has settled, cracked or moved, investigate and repair as appropriate	As required

Eight

Flood Risk

8.1

The existing site is located within Flood Zone 1 and is considered to be at low risk of flooding from fluvial and tidal sources. The development site area is less than 1 hectare in plan area, and not located in an area identified by the London Borough of Camden as a Local Flood Risk Zone. As a result, in accordance with Paragraph 103 footnote 20 of the NPPF, a site-specific flood risk assessment is not required for planning.

Nine

Foul Water Drainage Strategy

9.1

Foul water appliances within the new basement level will be pumped via a private packaged pumping station to a suspended above ground network (detailed by the M&E engineer). The pumping station will be specified with a dual pump arrangement (duty and standby) and installed with non-return valve, alarms and telemetry. All foul drainage from ground floor and above will be drained to the below ground drainage network by gravity

Ten

Conclusion

10.1

In summary, following the advice and guidance provided by the London Borough of Camden, a SuDS strategy has been produced for the planning application associated with The Network Building.

10.2

The SuDS Hierarchy has been followed in order to employ the most suitable and practicable SuDS techniques to improve surface water run off rates from the site. The proposed development will restrict surface water run off to the public sewer to a peak discharge of 37.4l/s for the site. This provides a betterment on existing of over 54% for the 1 in 100-year event + 40% climate change event.

10.3

A blue roof system over the main roof area and terraces at Level 05 will provide surface water attenuation above ground level and help restrict these areas of the site to a peak discharge rate of 1.4l/s for the 100 year + 40% climate change return period.

A partial green roof at level 08 and 09 will help with the reduction in peak runoff from the site and also improve the biodiversity of the site, and help reduce the urban heat island effect.

Due to the available build-up depth for the other roof terraces, it is not possible to drain all areas through the blue roof system. It is therefore proposed to allow the remaining areas to drain freely to the sewer. The site achieves an improvement of over 55% in the 1 in 100-year event + 40% climate change event, which is in line with the minimum 50% reduction stated by LBC in the guidance documents. .

10.4

Through the use of SuDS techniques and following the guidance and policy provided by the London Borough of Camden, the surface water management of the proposed site will see a significant betterment from the existing case.

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Appendices

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A Topographic Survey

Sources: Levels are related to Ordnance Survey Datum via GPS Observations

Survey location is related to Ordnance Survey Grid via GPS Observations.

All information contained in this drawing (including digital data) should be checked and verified prior to any fabrication or construction.

Stations:
STN 001 529410.051, 182015.219, 27.831
STN 002 529331.322, 182025.990, 27.942
STN 003 529363.649, 181979.221, 27.820

Key:

A/C	Air Conditioning Unit
B	Bollard
BP	Brick Paving
BT	BT Inspection Cover
CATV	Cable Television Inspection Cover
CPS	Concrete Paving Slab
DK	Dropped Kerb
DP	Down Pipe
EC	Electricity Inspection Cover
EL	Eaves Level
FH	Fire Hydrant
G	Gully
GP	Gate Post
IC	Inspection Cover
ILB	Illuminated Bollard
IRS	Illuminated Road Sign
JB	Junction Box
LP	Lamp Post
MH	Man Hole Cover
PB	Post Box
PL	Pavement Light
PO	Post
RL	Ridge Level
SRFC	Surface Change
S/O	Smoke Outlet
SV	Stop Valve
TCB	Telephone Call Box
TP	Tactile Paving
W	Water Inspection Cover
WM	Water Meter

N Indicative

S1
S2

Project: Network Building, 90 Whitfield Street

Title: Topographic Survey Sheet 1

Drawn By: SC

Scale: 1:100 @ A0

Date: December 2017

Dwg No: P1618/T/01

Point 2 Surveyors Ltd,
3rd Floor,
17 Slingsby Place,
London WC2E 9AB,
0207 836 5828
www.point2surveyors.com

Sources: Levels are related to Ordnance Survey Datum via GPS Observations

Survey location is related to Ordnance Survey Grid via GPS Observations.

All information contained in this drawing (including digital data) should be checked and verified prior to any fabrication or construction.

Stations:

STN 001	529410.051	182015.219, 27.831
STN 002	529331.322	182025.990, 27.942
STN 003	529363.649	181979.221, 27.820

Key:

A/C	Air Conditioning Unit
B	Bollard
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BT	BT Inspection Cover
CATV	Cable Television Inspection Cover
CPS	Concrete Paving Slab
DK	Dropped Kerb
DP	Down Pipe
EC	Electricity Inspection Cover
EL	Eaves Level
FH	Fire Hydrant
G	Gully
GP	Gate Post
IC	Inspection Cover
ILB	Illuminated Bollard
IRS	Illuminated Road Sign
JB	Junction Box
LP	Lamp Post
MH	Man Hole Cover
PB	Post Box
PL	Pavement Light
PO	Post
RL	Ridge Level
SRFC	Surface Change
S/O	Smoke Outlet
SV	Stop Valve
TCB	Telephone Call Box
TP	Tactile Paving
W	Water Inspection Cover
WM	Water Meter

S1

S2

Project: Network Building, 90 Whitfield Street			Title: Topographic Survey Sheet 2
Drawn By: SC	Scale: 1:100 @ A0	Date: December 2017	Dwg No: **P1618/T/02**

Point 2 Surveyors Ltd,
3rd Floor,
17 Slingsby Place,
London WC2E 9AB,
0207 836 5828
www.point2surveyors.com

B Thames Water Asset Records

Asset location search

Property Searches

Elliott Wood Partnership LLP
241The Broadway
LONDON
SW19 1SD

Search address supplied 93
Tottenham Court Road
London
W1T 4TW

Your reference 2170754

Our reference ALS/ALS Standard/2017_3692965

Search date 20 November 2017

Keeping you up-to-date

Knowledge of features below the surface is essential in every development. The benefits of this not only include ensuring due diligence and avoiding risk, but also being able to ascertain the feasibility for any commercial or residential project.

An asset location search provides information on the location of known Thames Water clean and/or wastewater assets, including details of pipe sizes, direction of flow and depth. Please note that information on cover and invert levels will only be provided where the data is available.

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

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

0845 070 9148

searchcode

Asset location search

Property Searches

Search address supplied: 93, Tottenham Court Road, London, W1T 4TW

Dear Sir / Madam

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

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

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

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

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

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

Contact Us

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

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

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

Waste Water Services

Please provide a copy extract from the public sewer map.

The following quartiles have been printed as they fall within Thames' sewerage area:

TQ2982SE
TQ2982SW
TQ2981NE
TQ2981NW

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

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

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

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

For your guidance:

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

Clean Water Services

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

The following quartiles have been printed as they fall within Thames' water area:

TQ2982SE
TQ2982SW

Asset location search

Thames Water Property Searches

TQ2981NE
TQ2981NW

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

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

For your guidance:

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

Payment for this Search

A charge will be added to your suppliers account.

Further contacts:

Waste Water queries

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

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

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

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

Clean Water queries

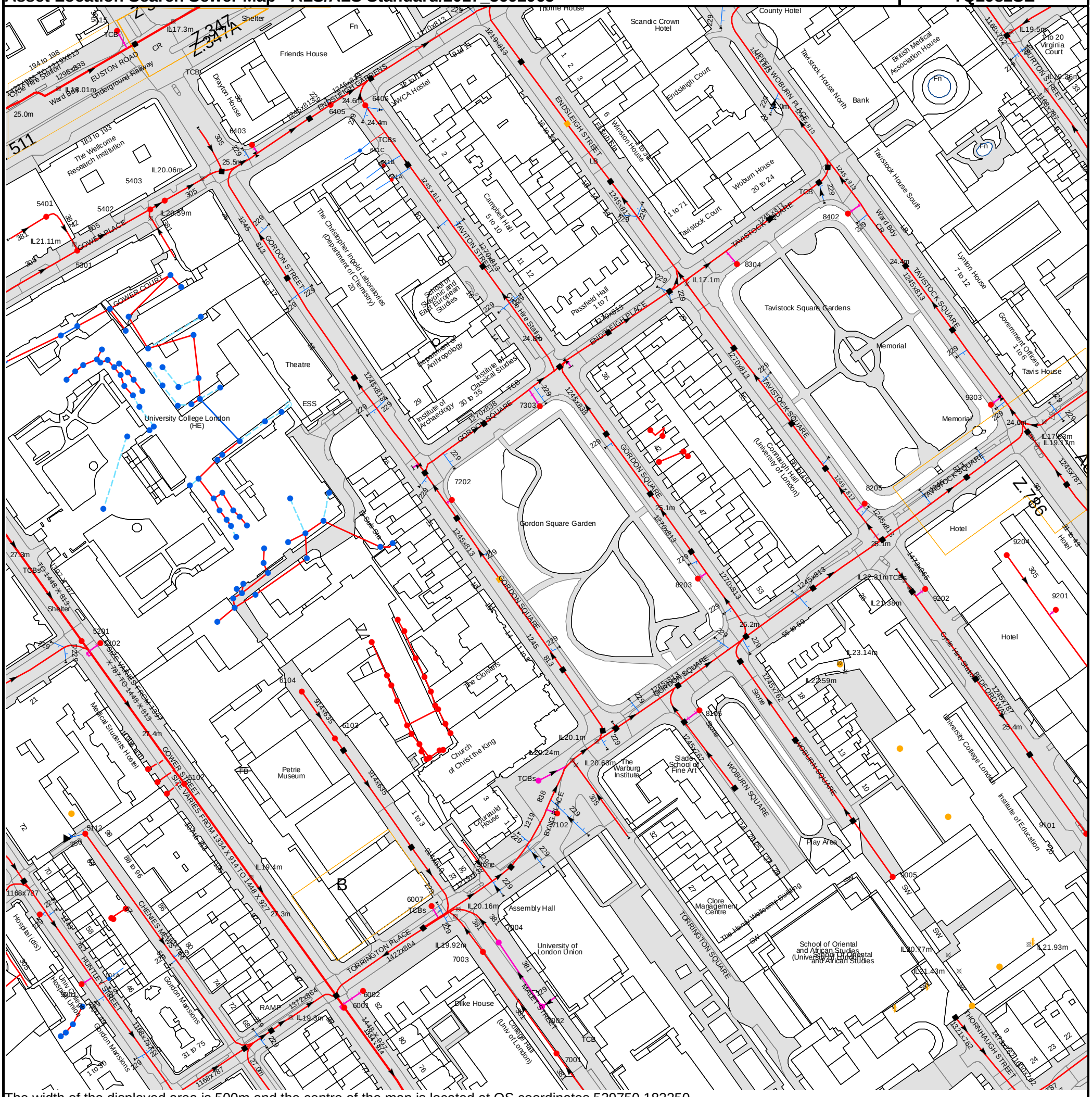
Should you require any advice concerning clean water operational issues or clean water connections, please contact:

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

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

Asset Location Search Sewer Map - ALS/ALS Standard/2017_3692965

TQ2982SE



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 529750,182250

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

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

Manhole Reference	Manhole Cover Level	Manhole Invert Level
8402	n/a	n/a
62CI	n/a	n/a
62DD	n/a	n/a
62DF	n/a	n/a
62DE	n/a	n/a
62DH	n/a	n/a
62DI	n/a	n/a
62CG	n/a	n/a
62DA	n/a	n/a
62EB	n/a	n/a
62EC	n/a	n/a
62CH	n/a	n/a
62BJ	n/a	n/a
62CJ	n/a	n/a
62CB	n/a	n/a
62CE	n/a	n/a
62DJ	n/a	n/a
62CA	n/a	n/a
62CD	n/a	n/a
62CC	n/a	n/a
7202	n/a	n/a
62CF	n/a	n/a
62EA	n/a	n/a
62BI	n/a	n/a
63CA	n/a	n/a
63BJ	n/a	n/a
7303	n/a	n/a
63BI	n/a	n/a
641C	n/a	n/a
7102	n/a	n/a
7101	n/a	n/a
61BI	n/a	n/a
61BJ	n/a	n/a
61BH	n/a	n/a
61CA	n/a	n/a
71DI	n/a	n/a
61BG	n/a	n/a
6103	24.85	n/a
61BF	n/a	n/a
71DH	n/a	n/a
61BE	n/a	n/a
71DG	n/a	n/a
61BA	n/a	n/a
61AJ	n/a	n/a
61BD	n/a	n/a
6104	24.91	21.48
61AI	n/a	n/a
61BC	n/a	n/a
61AH	n/a	n/a
61BB	n/a	n/a
61AG	n/a	n/a
62EG	n/a	n/a
62EF	n/a	n/a
62EE	n/a	n/a
62DB	n/a	n/a
62DC	n/a	n/a
73DA	n/a	n/a
82DH	n/a	n/a
83BI	n/a	n/a
82DF	n/a	n/a
82DG	n/a	n/a
8203	n/a	n/a
8105	n/a	n/a
8304	n/a	n/a
8205	n/a	n/a
9202	n/a	n/a
9303	n/a	n/a
9204	24.98	21.47
9201	24.8	n/a
7001	26.52	20.32
6001	n/a	n/a
7002	26.47	20.45
6002	n/a	n/a
7003	26.34	19.96
7004	26.2	20.18
6007	n/a	n/a
9005	n/a	n/a
9101	25.29	21.12
50DD	n/a	n/a
5112	24.55	23.1
501A	n/a	n/a
50CC	n/a	n/a
50BH	n/a	n/a
50DE	n/a	n/a
50EJ	n/a	n/a
50FA	n/a	n/a
50FB	n/a	n/a
50FC	n/a	n/a
5001	n/a	n/a
5401	n/a	n/a
5415	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
5402	25.62	20.44
5403	25.59	20.35
6403	n/a	n/a
6405	n/a	n/a
6406	24.31	17.04
641B	n/a	n/a
641A	n/a	n/a
53BH	n/a	n/a
53DI	n/a	n/a
53DG	n/a	n/a
53BF	n/a	n/a
53DB	n/a	n/a
53DJ	n/a	n/a
53DF	n/a	n/a
53CA	n/a	n/a
53DA	n/a	n/a
53DE	n/a	n/a
53BG	n/a	n/a
53EA	n/a	n/a
53DC	n/a	n/a
53CJ	n/a	n/a
53DD	n/a	n/a
53EB	n/a	n/a
53AI	n/a	n/a
53AG	n/a	n/a
53AJ	n/a	n/a
53BD	n/a	n/a
53BB	n/a	n/a
53CD	n/a	n/a
53AH	n/a	n/a
53BC	n/a	n/a
53BE	n/a	n/a
53AD	n/a	n/a
5301	25.89	20.88
5116	n/a	n/a
5102	27.22	19.69
5115	n/a	n/a
5114	n/a	n/a
5202	n/a	n/a
5201	27.41	19.84
52BH	n/a	n/a
52BE	n/a	n/a
52BG	n/a	n/a
52BD	n/a	n/a
52BF	n/a	n/a
52BA	n/a	n/a
52BB	n/a	n/a
52BC	n/a	n/a
52AE	n/a	n/a
53EC	n/a	n/a
53CE	n/a	n/a
53CF	n/a	n/a
53CG	n/a	n/a
53BI	n/a	n/a
53BJ	n/a	n/a
53BA	n/a	n/a
53CH	n/a	n/a
53DH	n/a	n/a
53CC	n/a	n/a
53CB	n/a	n/a
53CI	n/a	n/a

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Asset Location Search Sewer Map - ALS/ALS Standard/2017_3692965

TQ2982SW

The width of the displayed area is 500m and the centre of the map is located at OS coordinates 529250,182250

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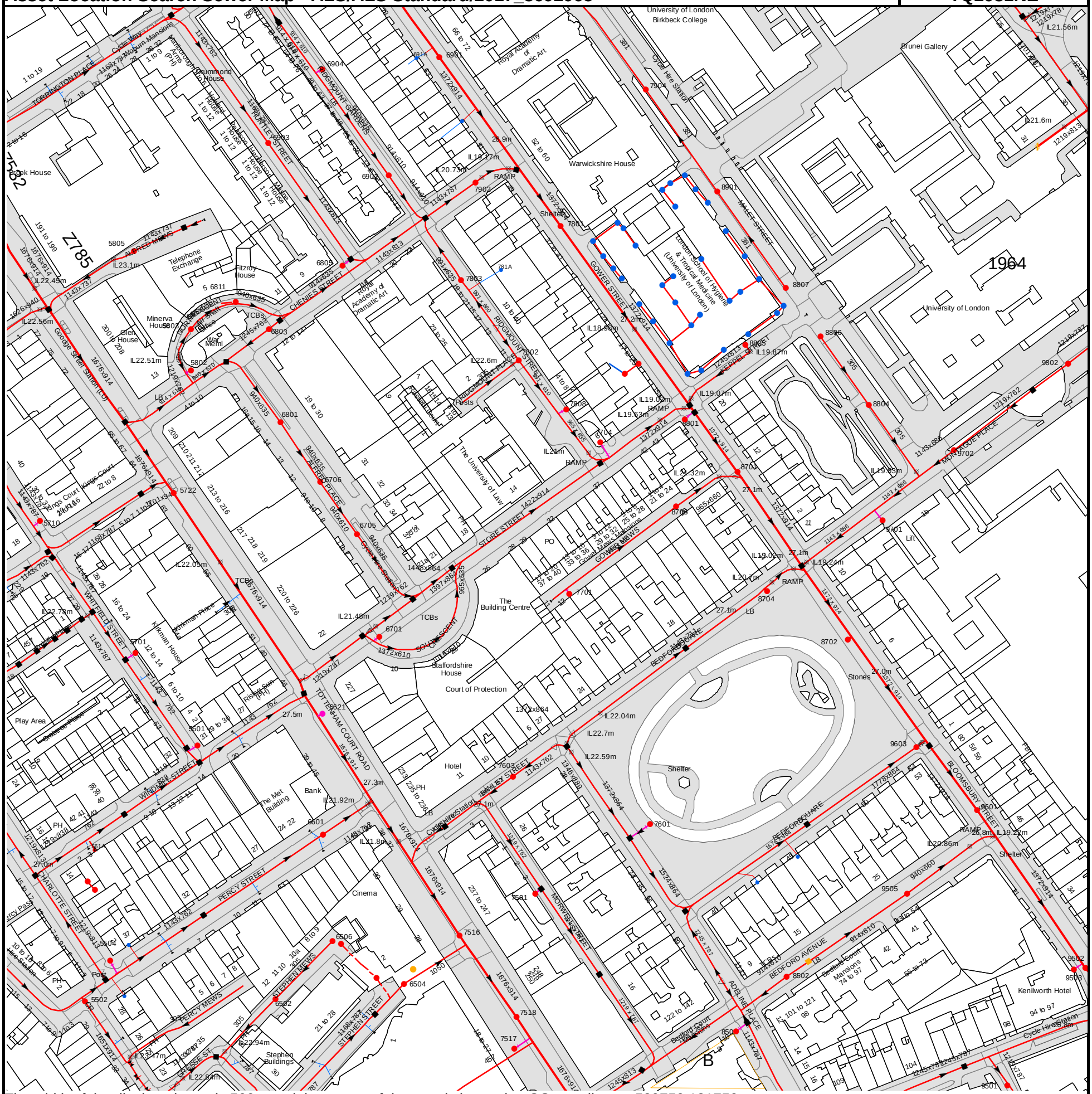
NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
4001	n/a	n/a
4101	27.16	22.29
41DC	n/a	n/a
40DJ	n/a	n/a
4005	27.38	22.77
40DF	n/a	n/a
40DG	n/a	n/a
40EA	n/a	n/a
40ED	n/a	n/a
40EE	n/a	n/a
401F	27.05	22.7
401A	n/a	n/a
401D	n/a	n/a
401B	n/a	n/a
401C	n/a	n/a
401E	n/a	n/a
1002	n/a	n/a
1001	27.66	25.37
1003	n/a	n/a
101B	n/a	n/a
2101	27.93	23.95
2002	n/a	n/a
2003	n/a	n/a
3045	n/a	n/a
3004	27.12	24.5
311B	n/a	n/a
3044	27.77	22.98
4006	n/a	n/a
3426	n/a	n/a
3425	n/a	n/a
341A	n/a	n/a
3422	25.42	n/a
44BI	n/a	n/a
4401	25.45	n/a
4403	24.14	19.78
441A	n/a	n/a
0403	27.49	24.69
0303	28.39	25.21
0401	n/a	n/a
141A	n/a	n/a
2309	26.97	24.83
2310	27.22	25.74
2401	n/a	n/a
241H	n/a	n/a
241G	n/a	n/a
3403	27.64	n/a
241F	n/a	n/a
241I	n/a	n/a
241A	n/a	n/a
241E	n/a	n/a
241C	n/a	n/a
241B	n/a	n/a
2402	n/a	n/a
2405	26.62	n/a
01FD	n/a	n/a
0134	28.09	25.32
0205	28.04	17.64
01FE	n/a	n/a
011B	n/a	n/a
011A	n/a	n/a
011C	n/a	n/a
0104	27.97	24.59
0301	28.2	23.63
0108	n/a	25.02
0207	27.63	17.81
1103	27.84	24.08
011D	n/a	n/a
011E	n/a	n/a
0107	27.83	24.8
011F	n/a	n/a
1106	26.79	25.34
1201	n/a	n/a
0202	27.66	25.77
0203	n/a	n/a
1204	27.64	26.83
1205	27.69	26.52
1206	27.53	26.71
1207	27.44	26.62
1210	24.63	22.45
1302	27.54	18
0302	28.15	23.18
311C	n/a	n/a
33DE	n/a	n/a
3306	23.78	21.81
3122	27.54	23.16
3307	26.3	25.26
3304	23.78	21.81
331A	n/a	n/a
3303	26.27	n/a
3202	24.09	22.39

Manhole Reference	Manhole Cover Level	Manhole Invert Level
3334	27.3	24.02
3301	27.23	22
3305	26.07	25.01
3308	26.13	24.55
4201	n/a	n/a
4145	n/a	n/a
41DH	n/a	n/a
4304	26.7	21.99
4302	26.92	19.83
42CG	n/a	n/a
4301	27	n/a
41EA	n/a	n/a
42CA	n/a	n/a
41DJ	n/a	n/a
41EE	n/a	n/a
41ED	n/a	n/a
43CC	n/a	n/a
4305	26.31	21.49
2102	27.79	23.7
211B	n/a	n/a
211A	n/a	n/a
1105	26.99	n/a
2103	n/a	n/a
1107	26.91	25.39
3210	27.3	23.75
2239	27.61	n/a
3233	27.3	23.01
1208	27.29	26.5
2202	27.29	23.84
2204	27.22	26.17
1209	24.63	22.45
2205	27.43	26.12
2206	27.5	25.5
32BB	n/a	n/a
2207	27.68	23.11
32BA	n/a	n/a
2203	n/a	n/a
32BC	n/a	n/a
2301	27.15	22.66
2302	27.65	26.37
3302	26.91	25.05
231A	n/a	n/a
2303	20.54	18.43
2304	20.54	n/a
2307	20.78	18.64
2306	27.85	18.18
2308	20.78	18.64
0001	27.17	23.03
0008	27.33	n/a
0007	n/a	n/a
0006	28.07	23.98
0002	26.3	24.21

Asset Location Search Sewer Map - ALS/ALS Standard/2017_3692965

TQ2981NE



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 529750,181750

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Manhole Reference	Manhole Cover Level	Manhole Invert Level
9501	25.87	20.91
9502	n/a	n/a
9503	25.9	18.52
8801	27.06	n/a
88CI	n/a	n/a
88DA	n/a	n/a
88DB	n/a	n/a
88CH	n/a	n/a
88DF	n/a	n/a
88CG	n/a	n/a
88BJ	n/a	n/a
88DG	n/a	n/a
8701	27.07	18.97
88DH	n/a	n/a
88CD	n/a	n/a
8805	n/a	n/a
88CF	n/a	n/a
88CA	n/a	n/a
8704	26.99	n/a
88CC	n/a	n/a
88CB	n/a	n/a
8807	26.91	21.22
8806	26.99	20.38
8702	26.92	n/a
8804	26.88	20.12
9701	n/a	n/a
9603	26.91	21.2
9702	26.64	19.6
9601	26.8	18.78
9802	26.06	19.78
6506	25.67	23.97
651A	n/a	n/a
651B	n/a	n/a
6504	n/a	n/a
7516	26.89	21.71
7517	26.57	n/a
7518	26.53	21.58
7501	n/a	n/a
8501	n/a	n/a
851A	n/a	n/a
8502	26.54	22.4
861A	n/a	n/a
9505	26.46	21.38
78CI	n/a	n/a
7801	26.98	19.1
79BD	n/a	n/a
89AC	n/a	n/a
89AI	n/a	n/a
8901	26.72	20.88
89AD	n/a	n/a
89AH	n/a	n/a
89AE	n/a	n/a
7902	26.85	n/a
6902	26.69	21.85
89AF	n/a	n/a
791B	n/a	n/a
7904	26.63	20.58
6904	26.78	n/a
691A	n/a	n/a
6901	26.95	19.11
6621	27.63	n/a
6601	27.24	22.15
6805	n/a	n/a
6705	27.04	21.46
6701	n/a	n/a
7803	26.21	21.94
781A	n/a	n/a
7603	27.13	22.11
7802	26.26	22.22
7808	26.58	26.58
7701	26.15	n/a
78CJ	n/a	n/a
7704	n/a	n/a
78DC	n/a	n/a
78DB	n/a	n/a
78DA	n/a	n/a
78BA	n/a	n/a
78CH	n/a	n/a
78BC	n/a	n/a
78CF	n/a	n/a
7601	n/a	n/a
78CG	n/a	n/a
88DC	n/a	n/a
88CJ	n/a	n/a
88DE	n/a	n/a
88DD	n/a	n/a
8706	26.06	21.66
5502	27.06	n/a
6502	25.77	23.41
551A	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
5504	n/a	n/a
551B	n/a	n/a
55BB	n/a	n/a
55BD	n/a	n/a
561A	n/a	n/a
5601	n/a	n/a
5701	n/a	n/a
5710	n/a	n/a
5722	27.69	22.16
6706	27.23	21.62
6801	27.47	21.81
5802	n/a	n/a
5803	27.92	23.62
6803	27.23	22.24
6811	n/a	n/a
5805	28.01	23.46
6903	26.76	21.51

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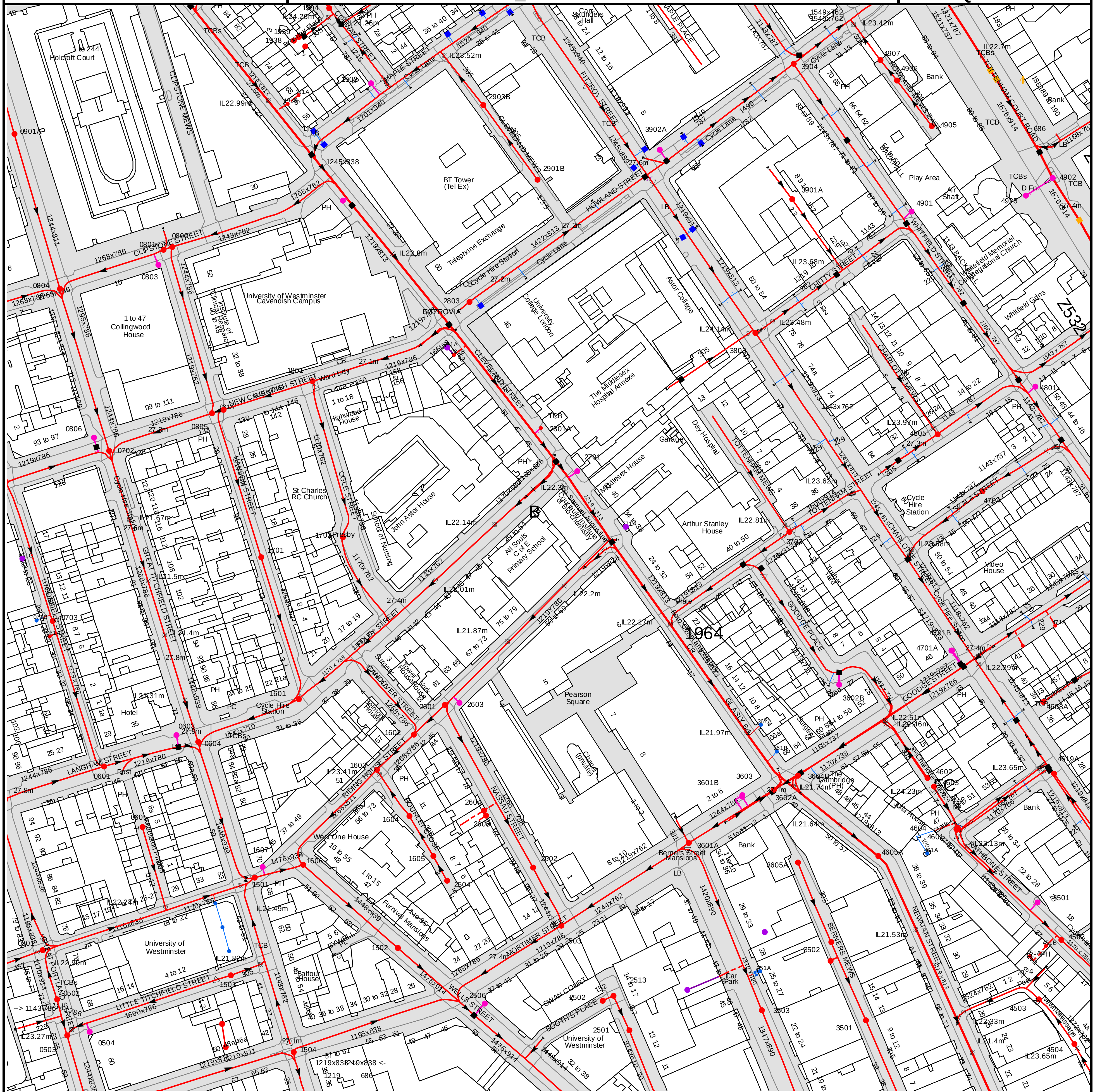
Asset Location Search Sewer Map - ALS/ALS Standard/2017_3692965	TQ2981NW



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 529250,181750

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

Manhole Reference	Manhole Cover Level	Manhole Invert Level
4504	25.23	23.05
4503	25.7	22.83
451A	n/a	n/a
451B	n/a	n/a
4502	26.85	22.82
4501	n/a	n/a
4619A	27.2	22.69
4608A	n/a	n/a
471B	n/a	n/a
471A	n/a	n/a
4801	n/a	n/a
4901	n/a	n/a
4925	27.31	n/a
4902	27.41	22.57
4905	26.51	25.29
3501	26.87	23.82
3503	27.31	22.73
351D	n/a	n/a
351A	n/a	n/a
351B	n/a	n/a
3502	26.65	23.99
351C	n/a	n/a
3605A	26.98	24.24
4605A	26.83	21.57
461A	n/a	n/a
3601A	27.73	21.4
4601	26.87	23.49
4604	26.87	23.13
3601B	n/a	n/a
3603	n/a	n/a
3602A	27.07	21.73
4603	27.13	24.23
4602	27.13	26.21
3604B	27.04	21.83
361B	n/a	n/a
361A	n/a	n/a
3602B	n/a	n/a
4701A	n/a	n/a
4701B	n/a	n/a
3703	n/a	n/a
4704	27.22	n/a
4805	n/a	n/a
3803	27.34	23.12
191B	n/a	n/a
1938	n/a	n/a
191A	n/a	n/a
1939	n/a	n/a
1937	n/a	n/a
1904	28	23.88
191C	n/a	n/a
1903	n/a	n/a
2903B	26.08	23.64
2901B	26.29	24.25
3902A	n/a	n/a
3901A	26.69	25.23
3904	27.79	23.24
4907	26.67	n/a
4906	n/a	n/a
1504	27.05	21.64
2501	27.69	23.13
2506	n/a	n/a
2502	27.66	26.64
2513	27.64	n/a
1502	27.43	20.82
2503	27.57	21.13
2504	26.59	25.21
2602	27.38	21.24
1607	n/a	n/a
1606	27.82	20.94
1605	26.34	24.36
1604	26.78	24.13
2605	n/a	n/a
2604	n/a	n/a
1603	37.39	21.37
1602	27.43	21.46
2601	27.51	21.55
2603	n/a	n/a
1601	37.38	21.67
1701	27.04	21.93
1702	27.2	22.43
271A	n/a	n/a
2701	27.05	n/a
2801A	27.7	25.7
1801	27.06	22.35
281B	n/a	n/a
281A	n/a	n/a
2803	27.15	23.84
071C	n/a	n/a
071B	n/a	n/a
071A	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
0703	27.51	21.92
0804	26.69	22.12
0806	27.26	n/a
0601	27.78	21.58
0702	27.42	21.79
0803	n/a	n/a
0603	n/a	n/a
0604	27.83	21.25
0805	27.25	22.11
081A	n/a	n/a
0901A	26.52	22.39
0801	26.94	22.42
0802	26.94	22.47
0501	27.8	22.83
0502	27.64	23.24
0503	27.55	23.06
0504	n/a	n/a
0605	27.96	24.54
051B	n/a	n/a
05BH	n/a	n/a
051A	n/a	n/a
05BI	n/a	n/a
151A	n/a	n/a
1503	27.52	23.51
1501	27.85	21.03

ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

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

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

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

Trunk Surface Water

Trunk Foul

Storm Relief

Trunk Combined

Vent Pipe

Bio-solids (Sludge)

Proposed Thames Surface Water Sewer

Proposed Thames Water Foul Sewer

Gallery

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Sludge Rising Main

Proposed Thames Water Rising Main

Vacuum

Sewer Fittings

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

Air Valve

Dam Chase

Fitting

Meter

Vent Column

Operational Controls

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

Control Valve

Drop Pipe

Ancillary

Weir

End Items

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

Outfall

Undefined End

Inlet

Other Symbols

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

Public/Private Pumping Station

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

Invert Level

Summit

Areas

Lines denoting areas of underground surveys, etc.

Agreement

Operational Site

Chamber

Tunnel

Conduit Bridge

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

Foul Sewer

Surface Water Sewer

Combined Sewer

Gulley

Culverted Watercourse

Proposed

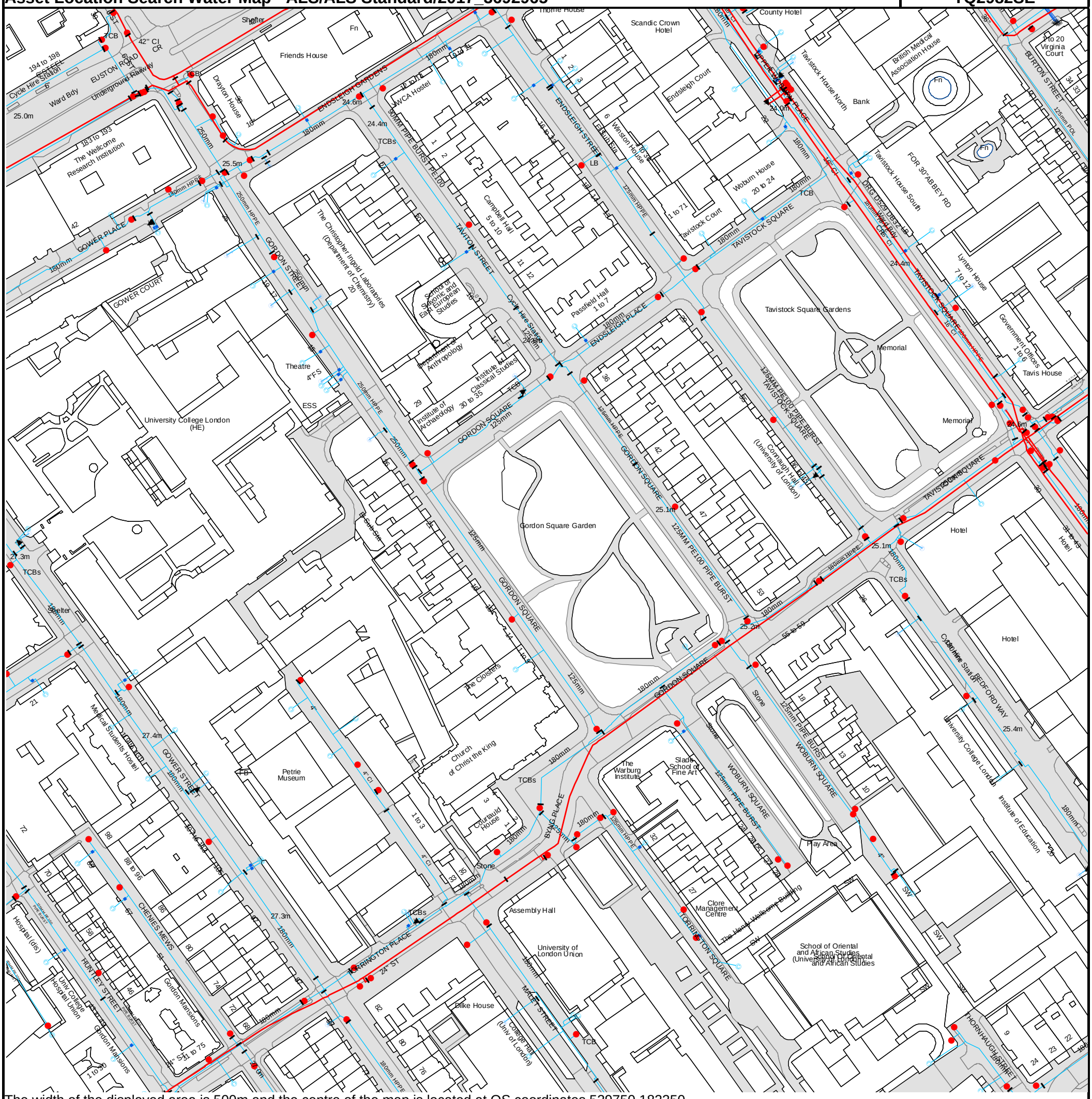
Abandoned Sewer

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.
2) All measurements on the plans are metric.
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.
4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.
5) 'na' or '0' on a manhole level indicates that data is unavailable.
6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 0845 070 9148.

Asset Location Search Water Map - ALS/ALS Standard/2017_3692965

TQ2982SE



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 529750,182250

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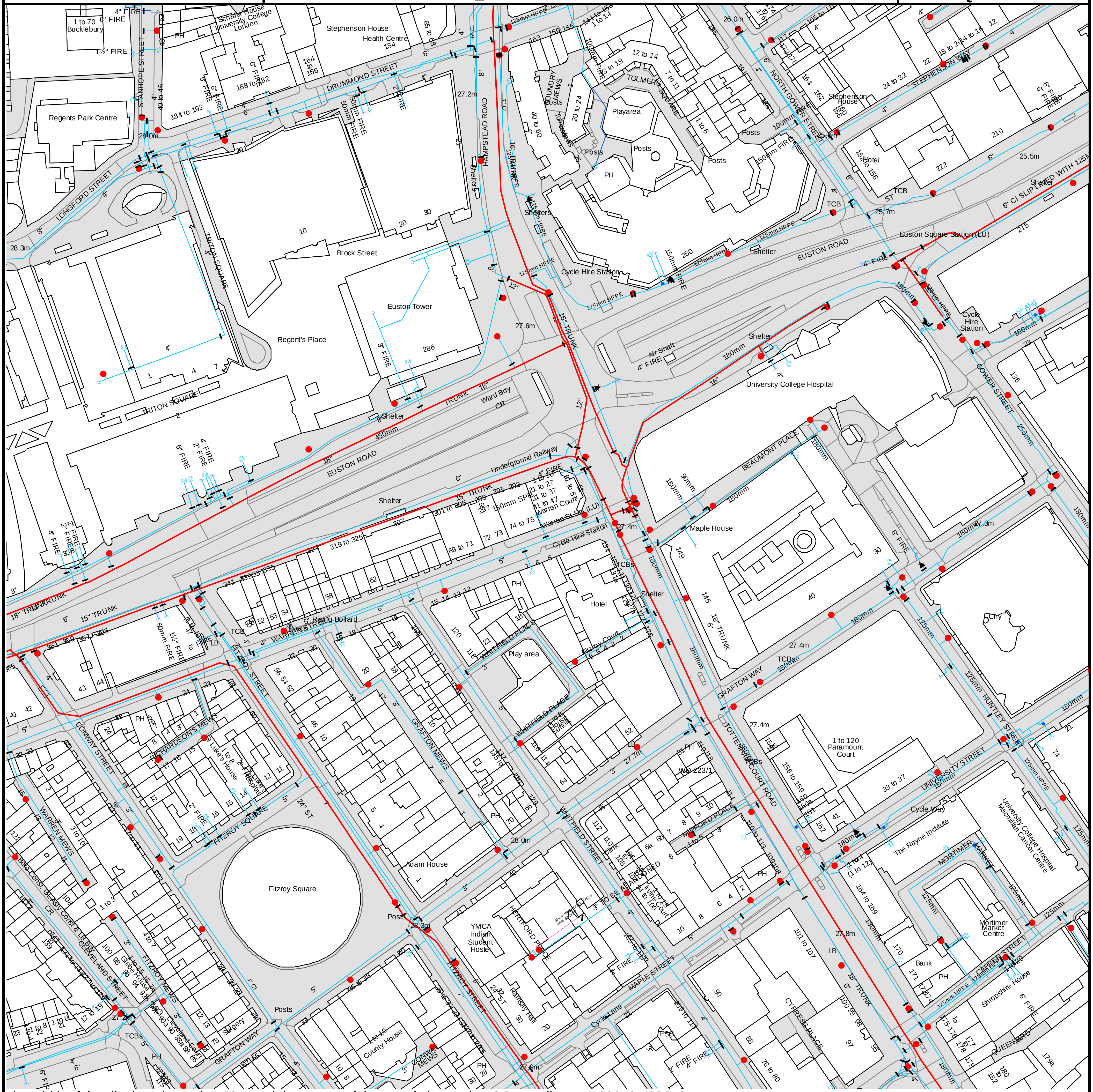
Asset Location Search Water Map - ALS/ALS Standard/2017_3692965	TQ2982SW



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 529250,182250

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Asset Location Search Water Map - ALS/ALS Standard/2017_3692965

TQ2981NE

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Asset Location Search Water Map - ALS/ALS Standard/2017_3692965

TQ2981NW

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ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)

4"

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

16"

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

3" SUPPLY

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

3" FIRE

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

3" METERED

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

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

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

Valves

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

Hydrants

- Single Hydrant

Meters

- Meter

End Items

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

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

Operational Sites

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

Other Symbols

- Data Logger

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

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

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

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

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

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

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

Ways to pay your bill

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

Search Code

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- sets out minimum standards which firms compiling and selling search reports have to meet
- promotes the best practise and quality standards within the industry for the benefit of consumers and property professionals
- enables consumers and property professionals to have confidence in firms which subscribe to the code, their products and services.

By giving you this information, the search firm is confirming that they keep to the principles of the Code. This provides important protection for you.

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- display the Search Code logo prominently on their search reports
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TPOs Contact Details

The Property Ombudsman scheme
Milford House
43-55 Milford Street
Salisbury
Wiltshire SP1 2BP
Tel: 01722 333306
Fax: 01722 332296
Email: admin@tpos.co.uk

You can get more information about the PCCB from www.propertycodes.org.uk

PLEASE ASK YOUR SEARCH PROVIDER IF YOU WOULD LIKE A COPY OF THE SEARCH CODE

C CCTV Drainage Survey

Below-ground

Drainage Report

WJSHIRLEY
DRAINAGE & ENVIRONMENTAL EST. 1928

85 Great Portland Street
London
W1W 7LT

Inspection Date

Tuesday, 3 November 2020

Report prepared for

Elliott Wood

55 Whitfield Street
London
W1T 4AH

Site address

The Network Building

95-100 Tottenham Court road
London
W1T 4TW

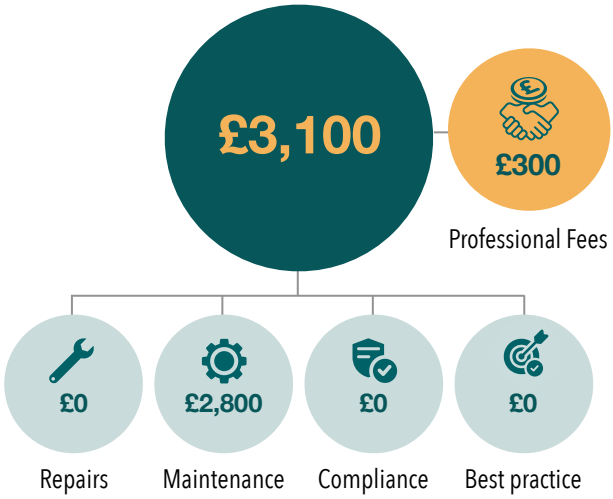
Executive Summary

Overall, the below-ground drains are in moderate condition.

There are accumulations of silt, debris and fat deposits in the below-ground drains which should be cleared to restore its full capacity. There is an oil interceptors serving the surface-water system. There are some accumulations of hard scale which we recommend are removed with a combination of a mechanical de-scaler and high pressure jetting. There is a seized and a buried inspection chamber.

An overall summary of the key findings of the inspection.

Costs



5 Year Costs

Verdict

Structure

State of repair
Structural condition

Operation

Maintenance
Operational condition

Environmental

Environmental risk presented via the drainage system

Key Points

Foul & Surface-water **Drainage Type**

FW	Mains	
SW	Mains	Separate

- Drains in good structural condition
- Drains operating moderately well overall
- Oil interceptor
- De-silting & de-scaling works required
- Fat deposits
- Seized and buried inspection covers

1. Inspection

The background, scope of engagement and level of inspection.

Section Contents

1.1 Method of Assessment

Inspection and assessment was carried out by desktop research, a site walkover and push-rod CCTV inspection along the below-ground drains where practicable.

1.3 Access

There was good general access to the site, however there is one seized inspection cover at MH8, a buried chamber at MH19 and no access to MH 17 and MH 18 which prevented a full inspection.

1.4 Scope

We take a fair-minded and common sense view that we will attempt to inspect and assess as much of the below-ground drainage as is reasonably possible in the circumstances. We cannot usually inspect blind connections where there is no inspection access nor can we inspect drains deeper than approx. 3m without special equipment and/or Confined Spaces entry. The presence of silt or debris may hide defects until de-silting works are undertaken.

Job No.

2492

Instruction

WJ Shirley Ltd were instructed by
ELLIOTT WOOD
55 Whitfield Street
London
W1T 4AH

to carry out a drainage inspection at
THE NETWORK BUILDING
95-100 Tottenham Court road
London
W1T 4TW

We understand this is in relation to a redevelopment project.

Report issue date:

6/11/20

Report prepared by:

Laueren Coupland
Associate

Authorised by:

Robert Shirley BA (Hons) PhD
Director, WJ Shirley Consultancy Ltd

2. Drainage Assets

What drainage assets are present, materials, sizes, ownership and disposal method.

Section Contents

2.1 What's there?

In terms of below-ground drainage assets, there are foul manholes, surface-water manholes, an oil interceptor, gullies and pipe sections.

2.2 Drainage type

Foul and surface-water drainage systems are separate, running through different pipes and manholes. Thus is unusual in Central London as the sewers are usually combined. The drains flow by gravity (are not pumped).

2.3 Ownership

Identification of the status of drains on site is beyond the scope of our inspection, however all drains detailed in our report within the site boundary are likely to be private.

Manholes	**19**
Pipe sections	**54**
Oil interceptors	**1**
Pumping chambers	**0**
Soakaways	**0**
Drainage type	**Separate**
Ownership	**Private**
Dispoal method	**Mains**

Total length of below-ground drainage

0.3 km

2.4 Materials

Pipe Diameter	Pipe Materials	Inspection Chambers	Inspection Covers
100mm	Cast iron	Concrete	Concrete
150mm	Vitrified clay	Rendered, probably over brickwork	Pressed steel
300mm			

2.5 Disposal Method

The property is believed to be on mains drainage.

2.6 Drainage Plan

Foul drain
Surface-water drain
ACO drain
Defect
Oil interceptor

3. Condition

A summary and assessment of the current structural conditions and operation of the drains.

Section Contents

3.1 Operation & maintenance

Overall, the below-ground drains are moderate operational condition. We noted the following operational defects:

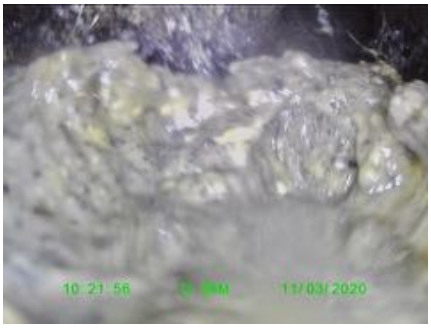
Occurrences	Defect
4	Scaling
3	Silt & debris
1	Fat deposits
1	Cover in a seized frame

Maintenance	£2,800
Repairs	£0

Total Costs Repairs & Maintenance

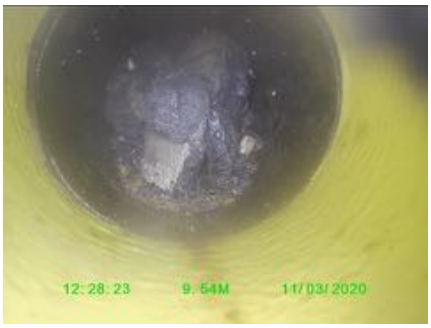
£2,800

There are accumulations of scale in 4 drains. Scale consists of hard deposits inside the drain pipes which provide a rough surface and can reduce the effective diameter and flow capacity of the pipe increasing the likelihood of blockages. We recommend they are cleared with a mechanical de-scaler in conjunction with high pressure jetting.



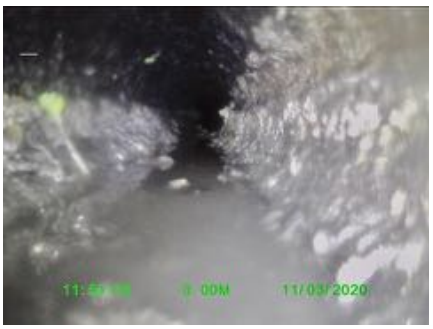
Scaling

There are accumulations of silt and debris in the below-ground drains causing reduced flow. This usually occurs through a natural build-up of decomposing leaf litter or soil washed into the rainwater pipes and surface gullies. Silt causes a restriction to the flow, and can reduce the speed and effective capacity of the drains increasing the likelihood of further silting, blockages and even surface flooding. We recommend the silt is cleared and removed from site with a combination of a suction tanker and high pressure water jetting in order to restore the full capacity and efficiency of the system. There is the possibility that further defects will be revealed following these de-silting works.



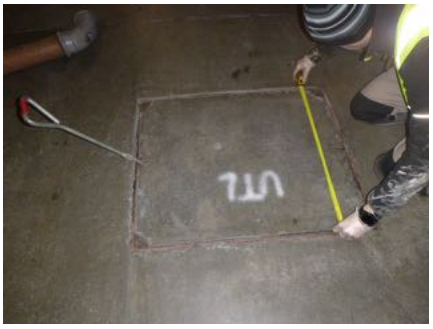
Silt & debris

There are some accumulations of fat deposits. This causes a restriction to the flow, and can reduce the speed and effective capacity of the drains increasing the likelihood of further silting, blockages and even surface flooding. We recommend the fat is cleared and removed from site with high pressure water jetting in order to restore the full and capacity efficiency of the system.



Fat deposits

There is a seized inspection cover at MH 8. Ideally this should be broken out and renewed to allow full maintenance and inspection access.



Seized inspection cover

3.2 Structure & state of repair

Overall, the below-ground drains are in good structural condition and we found no significant defects.

3.3 Planned, preventative maintenance

It is generally considered that good asset management involves an optimal amount of planned preventative maintenance. As a general rule we recommend a CCTV inspection every 5 years so that any developing structural defects can be addressed before they deteriorate too far, annual de-silting, annual pump maintenance (if present) and annual oil interceptor maintenance (if present). Time intervals on specific sites can be tweaked depending on local circumstances or conditions. A suggested site-specific 5-year maintenance plan in is available free of charge on request.

4. Suitability

An assessment of the suitability of the drainage design, materials present and opportunity for maintenance access.

Section Contents

- Capacity ✓
- Access ✓
- Materials ✓

4.1 Capacity

A full assessment of drainage capacity would require accurate surveyed levels or a topographic survey and flow modelling calculations to be undertaken, however we found no evidence to suggest that the drains are under-sized.

4.2 Access

There is adequate general maintenance access to the drainage system, with the exception of the seized and buried inspection covers.

4.3 Materials

Inspection covers, chambers are pipe sections are in suitable materials.

5. Environmental

An assessment of the environmental risk presented by the drainage systems.

Section Contents

- Not included

5.1 Background

An assessment of the environmental risk presented by the drainage system was not part of our inspection.

Oil interceptors	1
Waste & material storage	X
Re-fuelling facilities	X
Sustainability	X

Costs associated with environmental best-practice

£0

6. Legal Compliance

Section Contents

Do the drains comply with relevant legislation?

6.1 Mis-connections

We found no evidence of mis-connections, e.g foul connected illegally to surface-water drainage etc.

6.2 Oil interceptors

There is usually no legal requirement to fit oil interceptors (unless under the conditions of an Environmental Permit, Trade Effluent Consent or planning consent.

6.3 Pressure washers

We found no wash-down areas on site and thus there are no implications for drainage regarding this matter. However, if pressure washers are used, it is a legal requirement to route any effluent to the foul drains with prior permission from the sewer provider and a Trade Effluent consent[1]

Mis-connections	✓
Oil interceptors	✓
Pressure washers	X
Trade Effluent Consents	X
Environmental Permits	X

Cost associated with Legal Compliance

£0

6.4 Trade effluent consents

Although beyond the scope of our inspection, we found no practices on site which are likely to require a Trade Effluent Consent.

6.5 Environmental permits

Although beyond the scope of our inspection, we found no practices on site which are likely to require an Environmental Permit.

---

[1] The preferred method is to pass through a settlement tank and recycle wash-water but other methods include containment in a tank for periodic emptying by a registered waste carrier.

7. Costs

Estimated budget costs for our recommendations. A firm price can be obtained on request

Section Contents

Reason for spend

Repairs	£0
Maintenance	£2,800
Compliance	£0
Best practice	£0

£2,800

Type of spend

Structural	£0
Operational	£2,800
Environmental	£0

£2,800

Spend timeline

Year 1	£2,800
Year 2	£0
Year 3	£0
Year 4	£0
Year 5	£0

£2,800

£2,800

Cost details

De-silting & de-scaling works	£2,000
Inspection covers	£800

£2,800

Complete total

Total	£2,800
10% Professional fees	£300

£3,100

8. Action plan

Recommended action plan or repairs & maintenance

Section Contents

8.1 Action plan

The table below summarises our recommendations.

Drainage Repair & Maintenance Programme

Year	By	Asset	Defect	Recommendation	Cost
1	May 2021	**MH 2** D 9	Silt, moderate	Clear with high pressure water jetting	£200
	May 2021	**MH 3** D 8	Blockage	Clear with high pressure water jetting	£200
	May 2021	**MH 7** D 2	Scale, moderate	De-scale	£300
	May 2021	**MH 7** D 3	Silt, moderate	Clear with high pressure water jetting	£200
	May 2021	**MH 8** D 1	Cover seized in frame	Break out and renew cover and frame	£800
	May 2021	**MH 9** D 4	Scale, moderate	De-scale	£300
	May 2021	**MH 13** D 7	Scale, moderate	De-scale	£300
	May 2021	**MH 14** D 5	Fat deposits, moderate	Clear with high pressure water jetting	£200
	May 2021	**MH 14** D 6	Scale, moderate	De-scale	£300
	May 2021	**MH 2** D 9	Silt, moderate	Clear with high pressure water jetting	£200
	May 2021	**MH 3** D 8	Blockage	Clear with high pressure water jetting	£200
	May 2021	**MH 7** D 2	Scale, moderate	De-scale	£300
				TOTAL	£3,500
				Approx. 10% professional fees *	£400
					£3,900

* Professional fees - what are these? They are included to give an overall total cost, for example if a Project Manager is involved and are not charged by us

8.2 Repair & maintenance techniques

We have recommended various repair and maintenance techniques in this report. Below is a short summary of what is involved.

Technique	Notes
Buried chamber	A CCTV camera with a sonde transmitter is pushed along the below-ground drains to the buried manhole. The sonde is located on the service with a CAT scanner and the cover exposed. If the cover is seized or needs renewing, the frame is broken out and a new cover and frame fitted.
New inspection cover	The cover surround is broken out with an angle grinder and a new cover and frame fitted by bedding in concrete and surfaced as necessary.
De-silting works & fat removal	High pressure water jetting is used in conjunction with a lorry-based suction tanker to loosen and remove silt, debris and wash-water from the drains. The silt and debris is removed from site and disposed of at a Waste Transfer station.
De-scaling works	High pressure water jetting in conjunction with a mechanical de-scaler grinds the scale off the pipe, washes it clean and the debris removed from site.

Drainage Assets

Details of the drainage infrastructure inspected including, where appropriate, an note and assessment of any defects.

MH 1 Surface-water inspection chamber

No Budget Costs

Chamber

Location (Lat,Lon)	Depth mm	Construction	Inspection
51.5224, -0.1368	730	Concrete section	Close

Cover

Size	Material	Description	Inspection
1200 x 800	Pressed steel		Close

Pipe sections

Section	Diameter mm	Material	Length m	Inspection
SW 15	150	Vitrified clay	16.8	CCTV
SW 16	100	Vitrified clay	11.8	CCTV
SW 18	100	Vitrified clay	9.0	CCTV
SW 20	150	Vitrified	4.2	CCTV

Defects & recommendations

No defects

Photos

MH 1 chamber

Section SW 15

Section SW 16

Section SW 18

Section SW 20

MH 2 Surface-water inspection chamber

Budget Costs £200

Chamber

Location (Lat,Lon)	Depth mm	Construction	Inspection
51.5224, -0.1368	900	Concrete section	Close

Cover

Size	Material	Description	Inspection
1200 x 800	Pressed steel		Close

Pipe sections

Section	Diameter mm	Material	Length m	Inspection
SW 13	150	Vitrified clay	4.0	CCTV
SW 14	150	Vitrified clay	2.9	CCTV
SW 3	150	Vitrified clay	31.0	CCTV

Defects & recommendations

Location	Defect	Recommendation	Urgency	Cost
D 9	Silt	Clear with high pressure water jetting	Moderate	£200

Photos

MH 2 chamber

Defects

Silt

Section SW 13

Section SW 14

MH 3 Foul inspection chamber

Budget Costs £200

Chamber

Location (Lat,Lon)	Depth mm	Construction	Inspection
51.5225, -0.1368	820	Concrete section	Close

Cover

Size	Material	Description	Inspection
1200 x 800	Pressed steel		Close

Pipe sections

Section	Diameter mm	Material	Length m	Inspection
FW 23	150	Vitrified clay	11.3	CCTV
FW 25	100	Cast iron	13.7	CCTV
FW 26	100	Cast iron	9.4	CCTV
FW 27	100	Vitrified clay	8.9	CCTV

Defects & recommendations

Location	Defect	Recommendation	Urgency	Cost
D 8	Blockage	Clear with high pressure water jetting	Moderate	£200

Photos

MH 3 chamber

Defects

Blockage

Section FW 23

Section FW 25

Section FW 26

Section FW 27

MH 4 Surface-water inspection chamber

No Budget Costs

Chamber

Location (Lat,Lon)	Depth mm	Construction	Inspection
51.5225, -0.1369	1120	Concrete	Close

Cover

Size	Material	Description	Inspection
800 x 800	Pressed steel		Close

Pipe sections

Section	Diameter mm	Material	Length m	Inspection
SW 15	150	Vitrified clay	16.8	CCTV
SW 4	300	Vitrified clay	11.6	CCTV
SW 6	150	Vitrified clay	5.7	CCTV

Defects & recommendations

No defects

Photos

MH 4 chamber

Section SW 15

Section SW 4

Section SW 6

MH 5 Oil interceptor

No Budget Costs

Chamber

Location (Lat,Lon)	Depth mm	Construction	Inspection
51.5221, -0.1365	1540	Concrete section	Close

Cover

Size	Material	Description	Inspection
800 x 0	Concrete		Close

Pipe sections

Section	Diameter mm	Material	Length m	Inspection
SW 12	100	Cast iron	1.8	CCTV

Defects & recommendations

No defects

Photos

MH 5 chamber

Section SW 12

MH 6 Oil interceptor

No Budget Costs

Chamber

Location (Lat,Lon)	Depth mm	Construction	Inspection
51.5221, -0.1366	1500	Concrete section	Close

Cover

Size	Material	Description	Inspection
800 x 0	Concrete		Close

Pipe sections

Section	Diameter mm	Material	Length m	Inspection
SW 11	100	Cast iron	1.8	CCTV
SW 12	100	Cast iron	1.8	CCTV

Defects & recommendations

No defects

Photos

MH 6 chamber

Section SW 11

Section SW 12

MH 7 Oil interceptor

Budget Costs £500

Chamber

Location (Lat,Lon)	Depth mm	Construction	Inspection
51.5220, -0.1366	700	Concrete section	Close

Cover

Size	Material	Description	Inspection
800 x 0	Concrete		Close

Pipe sections

Section	Diameter mm	Material	Length m	Inspection
SW 10	100	Cast iron	2.0	CCTV
SW 11	100	Cast iron	1.8	CCTV
SW 7	100	Cast iron	2.0	CCTV
SW 8	100	Cast iron	25.4	CCTV

Defects & recommendations

Location	Defect	Recommendation	Urgency	Cost
D 2	Scale	De-scale	Moderate	£300
D 3	Silt	Clear with high pressure water jetting	Moderate	£200

Photos

MH 7 chamber

Defects

Scale

Silt

Section SW 10

Section SW 11

Section SW 7

MH 8 -None Selected-

Budget Costs £800

Chamber

Location (Lat,Lon)	Depth mm	Construction	Inspection
51.5220, -0.1367	0	-None Selected-	Close

Cover

Size	Material	Description	Inspection
900 x 750	Concrete		Close

Pipe sections

No data

Defects & recommendations

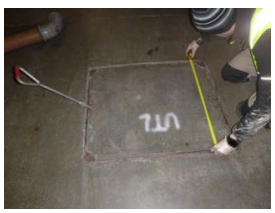
Location	Defect	Recommendation	Urgency	Cost
D 1	Cover seized in frame	Break out and renew cover and frame	Moderate	£800

Photos

MH 8 chamber



Defects



Cover seized in frame

None

MH 9 Foul inspection chamber

Budget Costs £300

Chamber

Location (Lat,Lon)	Depth mm	Construction	Inspection
51.5221, -0.1365	750	Rendered, probably over brickwork	Close

Cover

Size	Material	Description	Inspection
1050 x 1050	Concrete		Close

Pipe sections

Section	Diameter mm	Material	Length m	Inspection
FW 1	150	Cast	7.5	CCTV
FW 2	100	Cast iron	2.6	CCTV
FW 3	100	Cast iron	2.6	CCTV
FW 4	150	Cast iron	18.8	CCTV

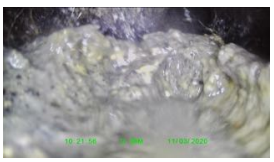
Defects & recommendations

Location	Defect	Recommendation	Urgency	Cost
D 4	Scale	De-scale	Moderate	£300

Photos

MH 9 chamber

Defects



Scale

Section FW 1

Section FW 2

Section FW 3

Section FW 4

MH 10 Surface-water inspection chamber

No Budget Costs

Chamber

Location (Lat,Lon)	Depth mm	Construction	Inspection
51.5222, -0.1366	0	-None Selected-	Distant/partial

Cover

Size	Material	Description	Inspection
0 x 0	-None Selected-		Distant/partial

Pipe sections

No data

Defects & recommendations

No defects

Photos

MH 10 chamber

None

MH 11 Foul inspection chamber

No Budget Costs

Chamber

Location (Lat,Lon)	Depth mm	Construction	Inspection
51.5222, -0.1367	700	Concrete	Close

Cover

Size	Material	Description	Inspection
750 x 750	Concrete		Close

Pipe sections

Section	Diameter mm	Material	Length m	Inspection
FW 10	100	Cast iron	2.2	CCTV
FW 11	100	Cast iron	2.2	CCTV
FW 4	150	Cast iron	18.8	CCTV
FW 8	100	Vitrified clay	4.0	CCTV
FW 9	100	Cast iron	3.2	CCTV

Defects & recommendations

No defects

Photos

MH 11 chamber

Section FW 10

Section FW 11

Section FW 4

Section FW 8

Section FW 9

MH 12 Foul inspection chamber

No Budget Costs

Chamber

Location (Lat,Lon)	Depth mm	Construction	Inspection
51.5222, -0.1367	640	Concrete	Close

Cover

Size	Material	Description	Inspection
750 x 750	Concrete		Close

Pipe sections

Section	Diameter mm	Material	Length m	Inspection
FW 20	100	Cast iron	1.0	CCTV
FW 21	100	Cast iron	1.9	CCTV
FW 22	100	Cast iron	2.4	CCTV
FW 8	100	Vitrified clay	4.0	CCTV

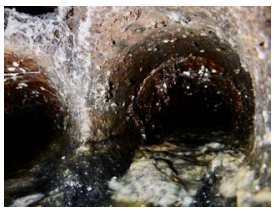
Defects & recommendations

No defects

Photos

MH 12 chamber

Section FW 20



Section FW 21

Section FW 22

Section FW 8

MH 13 Foul inspection chamber

Budget Costs £300

Chamber

Location (Lat,Lon)	Depth mm	Construction	Inspection
51.5223, -0.1366	550	Concrete section	Close

Cover

Size	Material	Description	Inspection
750 x 600	-None Selected-		Close

Pipe sections

Section	Diameter mm	Material	Length m	Inspection
FW 14	150	Cast iron	4.4	CCTV
FW 17	100	Cast iron	1.0	CCTV
FW 18	150	Cast iron	1.7	CCTV
FW 19	100	Cast iron	1.2	CCTV

Defects & recommendations

Location	Defect	Recommendation	Urgency	Cost
D 7	Scale	De-scale	Moderate	£300

Photos

MH 13 chamber

Defects

Scale

Section FW 14

Section FW 17

Section FW 18

Section FW 19

MH 14 Foul inspection chamber

Budget Costs £500

Chamber

Location (Lat,Lon)	Depth mm	Construction	Inspection
51.5223, -0.1365	560	Concrete section	Close

Cover

Size	Material	Description	Inspection
750 x 600	Concrete		Close

Pipe sections

Section	Diameter mm	Material	Length m	Inspection
FW 12	150	Cast iron	15.8	CCTV
FW 13	0	Cast iron	2.4	CCTV
FW 14	150	Cast iron	4.4	CCTV
FW 15	100	Cast iron	2.7	CCTV
FW 16	100	Cast iron	2.0	CCTV

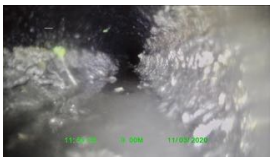
Defects & recommendations

Location	Defect	Recommendation	Urgency	Cost
D 5	Fat deposits	Clear with high pressure water jetting	Moderate	£200
D 6	Scale	De-scale	Moderate	£300

Photos

MH 14 chamber

Defects



Fat deposits

Scale

Section FW 12

Section FW 13

Section FW 14

Section FW 15

Section FW 16

MH 15 Surface-water inspection chamber

No Budget Costs

Chamber

Location (Lat,Lon)	Depth mm	Construction	Inspection
51.5223, -0.1366	0	-None Selected-	Not inspected

Cover

Size	Material	Description	Inspection
0 x 0	-None Selected-		Not inspected

Pipe sections

Section	Diameter mm	Material	Length m	Inspection
FW 18	150	Cast iron	1.7	CCTV
FW 34	0		4.3	CCTV

Defects & recommendations

No defects

Photos

MH 15 chamber

Section FW 18

MH 16 Foul inspection chamber

No Budget Costs

Chamber

Location (Lat,Lon)	Depth mm	Construction	Inspection
51.5226, -0.1369	1300	Concrete section	Close

Cover

Size	Material	Description	Inspection
1200 x 800	Pressed steel		Close

Pipe sections

Section	Diameter mm	Material	Length m	Inspection
FW 23	150	Vitrified clay	11.3	CCTV
FW 28	100	Vitrified clay	6.8	CCTV
FW 29	150	Vitrified clay	8.0	CCTV
FW 30	0	Vitrified clay	5.9	CCTV
FW 31	100	Vitrified clay	9.3	CCTV
FW 32	100	Cast iron	10.0	CCTV
FW 33	100	Cast iron	3.0	CCTV

Defects & recommendations

No defects

Photos

MH 16 chamber

Section FW 23

Section FW 28

Section FW 29

Section FW 30

Section FW 31

Section FW 32

Section FW 33

MH 17 Foul inspection chamber

No Budget Costs

Chamber

Location (Lat,Lon)	Depth mm	Construction	Inspection
51.5221, -0.1364	0	-None Selected-	Not inspected

Cover

Size	Material	Description	Inspection
0 x 0	-None Selected-		Not inspected

Pipe sections

Section	Diameter mm	Material	Length m	Inspection
FW 12	150	Cast iron	15.8	CCTV

Defects & recommendations

No defects

Photos

MH 17 chamber



Section FW 12

MH 18 Surface-water inspection chamber

No Budget Costs

Chamber

Location (Lat,Lon)	Depth mm	Construction	Inspection
51.5221, -0.1364	0	-None Selected-	Not inspected

Cover

Size	Material	Description	Inspection
0 x 0	-None Selected-		Not inspected

Pipe sections

No data

Defects & recommendations

No defects

Photos

MH 18 chamber

None

MH 19 Surface-water inspection chamber

No Budget Costs

Chamber

Location (Lat,Lon)	Depth mm	Construction	Inspection
51.5223, -0.1366	0	-None Selected-	Not inspected

Cover

Size	Material	Description	Inspection
0 x 0	-None Selected-		Not inspected

Pipe sections

Section	Diameter mm	Material	Length m	Inspection
FW 34	0		4.3	CCTV

Defects & recommendations

No defects

Photos

MH 19 chamber

D ABG Ltd Blue Roof Calculations

BLUE ROOF STORAGE AND OUTFLOW SUMMARY

PRIVATE & CONFIDENTIAL - NOT FOR DISTRIBUTION

abg creative geosynthetic engineering

Project Name:	The Network Building, London, W1T 4TW - Plant Area (Level 08) - 1-in-1yr. +0% CC - Option 2
Prepared for:	Elliott Wood, London
Date:	05/11/2020
ABG Project ID:	21907 Calculator version: 1.29
Prepared by:	Andrew Keer, andrew@abgltd.com, 07525-808700
Notes/description:	Plant area - pavers on pedestals or ballasted - TBC. Plant support method TBC with ABG & structural engineer. Maintenance access only - TBC. 'Higher strength', 'blue roof' system to be utilised. Inverted roof, construction, with zero falls - TBC. 'Option 2' = additional catchment area from lift/stair cores.

Blue Roof Estimate

Input Parameters - Rainfall Information (Flood Studies Report 1975)		
Return period:	1 year	*As supplied by Client*
Allowance for Climate Change:	0 %	*As supplied by Client*
Location selected for FSR data:	London (Central)	

Input Parameters - Roof Information		
Total catchment area:	900 m^2	*As supplied by Client*
Attenuation area:	660 m^2	*As supplied by Client*
Maximum allowable runoff:	1.4 l/s	*As supplied by Client*

Output - Rainfall Calculation

Duration	Time to Empty	Restricted Outflow (l/s)
15 mins	0 hours and 20 minutes	0.2
30 mins	1 hour and 10 minutes	0.3
1 hour	2 hours and 30 minutes	0.4
2 hours	4 hours and 10 minutes	0.5
4 hours	4 hours and 50 minutes	0.6
6 hours	4 hours and 50 minutes	0.6
10 hours	3 hours and 50 minutes	0.5
24 hours	0 hours and 40 minutes	0.2
48 hours	#VALUE!	#VALUE!

#VALUE! m^3
#VALUE!

Output - Recommended Blue Roof System

System Name:	ABG blueroof VF HD+ 108mm
Description:	Areas of soft landscaping may require locally, an additional 25mm deep, reservoir board ('ABG Roofdrain 25'). Additional 'tell-tale'/overflow positions may be included by the architect, within the roofing design. No.of control positions TBC by design team, and also with the structural engineer's deflection analysis.
Total attenuation capacity:	64.0 m^3
Number of Blue Roof outlets:	3

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 for the performance of the system relate to testing, modelling and analysis of our systems obtained from laboratories and testing institutes. In line with our policy of continuous improvement the right is reserved to make changes to our systems without notice at any time.
3. 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.
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BLUE ROOF STORAGE AND OUTFLOW SUMMARY

PRIVATE & CONFIDENTIAL - NOT FOR DISTRIBUTION

Project Name:	The Network Building, London, W1T 4TW - Plant Area (Level 08) - 1-in-30yr. +0% CC - Option 2
Prepared for:	Elliott Wood, London
Date:	05/11/2020
ABG Project ID:	21907 Calculator version: 1.29
Prepared by:	Andrew Keer, andrew@abgltd.com, 07525-808700
Notes/description:	Plant area - pavers on pedestals or ballasted - TBC. Plant support method TBC with ABG & structural engineer. Maintenance access only - TBC. 'Higher strength', 'blue roof' system to be utilised. Inverted roof, construction, with zero falls - TBC. 'Option 2' = additional catchment area from lift/stair cores.

Blue Roof Estimate

Input Parameters - Rainfall Information (Flood Studies Report 1975)			
Return period:	30	years	*As supplied by Client*
Allowance for Climate Change:	0	%	*As supplied by Client*
Location selected for FSR data:	London (Central)		

Input Parameters - Roof Information			
Total catchment area:	900	m^2	*As supplied by Client*
Attenuation area:	660	m^2	*As supplied by Client*
Maximum allowable runoff:	1.4	l/s	*As supplied by Client*

Output - Rainfall Calculation

Duration	Time to Empty	Restricted Outflow (l/s)
15 mins	7 hours and 30 minutes	0.7
30 mins	9 hours and 10 minutes	0.9
1 hour	10 hours and 30 minutes	0.9
2 hours	11 hours and 20 minutes	1.0
4 hours	11 hours and 40 minutes	1.0
6 hours	11 hours and 20 minutes	1.0
10 hours	10 hours and 20 minutes	0.9
24 hours	5 hours and 40 minutes	0.6
48 hours	0 hours and 10 minutes	0.2

Total attenuation required: 35.3 m^3
Half empty time: 1 hours and 0 minutes.

Output - Recommended Blue Roof System	
System Name:	ABG blueroof VF HD+ 108mm
Description:	Areas of soft landscaping may require locally, an additional 25mm deep, reservoir board ('ABG Roofdrain 25'). Additional 'tell-tale'/overflow positions may be included by the architect, within the roofing design. No.of control positions TBC by design team, and also with the structural engineer's deflection analysis.
Total attenuation capacity:	64.0 m^3
Number of Blue Roof outlets:	3

Notes:

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BLUE ROOF STORAGE AND OUTFLOW SUMMARY

PRIVATE & CONFIDENTIAL - NOT FOR DISTRIBUTION

abg creative geosynthetic engineering

Project Name:	The Network Building, London, W1T 4TW - Plant Area (Level 08) - 1-in-100yr. +0% CC - Option 2
Prepared for:	Elliott Wood, London
Date:	05/11/2020
ABG Project ID:	21907 Calculator version: 1.29
Prepared by:	Andrew Keer, andrew@abgltd.com, 07525-808700
Notes/description:	Plant area - pavers on pedestals or ballasted - TBC. Plant support method TBC with ABG & structural engineer. Maintenance access only - TBC. 'Higher strength', 'blue roof' system to be utilised. Inverted roof, construction, with zero falls - TBC. 'Option 2' = additional catchment area from lift/stair cores.

Blue Roof Estimate

Input Parameters - Rainfall Information (Flood Studies Report 1975)			
Return period:	100	years	*As supplied by Client*
Allowance for Climate Change:	0	%	*As supplied by Client*
Location selected for FSR data:	London (Central)		

Input Parameters - Roof Information			
Total catchment area:	900	m^2	*As supplied by Client*
Attenuation area:	660	m^2	*As supplied by Client*
Maximum allowable runoff:	1.4	l/s	*As supplied by Client*

Output - Rainfall Calculation

Duration	Time to Empty	Restricted Outflow (l/s)
15 mins	9 hours and 10 minutes	0.9
30 mins	11 hours and 10 minutes	1.0
1 hour	12 hours and 40 minutes	1.1
2 hours	13 hours and 30 minutes	1.1
4 hours	14 hours and 0 minutes	1.1
6 hours	13 hours and 40 minutes	1.1
10 hours	12 hours and 50 minutes	1.1
24 hours	7 hours and 50 minutes	0.8
48 hours	1 hour and 10 minutes	0.3

Total attenuation required: 44.7 m^3
Half empty time: 3 hours and 20 minutes.

Output - Recommended Blue Roof System	
System Name:	ABG blueroof VF HD+ 108mm
Description:	Areas of soft landscaping may require locally, an additional 25mm deep, reservoir board ('ABG Roofdrain 25'). Additional 'tell-tale'/overflow positions may be included by the architect, within the roofing design. No.of control positions TBC by design team, and also with the structural engineer's deflection analysis.
Total attenuation capacity:	64.0 m^3
Number of Blue Roof outlets:	3

Notes:

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BLUE ROOF STORAGE AND OUTFLOW SUMMARY

PRIVATE & CONFIDENTIAL - NOT FOR DISTRIBUTION

Project Name:	The Network Building, London, W1T 4TW - Plant Area (Level 08) - Option 2		
Prepared for:	Elliott Wood, London		
Date:	05/11/2020		
ABG Project ID:	21907	Calculator version:	1.29
Prepared by:	Andrew Keer, andrew@abgltd.com, 07525-808700		
Notes/description:	Plant area - pavers on pedestals or ballasted - TBC. Plant support method TBC with ABG & structural engineer. Maintenance access only - TBC. 'Higher strength', 'blue roof' system to be utilised. Inverted roof, construction, with zero falls - TBC. 'Option 2' = additional catchment area from lift/stair cores.		

Blue Roof Estimate

Input Parameters - Rainfall Information (Flood Studies Report 1975)			
Return period:	100	years	*As supplied by Client*
Allowance for Climate Change:	40	%	*As supplied by Client*
Location selected for FSR data:	London (Central)		

Input Parameters - Roof Information			
Total catchment area:	900	m^2	*As supplied by Client*
Attenuation area:	660	m^2	*As supplied by Client*
Maximum allowable runoff:	1.4	l/s	*As supplied by Client*

Output - Rainfall Calculation

Duration	Time to Empty	Restricted Outflow (l/s)
15 mins	12 hours and 0 minutes	1.0
30 mins	14 hours and 20 minutes	1.2
1 hour	16 hours and 0 minutes	1.3
2 hours	17 hours and 10 minutes	1.3
4 hours	18 hours and 0 minutes	1.4
6 hours	17 hours and 40 minutes	1.4
10 hours	17 hours and 0 minutes	1.3
24 hours	12 hours and 10 minutes	1.0
48 hours	4 hours and 0 minutes	0.5

Total attenuation required: 63.4 m^3
Half empty time: 7 hours and 20 minutes.

Output - Recommended Blue Roof System		
System Name:	ABG blueroof VF HD+ 108mm	
Description:	Areas of soft landscaping may require locally, an additional 25mm deep, reservoir board ('ABG Roofdrain 25'). Additional 'tell-tale'/overflow positions may be included by the architect, within the roofing design. No.of control positions TBC by design team, and also with the structural engineer's deflection analysis.	
Total attenuation capacity:	64.0	m^3
Number of Blue Roof outlets:	3	

Notes:

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1. DEFINITIONS

'Consultant' means ABG Geosynthetics Ltd and its legal successors. 'Client' means the person, firm, company or organisation for whom the Consultant is performing the Services. 'Agreement' means the contract referred to in Clause 2. 'Services' means the services to be performed by the Consultant in accordance with the proposal from the Consultant. 'Project' means the project or works for which the Client has commissioned the Services.

2. GENERAL

Unless and until a formal agreement is entered into, the Client's acceptance of the proposal for Services from the Consultant or a request for some or all the Services to be performed by the Consultant, shall constitute a binding
contract between the Client and the Consultant which contract will be subject to any terms and conditions contained or referred to in the aforementioned proposal and these terms and conditions. In the event of any conflict, the terms and conditions in the proposal shall prevail over these terms and conditions. The Agreement so formed shall supersede all previous understandings, commitments or agreements whether written or oral between the Client and the Consultant relating to the subject matter hereof. No person or entity shall have any rights in relation to this Agreement, whether as third parties or otherwise, save the parties to this Agreement. Should any term or condition of this Agreement be held to be unenforceable or invalid by the courts of any jurisdiction to which it is subject then such term or condition shall be disregarded and the remaining terms and conditions shall remain in full force and effect.

3. PERFORMANCE OF SERVICES AND SCOPE

The Consultant shall perform the Services using the degree of skill care and diligence to be expected from a consultant experienced in the provision of services of similar scope size and complexity. The Consultant shall use reasonable endeavours to complete the Services within the time or programme agreed but shall not be responsible for any delay beyond the reasonable control of the Consultant.

The fee contained in the proposal is for the scope of services as defined therein. If not already contained in the proposal the Consultant and the Client shall agree as an initial activity an integrated project services programme to
include the activities of all the parties to the Project relevant to the Services to be supplied by the Consultant. The
aforesaid programme shall show the key dates for final information and the delivery of such to the Consultant so as to enable the Consultant to carry out the services in an efficient once through manner to achieve the programme delivery dates for the Services.

The Consultant provides various services including Design and Product use advice which is distinct from a Design Service. The Design Service may or may not attract a fee.

Where the Consultant's services are of an advisory nature and dependent upon the degree of information and release thereof by the Client then the Client agrees that any reliance placed on the services by the Client shall take due account of such constraints.

4. CONFIDENTIALITY AND INTELLECTUAL PROPERTY RIGHTS

i. The Consultant and the Client shall keep confidential all information pertaining to the Services.

ii. Copyright for all reports, documents and the like produced by the Consultant in the performance of the Services
shall remain vested with the Consultant but the Consultant shall grant an irrevocable royalty free license to the Client to use such reports, documents and the like for any purpose in connection with the Project.

5. LIABILITY

i. The Consultant shall be liable to pay compensation to the Client arising out of or in connection with this
Agreement only if a breach of the duty of care in Clause 3 is established against the Consultant.

ii. Notwithstanding any other term to the contrary in this Agreement or any related document and whether the cause of action for any claim arises under or in connection with the Agreement in contract or in tort, in negligence or for breach of statutory duty or otherwise the Consultant shall have no liability to the Client in respect of any claim for loss or damage arising from acts of war or terrorism or arising from flooding, burst water mains or failed drainage or arising from any incidence of toxic mould or asbestos but otherwise in relation to any cause of action as aforesaid the total liability of the Consultant in the aggregate for all claims shall be limited to a sum equivalent to ten (10) times the fee payable under this Agreement or £50,000, whichever is the lesser, or such other sum as may be expressly stated in the Consultant's proposal, and further but without prejudice to the aforesaid limit of liability any such liability of the Consultant shall be limited to such sum or sums as it would be just and equitable for the Consultant to pay having regard to the Consultant's responsibility for the same and on the basis that all other parties appointed or to be appointed by the Client to perform related services in connection with the Project shall be deemed to have provided undertakings on terms no less onerous than this Agreement and shall be deemed to have paid to the Client such contribution as it would be just and equitable for them to pay having regard to their responsibility for any loss or damage and providing that it shall be deemed that such other parties have not limited or excluded their liability to the Client for such loss or damage in any way which may be prejudicial to the Consultant's liability under this clause. Nothing in this clause shall operate to exclude or limit the Consultant's liability for death or personal injury.

iii. The Client shall indemnify and keep indemnified the Consultant from and against all claims, demands,
proceedings, damages, costs and expenses arising out of or in connection with this Agreement or the Project
arising from acts of terrorism or arising otherwise in excess of the liability of the Consultant under this
Agreement or which may be made in respect of events occurring after the expiry of the period of liability stated
in this Agreement.

iv. No action or proceedings under or in connection with this Agreement shall be commenced against the Consultant after the expiry of one year from completion of the Services.

v. ABG Geosynthetics Ltd is not responsible for consequential, indirect or incidental losses.

6. INSURANCE

The Consultant shall arrange Professional Indemnity Insurance cover for the amount stated in Clause 5(ii). The Consultant will use all reasonable endeavours to maintain Professional Indemnity Insurance cover for the period stated in 5(iv) above, providing such insurance remains available to the Consultant at commercially reasonable rates.

7. CLIENT'S OBLIGATIONS

The Client shall supply, without charge and in such time so as not to delay or disrupt the performance of the Consultant in carrying out the Services, all necessary and relevant information, in his possession or available to him from his other agents or consultants and all necessary approvals or consents. Any deviation on any information from the proposal shall be confirmed in writing and any attendant consequential fees will be forwarded for approval by the Client before any changes are made. The Consultant shall not be liable for any consequential delays on site. Every reasonable effort will be made to mitigate against delays, however no liability for losses and costs will be accepted. The approval or consent by the Client to the Services shall not relieve the Consultant from any liability under this Agreement. All work undertaken by the Consultant must be ratified and signed off by the Client.

8. PAYMENT

i. The Client shall pay the Consultant for the Services in accordance with the proposal and this Agreement. If the Consultant performs any additional services or if the Services are delayed or disrupted for reasons beyond the
reasonable control of the Consultant then the Consultant shall be entitled to such additional fees as are fair and
reasonable in the circumstances. The Consultant may render an invoice at monthly intervals for services properly
performed. The agreed invoice, or in the event of a dispute the undisputed element, shall be paid within 28 days of receipt of the invoice by the Client. Any invoice paid after this period will attract interest at 3% above the base
rate of the central bank of the country of the currency of payment along with any collection costs which may occur.

ii. The Client shall not withhold any payment of any sum or part of a sum due to the Consultant under this
Agreement by reason of claims or alleged claims against the Consultant unless the amount to be withheld has
been agreed between the Client and the Consultant as due to the Client or such sum arises from an award in
adjudication, arbitration or litigation in favour of the Client and arises under or in connection with the Agreement.
Save as aforesaid all rights of set off at common law, in equity or otherwise which the Client may otherwise be
entitled to exercise are hereby expressly excluded.

9. TERMINATION

If a party is in breach of a material term of this Agreement and despite written notice from the other party fails to
remedy such breach within 30 days or such other period as may be agreed between the parties, then the other party shall be entitled to terminate this Agreement forthwith. The Consultant may seek to recoup costs incurred for works completed prior to termination.

10. DISPUTE RESOLUTION

Any dispute between the parties that cannot be settled by mutual agreement shall be referred for final settlement to the arbitration of a person agreed between the parties or failing such agreement appointed upon the application of either party by the President of the Chartered Institute of Arbitrators and the said arbitration shall be carried out in accordance with the Construction Industry Model Arbitration Rules 1998 or such other version current at the time of the referral under this clause. Where the Agreement is subject to a governing law other than that of England and Wales then any dispute between the parties that cannot be settled by mutual agreement shall be finally settled by arbitration in accordance with the UNCITRAL Arbitration Rules by one arbitrator appointed in compliance with the said Rules. In either case such rules as appropriate are deemed to be incorporated into this Agreement by reference.

11. COMPLIANCE WITH LAWS

This Agreement shall be governed by and construed in accordance with the law of England and Wales unless stated
otherwise in the proposal for services from the Consultant.

Changes to the above terms and conditions will only be considered if agreed in writing as
part of the appointment process prior to ABG Geosynthetics commencing work.

E Green Roof Runoff Calculations

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	99.028	0.028	0.5	0.0	O K
30 min Summer	99.047	0.047	1.3	0.1	O K
60 min Summer	99.054	0.054	1.7	0.1	O K
120 min Summer	99.058	0.058	1.9	0.1	O K
180 min Summer	99.054	0.054	1.7	0.1	O K
240 min Summer	99.052	0.052	1.6	0.1	O K
360 min Summer	99.047	0.047	1.3	0.1	O K
480 min Summer	99.043	0.043	1.1	0.1	O K
600 min Summer	99.040	0.040	0.9	0.0	O K
720 min Summer	99.037	0.037	0.8	0.0	O K
960 min Summer	99.034	0.034	0.7	0.0	O K
1440 min Summer	99.030	0.030	0.5	0.0	O K
2160 min Summer	99.025	0.025	0.4	0.0	O K
2880 min Summer	99.023	0.023	0.3	0.0	O K
4320 min Summer	99.019	0.019	0.2	0.0	O K
5760 min Summer	99.016	0.016	0.2	0.0	O K
7200 min Summer	99.015	0.015	0.2	0.0	O K
8640 min Summer	99.014	0.014	0.1	0.0	O K
10080 min Summer	99.013	0.013	0.1	0.0	O K
15 min Winter	99.037	0.037	0.8	0.0	O K
30 min Winter	99.054	0.054	1.7	0.1	O K
60 min Winter	99.062	0.062	2.2	0.1	O K
120 min Winter	99.061	0.061	2.1	0.1	O K
180 min Winter	99.052	0.052	1.6	0.1	O K
240 min Winter	99.048	0.048	1.3	0.1	O K
360 min Winter	99.042	0.042	1.0	0.0	O K
480 min Winter	99.038	0.038	0.9	0.0	O K
600 min Winter	99.035	0.035	0.7	0.0	O K
720 min Winter	99.033	0.033	0.7	0.0	O K
960 min Winter	99.030	0.030	0.5	0.0	O K
1440 min Winter	99.025	0.025	0.4	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	33.632	0.0	0.6	43
30 min Summer	21.704	0.0	1.5	37
60 min Summer	13.524	0.0	2.6	48
120 min Summer	8.246	0.0	3.7	74
180 min Summer	6.141	0.0	4.4	102
240 min Summer	4.975	0.0	4.9	128
360 min Summer	3.671	0.0	5.6	194
480 min Summer	2.954	0.0	6.1	252
600 min Summer	2.495	0.0	6.5	310
720 min Summer	2.173	0.0	6.9	372
960 min Summer	1.748	0.0	7.3	498
1440 min Summer	1.286	0.0	8.0	730
2160 min Summer	0.947	0.0	8.5	1092
2880 min Summer	0.762	0.0	8.7	1464
4320 min Summer	0.560	0.0	8.6	2184
5760 min Summer	0.450	0.0	8.3	2920
7200 min Summer	0.380	0.0	8.0	3680
8640 min Summer	0.331	0.0	7.8	4312
10080 min Summer	0.295	0.0	7.6	5104
15 min Winter	33.632	0.0	1.0	35
30 min Winter	21.704	0.0	2.0	34
60 min Winter	13.524	0.0	3.2	46
120 min Winter	8.246	0.0	4.5	72
180 min Winter	6.141	0.0	5.3	96
240 min Winter	4.975	0.0	5.9	138
360 min Winter	3.671	0.0	6.7	194
480 min Winter	2.954	0.0	7.3	254
600 min Winter	2.495	0.0	7.7	314
720 min Winter	2.173	0.0	8.1	368
960 min Winter	1.748	0.0	8.7	502
1440 min Winter	1.286	0.0	9.5	740

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
2160 min Winter	99.021	0.021	0.3	0.0	O K
2880 min Winter	99.018	0.018	0.2	0.0	O K
4320 min Winter	99.015	0.015	0.2	0.0	O K
5760 min Winter	99.013	0.013	0.1	0.0	O K
7200 min Winter	99.012	0.012	0.1	0.0	O K
8640 min Winter	99.011	0.011	0.1	0.0	O K
10080 min Winter	99.011	0.011	0.1	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
2160 min Winter	0.947	0.0	10.2	1092
2880 min Winter	0.762	0.0	10.5	1468
4320 min Winter	0.560	0.0	10.7	2152
5760 min Winter	0.450	0.0	10.5	2712
7200 min Winter	0.380	0.0	10.1	3672
8640 min Winter	0.331	0.0	9.7	3984
10080 min Winter	0.295	0.0	9.4	5088

Rainfall Details

Rainfall Model	FSR	Ratio R	0.439	Cv (Winter)	0.840
Return Period (years)	1	Summer Storms	Yes	Shortest Storm (mins)	15
Region	England and Wales	Winter Storms	Yes	Longest Storm (mins)	10080
M5-60 (mm)	21.000	Cv (Summer)	0.750	Climate Change %	+0

Green Roof

Area (m^3) 529 Depression Storage (mm) 5 Evaporation (mm/day) 3 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.009613	24	28	0.002895	48	52	0.000872	72	76	0.000263	96	100	0.000079
4	8	0.007870	28	32	0.002371	52	56	0.000714	76	80	0.000215	100	104	0.000065
8	12	0.006444	32	36	0.001941	56	60	0.000585	80	84	0.000176	104	108	0.000053
12	16	0.005276	36	40	0.001589	60	64	0.000479	84	88	0.000144	108	112	0.000043
16	20	0.004319	40	44	0.001301	64	68	0.000392	88	92	0.000118	112	116	0.000036
20	24	0.003536	44	48	0.001065	68	72	0.000321	92	96	0.000097	116	120	0.000029

Model Details

Storage is Online Cover Level (m) 100.000

Pipe Structure

Diameter (m) 0.150 Slope (1:X) 100.000 Length (m) 10.000 Invert Level (m) 99.000

Orifice Outflow Control

Diameter (m) 0.150 Discharge Coefficient 0.600 Invert Level (m) 99.000

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	99.088	0.088	4.6	0.1	O K
30 min Summer	99.097	0.097	5.2	0.1	O K
60 min Summer	99.105	0.105	5.9	0.2	O K
120 min Summer	99.087	0.087	4.4	0.1	O K
180 min Summer	99.081	0.081	3.8	0.1	O K
240 min Summer	99.076	0.076	3.3	0.1	O K
360 min Summer	99.071	0.071	2.8	0.1	O K
480 min Summer	99.064	0.064	2.3	0.1	O K
600 min Summer	99.059	0.059	2.0	0.1	O K
720 min Summer	99.056	0.056	1.8	0.1	O K
960 min Summer	99.051	0.051	1.5	0.1	O K
1440 min Summer	99.043	0.043	1.1	0.1	O K
2160 min Summer	99.037	0.037	0.8	0.0	O K
2880 min Summer	99.033	0.033	0.7	0.0	O K
4320 min Summer	99.028	0.028	0.5	0.0	O K
5760 min Summer	99.025	0.025	0.4	0.0	O K
7200 min Summer	99.022	0.022	0.3	0.0	O K
8640 min Summer	99.020	0.020	0.3	0.0	O K
10080 min Summer	99.018	0.018	0.2	0.0	O K
15 min Winter	99.098	0.098	5.4	0.1	O K
30 min Winter	99.105	0.105	5.9	0.2	O K
60 min Winter	99.099	0.099	5.4	0.2	O K
120 min Winter	99.086	0.086	4.3	0.1	O K
180 min Winter	99.078	0.078	3.5	0.1	O K
240 min Winter	99.073	0.073	3.0	0.1	O K
360 min Winter	99.064	0.064	2.3	0.1	O K
480 min Winter	99.057	0.057	1.9	0.1	O K
600 min Winter	99.053	0.053	1.6	0.1	O K
720 min Winter	99.049	0.049	1.4	0.1	O K
960 min Winter	99.044	0.044	1.1	0.1	O K
1440 min Winter	99.037	0.037	0.8	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	82.613	0.0	5.4	17
30 min Summer	52.928	0.0	7.7	23
60 min Summer	32.372	0.0	10.0	36
120 min Summer	19.209	0.0	12.4	70
180 min Summer	14.010	0.0	13.7	104
240 min Summer	11.153	0.0	14.7	134
360 min Summer	8.081	0.0	16.1	190
480 min Summer	6.424	0.0	17.1	254
600 min Summer	5.374	0.0	17.9	318
720 min Summer	4.643	0.0	18.6	372
960 min Summer	3.685	0.0	19.6	490
1440 min Summer	2.658	0.0	21.0	736
2160 min Summer	1.915	0.0	22.3	1100
2880 min Summer	1.517	0.0	23.0	1464
4320 min Summer	1.091	0.0	23.7	2168
5760 min Summer	0.863	0.0	23.9	2928
7200 min Summer	0.720	0.0	23.7	3656
8640 min Summer	0.620	0.0	23.3	4384
10080 min Summer	0.547	0.0	22.7	5008
15 min Winter	82.613	0.0	6.4	16
30 min Winter	52.928	0.0	9.0	22
60 min Winter	32.372	0.0	11.6	38
120 min Winter	19.209	0.0	14.2	72
180 min Winter	14.010	0.0	15.7	108
240 min Winter	11.153	0.0	16.8	132
360 min Winter	8.081	0.0	18.4	196
480 min Winter	6.424	0.0	19.6	260
600 min Winter	5.374	0.0	20.5	310
720 min Winter	4.643	0.0	21.3	378
960 min Winter	3.685	0.0	22.5	494
1440 min Winter	2.658	0.0	24.1	740

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
2160 min Winter	99.032	0.032	0.6	0.0	O K
2880 min Winter	99.028	0.028	0.5	0.0	O K
4320 min Winter	99.024	0.024	0.3	0.0	O K
5760 min Winter	99.020	0.020	0.3	0.0	O K
7200 min Winter	99.018	0.018	0.2	0.0	O K
8640 min Winter	99.016	0.016	0.2	0.0	O K
10080 min Winter	99.015	0.015	0.2	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
2160 min Winter	1.915	0.0	25.6	1084
2880 min Winter	1.517	0.0	26.6	1444
4320 min Winter	1.091	0.0	27.6	2172
5760 min Winter	0.863	0.0	28.0	2984
7200 min Winter	0.720	0.0	28.0	3568
8640 min Winter	0.620	0.0	27.8	4272
10080 min Winter	0.547	0.0	27.4	4864

Rainfall Details

Rainfall Model	FSR	Ratio R	0.439	Cv (Winter)	0.840
Return Period (years)	30	Summer Storms	Yes	Shortest Storm (mins)	15
Region	England and Wales	Winter Storms	Yes	Longest Storm (mins)	10080
M5-60 (mm)	21.000	Cv (Summer)	0.750	Climate Change %	+0

Green Roof

Area (m^3) 529 Depression Storage (mm) 5 Evaporation (mm/day) 3 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.009613	24	28	0.002895	48	52	0.000872	72	76	0.000263	96	100	0.000079
4	8	0.007870	28	32	0.002371	52	56	0.000714	76	80	0.000215	100	104	0.000065
8	12	0.006444	32	36	0.001941	56	60	0.000585	80	84	0.000176	104	108	0.000053
12	16	0.005276	36	40	0.001589	60	64	0.000479	84	88	0.000144	108	112	0.000043
16	20	0.004319	40	44	0.001301	64	68	0.000392	88	92	0.000118	112	116	0.000036
20	24	0.003536	44	48	0.001065	68	72	0.000321	92	96	0.000097	116	120	0.000029

Model Details

Storage is Online Cover Level (m) 100.000

Pipe Structure

Diameter (m) 0.150 Slope (1:X) 100.000 Length (m) 10.000 Invert Level (m) 99.000

Orifice Outflow Control

Diameter (m) 0.150 Discharge Coefficient 0.600 Invert Level (m) 99.000

Summary of Results for 100 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	99.113	0.113	6.5	0.2	O K
30 min Summer	99.120	0.120	7.1	0.2	O K
60 min Summer	99.118	0.118	6.9	0.2	O K
120 min Summer	99.105	0.105	5.9	0.2	O K
180 min Summer	99.094	0.094	5.0	0.1	O K
240 min Summer	99.086	0.086	4.4	0.1	O K
360 min Summer	99.078	0.078	3.5	0.1	O K
480 min Summer	99.073	0.073	3.0	0.1	O K
600 min Summer	99.069	0.069	2.6	0.1	O K
720 min Summer	99.064	0.064	2.3	0.1	O K
960 min Summer	99.057	0.057	1.9	0.1	O K
1440 min Summer	99.049	0.049	1.4	0.1	O K
2160 min Summer	99.042	0.042	1.0	0.1	O K
2880 min Summer	99.037	0.037	0.8	0.0	O K
4320 min Summer	99.032	0.032	0.6	0.0	O K
5760 min Summer	99.028	0.028	0.5	0.0	O K
7200 min Summer	99.025	0.025	0.4	0.0	O K
8640 min Summer	99.023	0.023	0.3	0.0	O K
10080 min Summer	99.021	0.021	0.3	0.0	O K
15 min Winter	99.120	0.120	7.1	0.2	O K
30 min Winter	99.126	0.126	7.8	0.2	O K
60 min Winter	99.121	0.121	7.2	0.2	O K
120 min Winter	99.102	0.102	5.7	0.2	O K
180 min Winter	99.089	0.089	4.7	0.1	O K
240 min Winter	99.082	0.082	3.9	0.1	O K
360 min Winter	99.073	0.073	3.0	0.1	O K
480 min Winter	99.066	0.066	2.4	0.1	O K
600 min Winter	99.060	0.060	2.1	0.1	O K
720 min Winter	99.056	0.056	1.8	0.1	O K
960 min Winter	99.050	0.050	1.4	0.1	O K
1440 min Winter	99.042	0.042	1.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	107.525	0.0	7.9	15
30 min Summer	69.398	0.0	11.0	21
60 min Summer	42.578	0.0	14.1	38
120 min Summer	25.224	0.0	17.1	70
180 min Summer	18.329	0.0	18.9	102
240 min Summer	14.532	0.0	20.1	130
360 min Summer	10.474	0.0	21.8	198
480 min Summer	8.297	0.0	23.1	250
600 min Summer	6.921	0.0	24.1	318
720 min Summer	5.965	0.0	24.9	374
960 min Summer	4.715	0.0	26.2	492
1440 min Summer	3.380	0.0	27.9	738
2160 min Summer	2.420	0.0	29.5	1096
2880 min Summer	1.907	0.0	30.5	1464
4320 min Summer	1.362	0.0	31.5	2168
5760 min Summer	1.072	0.0	31.8	2920
7200 min Summer	0.890	0.0	31.8	3560
8640 min Summer	0.764	0.0	31.5	4400
10080 min Summer	0.672	0.0	31.0	5000
15 min Winter	107.525	0.0	9.2	15
30 min Winter	69.398	0.0	12.6	21
60 min Winter	42.578	0.0	16.1	40
120 min Winter	25.224	0.0	19.5	74
180 min Winter	18.329	0.0	21.5	100
240 min Winter	14.532	0.0	22.8	138
360 min Winter	10.474	0.0	24.8	198
480 min Winter	8.297	0.0	26.3	252
600 min Winter	6.921	0.0	27.4	318
720 min Winter	5.965	0.0	28.3	378
960 min Winter	4.715	0.0	29.8	498
1440 min Winter	3.380	0.0	31.8	720

Summary of Results for 100 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
2160 min Winter	99.036	0.036	0.8	0.0	O K
2880 min Winter	99.032	0.032	0.6	0.0	O K
4320 min Winter	99.026	0.026	0.4	0.0	O K
5760 min Winter	99.024	0.024	0.3	0.0	O K
7200 min Winter	99.021	0.021	0.3	0.0	O K
8640 min Winter	99.019	0.019	0.2	0.0	O K
10080 min Winter	99.017	0.017	0.2	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
2160 min Winter	2.420	0.0	33.7	1120
2880 min Winter	1.907	0.0	34.9	1416
4320 min Winter	1.362	0.0	36.2	2228
5760 min Winter	1.072	0.0	36.9	2936
7200 min Winter	0.890	0.0	37.0	3528
8640 min Winter	0.764	0.0	37.0	4264
10080 min Winter	0.672	0.0	36.7	4856

Rainfall Details

Rainfall Model	FSR	Ratio R	0.439	Cv (Winter)	0.840
Return Period (years)	100	Summer Storms	Yes	Shortest Storm (mins)	15
Region	England and Wales	Winter Storms	Yes	Longest Storm (mins)	10080
M5-60 (mm)	21.000	Cv (Summer)	0.750	Climate Change %	+0

Green Roof

Area (m^3) 529 Depression Storage (mm) 5 Evaporation (mm/day) 3 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.009613	24	28	0.002895	48	52	0.000872	72	76	0.000263	96	100	0.000079
4	8	0.007870	28	32	0.002371	52	56	0.000714	76	80	0.000215	100	104	0.000065
8	12	0.006444	32	36	0.001941	56	60	0.000585	80	84	0.000176	104	108	0.000053
12	16	0.005276	36	40	0.001589	60	64	0.000479	84	88	0.000144	108	112	0.000043
16	20	0.004319	40	44	0.001301	64	68	0.000392	88	92	0.000118	112	116	0.000036
20	24	0.003536	44	48	0.001065	68	72	0.000321	92	96	0.000097	116	120	0.000029

Model Details

Storage is Online Cover Level (m) 100.000

Pipe Structure

Diameter (m) 0.150 Slope (1:X) 100.000 Length (m) 10.000 Invert Level (m) 99.000

Orifice Outflow Control

Diameter (m) 0.150 Discharge Coefficient 0.600 Invert Level (m) 99.000

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	99.140	0.140	9.3	0.3	O K
30 min Summer	99.149	0.149	10.2	0.3	O K
60 min Summer	99.144	0.144	9.6	0.3	O K
120 min Summer	99.130	0.130	8.2	0.2	O K
180 min Summer	99.119	0.119	7.0	0.2	O K
240 min Summer	99.108	0.108	6.1	0.2	O K
360 min Summer	99.093	0.093	4.9	0.1	O K
480 min Summer	99.085	0.085	4.2	0.1	O K
600 min Summer	99.079	0.079	3.7	0.1	O K
720 min Summer	99.075	0.075	3.2	0.1	O K
960 min Summer	99.069	0.069	2.6	0.1	O K
1440 min Summer	99.059	0.059	2.0	0.1	O K
2160 min Summer	99.050	0.050	1.4	0.1	O K
2880 min Summer	99.044	0.044	1.1	0.1	O K
4320 min Summer	99.037	0.037	0.8	0.0	O K
5760 min Summer	99.033	0.033	0.7	0.0	O K
7200 min Summer	99.030	0.030	0.5	0.0	O K
8640 min Summer	99.028	0.028	0.5	0.0	O K
10080 min Summer	99.026	0.026	0.4	0.0	O K
15 min Winter	99.151	0.151	10.4	0.3	O K
30 min Winter	99.155	0.155	10.9	0.3	O K
60 min Winter	99.147	0.147	10.0	0.3	O K
120 min Winter	99.128	0.128	8.0	0.2	O K
180 min Winter	99.113	0.113	6.5	0.2	O K
240 min Winter	99.100	0.100	5.5	0.2	O K
360 min Winter	99.085	0.085	4.3	0.1	O K
480 min Winter	99.077	0.077	3.4	0.1	O K
600 min Winter	99.072	0.072	2.9	0.1	O K
720 min Winter	99.068	0.068	2.5	0.1	O K
960 min Winter	99.060	0.060	2.0	0.1	O K
1440 min Winter	99.050	0.050	1.5	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	150.535	0.0	12.1	13
30 min Summer	97.157	0.0	16.5	19
60 min Summer	59.609	0.0	20.8	38
120 min Summer	35.314	0.0	25.1	68
180 min Summer	25.660	0.0	27.6	100
240 min Summer	20.345	0.0	29.3	134
360 min Summer	14.664	0.0	31.8	194
480 min Summer	11.616	0.0	33.6	250
600 min Summer	9.689	0.0	35.1	310
720 min Summer	8.351	0.0	36.2	370
960 min Summer	6.601	0.0	38.1	502
1440 min Summer	4.732	0.0	40.8	738
2160 min Summer	3.388	0.0	43.3	1112
2880 min Summer	2.670	0.0	45.0	1452
4320 min Summer	1.907	0.0	47.0	2188
5760 min Summer	1.501	0.0	48.2	2880
7200 min Summer	1.246	0.0	48.7	3680
8640 min Summer	1.070	0.0	48.9	4328
10080 min Summer	0.940	0.0	48.9	5080
15 min Winter	150.535	0.0	13.9	13
30 min Winter	97.157	0.0	18.8	21
60 min Winter	59.609	0.0	23.7	40
120 min Winter	35.314	0.0	28.5	74
180 min Winter	25.660	0.0	31.3	104
240 min Winter	20.345	0.0	33.2	134
360 min Winter	14.664	0.0	36.0	200
480 min Winter	11.616	0.0	38.0	254
600 min Winter	9.689	0.0	39.7	320
720 min Winter	8.351	0.0	41.0	374
960 min Winter	6.601	0.0	43.2	490
1440 min Winter	4.732	0.0	46.2	730

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
2160 min Winter	99.043	0.043	1.1	0.1	O K
2880 min Winter	99.038	0.038	0.8	0.0	O K
4320 min Winter	99.032	0.032	0.6	0.0	O K
5760 min Winter	99.028	0.028	0.5	0.0	O K
7200 min Winter	99.025	0.025	0.4	0.0	O K
8640 min Winter	99.023	0.023	0.3	0.0	O K
10080 min Winter	99.022	0.022	0.3	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
2160 min Winter	3.388	0.0	49.2	1148
2880 min Winter	2.670	0.0	51.1	1428
4320 min Winter	1.907	0.0	53.7	2240
5760 min Winter	1.501	0.0	55.1	2928
7200 min Winter	1.246	0.0	56.0	3656
8640 min Winter	1.070	0.0	56.5	4392
10080 min Winter	0.940	0.0	56.7	5032

Rainfall Details

Rainfall Model	FSR	Ratio R	0.439	Cv (Winter)	0.840
Return Period (years)	100	Summer Storms	Yes	Shortest Storm (mins)	15
Region	England and Wales	Winter Storms	Yes	Longest Storm (mins)	10080
M5-60 (mm)	21.000	Cv (Summer)	0.750	Climate Change %	+40

Green Roof

Area (m^3) 529 Depression Storage (mm) 5 Evaporation (mm/day) 3 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.009613	24	28	0.002895	48	52	0.000872	72	76	0.000263	96	100	0.000079
4	8	0.007870	28	32	0.002371	52	56	0.000714	76	80	0.000215	100	104	0.000065
8	12	0.006444	32	36	0.001941	56	60	0.000585	80	84	0.000176	104	108	0.000053
12	16	0.005276	36	40	0.001589	60	64	0.000479	84	88	0.000144	108	112	0.000043
16	20	0.004319	40	44	0.001301	64	68	0.000392	88	92	0.000118	112	116	0.000036
20	24	0.003536	44	48	0.001065	68	72	0.000321	92	96	0.000097	116	120	0.000029

Model Details

Storage is Online Cover Level (m) 100.000

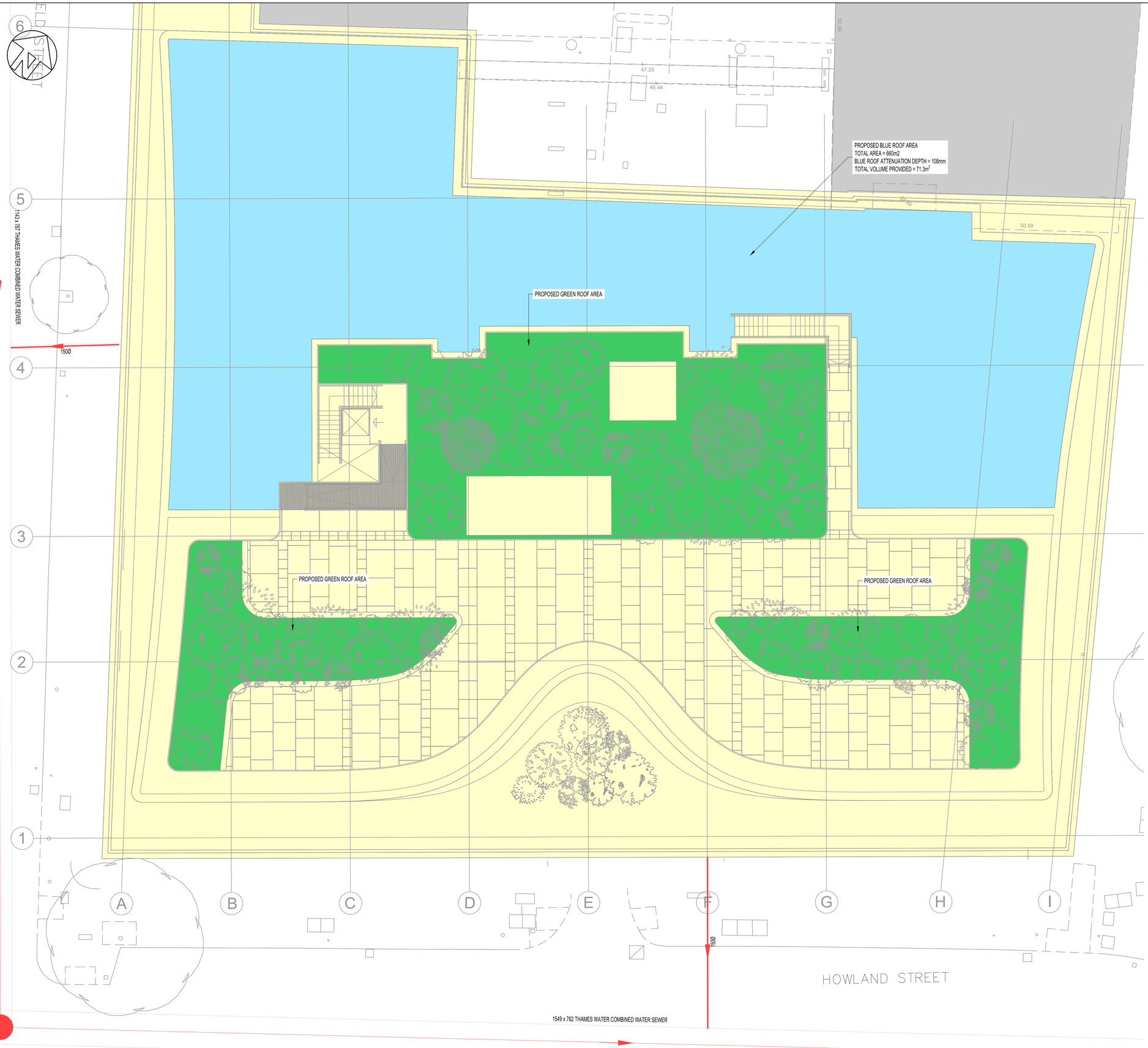
Pipe Structure

Diameter (m) 0.150 Slope (1:X) 100.000 Length (m) 10.000 Invert Level (m) 99.000

Orifice Outflow Control

Diameter (m) 0.150 Discharge Coefficient 0.600 Invert Level (m) 99.000

F Proposed Below Ground Drainage



BELOW GROUND DRAINAGE NOTES

1. THE LOCATION AND LEVEL OF EXISTING DRAINAGE CONNECTIONS AND EXISTING SERVICES IS TO BE CHECKED PRIOR TO COMMENCEMENT OF DRAINAGE WORKS. ANY VARIANCE TO THE DETAILS ON THIS DRAWING AND THE SCHEDULE IS TO BE BROUGHT TO THE ATTENTION OF THE ENGINEER.
2. THE DESIGN IS BASED ON THE INFORMATION AVAILABLE ON THE DATE OF ISSUE FROM OTHER PARTIES (EG. ARCHITECT AND M & E ENGINEER). IT IS SUBJECT TO CHANGE RESULTING FROM UPDATES TO THE AVAILABLE INFORMATION FROM OTHERS.
3. THE DRAWINGS ARE TO BE READ IN CONJUNCTION WITH THE NBS SPECIFICATIONS, ASSOCIATED MANHOLE SCHEDULE AND STANDARD DRAINAGE DETAIL DRAWINGS WHERE APPLICABLE.
4. THE POSITIONS OF FOUL AND SURFACE WATER DRAINAGE POINTS ARE INDICATIVE ONLY, REFER TO THE ARCHITECTS DRAWINGS FOR SETTING OUT DETAILS.
5. PRIVATE FOUL AND SURFACE WATER DRAINAGE IS TO BE CONSTRUCTED IN ACCORDANCE WITH BUILDING REGULATIONS PART H, BS EN752 AND BS EN12056.
6. DRAINS AT BASEMENT LEVEL ARE TO BE CONSTRUCTED USING CAST IRON (ENSIGN OR EQUIVALENT) AND FLEXIBLY JOINTED TO BS 437.
7. DRAINS AT GROUND LEVEL ARE TO BE CONSTRUCTED USING VITRIFIED CLAY PIPES TO BS EN 295-1 SUPER STRENGTH SPECIFICATION (HEPWORTH SUPERSLEVE) OR SIMILAR APPROVED.
8. ALL SOIL CONNECTIONS UNDER BUILDINGS TO BE 100mm DIA LAID AT A MINIMUM GRADIENT OF 1/40 UNLESS NOTED OTHERWISE.
9. ALL SURFACE WATER CONNECTIONS TO BE 150mm DIAMETER AND TO BE LAID AT A MINIMUM GRADIENT OF 1/80 UNLESS NOTED OTHERWISE .
10. ALL SOIL CONNECTIONS AND RAINWATER PIPES SHOULD BE RODDABLE FROM GROUND LEVEL.
11. RAINWATER DOWN PIPES ARE TO CONNECT TO A DRAIN VIA A REST BEND. WHERE DRAINAGE IS COMBINED A 'P' TRAP MUST ALSO BE PROVIDED.
12. IN CASES OF IN SITU CONCRETE FLOOR SLABS, DRAINS ARE TO BE CAST INTEGRAL WITH THE SLAB WHERE PIPE COVER TO THE CROWN IS LESS THAN 300mm. - NOTE SPECIAL PROVISIONS APPLY TO BASEMENT FLOOR SLABS - SEE DETAILED DRAINAGE AND STRUCTURAL DRAWINGS. CONCRETE ENCASEMENT TO BE REINFORCED AS PER DRAINAGE DETAIL.
13. IN CASES OF SUSPENDED FLOORS WHERE A VOID OF 300mm OR MORE EXISTS BELOW FLOOR DRAINS ARE TO BE SUSPENDED USING A PROPRIETARY HANGER SYSTEM OR CAST INTEGRAL WITH THE FLOOR.
14. WHERE DRAINS PASS THROUGH FOUNDATIONS OR OTHER RIGID STRUCTURES A LINTEL OR SLEEVE IS TO BE USED AND PROVISION FOR FLEXIBILITY IS TO BE MADE USING ROCKER PIPES.
15. BACKFILLING OF DRAIN TRENCHES ADJACENT TO BUILDING OR OTHER STRUCTURES IS TO BE IN ACCORDANCE WITH DIAGRAM 8 OF THE BUILDING REGULATIONS.
16. ANY PIPE OR GULLY OR OTHER FITTING OR DUCT PENETRATING THE BASEMENT SLAB OR WALL IS TO BE WATERPROOFED USING HYDROPHILIC STRIPS OR PUDDLE FLANGES TO ENSURE A WATER TIGHT JOINT. CONCRETE SURROUND TO DRAINAGE PIPES AND FITTINGS MAY BE REQUIRED IN CERTAIN CASES - REFER TO DETAILED DRAINAGE DRAWINGS AND RELEVANT STRUCTURAL DETAILS.
17. EXISTING FOUNDATIONS AND RETAINING WALLS MUST NOT BE UNDERMINED BY NEW DRAINAGE RUNS UNLESS AGREED IN WRITING WITH THE STRUCTURAL ENGINEER. CONTRACTOR TO SUBMIT METHOD STATEMENTS AND TEMPORARY WORKS PROPOSALS TO THE STRUCTURAL ENGINEER FOR COMMENT PRIOR TO COMMENCEMENT OF WORKS.
18. ALL DRAINAGE EXCAVATIONS SHOULD BE RISK ASSESSED BY THE CONTRACTOR TO ENSURE TRENCH SAFETY / STABILISATION MEASURES ARE CONSIDERED DURING THE CONSTRUCTION PERIOD. ANY EXCAVATIONS LEFT EXPOSED SHOULD BE INSPECTED BY A COMPETENT PERSON ON A DAILY BASIS. GROUND CONDITIONS SHOULD BE MONITORED AND TOOL BOX TALKS SHOULD INCLUDE SITE INVESTIGATION INFORMATION TO AID THE CONTRACTORS ONGOING RISK ASSESSMENT AND METHOD OF EXCAVATION. ALL EXCAVATIONS SHOULD BE ASSESSED BY A COMPETENT PERSON FOR CONFINED SPACES REQUIREMENTS.
19. THE CONTRACTOR IS TO CONSIDER PHASING OF THE DRAINAGE INSTALLATION AND ARE TO PROVIDE TEMPORARY DRAINAGE MEASURES THEY DETERMINE ARE REQUIRED.
20. SuDS ARE TO BE INSTALLED IN ACCORDANCE WITH THE RECOMMENDATIONS MADE WITHIN THE CIRIA SUDS MANUAL C753 (WITH PARTICULAR ATTENTION DRAWN TO CHAPTER 31) AND CIRIA GUIDANCE ON THE CONSTRUCTION OF SuDS C768. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO CONSIDER CONSTRUCTION PROGRAMME OF SuDS.
21. DETAILED DESIGN OF GEOCELLULAR ATTENUATION CRATES IS A CDP ITEM AND SHOULD BE BASED ON LEVEL, LAYOUT AND VOLUME DETAILS SHOWN. DETAILED DESIGN INFORMATION SHOULD BE PROVIDED TO THE CIVIL ENGINEER TO PASS COMMENT.

This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.

Do not scale from this drawing.

LEGEND

- EXISTING COMBINED WATER
- PROPOSED COMBINED WATER
- BLUE ROOF AREA
- GREEN ROOF AREA
- EXISTING BUILDING
- PROPOSED BUILDING

NOT FOR CONSTRUCTION

rev	sc	date	by	chk	description
P1	S2	06.11.20	WHu	PDa	Issued for planning

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Project
The Network Building
London
W1T 4TP

Drawing title
Proposed Below Ground Drainage Strategy - Ground Floor

Scale (s)	Date	Drawn
1:100@ A1; 1:200@ A3	November 2020	WHu

Drawing status	Status	Revision
Preliminary	S2	P1

Project no.	Originator	Zone	Level	Type	Role	drg no.
2170754	EWP	ZZ	00	DR	C	1000

G London Borough of Camden Surface Water Drainage Pro-forma

Surface Water Drainage Pro-forma for new developments

This pro-forma accompanies our advice note on surface water drainage. Developers should complete this form and submit it to the Local Planning Authority, referencing from where in their submission documents this information is taken. The pro-forma is supported by the Defra/EA guidance on Rainfall Runoff Management and uses the storage calculator on www.UKsuds.com. This pro-forma is based on current industry best practice and focuses on ensuring surface water drainage proposals meet national and local policy requirements. The pro-forma should be considered alongside other supporting SuDS Guidance.

1. Site Details

Site	The Network Building
Address & post code or LPA reference	97 Tottenham Court Road, London, W1T 4TP
Grid reference	529369E , 182018N
Is the existing site developed or Greenfield?	Developed
Is the development in a LFRZ or in an area known to be at risk of surface or ground water flooding? If yes, please demonstrate how this is managed, in line with DP23?	No
Total Site Area served by drainage system (excluding open space) (Ha)*	0.207

***** The Greenfield runoff off rate from the development which is to be used for assessing the requirements for limiting discharge flow rates and attenuation storage from a site should be calculated for the area that forms the drainage network for the site whatever size of site and type of drainage technique. Please refer to the Rainfall Runoff Management document or CIRIA manual for detail on this.

2. Impermeable Area

	Existing	Proposed	Difference (Proposed-Existing)	Notes for developers
Impermeable area (ha)	0.207	0.207	0	If the proposed amount of impermeable surface is greater, then runoff rates and volumes will increase. Section 6 must be filled in. If proposed impermeability is equal or less than existing, then section 6 can be skipped and section 7 filled in.
Drainage Method (infiltration/sewer/watercourse)	sewer	sewer	N/A	If different from the existing, please fill in section 3. If existing drainage is by infiltration and the proposed is not, discharge volumes may increase. Fill in section 6.

3. Proposing to Discharge Surface Water via

	Yes	No	Evidence that this is possible	Notes for developers
Existing and proposed MicroDrainage calculations				Please provide MicroDrainage calculations of existing and proposed run-off rates and volumes in accordance with a recognised methodology or the results of a full infiltration test (see line below) if infiltration is proposed.
Infiltration		x		e.g. soakage tests. Section 6 (infiltration) must be filled in if infiltration is proposed.
To watercourse		x		e.g. Is there a watercourse nearby?
To surface water sewer		x		Confirmation from sewer provider that sufficient capacity exists for this connection.
Combination of above		x		e.g. part infiltration part discharge to sewer or watercourse. Provide evidence above.
Has the drainage proposal had regard to the SuDS hierarchy?	X			Evidence must be provided to demonstrate that the proposed Sustainable Drainage strategy has had regard to the SuDS hierarchy as outlined in Section 2.5 above.
Layout plan showing where the sustainable drainage infrastructure will be located on site.	X			Please provide plan reference numbers showing the details of the site layout showing where the sustainable drainage infrastructure will be located on the site. If the development is to be constructed in phases this should be shown on a separate plan and confirmation should be provided that the sustainable drainage proposal for each phase can be constructed and can operate independently and is not reliant on any later phase of development.

4. Peak Discharge Rates – This is the maximum flow rate at which storm water runoff leaves the site during a particular storm event.

	Existing Rates (l/s)	Proposed Rates (l/s)	Difference (l/s) (Proposed-Existing)	% Difference (difference /existing x 100)	Notes for developers
Greenfield QBAR	0.8	N/A	N/A	N/A	QBAR is approx. 1 in 2 storm event. Provide this if Section 6 (QBAR) is proposed.
1 in 1	19.4	8.8	-10.6	54	Proposed discharge rates (with mitigation) should aim to be equivalent to greenfield rates for all corresponding storm events. As a minimum, peak discharge rates must be reduced by 50% from the existing sites for all corresponding rainfall events.
1 in 30	47.5	21.6	-25.9	55	
1in 100	61.9	28.1	-33.8	55	
1 in 100 plus climate change	N/A	37.4	NA	>55	The proposed 1 in 100 +CC peak discharge rate (with mitigation) should aim to be equivalent to greenfield rates. As a minimum, proposed 1 in 100 +CC peak discharge rate must be reduced by 50% from the existing 1 in 100 runoff rate sites.

5. Calculate additional volumes for storage –The total volume of water leaving the development site. New hard surfaces potentially restrict the amount of stormwater that can go to the ground, so this needs to be controlled so not to make flood risk worse to properties downstream.

	Greenfield runoff volume (m^3)	Existing Volume (m^3)	Proposed Volume (m^3)	Difference (m^3) (Proposed-Existing)	Notes for developers
1 in 1					Proposed discharge volumes (with mitigation) should be constrained to a value as close as is reasonably practicable to the greenfield runoff volume wherever practicable and as a minimum should be no greater than existing volumes for all corresponding storm events. Any increase in volume increases flood risk elsewhere. Where volumes are increased section 6 must be filled in.
1 in 30					
1in 100 6 hour					
1 in 100 6 hour plus climate change					The proposed 1 in 100 +CC discharge volume should be constrained to a value as close as is reasonably practicable to the greenfield runoff volume wherever practicable. As a minimum, to mitigate for climate change the proposed 1 in 100 +CC volume discharge from site must be no greater than the existing 1 in 100 storm event. If not, flood risk increases under climate change.

6. Calculate attenuation storage – Attenuation storage is provided to enable the rate of runoff from the site into the receiving watercourse to be limited to an acceptable rate to protect against erosion and flooding downstream. The attenuation storage volume is a function of the degree of development relative to the greenfield discharge rate.

		Notes for developers
Storage Attenuation volume (Flow rate control) required to meet greenfield run off rates (m^3)	160	Volume of water to attenuate on site if discharging at a greenfield run off rate. Can't be used where discharge volumes are increasing
Storage Attenuation volume (Flow rate control) required to reduce rates by 50% (m^3)	84	Volume of water to attenuate on site if discharging at a 50% reduction from existing rates. Can't be used where discharge volumes are increasing
Storage Attenuation volume (Flow rate control) required to meet [OTHER RUN OFF RATE (as close to greenfield rate as possible] (m^3)	71.3	Volume of water to attenuate on site if discharging at a rate different from the above – please state in 1st column what rate this volume corresponds to. On previously developed sites, runoff rates should not be more than three times the calculated greenfield rate. Can't be used where discharge volumes are increasing
Storage Attenuation volume (Flow rate control) required to retain rates as existing (m^3)	0	Volume of water to attenuate on site if discharging at existing rates. Can't be used where discharge volumes are increasing
Percentage of attenuation volume stored above ground,	100	Percentage of attenuation volume which will be held above ground in swales/ponds/basins/green roofs etc. If 0, please demonstrate why.

7. How is Storm Water stored on site?

Storage is required for the additional volume from site but also for holding back water to slow down the rate from the site. This is known as attenuation storage and long term storage. The idea is that the additional volume does not get into the watercourses, or if it does it is at an exceptionally low rate. You can either infiltrate the stored water back to ground, or if this isn't possible hold it back with on site storage. Firstly, can infiltration work on site?

			Notes for developers
Infiltration	**State the Site's Geology and known Source Protection Zones (SPZ)**		Avoid infiltrating in made ground. Infiltration rates are highly variable and refer to Environment Agency website to identify and source protection zones (SPZ)
	Are infiltration rates suitable?	No	Infiltration rates should be no lower than $1x10^{-6}$ m/s.
	State the distance between a proposed infiltration device base and the ground water (GW) level		Need 1m (min) between the base of the infiltration device & the water table to protect Groundwater quality & ensure GW doesn't enter infiltration devices. Avoid infiltration where this isn't possible.

	Were infiltration rates obtained by desk study or infiltration test?	No	Infiltration rates can be estimated from desk studies at most stages of the planning system if a back up attenuation scheme is provided..
	Is the site contaminated? If yes, consider advice from others on whether infiltration can happen.		Advice on contaminated Land in Camden can be found on our supporting documents webpage Water should not be infiltrated through land that is contaminated. The Environment Agency may provide bespoke advice in planning consultations for contaminated sites that should be considered.
In light of the above, is infiltration feasible?	**Yes/No? If the answer is No, please identify how the storm water will be stored prior to release**	No	If infiltration is not feasible how will the additional volume be stored?. The applicant should then consider the following options in the next section.

Storage requirements

The developer must confirm that either of the two methods for dealing with the amount of water that needs to be stored on site.

Option 1 Simple – Store both the additional volume and attenuation volume in order to make a final discharge from site at the greenfield run off rate. This is preferred if no infiltration can be made on site. This very simply satisfies the runoff rates and volume criteria.

Option 2 Complex – If some of the additional volume of water can be infiltrated back into the ground, the remainder can be discharged at a very low rate of 2 l/sec/hectare. A combined storage calculation using the partial permissible rate of 2 l/sec/hectare and the attenuation rate used to slow the runoff from site.

		Notes for developers
Please confirm what option has been chosen and how much storage is required on site.	simple	The developer at this stage should have an idea of the site characteristics and be able to explain what the storage requirements are on site and how it will be achieved.

8. Please confirm

		Notes for developers
Which Drainage Systems measures have been used, including green roofs?	Blue Roof	SUDS can be adapted for most situations even where infiltration isn't feasible e.g. impermeable liners beneath some SUDS devices allows treatment but not infiltration. See CIRIA SUDS Manual C697.
Drainage system can contain in the 1 in 30 storm event without flooding	Yes	This a requirement for sewers for adoption & is good practice even where drainage system is not adopted.
Will the drainage system contain the 1 in 100 +CC storm event? If no please demonstrate how buildings and utility plants will be protected.	Yes	National standards require that the drainage system is designed so that flooding does not occur during a 1 in 100 year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development.
Any flooding between the 1 in 30 & 1 in 100 plus climate change storm events will be safely contained on site.	No	**Safely:** not causing property flooding or posing a hazard to site users i.e. no deeper than 300mm on roads/footpaths. Flood waters must drain away at section 6 rates. Existing rates can be used where runoff volumes are not increased.
How will exceedance events be catered on site without increasing flood risks (both on site and outside the development)?	Surface Water dealt with at roof level	**Safely:** not causing property flooding or posing a hazard to site users i.e. no deeper than 300mm on roads/footpaths. Flood waters must drain away at section 6 rates. Existing rates can be used where runoff volumes are not increased. Exceedance events are defined as those larger than the 1 in 100 +CC event.
How are rates being restricted (vortex control, orifice etc)	Blue Roof control orifices	Detail of how the flow control systems have been designed to avoid pipe blockages and ease of maintenance should be provided.
Please confirm the owners/adopters of the entire drainage systems throughout the development. Please list all the owners.	The system will be owned by the property management company	If these are multiple owners then a drawing illustrating exactly what features will be within each owner's remit must be submitted with this Proforma.
How is the entire drainage system to be maintained?	In line with the CIRIA SuDS Manual Guidance	If the features are to be maintained directly by the owners as stated in answer to the above question please answer yes to this question and submit the relevant maintenance schedule for each feature. If it is to be maintained by others than above please give details of each feature and the maintenance schedule. Clear details of the maintenance proposals of all elements of the proposed drainage system must be provided. Details must demonstrate that maintenance and operation requirements are economically proportionate. Poorly maintained drainage can lead to increased flooding problems in the future.

9. Evidence Please identify where the details quoted in the sections above were taken from. i.e. Plans, reports etc. Please also provide relevant drawings that need to accompany your proforma, in particular exceedance routes and ownership and location of SuDS (maintenance access strips etc

Pro-forma Section	Document reference where details quoted above are taken from	Page Number
Section 2	Section 4	1
Section 3	Section 6	2
Section 4		3
Section 5		3
Section 6		3
Section 7		3
Section 8		3

The above form should be completed using evidence from the Flood Risk Assessment and site plans. It should serve as a summary sheet of the drainage proposals and should clearly show that the proposed rate and volume as a result of development will not be increasing. If there is an increase in rate or volume, the rate or volume section should be completed to set out how the additional rate/volume is being dealt with.

This form is completed using factual information from the Flood Risk Assessment and Site Plans and can be used as a summary of the surface water drainage strategy on this site.

Form Completed By: Will Hudson
Qualification of person responsible for signing off this pro-forma MEng (hons)

Company Elliott Wood Partnership
On behalf of (Client's details) Blackburn & Co
Date: 06/11/2020

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