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REPORT

135-149 Shaftesbury Avenue, London, WC2H 8AH

Drainage and SuDS Strategy Report

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Job Number:	25916

Date	Version	Notes/Amendments/Issue Purpose
November 2017	1	Draft Planning
December 2017	2	Planning

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Appendices:

Acronyms	
AOD	Above Ordnance Datum
BGS	British Geological Survey
EA	Environment Agency
FEH	Flood Estimation Handbook
SuDS	Sustainable Drainage System
TW	Thames Water

1 Introduction

Price & Myers have been commissioned to undertake a drainage strategy for the redevelopment of 135-149 Shaftesbury Avenue, London, WC2H 8AH, in the London Borough of Camden. The purpose of this report is to set out the drainage design proposals for the development with particular focus on surface water management and Sustainable Drainage Systems (SuDS).

This report and the drainage strategy for the site have been developed in accordance with The London Borough of Camden's SuDS guidance, the Environment Agency (EA), Building Regulations Part H and CIRIA documents, with the objective of adopting the most sustainable drainage solution for the proposed development. The EA's updated guidance on climate change has been considered for the surface water drainage calculations.

The EA's indicative floodplain map indicates that the site is in Flood Zone 1 and the site area is less than 1 ha, thus a Flood Risk Assessment is not required.

2 Site Description and Location

The existing site is a cinema complex with a total site area of approximately 830m^2 (0.083ha) all of which is impermeable. The site is bordered on all sides by public highway. There is a garden to the north, and commercial buildings east, south and west of the site. The main site entrance is from Shaftesbury Avenue from the south-east. Site co-ordinates are at grid reference OS 529977 / 181149. The topographical survey indicates that the site is generally flat with a slight downwards slope from north-west towards south-east. Site levels vary between 23.500m AOD at the highest (NW) and 22.850m AOD at the lowest point (SE).

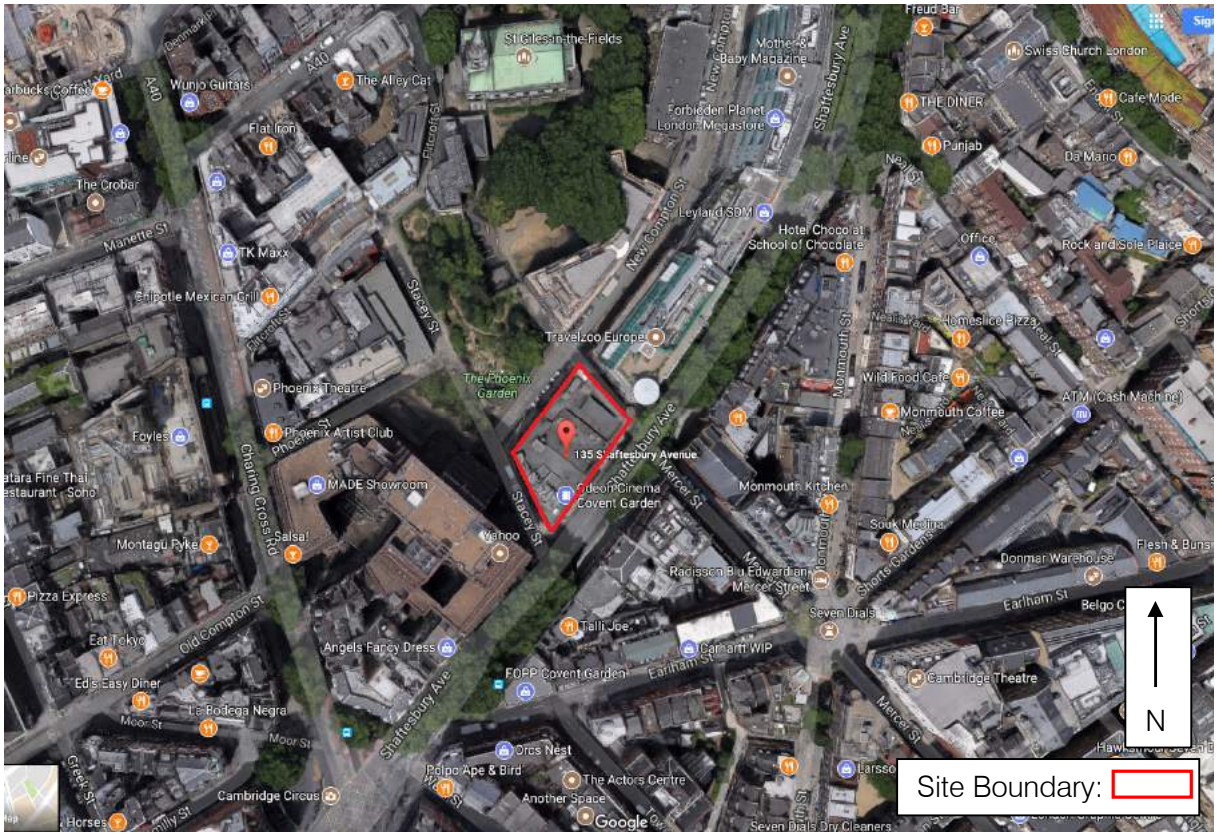


Figure 2.1: Site Location Plan (Google Maps, 2017)

3 Development Proposal

Development proposals involve the comprehensive refurbishment of the existing building to provide a new 94 room hotel room, a new four screen cinema, a restaurant/bar, as well as a spa. The proposals would include a new basement extension and a two storey roof top extension. The new hotel would be provided over six levels, with the hotel reception and restaurant/bar provided at ground level. The new four screen cinema and spa would be provided in the basement levels.

It is proposed that the existing building façade be maintained with the new development to be constructed within and on top of the existing building. A proposed development visualisation is shown in Figure 3.1 with plans provided in Appendix B.

Figure 3.1: Proposed Development Visualisation (view from Shaftsbury Avenue SW)

4 Existing Drainage

Thames Water (TW) asset location plans (Figure 4.1) show combined public sewers running along all the streets surrounding the building, with a trunk sewer in Shaftsbury Avenue.

Information regarding the sites existing below ground drainage arrangement was not available at the time of writing this report. However, as the existing building occupies the entire site footprint, all surface water run-off is from the roof, which is assumed to discharge unrestricted via rainwater pipes to the public sewer.

From a site visit drainage pipework was seen to discharge at high level from the building towards the highway. The majority of foul water appliances were also seen to be at the northeast end of the site. It is therefore assumed that all ground floor and above foul water drainage discharges via gravity to the public sewer in Compton Street. TW asset records indicate that the public sewer is at a higher level than the existing basement. It is therefore assumed all foul water drainage from basements levels are pumped into the public sewer.

A CCTV Survey will be carried out to determine the exact arrangement of the sites foul and surface water drainage, and points of discharge to the public sewer.

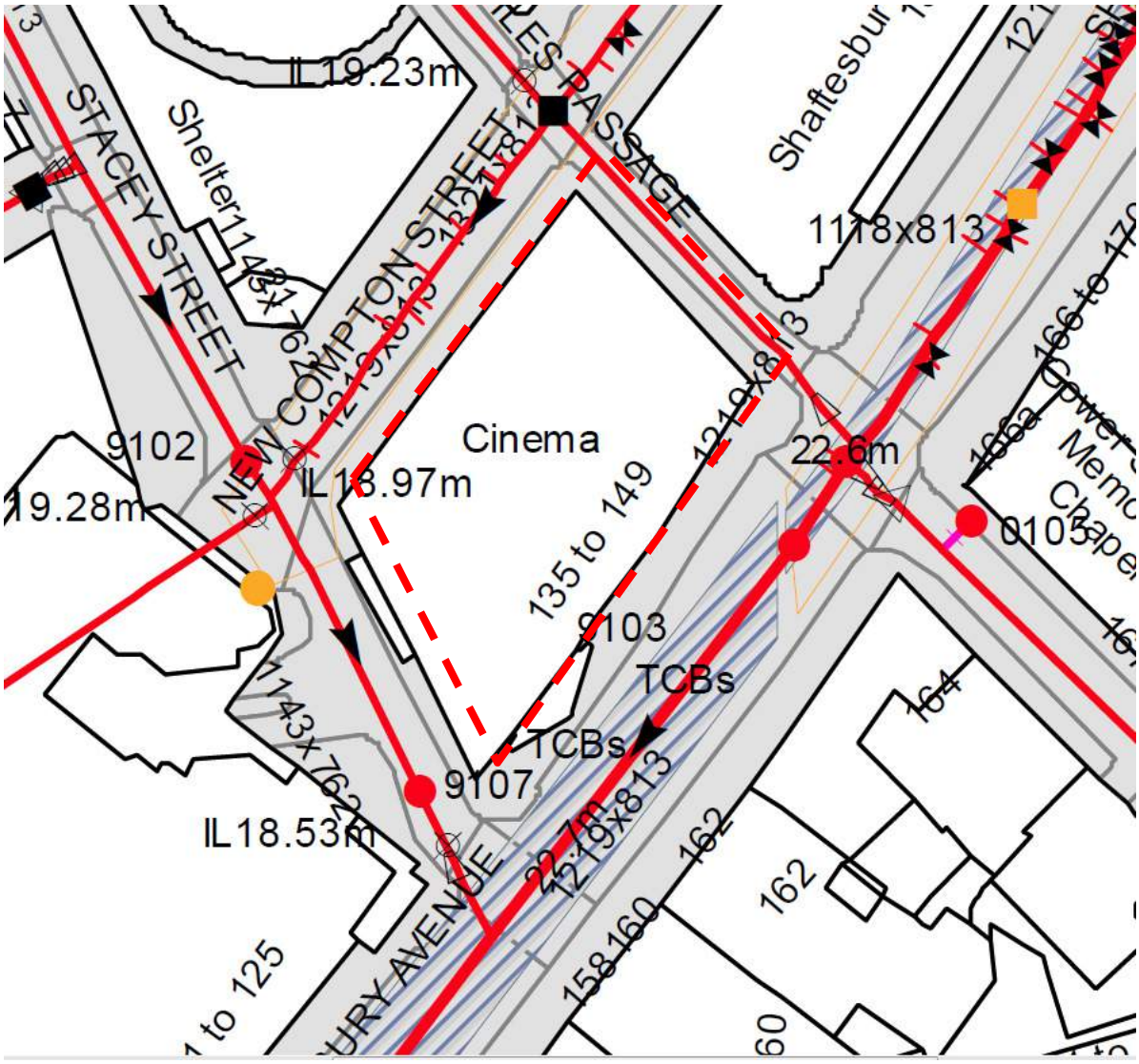


Figure 4.1: Thames Water Sewer Records

Site Location:

4.1 Existing Surface Water Run-Off

The entire 830m² site area (0.083ha), is currently impermeable. The existing run-off rate for the 1 in 100 year storm event was calculated using the modified rational method as shown below:

Q100 = 2.78 x A x i (where 'A' is the catchment area in ha, and 'i' is the rainfall intensity in mm/hr as estimated from the Micro Drainage software)

Q100 = 2.78 x 0.083 x 106 = 24.46 l/sec

4.2 Existing Foul Water Flow Rates

Guidance from Table 5 of Building Regulations – Part H, and existing site layout plans indicating the quantity and types of proposed foul water appliances, has been used to calculate the anticipated total peak foul water flow rate to the public sewers. This was found to be approximately 7.27 l/sec. Refer to Appendix D for full calculations.

5 Proposed Surface Water Drainage

The proposed development will result in no change in the sites impermeable area and thus no increase to the surface water run-off rate. However, an additional allowance for climate change should also be made.

It is important to note that the EA have recently updated their advice regarding climate change. The new guidance states that there is a 10% chance the peak rainfall intensity will increase by 40% or more and that there is a 50% chance it will increase by 20% or more, for the years 2070 to 2115. In order to decide which allowance to use the vulnerability of the development and the 'built in' resilience measures should be considered.

The proposed development is not located in an area with known surface water flood issues. Therefore, a climate change allowance of 20% is considered appropriate in this instance.

The run-off rate from the proposed development was also calculated using the modified rational method as outlined below.

Q 100 (POST UNMITIGATED) +20% = 2.78 x 0.083 x 127 = 29.30 l/sec

According to the EA guidelines, Building Regulations and Water Authorities advice, an infiltration drainage system is the preferred method of surface water drainage for any new development. Infiltration is an effective way to reduce the impact of urbanisation on watercourse flows, ensure the protection and enhancement of water quality and encourage the recharge of groundwater in a natural way. Drainage to public sewers will only be considered if all other options proved unsuitable. In accordance with The London Borough of Camden's SuDS guidance, a variety of SuDS options have been considered for the proposed development.

The following drainage hierarchy was used to determine a suitable and sustainable SuDS strategy:

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.

5.1 Water Harvesting and Green/ Brown Roofs

Rainwater harvesting and green/brown roofs are often the preferred SuDS as they intercept water at high level and provide other sustainability benefits such as reducing the water demand of the building and increasing biodiversity.

However, the SuDS manual states that "the hydraulic performance of green/brown roofs during extreme events tends to be fairly similar to standard roofs". This means that green and brown roofs will reduce the run-off rates in smaller storm events such as the annual and the 1 in 2 year events. However, they provide no attenuation benefits in high storm events such as the 1 in 30 year and 1 in 100 year storms, which are considered in the design of surface water drainage systems.

Furthermore, the capacity to attenuate rainwater in rainwater harvesting systems depends on water use in the building. If there is no activity in the building and the harvester is full, no attenuation will be provided in a subsequent storm event.

Therefore, whilst it is proposed that biodiverse green roofs and rainwater harvesting be considered for the proposed development thus providing sustainability benefits, the benefits of these systems cannot be considered in the design of the attenuation system. Furthermore, the proposed building roof comprises of a roof terrace bar, which means there is no available space for a green roof system.

However, greywater harvesting is proposed for the site. This provides sustainability benefits of reducing the water demand in the building.

5.2 Infiltration Techniques

The British Geological Survey (BGS) records shows that the site is underlain by London Clay Formation (Clay, Silt and Sand). A preliminary Ground investigation for the site has been carried out confirming the BGS records showing made ground up to a depth of roughly 3.5m, a sand layer to a further depth of 1m followed by clay to the full depth of the borehole at 35m. This suggests that the site is unlikely to be suitable for infiltration techniques. Furthermore, building regulations require soakaways to be 5m from any building which is not possible for this site.

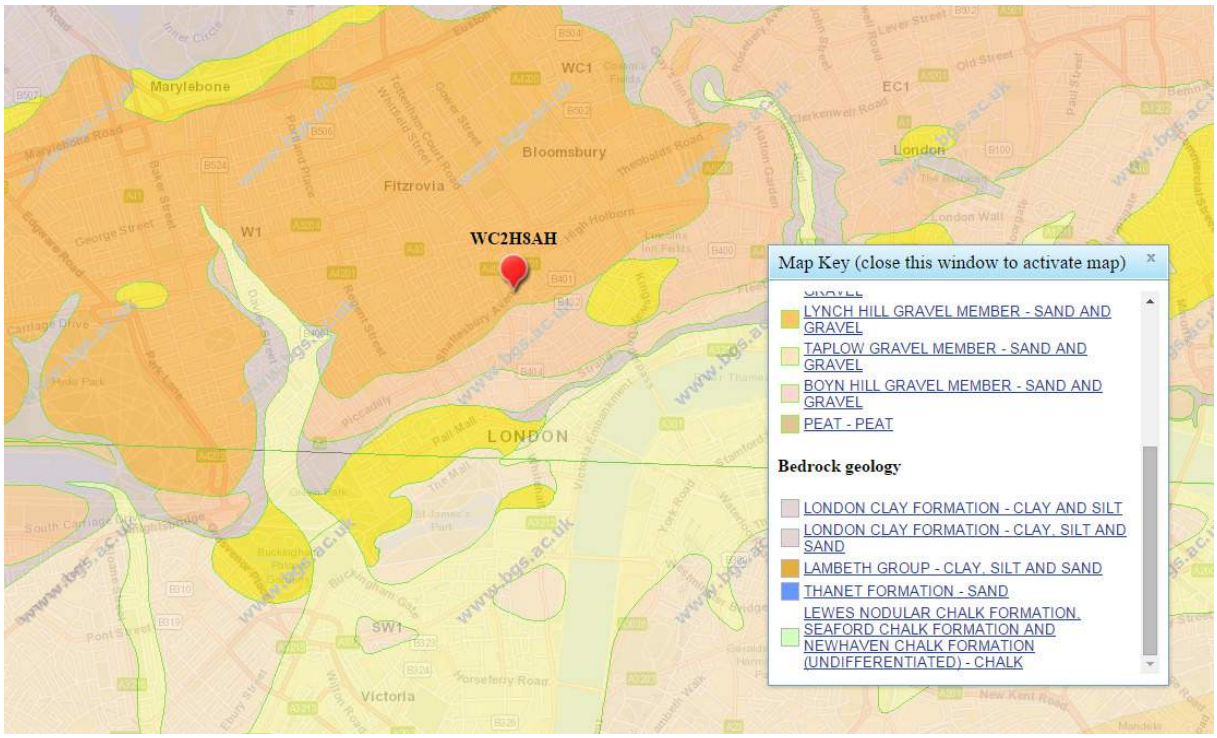


Figure 5.1: British Geology Survey (BGS)

5.3 Attenuation Techniques

Where infiltration is not feasible, the next preferred method is attenuation of surface water to Greenfield run-off rates. It is preferable to attenuate rainwater in ponds or permeable paving, as opposed to below ground tanks, as they provide additional sustainability benefits. However, as the site area consists entirely of the building footprint, such systems are not possible for this site.

Surface water attenuation tanks have also been considered for the proposed development. However, as development proposals involve a deep basement extension, there is no feasible space or means of providing attenuation whilst maintaining a gravity connection to the public sewer. The only available space for an attenuation tank would be below the proposed three level basement. This would require even larger excavations and a pumped connection creating an associated flood risk to the building in the event of a pump malfunction.

Therefore, considering development proposals involve alterations to an existing building, maintaining its facade, with no increase in proposed hardstanding area/ surface water run-off, it is proposed that rainwater continue to drain directly to the public sewer via existing connections mimicking current conditions.

6 Proposed Foul Water Drainage

Guidance from Table 5 of Building Regulations – Part H, and architectural plans indicating the quantity and types of proposed foul water appliances, has been used to calculate the anticipated total peak foul water flow rate to the public sewers. This was found to be approximately 13.07 l/sec. Refer to Appendix D for full calculations.

A CCTV Survey of the sites existing drainage network is proposed in order to confirm existing drainage connections and inform the proposed foul water below ground drainage design. In accordance with Building Regulations - Part H, the preferred option for foul water drainage from new developments is into the public sewers. Foul water will therefore drain to the public foul water sewer, mimicking existing conditions. It is anticipated that existing connections to the public sewer will be reused where possible from ground level and above.

The development proposals basement extension will include facilities which will require foul water drainage connections. Foul water drainage pumping will be required to discharge foul water flows from the basement and lower basement level. Foul water pumps will include necessary storage, a duty standby pump and alarms for the event of a system failure.

Thames Water's consent (S106) is required for all new connections (direct and indirect) to the public foul water sewer. Proposed Run-off. A pre-development enquiry should also be made with TW to ensure the network has sufficient capacity.

7 Flood Risk Assessment

The London Borough of Camden Flood Risk Management Strategy shows the site as not being in a critical drainage area. Furthermore, The Environment Agency's (EA) indicative floodplain map (Figure 7.1) shows that the site is located in Flood Zone 1 and is not at risk of flooding from watercourses. A site specific flood risk assessment is therefore not required as the site area is less than 1ha.

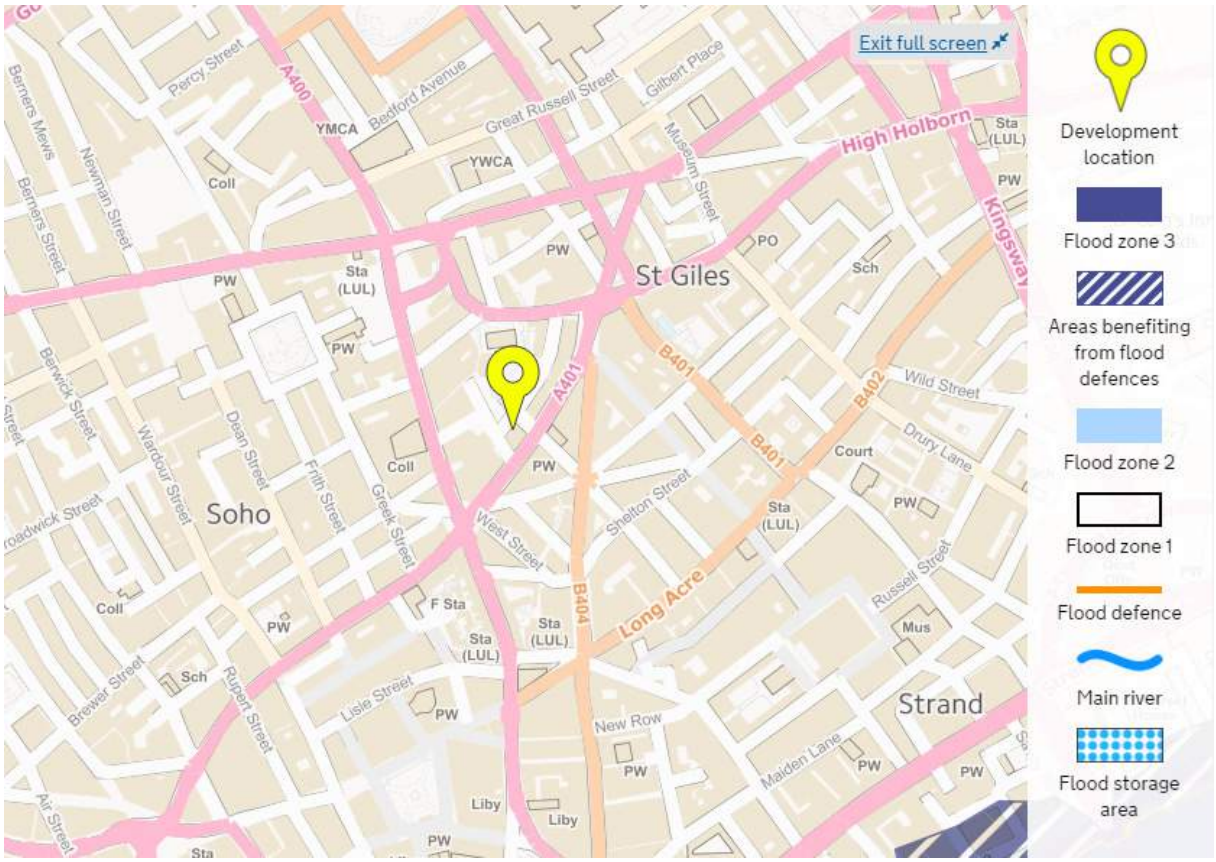


Figure 7.1: Environment Agency/Gov Indicative Floodplain Map (EA/Gov website)

The EA/Gov information (Figure 7.2) shows that the site is at a low risk of surface water flooding with surface water flows being confined to Shaftsbury Avenue where ground levels are lower.

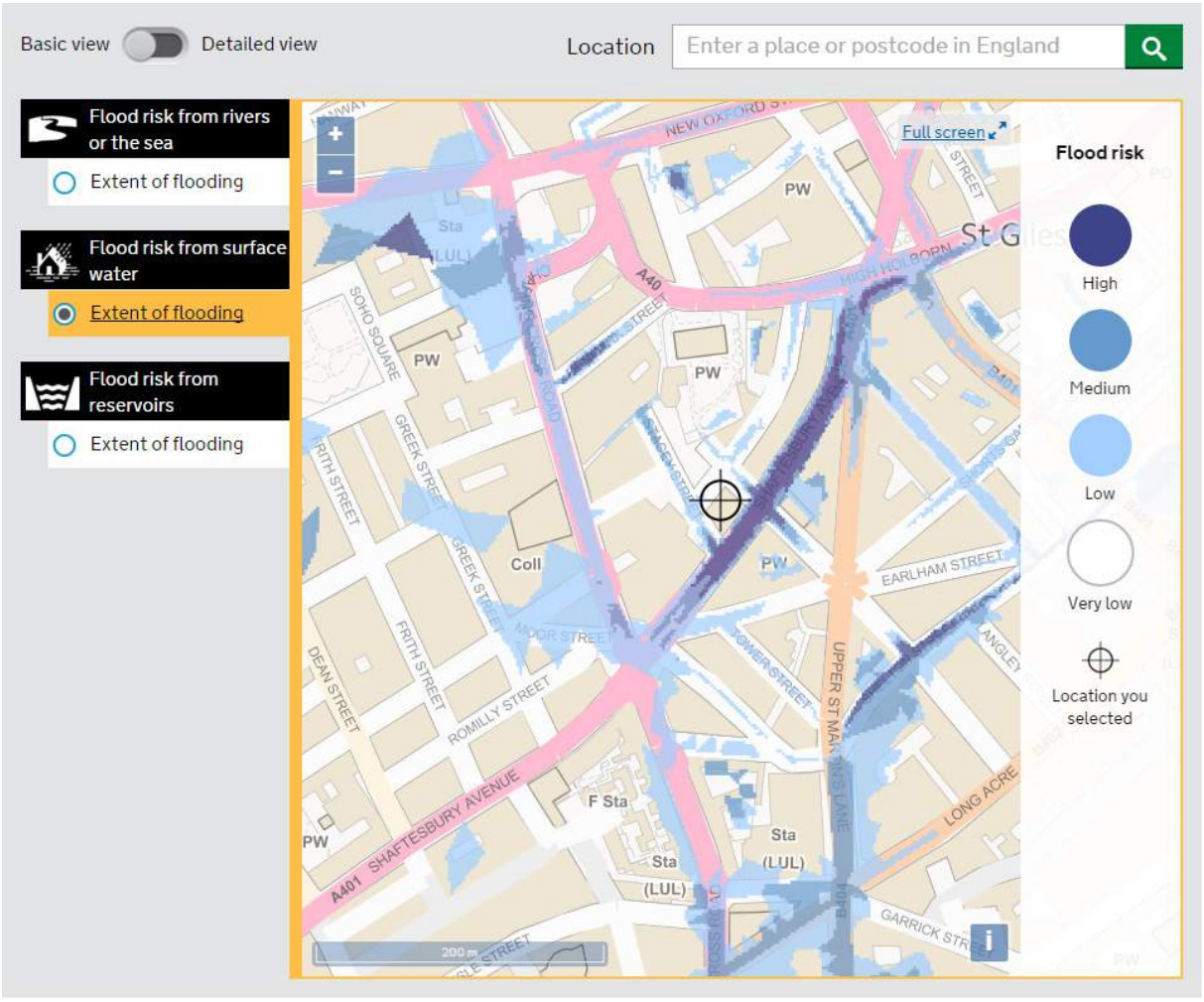


Figure 7.2: Environment Agency/Gov Indicative Surface Water Flooding Map (EA/Gov Long Term Flood Risk Information website)

The Strategic Flood Risk Assessment for the London Borough of Camden shows the site to be located in an area with increased susceptibility to elevated groundwater. However, any potential risk of groundwater flooding will be mitigated with cavity drainage, appropriate tanking and waterproof concrete used for construction of basement levels.

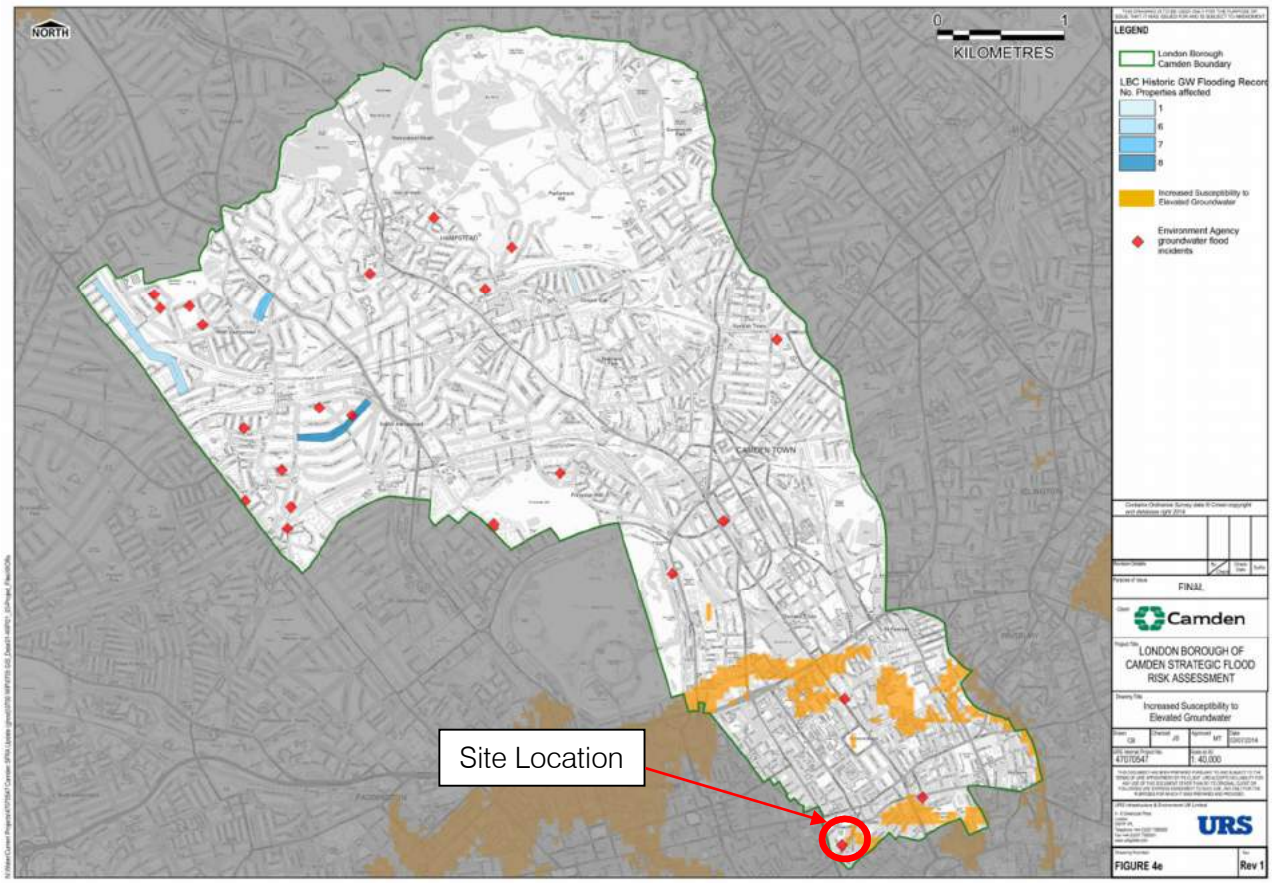


Figure 7.3: URS, London Borough of Camden SFRA, July 2014)

8 Conclusions

- The proposed development does not increase the sites impermeable area (0.083ha).

- It is assumed that all ground floor and above foul water drainage discharges via gravity to the public sewer in Compton Street. TW asset records indicate that public sewer is at a higher level than the existing basement. It is therefore assumed all foul water drainage from basements levels are pumped into the public sewer. All surface water run-off is from the roof, discharging via rainwater pipes to the public sewer. A CCTV Survey will be carried out to confirm the exact drainage arrangement prior to detailed design.

- Both the preliminary Site Investigations and BGS record information shows the site to be underlain with London Clay. This suggests that the site is not likely to be suitable for infiltration techniques. Furthermore, building regulations require soakaways to be 5m from any building which is not possible for this site.

- Surface water attenuation is not considered feasible for the proposed development due to space constraints and associated means of connection to the public sewer. Furthermore, proposals involve redevelopment of an existing building with no increase in hardstanding area therefore no increase in surface water run-off.

- Greywater harvesting is proposed for the development which will provide sustainability benefits in reducing water demand of the building.

- Surface water is proposed to discharge to the Thames Water sewers via the existing connections.

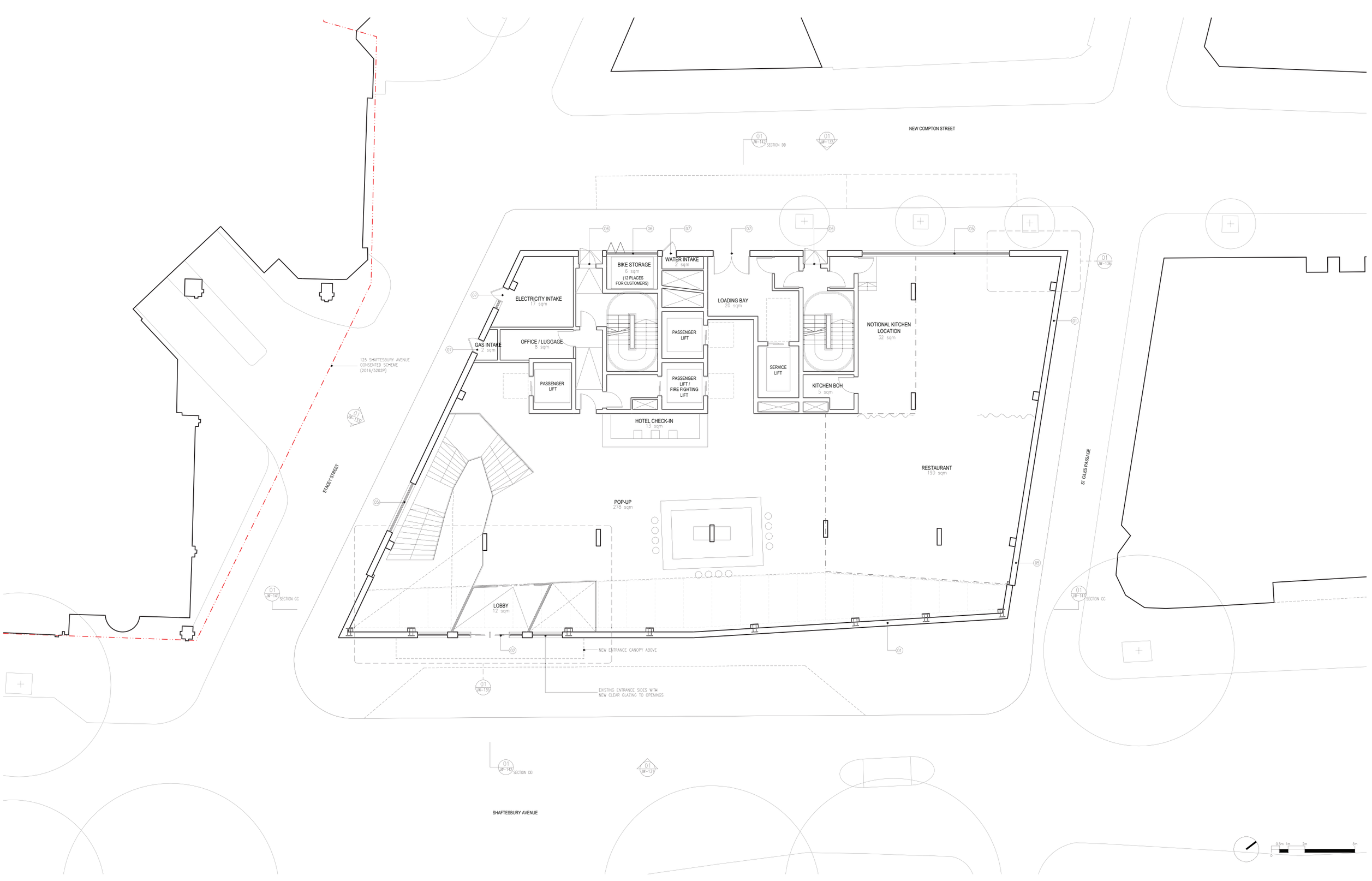
- Foul water is proposed to discharge to the Thames Water sewers using the existing connections for the ground levels and above of the new building. The basement levels will require pumping to discharge foul water flows from this area. Foul water pumps will include necessary storage, a duty standby pump arrangement and alarms for the event of a system failure.

- Thames Water's consent (S106) is required for all new connections (direct and indirect) to the public foul water sewer. A TW pre-development enquiry should also be carried out to confirm capacity in the public sewer given the anticipated increase in foul water discharge.

- The site is located in Flood Zone 1, and is at low risk of surface water flooding. It is also less than 1ha, therefore no Flood Risk Assessment is required.

Appendix A

Proposed Development Plans



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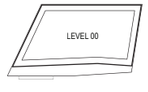
KEY PLAN



NOTES

01 RETAINED EXISTING WALL
02 PROPOSED GLAZED AUTOMATIC SLIDING DOORS
03 EXISTING WINDOW REGLAZED
04 EXISTING BRICKED-UP APERTURE OPENED-UP, NEW CLEAR GLAZING TO OPENING
05 NEW APERTURE WITH CLEAR GLAZING WITHIN EXISTING
06 SOLID METAL DOOR/CLADDING PANEL
07 VENTILATED METAL DOOR/CLADDING PANEL
08 NEW ENTRANCE CANOPY
09 GLAZED BALCONY PARTITION
10 GLAZED ROOF
11 GLAZED SMOKE VENT
12 STRUCTURAL STEEL PLATE
13 GLAZING WITH MESH OR FRIT TO CREATE 'CURTAIN' EFFECT
14 CLEAR GLAZING
15 FRITTED GLAZING
16 CLEAR GLASS BALUSTRADE

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LEVEL 00 PLAN

SCALE 1:100@A1 / 1:200@A3 — A1 SHEET

STATUS
PLANNING

DRAWING NO
2818–JW–113

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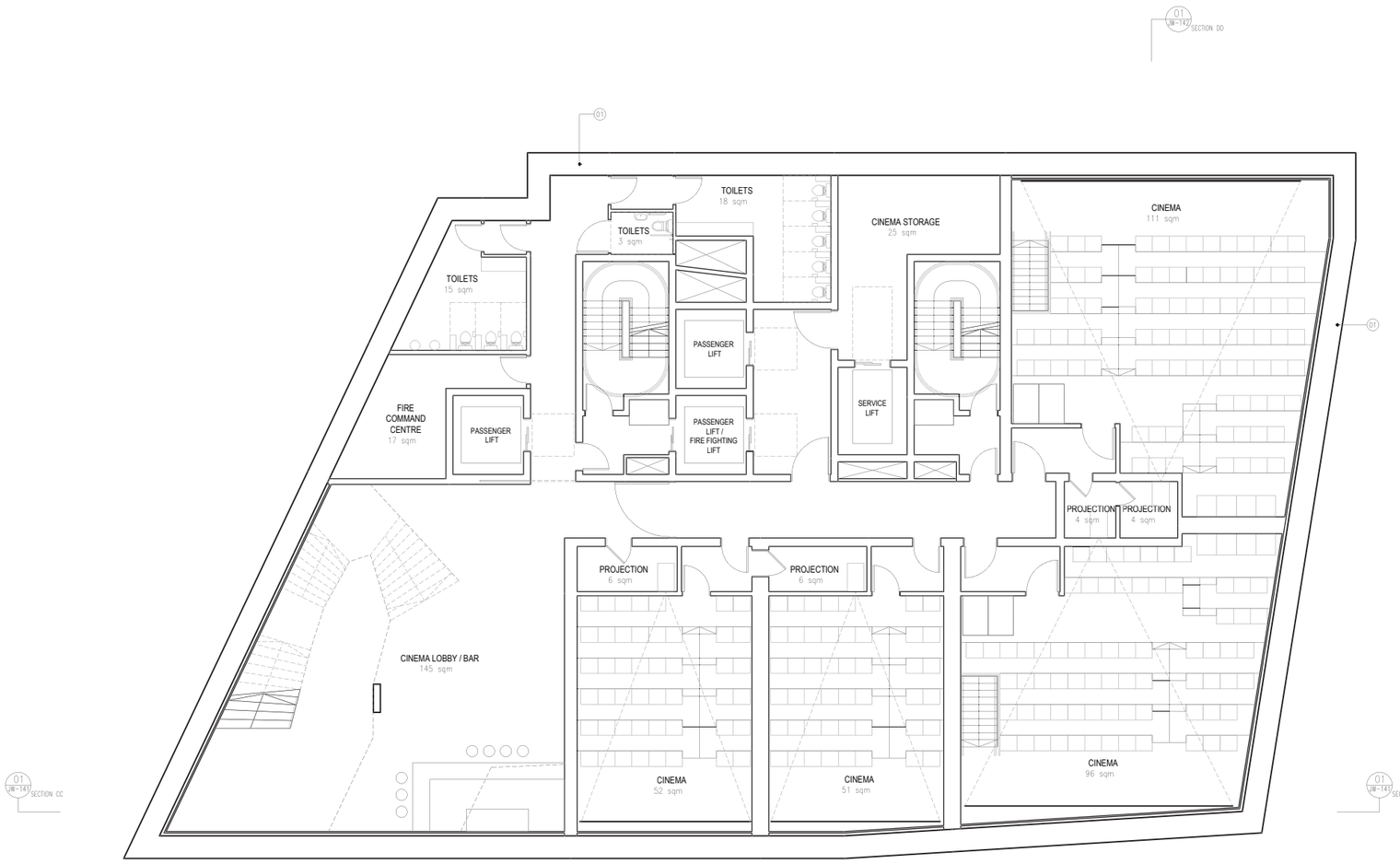

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KEY PLAN

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15 FRITTED GLAZING
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SCALE 1:100@A1 / 1:200@A3 — A1 SHEET

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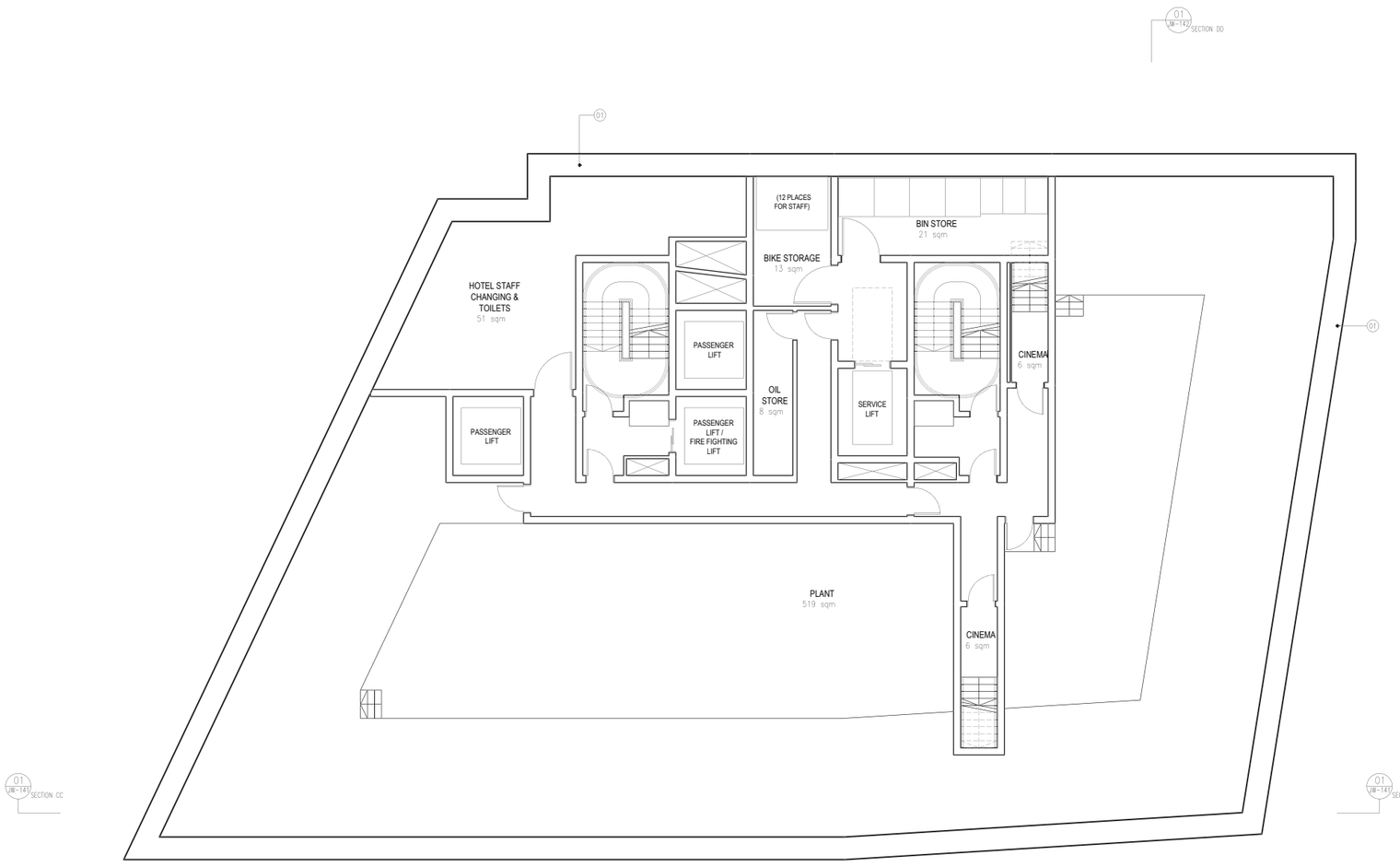

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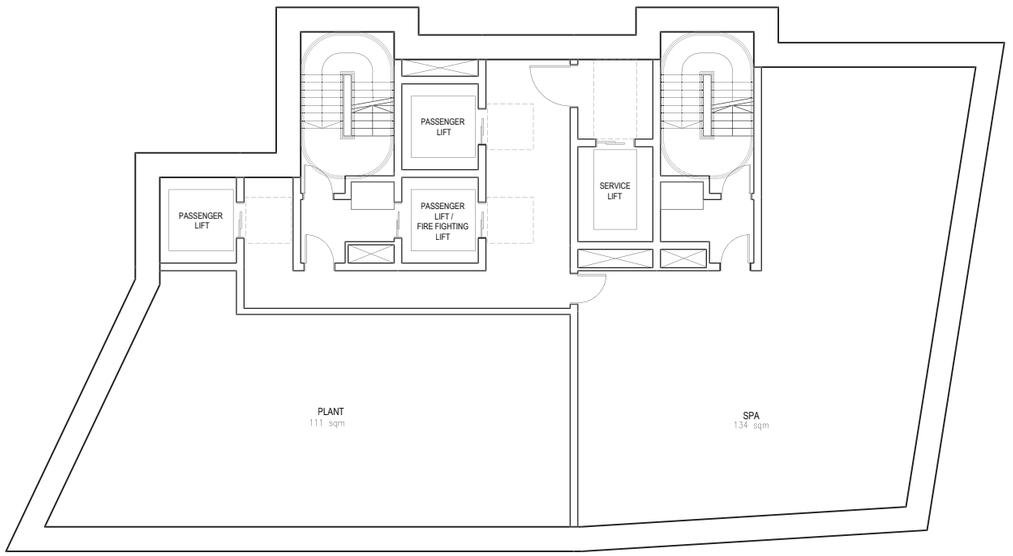

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LEVEL B3 PLAN

SCALE 1:100@A1 / 1:200@A3 A1 SHEET

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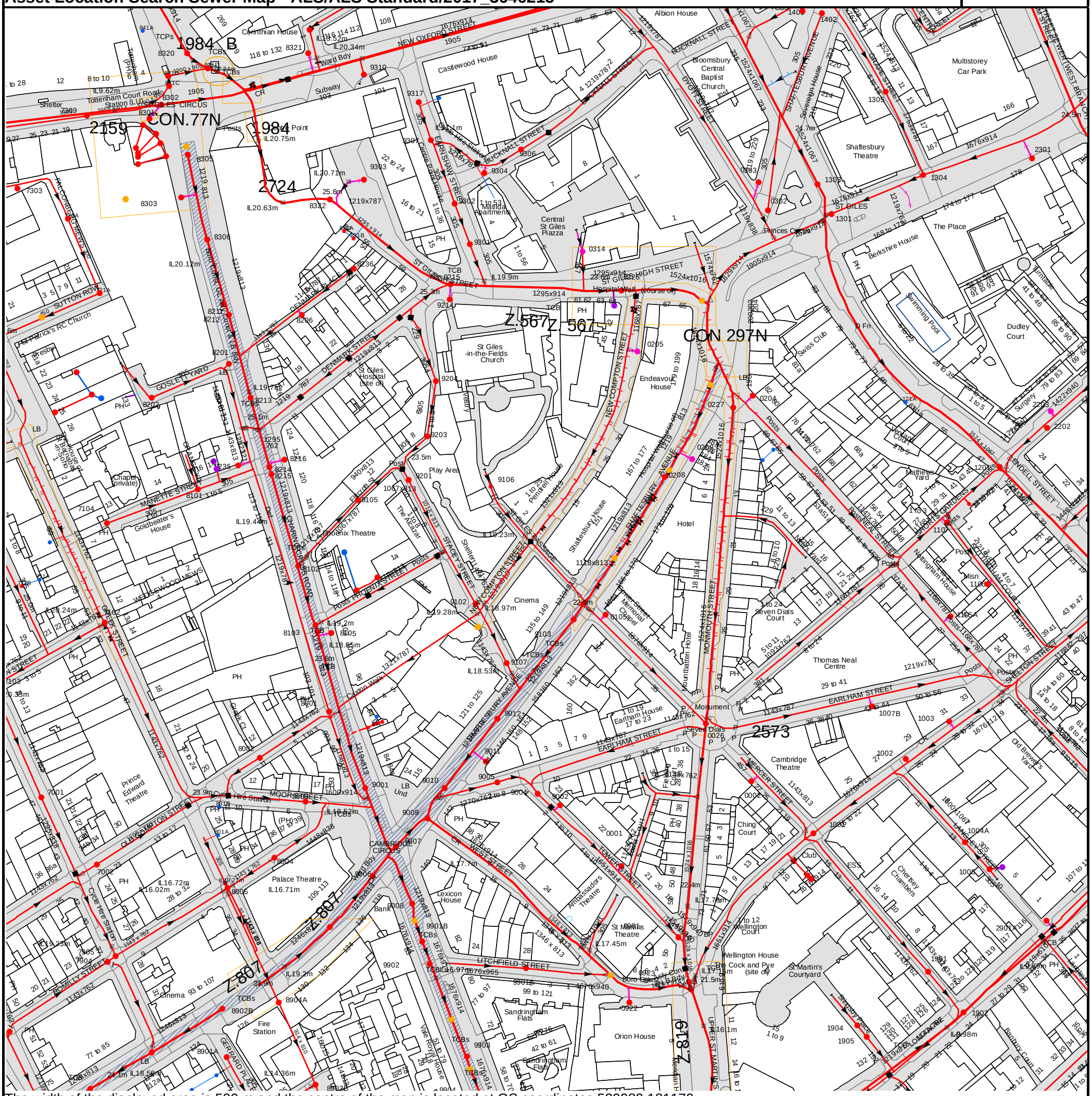
Appendix B

Thames Water Asset Location Map

Asset Location Search Sewer Map - ALS/ALS Standard/2017_3646215



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 529989,181170

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
1902	22.84	17.06
101A	n/a	n/a
0922	n/a	n/a
0901	22.01	17.8
0923	21.63	n/a
1904	22	20.33
1905	22.06	19.62
1901	22.93	18.11
2901A	23.43	n/a
99PP	n/a	n/a
1009	n/a	n/a
1011	n/a	n/a
1005	22.88	18.2
0001	n/a	n/a
1010	n/a	n/a
1004A	22.37	17.98
1001	21.15	17.45
9002	n/a	n/a
0002	n/a	n/a
1002	21.37	17.52
0026	23.79	18.17
1003	21.83	n/a
1007B	n/a	n/a
9103	22.76	n/a
1105A	-9999.9	-9999.9
0105	n/a	n/a
AUTO	n/a	n/a
1106	22.43	17.94
1107	n/a	n/a
111A	n/a	n/a
0208	n/a	18.37
1201	22.9	16.5
021A	n/a	n/a
0209	n/a	n/a
021B	n/a	n/a
0227	22.93	18.89
9903	21.85	n/a
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9902	22.86	n/a
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901E	n/a	n/a
9203	23.81	19.67
8213	n/a	19.7
9204	24.37	19.93
8201	24.83	19.83
8206	24.77	n/a
8212	n/a	n/a
8903B	22.74	14.08
891C	n/a	n/a
8901A	23.45	14.92
8901B	n/a	n/a
8902B	n/a	19.14
8904A	23.61	14.98
7904	24.16	18.13
7905	24.24	17.95
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7002	24.4	20.3
8004	23.74	17.45
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801B	n/a	n/a
8003	23.47	18.58
9001	n/a	18.58
8002	23.72	19.43
7902	n/a	18.35
891B	n/a	n/a
7912	n/a	n/a
7001	24.77	20.05
1305	24.15	20.1
121A	n/a	n/a
1304	23.52	19.43
2301	n/a	n/a
2202	23.02	n/a
2203	n/a	n/a
0204	n/a	n/a
0205	n/a	n/a
0268	n/a	n/a
9214	n/a	n/a
0226	23.39	19.29

Manhole Reference	Manhole Cover Level	Manhole Invert Level
9215	25.25	20.07
0314	n/a	n/a
9301	25.12	20.21
1301	23.34	19.14
0302	23.34	18.84
9302	25.27	20.39
1303	23.59	17.34
0303	n/a	n/a
9304	n/a	n/a
9306	24.82	20.86
1402	25.13	21.01
1403	n/a	n/a
83BD	n/a	n/a
8302	n/a	9.64
83BE	n/a	n/a
831D	n/a	n/a
831C	125.337	120.5
8303	n/a	n/a
8320	25.55	20.98
8305	n/a	20.49
8306	n/a	n/a
831E	n/a	n/a
8211	n/a	19.97
8321	25.63	n/a
841B	n/a	n/a
8322	25.54	20.55
831A	n/a	n/a
8236	25.26	20.76
831B	n/a	n/a
9303	25.56	n/a
9310	25.35	21.26
9317	25.47	20.71
9307	25.41	20.44
931A	n/a	n/a
711B	n/a	n/a
711A	n/a	n/a
711C	n/a	n/a
7102	24.51	20.01
7104	25.05	21.96
8101	25.12	20.31
821A	n/a	n/a
821B	n/a	n/a
8235	n/a	n/a
8214	n/a	19.48
8215	n/a	n/a
8216	n/a	n/a
8102	n/a	n/a
8103	n/a	18.89
8104	n/a	n/a
8001	23.65	18.79
8105	n/a	n/a
81AD	n/a	n/a
81AC	n/a	n/a
9105	23.84	19.67
91BI	n/a	n/a
9201	23.54	19.41
9102	23.34	18.98
9106	24.64	23.3
9012	22.85	18.2
9107	n/a	n/a
841A	n/a	n/a
7303	24.8	23.04
72BB	n/a	n/a
731A	n/a	n/a
72BD	n/a	n/a
7309	n/a	n/a
72BA	n/a	n/a
721A	n/a	n/a
72BC	n/a	n/a
73BF	n/a	n/a
73BI	n/a	n/a
73BG	n/a	n/a
73BH	n/a	n/a
83AJ	n/a	n/a
8301	n/a	n/a
8202	25.02	22.3
83BC	n/a	n/a

ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

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

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

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

Trunk Surface Water

Trunk Foul

Storm Relief

Trunk Combined

Vent Pipe

Bio-solids (Sludge)

Proposed Thames Surface Water Sewer

Proposed Thames Water Foul Sewer

Gallery

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Sludge Rising Main

Proposed Thames Water Rising Main

Vacuum

Sewer Fittings

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

Air Valve

Dam Chase

Fitting

Meter

Vent Column

Operational Controls

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

Control Valve

Drop Pipe

Ancillary

Weir

End Items

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

Outfall

Undefined End

Inlet

Other Symbols

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

Public/Private Pumping Station

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

Invert Level

Summit

Areas

Lines denoting areas of underground surveys, etc.

Agreement

Operational Site

Chamber

Tunnel

Conduit Bridge

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

Foul Sewer

Surface Water Sewer

Combined Sewer

Gulley

Culverted Watercourse

Proposed

Abandoned Sewer

Notes:

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

Appendix C

Foul Water Flow Calculations

EXISTING SITE FOUL WATER FLOW RATES

PRICE&MYERS
Consulting Engineers

Project	Shaftsbury Avenue
Project No.	25916
Designed	

Qww = K√∑DU
where Qww = Waste Water flowrate (lit/sec)
K = Frequency factor (dependant on the usage)
∑DU = Sum of discharge units

System 1

Appliance	Amount	DU	Σ DU
kitchen sink	5	0.8	4
WC with 7.5L cistern	35	2	70
wash basin, bidet	38	0.5	19
shower without plug	0	0.8	0
urinal with flushing valve	22	0.5	11
Floor Gully DN50	5	0.8	4
dishwasher	0	0.8	0
washing machine upto 6kg	0	0.8	0
-		-	
		Total	108

Calculation of Stack Size

Total DU	108	DU
Usage	hotel	
Qww	7.27	l/s
Type of Entry	Square Entries	

Calculation of Drain Size

chosen dia	150	mm
Qcap	19.77	l/s

-

PROPOSED SITE FOUL WATER FLOW RATES

PRICE & MYERS
Consulting Engineers

Project	Shaftsbury Avenue
Project No.	25916
Designed	

Qww = K√∑DU
where Qww = Waste Water flowrate (lit/sec)
K = Frequency factor (dependant on the usage)
∑DU = Sum of discharge units

System 1

Appliance	Amount	DU	Σ DU
kitchen sink	5	0.8	4
WC with 7.5L cistern	105	2	210
wash basin, bidet	95	0.5	47.5
shower without plug	95	0.8	76
urinal with flushing valve	6	0.5	3
Floor Gully DN50	10	0.8	8
dishwasher	0	0.8	0
washing machine upto 6kg	0	0.8	0
-		-	
	Total		348.5

Calculation of Stack Size

Total DU	348.5	DU
Usage	hotel	
Qww	13.07	l/s
Type of Entry	Square Entries	

Calculation of Drain Size

chosen dia	150	mm
Qcap	19.77	l/s

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