Report

Flood Risk Assessment & Surface Water Drainage Strategy

Sceaux Gardens, Camberwell, Southwark, London

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[1]	13.05.21	First Issue	Beverley Hunter	James Calvert	JRC

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1 Introduction

Sweco UK Ltd has been appointed by London Borough of Southwark to undertake a Flood Risk Assessment & Surface Water Drainage Strategy report for the proposed residential re-development at Sceaux Gardens, Camberwell, Southwark, London SE5 7DJ.

This report has been prepared for the sole use of London Borough of Southwark and the contents should not be relied upon by others without the express written authority of Sweco. If any unauthorised third party makes use of this report they do so at their own risk and Sweco owes them no duty of care or skill.

This report has been completed in accordance with the National Planning Policy Framework (NPPF) and its accompanying Planning Practice Guidance (PPG), and also takes into account the Department for Environment, Food and Rural Affairs (DEFRA) publication *Sustainable Drainage Systems Non-statutory technical standards for sustainable drainage systems* dated March 2015 and the London Plan policies SI 12 & SI 13. The report is an assessment of flood risk to the development, from on and off-site sources, and to off-site receptors caused by the re-development of the site. This report includes a SuDS assessment for the site, which sets out how the proposals will not increase off-site flood risk.

The site is shown on the Environment Agency (EA) *Flood map for planning* (see Figure 1) to lie in Flood Zone 1 (low risk). Flood Zone 1 is the area described as having less than a 0.1% annual probability of fluvial or tidal flooding. All land uses are appropriate in this flood zone.

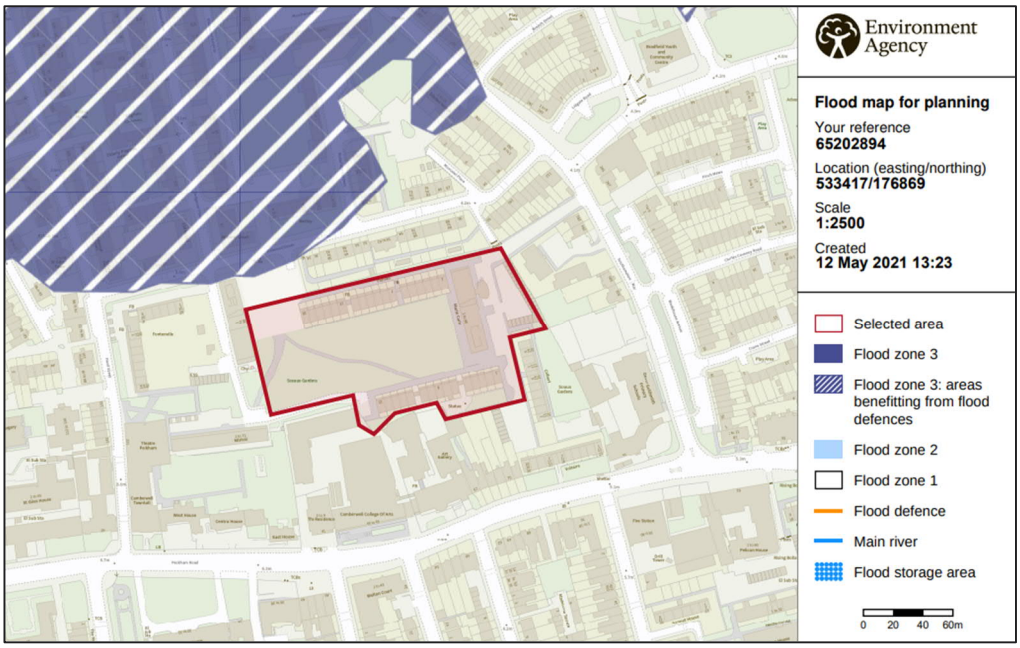


Figure 1 - EA Flood map for planning

The Sequential Test, the aim of which is to steer new development to the areas with the lowest probability of flooding, is met; the Exception Test is not required as the site is located within Flood Zone 1.

This report concludes that in flood risk context, the proposals are safe and appropriate and do not cause increased flood risk; instead the proposals should result in reduced flood risk.

2 Site Description

2.1 Existing site

The site comprises three buildings which are located within a predominantly residential area of the London Borough of Southwark. The site is centred on approximate Ordnance Survey (OS) grid reference 533397,176845 and the extent of the buildings extends to approximately 0.51 hectares.

The three buildings surround Sceaux Gardens and consist of 'Florian' to the north (Site 1), 'Racine' to the south (Site 2) and the Garage Site (Site 3) to the east. Sites 1 and 2 comprise existing residential development. Site 3 comprises single storey garages and is located to the east beyond the multi-storey residential block 'Marie Curie' which is located directly to the east of Sceaux Gardens.

Sceaux Gardens provides and established public open space in the centre of the development. The sites are surrounded by a range of residential development.

The existing site classification is 'More Vulnerable' in accordance with *Table 2: Flood Risk Vulnerability Classification* of the PPG.

2.2 Hydrology

The nearest watercourse is the River Thames which lies approximately 3.5 kilometres (km) to the north and north-west of the site.

2.3 Topography

A topographical survey of the site (see Appendix A) shows ground levels around Site 1 of circa 4.20 metres Above Ordnance Datum (mAOD). Ground levels around Site 2 are circa 4.4 mAOD and ground levels at Site 3 are circa 4.0 mAOD. A review of OS mapping shows land to generally fall from south to north.

As all of the sites are currently developed they are generally flat or have shallow surface gradients.

2.4 Geology

British Geological Survey (BGS) mapping shows the site as being underlain by Interglacial Lacustrine Deposits (Clay and Silt) with a bedrock geology of Lambeth Group (Clay, Silt and Sand).

2.5 Proposed site

It is proposed to demolish the existing buildings. The proposals are to then re-develop the site and create new residential units in a number of multi-storey blocks. The proposed site plan is included within the Appendix A.

The proposed site use classification is 'More Vulnerable' in accordance with *Table 2: Flood Risk Vulnerability Classification* of the PPG. As the site is located in Flood Zone 1 the proposed development is shown to be appropriate in accordance with *Table 3: Flood risk vulnerability and flood zone 'compatibility'* of the PPG and no Sequential Test (or Exception Test) is required.

3 Flood Risk

The NPPF requires flood risk from the following sources to be assessed:

- Fluvial sources (river flooding);
- Tidal sources (flooding from the sea);
- Pluvial sources (flooding resulting from overland flows);
- Groundwater sources;
- Artificial sources, canals, reservoirs etc, and;
- Increased surface water discharge.

Each of the sources are addressed separately below.

3.1 Tidal and fluvial

Tidal flooding is typically the result of extreme tidal conditions caused by severe weather which may cause a storm surge where water is pushed onshore through elements such as high winds and storms. Fluvial flooding occurs when excessive rainfall over an extended period, flash downpours or heavy snow melt causes a river to exceed its capacity.

The site is shown on the EA *Flood map for planning* (see Figure 1 above) to lie in the low probability flood zone (Flood Zone 1). The *Extent of flooding from rivers or the sea* map (see Figure 2) also shows that the site is not in an area at risk of flooding from these sources.

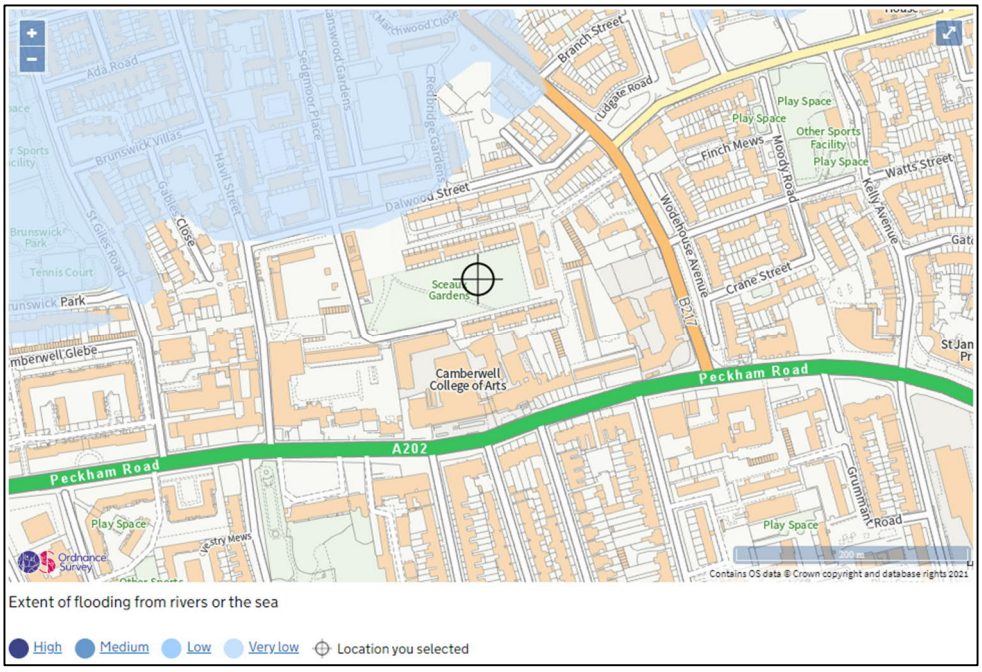


Figure 2 - EA Extent of flooding from rivers or the sea

The nearest watercourse is the River Thames which lies approximately 3.5 kilometres (km) to the north and north-west of the site.

The site is not at any significant risk of flooding from a tidal or fluvial source.

3.2 Pluvial

There is always a potential risk of surface water flooding from very high intensity rainfall events exceeding the capacity of drainage systems and causing flooding, especially in urban areas. Surface water run-off can be channelled either by natural features such as valley lines or by artificial features such as highways, to low points in the topography. If surface water is not able to flow away from the low points then pluvial flooding can occur.

Land to the south of the site lies at a higher elevation and as such has the potential to shed water in the direction of the site. Due to the urbanised nature of the land to the south, surface water is most likely to be intercepted by the highway drainage systems and other private drainage before reaching the site. Land to the north, east and west of the site lies at a similar elevation or lower than the site and therefore should not pose a flood risk to the site.

The GOV.UK *Extent of flooding from surface water* map (see Figure 3) shows the site to be at a very low risk of flooding from surface water.

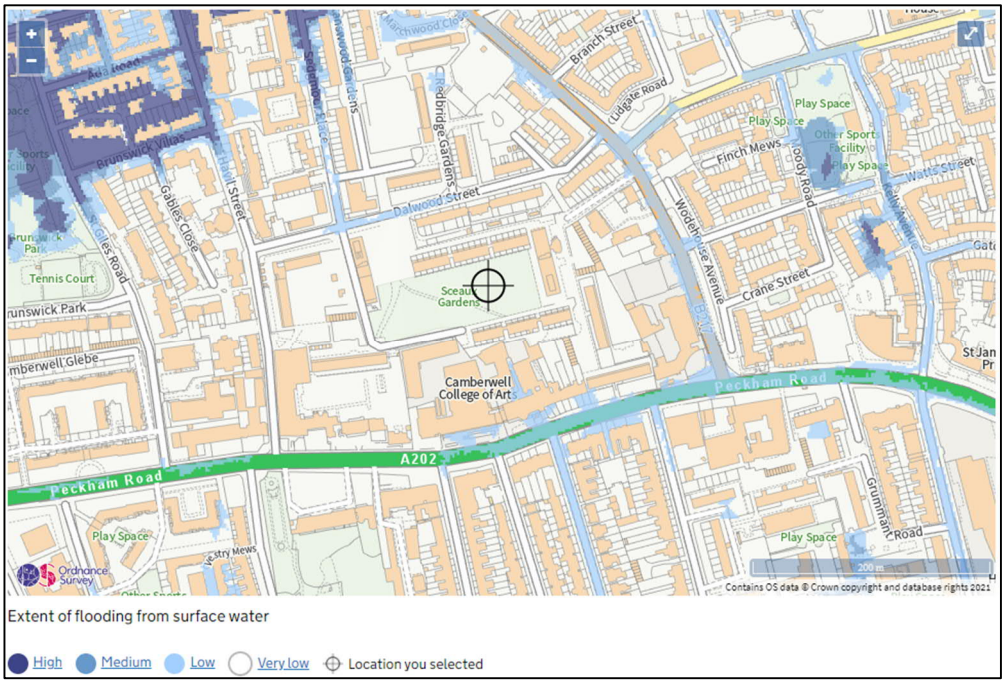


Figure 3 – Extent of flooding from surface water map

Finished floor levels should adhere to normal good practice and be set above surrounding ground level with slopes away from buildings which should prevent any minor localised ponding or overland surface flow from entering the development.

3.3 Infrastructure flooding

The closest sewer shown on the Thames Water (TW) sewer records (see Appendix B) is in Dalwood Street, north of the site. No connections are shown from the site, however, it is assumed that the on-site drainage network would discharge into this TW combined sewer.

If surcharging or blockage of the sewers/drains on or off site did occur it is possible that there may be localised surface flooding in areas surrounding the site. Raising ground levels above existing would help to mitigate against this low risk.

The site is considered to be at low risk of flooding from this source.

3.4 Water bodies

There is a lake located in Burgess Park approximately 1 km to the north of the site. This is at a lower elevation than that of the site and as such should not pose a flood risk to the site.

There are no other significant water bodies (lakes, large ponds, reservoirs etc.) within the immediate vicinity of the site that appear likely to pose a risk to the site.

The GOV.UK *Extent of flooding* map (see Figure 4) shows that the site is not at risk of flooding from reservoir failure.

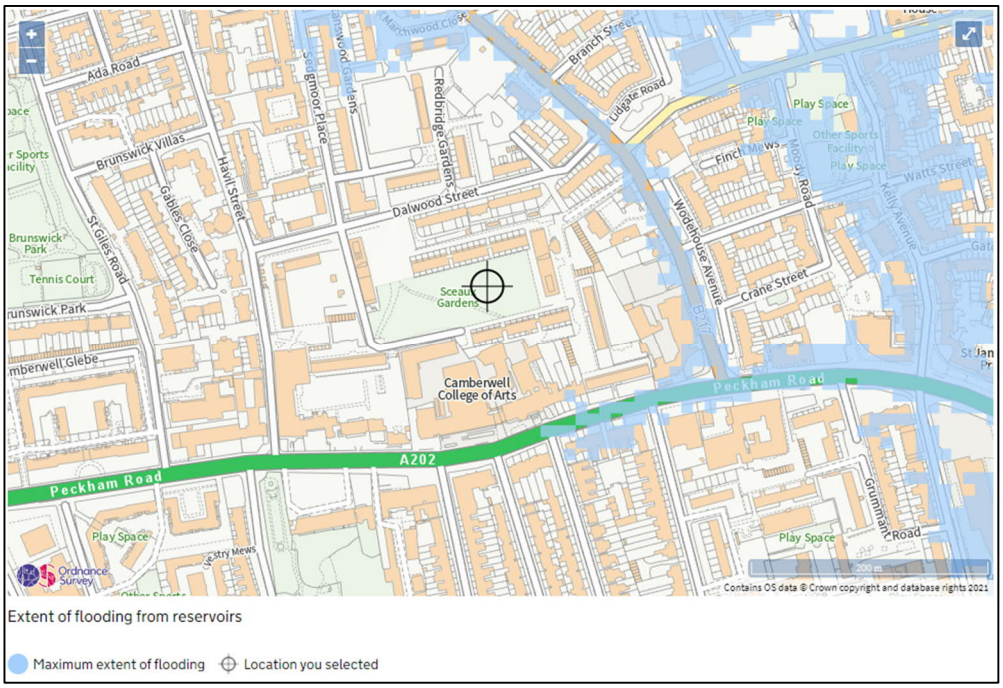


Figure 4 – Extent of flooding from reservoirs

The site is considered to be at low risk of flooding from this source.

3.5 Groundwater

BGS mapping shows the site as being underlain by Interglacial Lacustrine Deposits (Clay and Silt) with a bedrock geology of Lambeth Group (Clay, Silt and Sand). It is considered unlikely that surface water would rise within these soils and express at the surface. If any groundwater did express at the surface it would be routed away from the development as described above.

The site is not located in a Groundwater Source Protection Sone nor is it underlain by an aquifer.

The site is not considered to be at significant risk of flooding from groundwater.

3.6 Increased surface water discharge

The proposed development will decrease the impermeable area at the site which in turn would decrease surface water run-off generated by the site, however, surface water run-off should still be managed in order to not increase off-site flood risk. Surface water run-off from the site will be collected and attenuated on-site prior to discharge to the adjacent sewer which will provide betterment on the existing regime. See Section 4 for further information on the surface water drainage strategy.

The site is not considered to be at significant risk of flooding from surface water run-off generated on site.

3.7 Flood risk summary

The site is considered to be at a low risk of flooding from all sources.

4 Surface Water Drainage Strategy

4.1 Existing surface water drainage

It is currently assumed that all existing drainage from the existing buildings and hardstandings is drained via a private drainage networks and ultimately discharges to the TW sewer in Dalwood Street to the north.

The existing site is brownfield land with an impermeable area of approximately 0.388 ha. The existing surface water run-off rate has been calculated using the Modified Rational Method (see Brownfield Calculations in Appendix D) and are based on the existing impermeable areas of the three sites of development. The pre-development discharge rates are summarised in Table 1 below.

Table 1 - Brownfield rates

AEP Event	Brownfield Discharge Rate (l/s)		
	Site 1 (0.156ha)	Site 2 (0.128ha)	Site 3 (0.104ha)
100%	16.5	13.5	11.0
3.3%	40.5	33.2	27.0
1%	52.6	43.2	35.1

AEP = Annual Exceedance Probability

Due to the introduction of gardens / landscaped areas there will be a reduction in impermeable area.

4.2 Proposed surface water drainage

The proposed development will decrease the impermeable area at the site which in turn would decrease surface water run-off generated by the site, however, surface water run-off should still be managed in order to not increase off-site flood risk and comply with planning requirements. The proposed impermeable area is approximately 0.256 ha.

The SuDS hierarchy requires that surface water run-off is controlled and preferably re-used wherever possible. In the event that it cannot be re-used it should be disposed of to a receptor in the order described in Building Regulations Part H and the CIRIA publication *The SuDS Manual 2015* (C753):

- via infiltration,
- to watercourse, and finally,
- to sewers.

4.2.1 Infiltration

The underlying geology of clay does not offer an opportunity to utilise infiltration features

4.2.2 Watercourse

There are no watercourses in the vicinity of the site which are suitable for the discharge of surface water from the proposed development.

4.2.3 Sewer

It is proposed to discharge surface water to the TW sewer located in Dalwood Street as per the assumed existing regime.

4.3 Proposed surface water drainage strategy

The proposals result in a reduction in impermeable area and as such the discharge rate and volume of discharge will be reduced when compared to the existing site.

Due to the similar footprints and locations of the existing and proposed buildings, it is proposed that the surface water generated from the development will re-use the existing pipe network and connections.

It is recommended that a full CCTV survey / drainage survey of the existing pipework is carried out to establish confirmed routes and conditions of existing pipework.

Whilst the reduction in impermeable area results in a betterment in discharge rates / discharge volumes over the current scenario this should, where feasible, be improved on even further. However, due to the requirement to re-use existing connections from the site, the scope to incorporate attenuation features is limited. Where feasible, underground attenuation should be incorporated into the drainage design for the site as follows.

Attenuation has been sized to provide at least a 50% betterment on the existing brownfield discharge rates for each site to manage the temporary run-off storage required for rainfall events up to and including the 1% AEP annual probability event inclusive of 40% climate change. It is proposed that the attenuation is to be provided using cellular attenuation crates below ground located in parking/hardstanding areas. The contributing areas, volumes of attenuation required and discharge rates for each Site are summarised in Table 2.

Table 2 – Proposed attenuation volumes

Site	Contributing area (ha)	Attenuation volume required (m3)	Discharge rate (l/s)
1	0.080	23	25
2	0.121	45	20
3	0.055	17	15

The potential for incorporating SUD's features (i.e. lined permeable paving) should be further investigated and taken into account during the detailed design phase.

4.4 Surface water treatment

Table 3 (below) discusses types of SuDS (taken from C753) and whether they could be utilised at this site.

Table 3: SuDS site suitability

SuDS Component	Site Suitability	Comments
Green roofs	✓	Could be used subject to requirements for services etc.
Soakaways	✗	Ground conditions unlikely to be suitable.
Rainwater harvesting systems	✓	Could be utilised for W.C. flushing etc. to reduce the use of potable water for the development, subject to financial viability.
Filter strips	✗	Not suitable due to site layout.
Filter trenches	✗	Not suitable due to site layout.
Infiltration trenches	✗	Not suitable due to site layout and impermeable geology.
Swales	✗	Not suitable due to site layout.
Bioretention	✗	Not suitable due to space requirements.
Pervious pavements	✓	Could potentially be utilised in hardstanding areas to provide attenuation at sub-base.
Geocellular systems	✓	Proposed to provide temporary storage of surface water run-off.
Infiltration basins	✗	Not suitable due to site layout.
Detention basins	✗	Not suitable due to site layout.
Ponds	✗	Not suitable due to site layout.
Proprietary device	✓	Could be utilised for treatment requirements.

Stormwater wetlands	✗	Not suitable due to size of development and nature of ground.

4.5 SuDS management and maintenance

To ensure that the SuDS features remain optimised and fully functional during the life time of the development, thus preventing an increase in the flood risk both within the site and elsewhere, maintenance of the system is crucial across the short, medium and long term timescales. Once the full suite of SuDS features are designed into the site, a management and maintenance plan should be drawn up to ensure ongoing maintenance.

5 Conclusions

The proposed site is shown to lie in the low probability flood risk area (Flood Zone 1) according to the EA flood maps.

Other flood risks to the site have been assessed as low and the site is considered to be at low risk from all sources of flooding.

Due to the ground conditions not being suitable for infiltration and there being no suitable watercourse in the vicinity of the site to discharge surface water to, it is proposed to discharge surface water run-off from the site to the TW sewer following the existing regime. It is currently assumed the existing site discharges to the combined sewer in Dalwood Street and this connection should be re-utilised to serve the proposed site.

Where feasible, underground attenuation should be incorporated into the drainage design for the site to provide temporary storage of surface water to allow a lesser discharge rate from the site. Attenuation has been sized to provide at least a 50% betterment on the existing brownfield discharge rates for each site to manage the temporary run-off storage required for rainfall events up to and including the 1% AEP annual probability event inclusive of 40% climate change. It is proposed that the attenuation is to be provided using cellular attenuation crates below ground located in parking/hardstanding areas.

Further opportunities should be investigated to incorporate SuDS into the development where practicable. These can provide the benefits of slowing the discharge of surface water run-off, removal of pollutants from the run-off and providing ecological benefits to the development.

Careful thought should be given to the levels design on the site in accordance with normal good practice to ensure that there is no likely flooding caused by overland flow and that any overland flow is directed around buildings in the event of a failure to the piped drainage system.

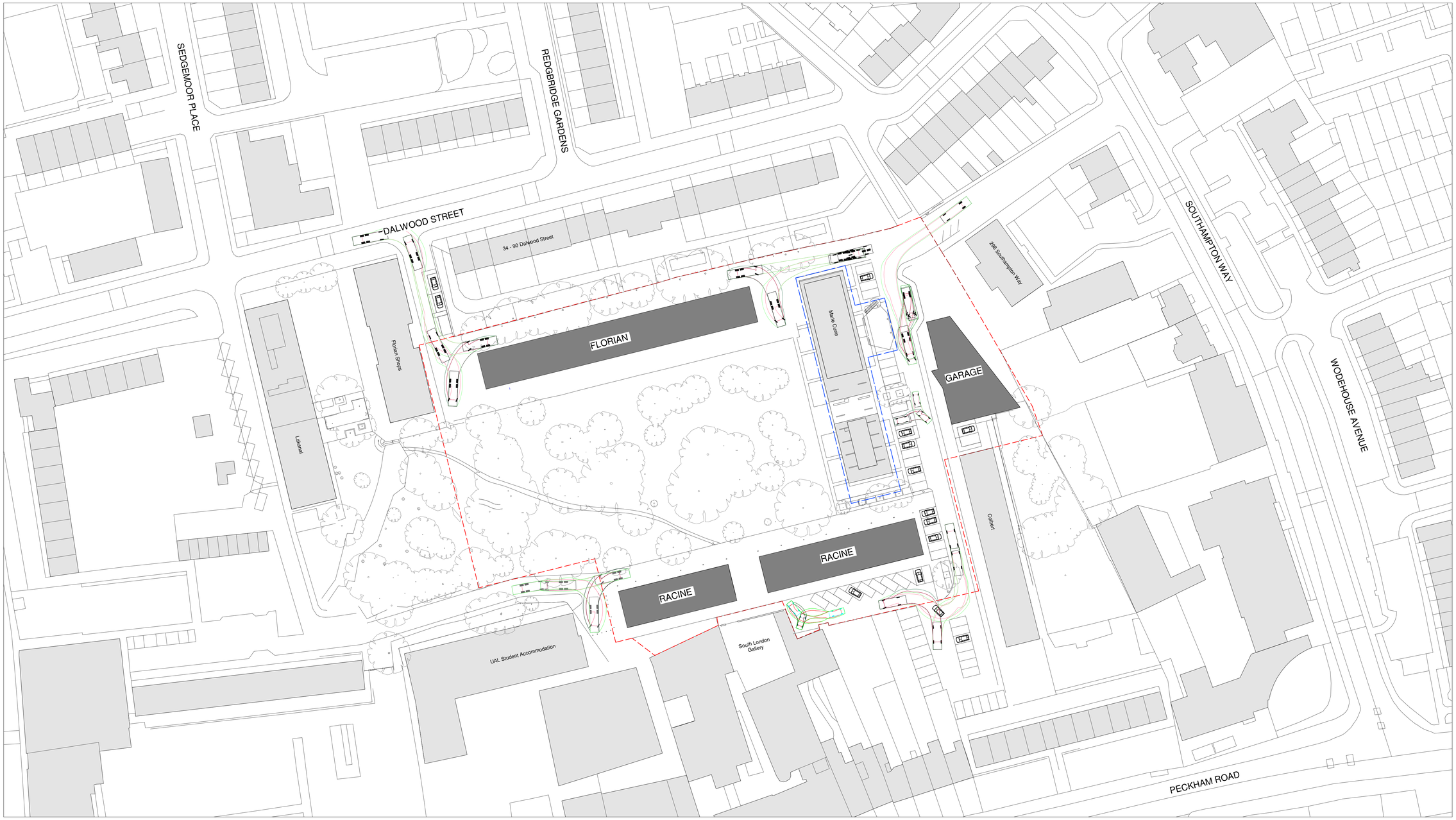
The site is located in Flood Zone 1 and is suitable for re-residential development. Surface water will be attenuated on-site and discharged at a restricted rate providing betterment on the current regime and thus reducing flood risk off-site.

Appendix A – Existing & Proposed Site

Site Block Plan

Topographical Survey

Proposed Site Plan

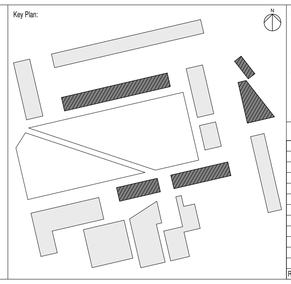


1:500 FULL SIZE A1

1. Do not scale drawings. Written dimension govern.
2. All dimensions are in millimetres unless noted otherwise.
3. All dimensions shall be verified on site before proceeding with the work. WW+P shall be notified in writing of any discrepancies.
4. This drawing must be read in conjunction with all relevant contracts, specifications and drawings.
5. Check all levels against survey drawings to surrounding works area.
6. All levels have been provided by the Surveyor

Notes:

Key Plan:



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Rev	Date	Description

Project:

Sceaux Gardens
CAMBERWELL

Title:

Site Block Plan

Date: 03/25/21

DRAFT

Project Status: PLANNING

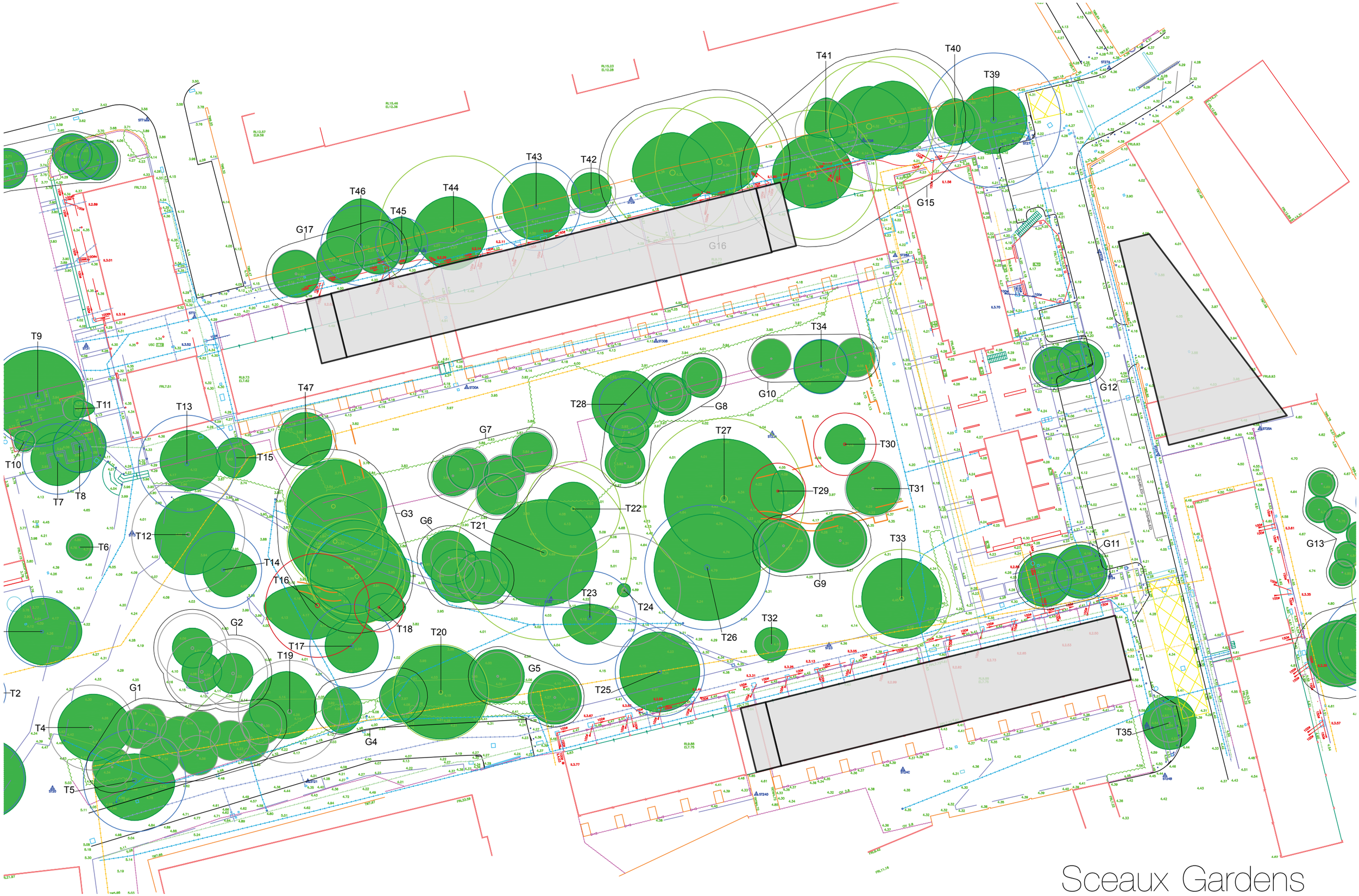
Scale: 1 : 500 @ A1

Drawn: AS | Checked: AS | Approved: ED

Project No. - Originator - Volume/System - Level/Location - Type - Role - Sheet No.:

A717-WWP-ZZ-00-DR-A-00100

Revision:



Sceaux Gardens
Arboricultural Survey Overlay
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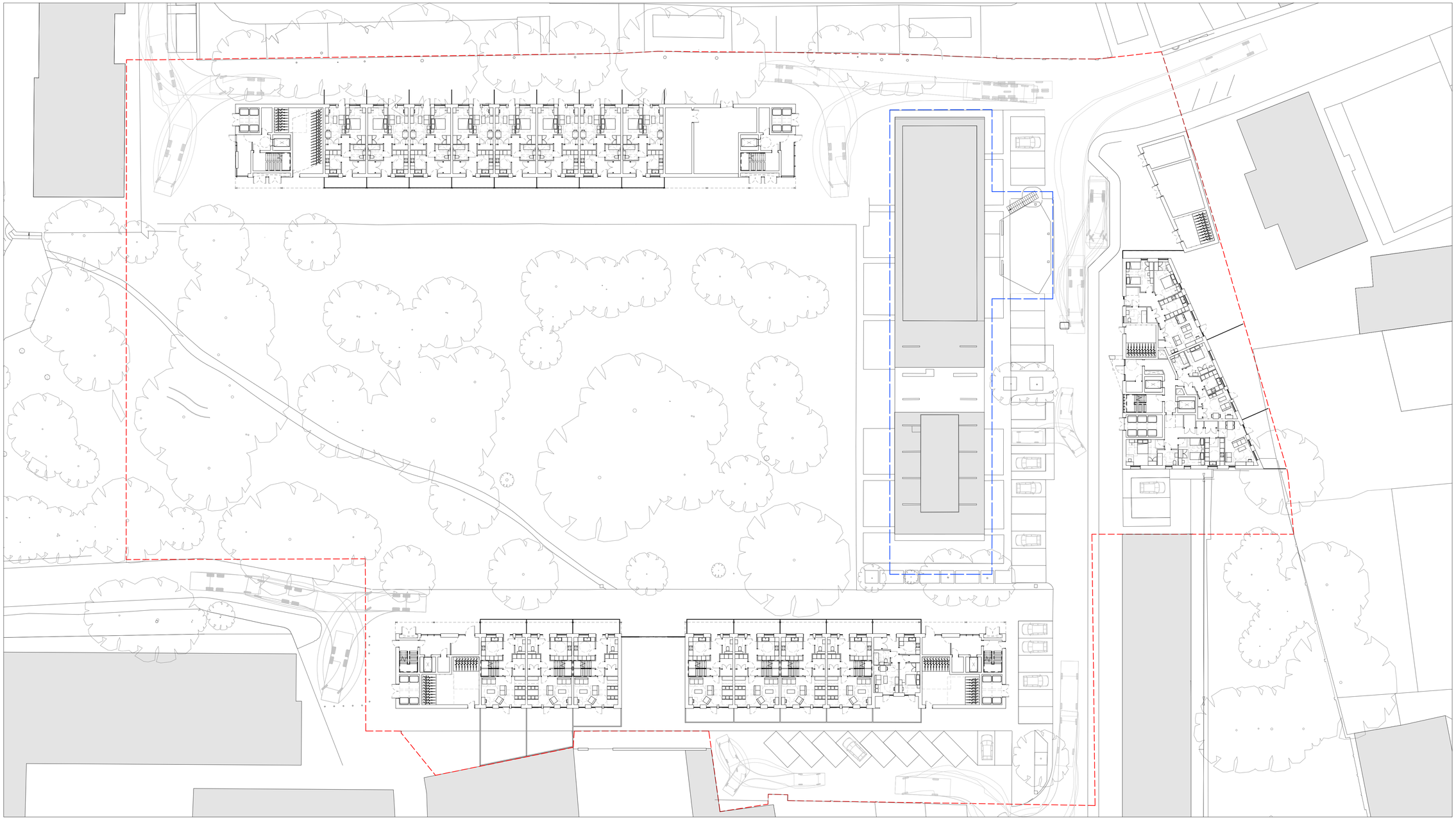
Southwark Council

Sceaux Gardens
Camberwell

WestonWilliamson+Partners



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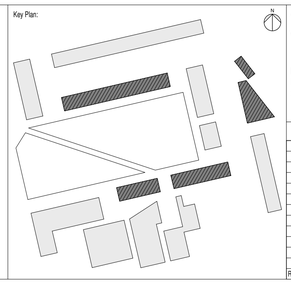

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Rev	Date	Description

Project:
Sceaux Gardens
CAMBERWELL

Title:
Proposed Site Plan

DRAFT

Date:	Project Status:		
03/25/21	PLANNING		
Scale:	Drawn:	Checked:	Approved:
1 : 250 @ A1	AS	AS	ED

Project No. - Originator - Volume/System - Level/Location - Type - Role - Sheet No.: **A717-WWP-ZZ-00-DR-A-00101**

Revision:

Appendix B – Sewer Records

Asset Location Search ref:ALS/ALS Standard/2017_3487440

Asset Location Search

MLM Consulting Engineers Limited
Felaw Maltings
46Felaw Street
IPSWICH
IP2 8PN

Search address supplied Sceaux Gardens
London
SE5 7DL

Your reference 618331

Our reference ALS/ALS Standard/2017_3487440

Search date 13 January 2017

Notification of Price Changes…

From **1 September 2016** Thames Water Property Searches will be increasing the prices of its Asset Location Searches. This will be the first price rise in three years and is in line with the RPI at 1.84%. The increase follows significant capital investment in improving our systems and infrastructure.

Enquiries received with a higher payment prior to 1 September 2016 will be non-refundable. For further details on the price increase please visit our website at

www.thameswater-propertysearches.co.uk

Asset Location Search

Search address supplied: Sceaux Gardens, London, SE5 7DL

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

Asset Location Search

Waste Water Services

Please provide a copy extract from the public sewer map.

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

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

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

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

For your guidance:

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

Clean Water Services

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

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

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

pressure test to be carried out for a fee.

For your guidance:

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

Payment for this Search

A charge will be added to your suppliers account.

Asset Location Search

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: 0845 850 2777
Email: developer.services@thameswater.co.uk

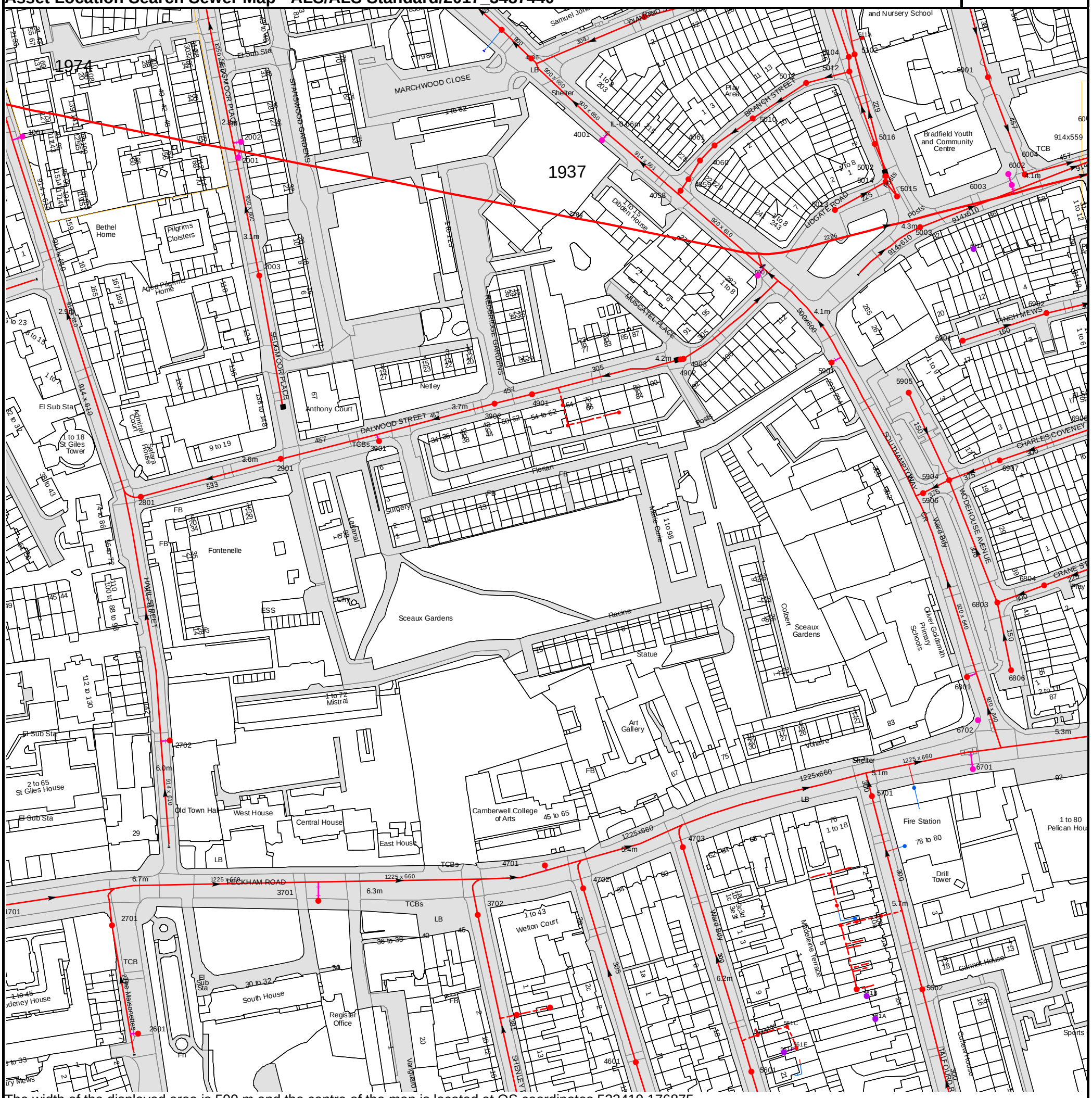
Clean Water queries

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: 0845 850 2777
Email: developer.services@thameswater.co.uk

Asset Location Search Sewer Map - ALS/ALS Standard/2017_3487440



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 533410,176875

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
5603	n/a	n/a
561B	n/a	n/a
5701	5.16	1.29
561A	n/a	n/a
5704	n/a	n/a
571C	n/a	n/a
571D	n/a	n/a
5602	6.23	2.37
6701	5.09	n/a
5905	4.4	3.43
5906	4.31	2.23
5904	3.78	2.55
6901	4.59	3.63
6801	4.71	n/a
601A	n/a	n/a
6702	n/a	n/a
6803	4.91	2.6
6907	4.51	2.45
6806	n/a	n/a
6804	4.91	2.69
6902	4.56	2.12
5015	n/a	n/a
5003	4.27	.99
6001	3.52	-.32
6002	n/a	n/a
6003	4.09	n/a
6004	4.03	-.57
4060	n/a	n/a
4061	n/a	n/a
5010	n/a	n/a
5011	n/a	n/a
5013	4.12	2.95
5104	n/a	n/a
5012	n/a	n/a
5102	3.77	.67
511A	n/a	n/a
5016	n/a	n/a
5014	4.27	2.81
5002	4	.97
5601	7.05	3.51
4601	7.12	3.9
561F	n/a	n/a
561E	n/a	n/a
561D	n/a	n/a
561C	n/a	n/a
3602	n/a	n/a
4602	n/a	n/a
5702	n/a	n/a
5703	n/a	n/a
571A	n/a	n/a
3702	5.96	2.53
571B	n/a	n/a
3701	6.32	n/a
4702	5.57	2.4
4701	5.38	n/a
4703	5.34	2.26
2901	3.5	.26
3901	3.57	n/a
491B	n/a	n/a
491A	n/a	n/a
491C	n/a	n/a
3902	3.68	.7
4901	3.76	.77
5901	3.95	n/a
4902	4.22	1.11
4903	4.22	1.11
2003	3.05	-.15
5001	3.804	.074
2001	2.6	n/a
2002	2.74	n/a
311A	n/a	-.732
4106	3.4	-.6
4001	3.39	n/a
4102	3.84	.67
4058	n/a	n/a
4059	n/a	n/a
2601	7.93	n/a
2701	6.91	3.91
2702	5.89	n/a
2801	3.71	.02
1001	2.51	n/a

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.

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.

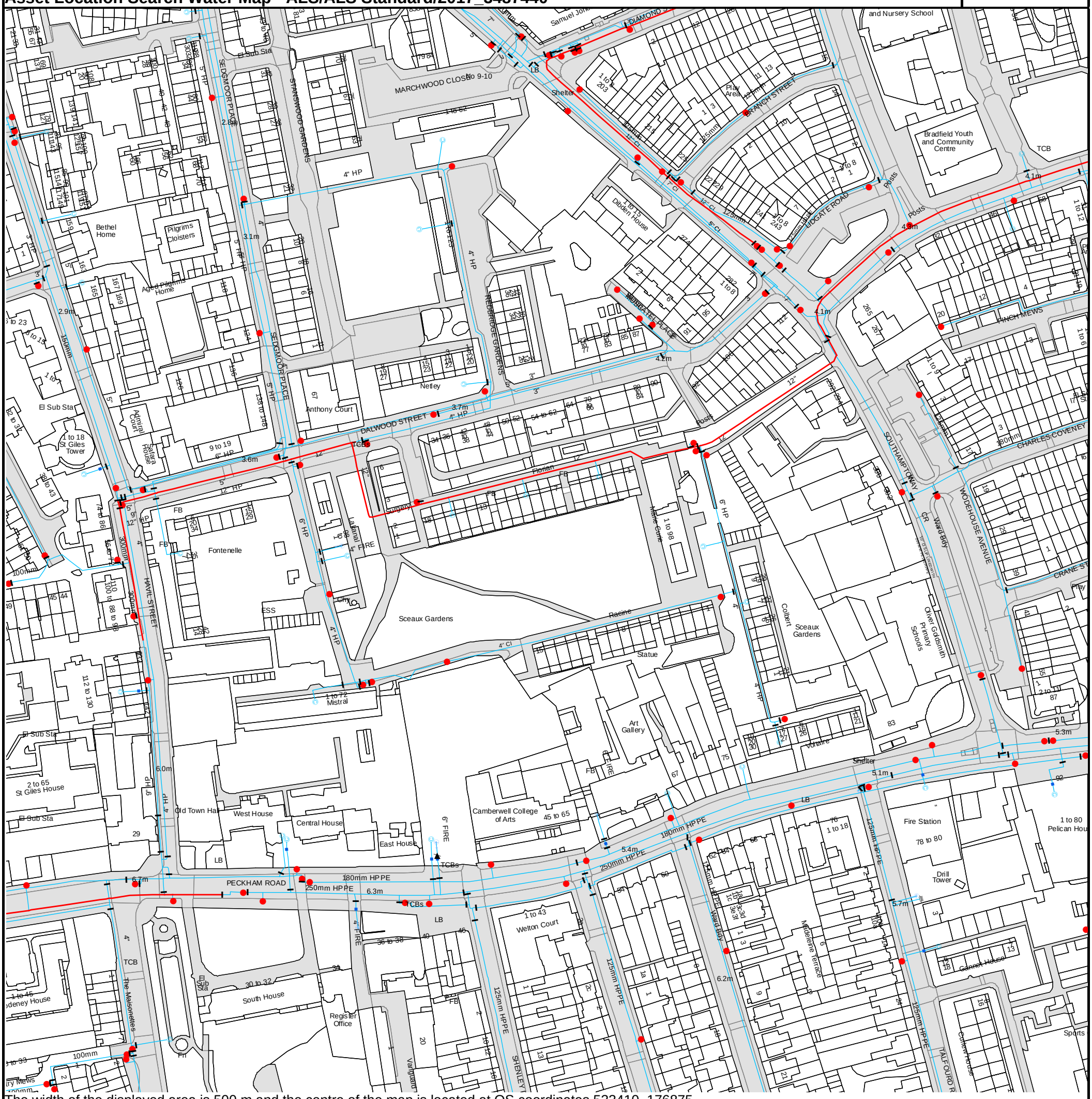
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.

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_3487440



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 533410, 176875.

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.

ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)

4"

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

16"

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

3" SUPPLY

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

3" FIRE

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

3" METERED

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

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

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

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

Valves

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

Hydrants

- Single Hydrant

Meters

- Meter

End Items

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

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

Operational Sites

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

Other Symbols

- Data Logger

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

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

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

Terms and Conditions

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

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

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

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

If you are unhappy with our service you can speak to your original goods or customer service provider. If you are not satisfied with the response, your complaint will be reviewed by the Customer Services Director. You can write to him 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.	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**

Thames Water Utilities Ltd Registered in England & Wales No. 2366661 Registered Office Clearwater Court, Vastern Rd, Reading, Berks, RG1 8DB.

Search Code

IMPORTANT CONSUMER PROTECTION INFORMATION

This search has been produced by Thames Water Property Searches, Clearwater Court, Vastern Road, Reading RG1 8DB, which is registered with the Property Codes Compliance Board (PCCB) as a subscriber to the Search Code. The PCCB independently monitors how registered search firms maintain compliance with the Code.

The Search Code:

- provides protection for homebuyers, sellers, estate agents, conveyancers and mortgage lenders who rely on the information included in property search reports undertaken by subscribers on residential and commercial property within the United Kingdom
- 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.

The Code's core principles

Firms which subscribe to the Search Code will:

- display the Search Code logo prominently on their search reports
- act with integrity and carry out work with due skill, care and diligence
- at all times maintain adequate and appropriate insurance to protect consumers
- conduct business in an honest, fair and professional manner
- handle complaints speedily and fairly
- ensure that products and services comply with industry registration rules and standards and relevant laws
- monitor their compliance with the Code

Complaints

If you have a query or complaint about your search, you should raise it directly with the search firm, and if appropriate ask for any complaint to be considered under their formal internal complaints procedure. If you remain dissatisfied with the firm's final response, after your complaint has been formally considered, or if the firm has exceeded the response timescales, you may refer your complaint for consideration under The Property Ombudsman scheme (TPOs). The Ombudsman can award compensation of up to £5,000 to you if he finds that you have suffered actual loss as a result of your search provider failing to keep to the Code.

Please note that all queries or complaints regarding your search should be directed to your search provider in the first instance, not to TPOs or to the PCCB.

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

Appendix C – Surface Water Drainage Strategy

Brownfield calculations

Sweco drawing 65202894-SWE-ZZ-XX-RP-C-0110 – Surface Water Drainage Strategy

Microdrainage calculations

Ref.	Calculation	Output

1. Brownfield Run-off Calculation

Based on the Modified Rational Method the current discharge rate from the site for the 100%, 3.3% and 1% annual exceedance probability (AEP) events (1, 30 & 100 year) can be calculated as:

Q = 3.61 CiA

C = Volumetric run-off co-efficient	0.9	
i = Rainfall intensity	see below	mm / hr
A = Contributing Area	0.156	ha

Rainfall intensity taken from MicroDrainage Rainfall Generator

100%	32.561	mm / hr
3.3%	79.949	mm / hr
1%	103.943	mm / hr

Discharge rate

100%	16.503	l / s
3.3%	40.522	l / s
1%	52.683	l / s

Ref.	Calculation	Output

1. Brownfield Run-off Calculation

Based on the Modified Rational Method the current discharge rate from the site for the 100%, 3.3% and 1% annual exceedance probability (AEP) events (1, 30 & 100 year) can be calculated as:

Q = 3.61 CiA

C = Volumetric run-off co-efficient	0.9	
i = Rainfall intensity	see below	mm / hr
A = Contributing Area	0.128	ha

Rainfall intensity taken from MicroDrainage Rainfall Generator

100%	32.561	mm / hr
3.3%	79.949	mm / hr
1%	103.943	mm / hr

Discharge rate

100%	13.541	l / s
3.3%	33.249	l / s
1%	43.227	l / s

Ref.	Calculation	Output

1. Brownfield Run-off Calculation

Based on the Modified Rational Method the current discharge rate from the site for the 100%, 3.3% and 1% annual exceedance probability (AEP) events (1, 30 & 100 year) can be calculated as:

Q = 3.61 CiA

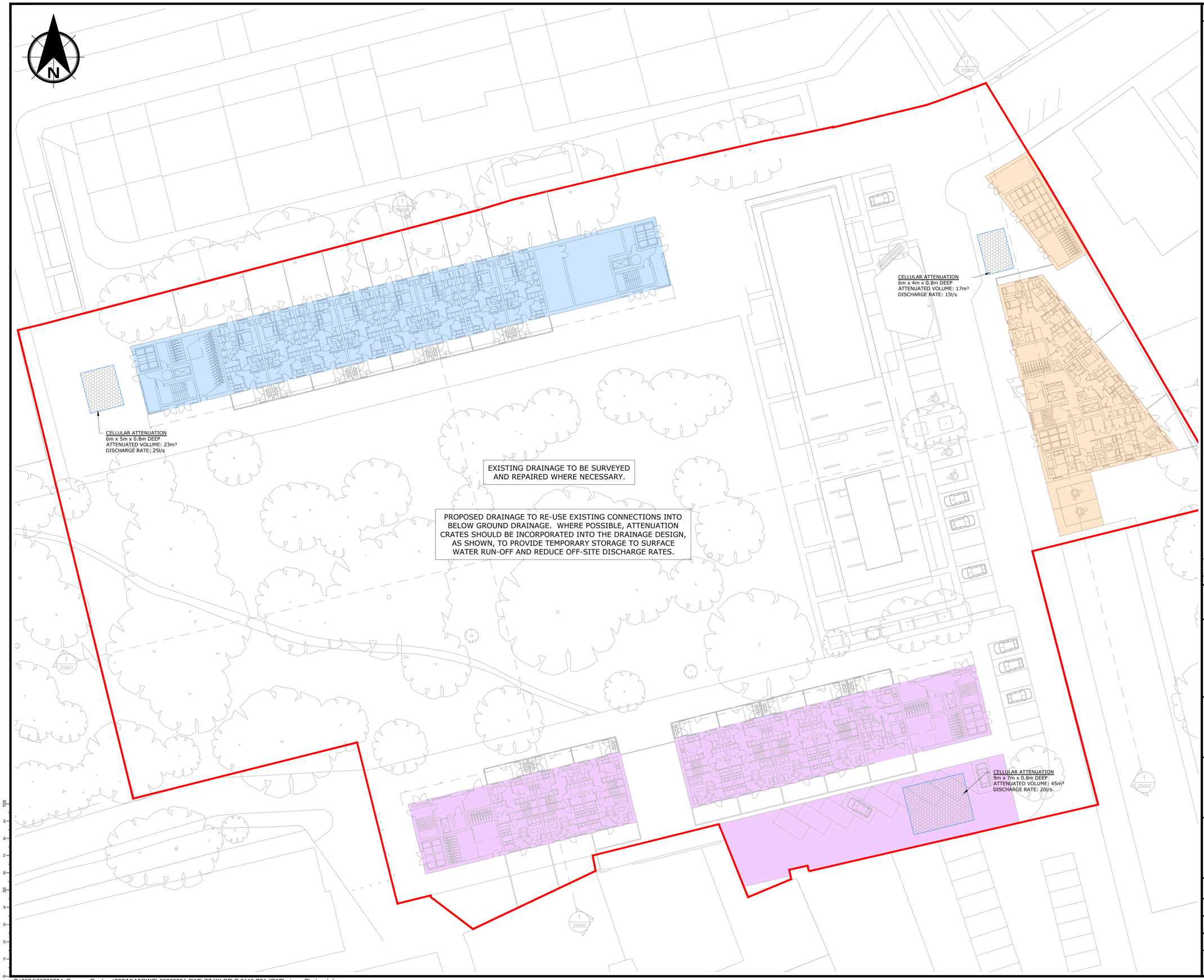
C = Volumetric run-off co-efficient	0.9	
i = Rainfall intensity	see below	mm / hr
A = Contributing Area	0.104	ha

Rainfall intensity taken from MicroDrainage Rainfall Generator

100%	32.561	mm / hr
3.3%	79.949	mm / hr
1%	103.943	mm / hr

Discharge rate

100%	11.002	l / s
3.3%	27.014	l / s
1%	35.122	l / s



NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ENGINEERS, ARCHITECTS AND SPECIALISTS DRAWINGS AND THE SPECIFICATION.
2. DO NOT SCALE FROM THIS DRAWING MANUALLY OR ELECTRONICALLY. WRITTEN PERMISSION MUST BE OBTAINED FROM MLM PRIOR TO SCALING ELECTRONICALLY OR USING THIS ELECTRONIC FILE.
3. THIS DRAINAGE STRATEGY DRAWING SHOWS HOW SURFACE WATER RUN-OFF COULD BE MANAGED ON SITE WITH A RESTRICTED OFF-SITE DISCHARGE, FOR ALL RAINFALL EVENTS UP TO AND INCLUDING THE 100 YEAR RETURN PERIOD EVENT PLUS 40% CLIMATE CHANGE TO ENSURE NO INCREASED FLOOD RISK TO OTHERS AS A RESULT OF THE PROPOSED DEVELOPMENT.

   THIS IS NOT INTENDED TO BE A DETAILED DESIGN AT THIS STAGE. PLEASE NOTE THAT THE FINAL LAYOUT MAY BE SUBJECT TO REFINEMENT TO MEET CERTAIN TECHNICAL CRITERIA.

KEY

- CELLULAR ATTENUATION CRATES
- APPROX. SITE BOUNDARY
- SITE 1 CONTRIBUTING AREA (0.080ha)
- SITE 2 CONTRIBUTING AREA (0.121ha)
- SITE 3 CONTRIBUTING AREA (0.055ha)

Rev	Date	Amendment Details	Dr'n	Chk'	App'
P01	12.05.2021	FIRST ISSUE	BP	JRC	JRC

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46 Felaw Street
Ipswich
IP2 8PN
Tel: +44 (0)1473 231 100
Web: www.sweco.co.uk

Client
LONDON BOROUGH OF SOUTHWARK

Project Title
SCEAUX GARDENS, SOUTHWARK

Drawing Title
SURFACE WATER DRAINAGE STRATEGY

Purpose Of Issue
PRELMINARY

Status	Status Description
S0	INITIAL STATUS OR WIP

Designed	Drawn	Checked	Approved
BP	BP	JRC	JRC

Sheet Size	Scale	SWECO Ref	Revision
A1	1:250	65202894	P01

Drawing Number
65202894-SWE-ZZ-XX-DR-C-0110

P:\6524\65202894_Sceaux_Gardens\000\MLM\DWG\ 65202894-SWE-ZZ-XX-DR-C-0110-P01 (SWDrainageStrategy).dwg

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

Half Drain Time : 10 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	3.500	0.700	0.0	25.0	25.0	20.0	O K
30 min Summer	3.396	0.596	0.0	25.0	25.0	17.0	O K
60 min Summer	3.198	0.398	0.0	25.0	25.0	11.3	O K
120 min Summer	3.018	0.218	0.0	24.0	24.0	6.2	O K
180 min Summer	2.976	0.176	0.0	18.7	18.7	5.0	O K
240 min Summer	2.954	0.154	0.0	15.3	15.3	4.4	O K
360 min Summer	2.927	0.127	0.0	11.3	11.3	3.6	O K
480 min Summer	2.912	0.112	0.0	9.0	9.0	3.2	O K
600 min Summer	2.901	0.101	0.0	7.6	7.6	2.9	O K
720 min Summer	2.894	0.094	0.0	6.6	6.6	2.7	O K
960 min Summer	2.883	0.083	0.0	5.3	5.3	2.4	O K
1440 min Summer	2.870	0.070	0.0	3.8	3.8	2.0	O K
2160 min Summer	2.859	0.059	0.0	2.8	2.8	1.7	O K
2880 min Summer	2.852	0.052	0.0	2.2	2.2	1.5	O K
4320 min Summer	2.843	0.043	0.0	1.5	1.5	1.2	O K
5760 min Summer	2.838	0.038	0.0	1.2	1.2	1.1	O K
7200 min Summer	2.834	0.034	0.0	1.0	1.0	1.0	O K
8640 min Summer	2.832	0.032	0.0	0.8	0.8	0.9	O K
10080 min Summer	2.830	0.030	0.0	0.7	0.7	0.8	O K
15 min Winter	3.597	0.797	0.0	25.0	25.0	22.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	226.146	0.0	33.9	13
30 min Summer	129.742	0.0	38.9	22
60 min Summer	74.435	0.0	44.6	36
120 min Summer	42.704	0.0	51.2	64
180 min Summer	30.854	0.0	55.5	94
240 min Summer	24.500	0.0	58.8	124
360 min Summer	17.701	0.0	63.7	184
480 min Summer	14.056	0.0	67.5	246
600 min Summer	11.754	0.0	70.5	306
720 min Summer	10.155	0.0	73.1	366
960 min Summer	8.069	0.0	77.4	486
1440 min Summer	5.834	0.0	84.0	734
2160 min Summer	4.219	0.0	91.1	1088
2880 min Summer	3.352	0.0	96.5	1468
4320 min Summer	2.349	0.0	101.5	2148
5760 min Summer	1.826	0.0	105.1	2936
7200 min Summer	1.501	0.0	108.1	3648
8640 min Summer	1.280	0.0	110.5	4328
10080 min Summer	1.118	0.0	112.7	5120
15 min Winter	226.146	0.0	38.0	14

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	3.452	0.652	0.0	25.0	25.0	18.6	O K
60 min Winter	3.153	0.353	0.0	25.0	25.0	10.1	O K
120 min Winter	2.982	0.182	0.0	19.5	19.5	5.2	O K
180 min Winter	2.947	0.147	0.0	14.3	14.3	4.2	O K
240 min Winter	2.928	0.128	0.0	11.4	11.4	3.7	O K
360 min Winter	2.907	0.107	0.0	8.3	8.3	3.0	O K
480 min Winter	2.894	0.094	0.0	6.6	6.6	2.7	O K
600 min Winter	2.885	0.085	0.0	5.6	5.6	2.4	O K
720 min Winter	2.879	0.079	0.0	4.8	4.8	2.2	O K
960 min Winter	2.869	0.069	0.0	3.8	3.8	2.0	O K
1440 min Winter	2.859	0.059	0.0	2.8	2.8	1.7	O K
2160 min Winter	2.849	0.049	0.0	2.0	2.0	1.4	O K
2880 min Winter	2.844	0.044	0.0	1.6	1.6	1.2	O K
4320 min Winter	2.837	0.037	0.0	1.1	1.1	1.0	O K
5760 min Winter	2.832	0.032	0.0	0.9	0.9	0.9	O K
7200 min Winter	2.829	0.029	0.0	0.7	0.7	0.8	O K
8640 min Winter	2.827	0.027	0.0	0.6	0.6	0.8	O K
10080 min Winter	2.825	0.025	0.0	0.5	0.5	0.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	129.742	0.0	43.6	23
60 min Winter	74.435	0.0	50.0	38
120 min Winter	42.704	0.0	57.4	64
180 min Winter	30.854	0.0	62.2	94
240 min Winter	24.500	0.0	65.8	124
360 min Winter	17.701	0.0	71.4	186
480 min Winter	14.056	0.0	75.5	246
600 min Winter	11.754	0.0	79.0	306
720 min Winter	10.155	0.0	81.9	366
960 min Winter	8.069	0.0	86.7	490
1440 min Winter	5.834	0.0	94.1	732
2160 min Winter	4.219	0.0	102.0	1100
2880 min Winter	3.352	0.0	108.1	1420
4320 min Winter	2.349	0.0	113.7	2192
5760 min Winter	1.826	0.0	117.8	2896
7200 min Winter	1.501	0.0	121.0	3608
8640 min Winter	1.280	0.0	123.8	4320
10080 min Winter	1.118	0.0	126.2	5008

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 533850 177350 TQ 33850 77350
C (1km)	-0.026
D1 (1km)	0.318
D2 (1km)	0.320
D3 (1km)	0.243
E (1km)	0.324
F (1km)	2.483
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.080

Time (mins) From:	To:	Area (ha)
0	4	0.080

Model Details

Storage is Online Cover Level (m) 4.200

Cellular Storage Structure

Invert Level (m) 2.800 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	30.0	0.0	0.801	0.0	0.0
0.800	30.0	0.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0221-2500-0800-2500
Design Head (m)	0.800
Design Flow (l/s)	25.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	221
Invert Level (m)	2.800
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	25.0
Flush-Flo™	0.341	25.0
Kick-Flo®	0.620	22.2
Mean Flow over Head Range	-	20.2

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.4	1.200	30.3	3.000	47.2	7.000	71.2
0.200	21.8	1.400	32.7	3.500	50.8	7.500	73.6
0.300	24.9	1.600	34.8	4.000	54.2	8.000	76.0
0.400	24.9	1.800	36.9	4.500	57.4	8.500	77.8
0.500	24.2	2.000	38.8	5.000	60.4	9.000	80.1
0.600	22.7	2.200	40.6	5.500	63.3	9.500	82.3
0.800	25.0	2.400	42.4	6.000	66.0		
1.000	27.8	2.600	44.0	6.500	68.7		

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

Half Drain Time : 19 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	3.652	0.652	0.0	20.0	20.0	39.0	O K
30 min Summer	3.628	0.628	0.0	20.0	20.0	37.6	O K
60 min Summer	3.541	0.541	0.0	20.0	20.0	32.4	O K
120 min Summer	3.388	0.388	0.0	20.0	20.0	23.2	O K
180 min Summer	3.281	0.281	0.0	19.9	19.9	16.8	O K
240 min Summer	3.218	0.218	0.0	19.5	19.5	13.0	O K
360 min Summer	3.171	0.171	0.0	16.0	16.0	10.2	O K
480 min Summer	3.148	0.148	0.0	13.1	13.1	8.9	O K
600 min Summer	3.133	0.133	0.0	11.2	11.2	8.0	O K
720 min Summer	3.123	0.123	0.0	9.8	9.8	7.3	O K
960 min Summer	3.108	0.108	0.0	7.9	7.9	6.4	O K
1440 min Summer	3.090	0.090	0.0	5.7	5.7	5.4	O K
2160 min Summer	3.075	0.075	0.0	4.2	4.2	4.5	O K
2880 min Summer	3.067	0.067	0.0	3.3	3.3	4.0	O K
4320 min Summer	3.055	0.055	0.0	2.3	2.3	3.3	O K
5760 min Summer	3.048	0.048	0.0	1.8	1.8	2.9	O K
7200 min Summer	3.044	0.044	0.0	1.5	1.5	2.6	O K
8640 min Summer	3.040	0.040	0.0	1.3	1.3	2.4	O K
10080 min Summer	3.038	0.038	0.0	1.1	1.1	2.2	O K
15 min Winter	3.743	0.743	0.0	20.0	20.0	44.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	226.146	0.0	51.3	16
30 min Summer	129.742	0.0	58.8	25
60 min Summer	74.435	0.0	67.5	42
120 min Summer	42.704	0.0	77.5	72
180 min Summer	30.854	0.0	84.0	102
240 min Summer	24.500	0.0	88.9	130
360 min Summer	17.701	0.0	96.4	188
480 min Summer	14.056	0.0	102.0	248
600 min Summer	11.754	0.0	106.6	308
720 min Summer	10.155	0.0	110.6	368
960 min Summer	8.069	0.0	117.1	490
1440 min Summer	5.834	0.0	127.0	734
2160 min Summer	4.219	0.0	137.8	1100
2880 min Summer	3.352	0.0	146.0	1456
4320 min Summer	2.349	0.0	153.5	2164
5760 min Summer	1.826	0.0	159.0	2864
7200 min Summer	1.501	0.0	163.5	3584
8640 min Summer	1.280	0.0	167.2	4304
10080 min Summer	1.118	0.0	170.4	5056
15 min Winter	226.146	0.0	57.4	16

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	3.712	0.712	0.0	20.0	20.0	42.6	O K
60 min Winter	3.594	0.594	0.0	20.0	20.0	35.6	O K
120 min Winter	3.355	0.355	0.0	20.0	20.0	21.2	O K
180 min Winter	3.219	0.219	0.0	19.5	19.5	13.1	O K
240 min Winter	3.178	0.178	0.0	16.7	16.7	10.6	O K
360 min Winter	3.143	0.143	0.0	12.4	12.4	8.5	O K
480 min Winter	3.124	0.124	0.0	9.9	9.9	7.4	O K
600 min Winter	3.111	0.111	0.0	8.3	8.3	6.7	O K
720 min Winter	3.102	0.102	0.0	7.2	7.2	6.1	O K
960 min Winter	3.090	0.090	0.0	5.8	5.8	5.4	O K
1440 min Winter	3.075	0.075	0.0	4.2	4.2	4.5	O K
2160 min Winter	3.063	0.063	0.0	3.0	3.0	3.8	O K
2880 min Winter	3.056	0.056	0.0	2.4	2.4	3.4	O K
4320 min Winter	3.047	0.047	0.0	1.7	1.7	2.8	O K
5760 min Winter	3.041	0.041	0.0	1.3	1.3	2.4	O K
7200 min Winter	3.037	0.037	0.0	1.1	1.1	2.2	O K
8640 min Winter	3.034	0.034	0.0	0.9	0.9	2.0	O K
10080 min Winter	3.032	0.032	0.0	0.8	0.8	1.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	129.742	0.0	65.9	26
60 min Winter	74.435	0.0	75.6	44
120 min Winter	42.704	0.0	86.8	76
180 min Winter	30.854	0.0	94.1	102
240 min Winter	24.500	0.0	99.6	130
360 min Winter	17.701	0.0	107.9	188
480 min Winter	14.056	0.0	114.3	248
600 min Winter	11.754	0.0	119.4	308
720 min Winter	10.155	0.0	123.8	370
960 min Winter	8.069	0.0	131.2	490
1440 min Winter	5.834	0.0	142.3	736
2160 min Winter	4.219	0.0	154.3	1100
2880 min Winter	3.352	0.0	163.5	1444
4320 min Winter	2.349	0.0	171.9	2156
5760 min Winter	1.826	0.0	178.1	2872
7200 min Winter	1.501	0.0	183.1	3672
8640 min Winter	1.280	0.0	187.2	4328
10080 min Winter	1.118	0.0	190.8	4952

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 533850 177350 TQ 33850 77350
C (1km)	-0.026
D1 (1km)	0.318
D2 (1km)	0.320
D3 (1km)	0.243
E (1km)	0.324
F (1km)	2.483
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.121

Time (mins) From:	To:	Area (ha)
0	4	0.121

Model Details

Storage is Online Cover Level (m) 4.400

Cellular Storage Structure

Invert Level (m) 3.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	63.0	0.0	0.801	0.0	0.0
0.800	63.0	0.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0201-2000-0800-2000
Design Head (m)	0.800
Design Flow (l/s)	20.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	201
Invert Level (m)	3.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	20.0
Flush-Flo™	0.315	20.0
Kick-Flo®	0.605	17.5
Mean Flow over Head Range	-	16.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.9	1.200	24.3	3.000	37.7	7.000	56.8
0.200	19.0	1.400	26.1	3.500	40.6	7.500	58.7
0.300	20.0	1.600	27.8	4.000	43.3	8.000	60.6
0.400	19.8	1.800	29.5	4.500	45.8	8.500	62.1
0.500	19.2	2.000	31.0	5.000	48.2	9.000	63.9
0.600	17.7	2.200	32.4	5.500	50.5	9.500	65.7
0.800	20.0	2.400	33.8	6.000	52.7		
1.000	22.2	2.600	35.2	6.500	54.8		

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

Half Drain Time : 10 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	3.341	0.641	0.0	15.0	15.0	14.6	O K
30 min Summer	3.259	0.559	0.0	15.0	15.0	12.8	O K
60 min Summer	3.099	0.399	0.0	15.0	15.0	9.1	O K
120 min Summer	2.915	0.215	0.0	14.8	14.8	4.9	O K
180 min Summer	2.861	0.161	0.0	12.6	12.6	3.7	O K
240 min Summer	2.838	0.138	0.0	10.4	10.4	3.1	O K
360 min Summer	2.814	0.114	0.0	7.7	7.7	2.6	O K
480 min Summer	2.799	0.099	0.0	6.2	6.2	2.3	O K
600 min Summer	2.790	0.090	0.0	5.3	5.3	2.1	O K
720 min Summer	2.783	0.083	0.0	4.6	4.6	1.9	O K
960 min Summer	2.773	0.073	0.0	3.6	3.6	1.7	O K
1440 min Summer	2.761	0.061	0.0	2.6	2.6	1.4	O K
2160 min Summer	2.752	0.052	0.0	1.9	1.9	1.2	O K
2880 min Summer	2.746	0.046	0.0	1.5	1.5	1.0	O K
4320 min Summer	2.738	0.038	0.0	1.1	1.1	0.9	O K
5760 min Summer	2.733	0.033	0.0	0.8	0.8	0.8	O K
7200 min Summer	2.730	0.030	0.0	0.7	0.7	0.7	O K
8640 min Summer	2.728	0.028	0.0	0.6	0.6	0.6	O K
10080 min Summer	2.726	0.026	0.0	0.5	0.5	0.6	O K
15 min Winter	3.433	0.733	0.0	15.0	15.0	16.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	226.146	0.0	23.3	14
30 min Summer	129.742	0.0	26.7	22
60 min Summer	74.435	0.0	30.7	38
120 min Summer	42.704	0.0	35.2	66
180 min Summer	30.854	0.0	38.2	94
240 min Summer	24.500	0.0	40.4	124
360 min Summer	17.701	0.0	43.8	184
480 min Summer	14.056	0.0	46.4	246
600 min Summer	11.754	0.0	48.5	306
720 min Summer	10.155	0.0	50.3	366
960 min Summer	8.069	0.0	53.2	486
1440 min Summer	5.834	0.0	57.7	734
2160 min Summer	4.219	0.0	62.6	1088
2880 min Summer	3.352	0.0	66.4	1464
4320 min Summer	2.349	0.0	69.8	2172
5760 min Summer	1.826	0.0	72.3	2936
7200 min Summer	1.501	0.0	74.3	3624
8640 min Summer	1.280	0.0	76.0	4304
10080 min Summer	1.118	0.0	77.5	5096
15 min Winter	226.146	0.0	26.1	15

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	3.324	0.624	0.0	15.0	15.0	14.2	O K
60 min Winter	3.073	0.373	0.0	15.0	15.0	8.5	O K
120 min Winter	2.868	0.168	0.0	13.2	13.2	3.8	O K
180 min Winter	2.833	0.133	0.0	9.8	9.8	3.0	O K
240 min Winter	2.815	0.115	0.0	7.9	7.9	2.6	O K
360 min Winter	2.795	0.095	0.0	5.7	5.7	2.2	O K
480 min Winter	2.783	0.083	0.0	4.6	4.6	1.9	O K
600 min Winter	2.775	0.075	0.0	3.8	3.8	1.7	O K
720 min Winter	2.770	0.070	0.0	3.3	3.3	1.6	O K
960 min Winter	2.761	0.061	0.0	2.6	2.6	1.4	O K
1440 min Winter	2.752	0.052	0.0	1.9	1.9	1.2	O K
2160 min Winter	2.744	0.044	0.0	1.4	1.4	1.0	O K
2880 min Winter	2.739	0.039	0.0	1.1	1.1	0.9	O K
4320 min Winter	2.732	0.032	0.0	0.8	0.8	0.7	O K
5760 min Winter	2.728	0.028	0.0	0.6	0.6	0.6	O K
7200 min Winter	2.726	0.026	0.0	0.5	0.5	0.6	O K
8640 min Winter	2.724	0.024	0.0	0.4	0.4	0.5	O K
10080 min Winter	2.722	0.022	0.0	0.4	0.4	0.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	129.742	0.0	30.0	24
60 min Winter	74.435	0.0	34.4	40
120 min Winter	42.704	0.0	39.4	66
180 min Winter	30.854	0.0	42.8	96
240 min Winter	24.500	0.0	45.3	126
360 min Winter	17.701	0.0	49.1	186
480 min Winter	14.056	0.0	51.9	244
600 min Winter	11.754	0.0	54.3	306
720 min Winter	10.155	0.0	56.3	364
960 min Winter	8.069	0.0	59.6	490
1440 min Winter	5.834	0.0	64.7	732
2160 min Winter	4.219	0.0	70.2	1092
2880 min Winter	3.352	0.0	74.3	1452
4320 min Winter	2.349	0.0	78.1	2188
5760 min Winter	1.826	0.0	81.0	2912
7200 min Winter	1.501	0.0	83.2	3624
8640 min Winter	1.280	0.0	85.1	4368
10080 min Winter	1.118	0.0	86.7	4992

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 533850 177350 TQ 33850 77350
C (1km)	-0.026
D1 (1km)	0.318
D2 (1km)	0.320
D3 (1km)	0.243
E (1km)	0.324
F (1km)	2.483
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.055

Time (mins) From:	To:	Area (ha)
0	4	0.055

Model Details

Storage is Online Cover Level (m) 4.100

Cellular Storage Structure

Invert Level (m) 2.700 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	24.0	0.0	0.801	0.0	0.0
0.800	24.0	0.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0177-1500-0800-1500
Design Head (m)	0.800
Design Flow (l/s)	15.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	177
Invert Level (m)	2.700
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	15.0
Flush-Flo™	0.288	15.0
Kick-Flo®	0.590	13.0
Mean Flow over Head Range	-	12.5

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.3	1.200	18.2	3.000	28.2	7.000	42.4
0.200	14.7	1.400	19.6	3.500	30.4	7.500	43.9
0.300	15.0	1.600	20.9	4.000	32.4	8.000	45.3
0.400	14.7	1.800	22.1	4.500	34.3	8.500	46.4
0.500	14.2	2.000	23.2	5.000	36.1	9.000	47.8
0.600	13.1	2.200	24.3	5.500	37.8	9.500	49.1
0.800	15.0	2.400	25.3	6.000	39.4		
1.000	16.7	2.600	26.3	6.500	40.9		