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11-12 INGESTRE ROAD, LONDON, NW5 1UX

Flood Risk Assessment and Drainage Strategy – Volume 1 of 4

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Flood Risk Assessment and Drainage Strategy

Client: Four Quarters (Ingestre Road) Ltd

Engineer: Create Consulting Engineers Limited
109-112 Temple Chambers
3-7 Temple Avenue
London
EC4Y 0HP

Tel: 020 7822 2300
Email: enquiries@createconsultingengineers.co.uk
Web: www.createconsultingengineers.co.uk

Report By: Elen Wyatt, BSc (Hons), MSc
Jessica Jordan, BSc (Hons), MSc

Approved By: Graham Sinclair, BSc (Hons), MSc, DIC, C.WEM, MCIWEM

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Contents

Figures

Appendices

Plans

01	Site Survey
02	Lower Ground Floor Plan
03	Ground and First Floor Plan
A-P11-00a	Proposed Basement Plan
A-P11-01a	Proposed Ground Floor Plan
A-P11-02	Proposed First Floor Plan
A-P11-03a	Proposed Second Floor Plan
A-P11-04	Proposed Third Floor Plan
A-P11-05	Proposed Fourth Floor Plan
A-P11-06	Proposed Fifth Floor Plan
A-P11-07a	Roof Plan
A-P11-10	Proposed Site Plan Ground Floor
A-P11-11	Proposed Site Plan First Floor
A-P12-01	Site Sections
A-P12-02a	Building Sections
A-P12-01a	Proposed Elevations
A-P13-02a	Proposed Elevations
A-P13-03a	Proposed Elevations

Registration of Amendments

Revision and Date	Amendment Details	Revision Prepared By	Revision Approved By
Rev A 04/07/18	Updated to address BWP comments.	JJ	CB

1.0 INTRODUCTION

Brief

1.1 Create Consulting Engineers Ltd was instructed by Four Quarters (Ingestre Road) Ltd to undertake a Flood Risk Assessment (FRA) and Drainage Strategy to inform the development proposals for a proposed Extra Care facility located on Ingestre Road, London, NW5 1UX.

Project Context

1.2 The site is currently occupied by a former care home and comprises a part two-storey, part three-storey building as shown on Drawings 02 and 03 (Existing Lower Ground Floor Plan and Existing Ground and First Floor Plan) attached to this report.

1.3 The client intends to submit a full planning application comprising the demolition of existing buildings and the erection of a six storey plus single storey basement building accommodating 50 Assisted Living residential apartments with associated communal and support facilities and ancillary cafe, salon and mini gym, together with external amenity spaces, car lift, basement parking, laundry, plant, CCTV, lighting, access, landscaping, infrastructure and other ancillary works.

1.4 Architect's Layouts are appended with this report.

Planning Policy Context

1.5 The potential consequences of inappropriate development in a flood risk area for occupiers, either of the development or elsewhere, pose significant risks in terms of personal safety and damage to property.

1.6 The National Planning Policy Framework[1] includes Government policy on development and flood risk stating that:

When determining planning applications, local planning authorities should ensure flood risk is not increased elsewhere and only consider development appropriate in areas at risk of flooding where, informed by a site-specific flood risk assessment following the Sequential Test, and if required the Exception Test, it can be demonstrated that:

- *within the site, the most vulnerable development is located in areas of lowest flood risk unless there are overriding reasons to prefer a different location; and*
- *development is appropriately flood resilient and resistant, including safe access and escape routes where required, and that any residual risk can be safely managed, including my emergency planning; and it gives priority to the use of sustainable drainage systems.*

[1] NPPF accessed online (June 2018) https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf

Local Planning Policy

1.7 The Local Development Plans for the Camden area are the Camden Local Plan (London Borough of Camden, 2017) and London Borough of Camden Local Development Framework (London Borough of Camden, 2010).

1.8 The relevant policies from the Local Plan (London Borough of Camden, 2017) are as follows:

- Policy CC2 – Adapting to climate change
- Policy CC3 – Water and flooding

1.9 The relevant policy from the Camden Local Development Framework Core Strategy (London Borough of Camden, 2010) is as follows:

- Policy DP23 – Water

1.10 The relevant policies from these local planning documents have been considered as part of this flood risk assessment and drainage strategy.

1.11 The Strategic Flood Risk Assessment (SFRA) for Camden (URS, 2014), the SFRA for North London (Mouchel, 2008) and the Preliminary Flood Risk Assessment (PFRA) for Camden (Drain and Halcrow, 2011) provides a summary of the flood risks for the local area.

Climate Change

1.12 Climate change has important implications for the assessment and management of flood risk. The NPPF requires that climate change is considered when making an assessment of flood risk posed to future development.

1.13 Climate change has the potential to affect all identified sources of flooding at the site. The likely impacts of climate change include increased severity of rainfall events as well as wetter winters leading to higher groundwater levels and increased frequency and severity of surface water flooding.

1.14 The influence of climate change on rainfall intensity has been taken into account by the surface water drainage strategy here as an inclusion of 40% has been made for climate change for all rainfall events up to and including the 1 in 100 year event in accordance with NPPF requirements, and 'Flood Risk Assessments: Climate Change Allowances'[2].

[2] Environment Agency (2016) *Flood Risk Assessments: Climate Change Allowances*.

Objectives

1.15 The following specific objectives were set by Create Consulting Engineers Ltd after a review of the available data:

- To assess the suitability of the scheme in relation to all sources of flooding;
- To assess the flood risk posed by the scheme once it is complete and operational;
- To suggest mitigation measures in order to reduce any residual risks to acceptable levels.

2.0 SOURCES OF INFORMATION

2.1 The Information contained in this report is based on a review of existing information and consultation with interested parties.

Records Review

2.2 Key reports and websites reviewed as part of this study are listed in Table 2.1 below.

Document/Website	Author/Publisher	Date
Fluvial/Tidal Flood Maps - https://flood-map-for-planning.service.gov.uk/	GOV.UK	Accessed June 2018
Groundwater Mapping – environment-agency.gov.uk	Environment Agency (EA)	Accessed June 2018
Surface Water and Reservoir Flood Mapping – flood-warning-information.service.gov.uk	GOV.UK	Accessed June 2018
BGS GeoIndex – Geology and borehole records - www.bgs.ac.uk/geoindex	British Geological Survey	Accessed June 2018
London Borough of Camden Strategic Flood Risk Assessment (SFRA)	URS	2014
SFRA for North London	Mouchel	2008
Preliminary Flood Risk Assessment (PFRA) for Camden	Drain and Halcrow	2011
The Lost Rivers of London	Nicholas Barton	1992
Existing Architect layout plans (Drawings 01, 02 and 03)	Blueprint Surveys Ltd	April 2013
Proposed Architect Layout Plans (Drawings A-P11-00a, A-P11-01a, A-P11-02, A-P11-03a, A-P11-04, A-P11-05, A-P11-06, A-P11-07a, A-P11-10, A-P11-11, A-P12-01, A-P12-02a, A-P12-01a, A-P13-02a, A-P13-03a)	Barton Willmore	June 2018
Thames Water asset plans - Commercial Drainage & Water Enquiry (Appendix A)	Thames Water	July 2017
Thames Water Pre Development Enquiry (Appendix B)	Thames Water	January 2018

Table 2.1: Key Information Sources

Consultation

2.3 The agencies and individuals consulted as part of this exercise to obtain records or seek input to the proposals as part of this FRA are listed in Table 2.2 and key records are included in the appendices.

Consultee	Form of Consultation	Topics Discussed and Actions Agreed
Thames Water Developer Services Team	Request for Asset Plans	Asset plans were requested in order to inform the foul and surface water drainage strategies. The asset plans (Appendix A), dated 17 July 2016 show foul water (combined and surface water) and clean water assets in the vicinity of the site.
Thames Water Developer Services Team	Pre Development Enquiry	A Pre Development Enquiry was submitted to ensure sufficient capacity is available the public sewer network for the foul and surface water flows from the site. A response received on 5 January 2018 confirmed there was sufficient capacity for the foul water flows (Appendix B). During email correspondence with Thames Water (during May and June 2018), which detailed the constraints of the site and proposed a discharge rate of 13.5 l/s, it was agreed that a reduced discharge rate of 9.0 l/s would be acceptable (Appendix C).

Table 2.2: List of Parties Consulted

3.0 SITE SETTING

Site Location

3.1 The site is located on Ingestre Road, London, NW5 1UX, within the London Borough of Camden. The site is approximately 30.0 m from the railway line to the north between Gospel Oak station 530.0 m to the west and Tufnell Park station 310.0 m to the east. The site lies at Ordnance Survey grid reference TQ 28803 85760 with its location shown in Figure 3.1.

Description of Site and Surroundings

3.2 The site comprises a two storey building with basement, which is a former old people's care home.

3.3 The site is bounded to the north by Ingestre Road and by access roads to the east and west with residential areas beyond. Residential buildings form the southern boundary of the site.

3.4 The Existing Site Survey, included in with this report on Drawing 01, summarises elevations in the area of the site. Relative to ordnance datum ground levels at the site fall from 51.10 mAOD in the south eastern corner of the site to 46.53 mAOD in the north western corner of the site.

Hydrological Setting

Surface Watercourses

3.5 Regents Canal is located approximately 1.55 km to the south of the site. The River Thames is located approximately 5.40 km to the south of the site.

Estuaries and Coastal Watercourses

3.6 The River Thames is tidal at this location, as it is downstream of the tidal limit at Teddington Lock.

Culverted Watercourses

3.7 According to the Lost Rivers of London Map (Barton, 1992), the site is located approximately 125.0 m meters away from the River Fleet to the east. The River Fleet is entirely incorporated within the sewer network, owned and maintained by Thames Water.

Ground Conditions

3.8 BGS mapping (accessed online at www.bgs.ac.uk/geoindex) shows bedrock geology at the site to be comprised of the London Clay Formation (Clay, Sand and Silt). There are no superficial deposits.

3.9 A borehole located 200.0 m west of the site at the junction of Chetwynd Road and Highgate Road encountered brown clay to a depth of 1.54 mbgl with brown gravel directly below to a depth of 1.83 mbgl. Sand and gravel was encountered below both layers of made ground to a depth of 9.14 m.

4.0 SCHEME DESCRIPTION

The Scheme

4.1 The client intends to submit a full planning application for the demolition of existing buildings and the erection of a six storey plus single storey basement building accommodating 50 Assisted Living residential apartments with associated 2160m^2 of communal space. The support facilities include and ancillary cafe, salon and mini gym, together with external amenity spaces, car lift, basement parking, laundry, plant, CCTV, lighting, access, landscaping, infrastructure and other ancillary works.

Proposed Land use Vulnerability Classification

4.2 The development is proposed to include residential which is defined as a 'more vulnerable' use according to the NPPF. Given the proposed land use classification and the location of the site being within Flood Zone 1, the Sequential and Exception Tests will not need to be satisfied for development to be acceptable.

5.0 FLOOD RISK ASSESSMENT

Scope of Work

5.1 The scope of this FRA was refined to meet the brief outlined in Chapter 1 of this report and considers the following:

- Flood risk to the development from all sources;
- Potential for the design, construction and operation of the site to increase the risk of flooding to neighbouring properties;
- Any necessary mitigation measures to mitigate identified potential flood risks;
- Climate change; and
- Residual flood risks.

5.2 The approach is consistent with the NPPF and associated Technical Guidance and the requirements of local planning policy.

Flood Risk to the Proposed Development

Flood Risk from Fluvial & Tidal Sources

5.3 The site lies within the Environment Agency's (EA) Flood Zone 1 (Figure 5.1) which is described within the NPPF Technical Guidance as having a less than 1 in 1000 year annual probability of river or tidal flooding (<0.1%) in any one year.

5.4 Given the proximity to the nearest watercourse and that the site is located in Flood Zone 1, it is considered that the site is adequately protected from, and not at risk of fluvial/tidal flooding.

Flood Risk from Groundwater

5.5 The site does not lie within any Groundwater Source Protection Zones, as identified by the Environment Agency mapping (EA website, accessed June 2018).

5.6 A BGS borehole record located 200.0 m west of the site identifies the presence of groundwater at a depth of 78.0 mbgl.

5.7 Due to the depth at which groundwater was found the flood risk from groundwater is considered to be low. However there is a likelihood that perched groundwater at shallower depths within the clay may be present, therefore, given that the proposals include a basement appropriate mitigation measures are discussed in Table 7.1.

Flood Risk from Artificial Water Bodies

5.8 There are no artificial water bodies within the immediate vicinity of the site. The closest is a series of reservoirs associated with Hampstead Heath located approximately 1.0 km north west of the site.

5.9 Whilst the site is not directly at risk of flooding as a result of a reservoir breech, it is located on a dry island, within the flood flow path from the reservoirs associated with Hampstead Heath (Figure 5.2). Ingestre Road and the railway to the north of the site, and Highgate Road to the west are shown to be at risk of flooding from Highgate Pond 2 and Highgate Pond 3, whilst Burghley Road to the east of the site is also shown to be at risk of flooding, from Maiden Lane Reservoir.

5.10 The risk of flooding from a reservoir breech is considered to be pose a residual risk as the reservoirs in question are maintained under the Reservoirs Act 1975. Access and egress to and from the site could be restricted as a result of a reservoir breech, and therefore appropriate mitigation measures are discussed in Table 7.1.

Flood Risk from Public Sewers

5.11 A Thames Water Asset Location Search is included in Appendix A. A combined sewer (of unknown size) drains along Ingestre Road in a westerly direction. A second combined sewer (of unknown size) drains in a northerly direct along the access road on the eastern boundary of the site.

5.12 No separate surface water sewers are shown on the asset plans provided and therefore surface water runoff in the area is assumed to drain to the combined sewer network.

5.13 A Thames Water Sewer Flooding History Enquiry (Appendix A) confirms no historic records of any surcharging sewers in the vicinity of the site.

5.14 With regard to surface water drainage from the site it is assumed that it drains informally to Ingestre Road via gullies into the combined sewer system.

5.15 No significant issues have been identified at the site, and the risk of sewer flooding is considered to be low.

5.16 Sewer flooding from blockage of internal building drainage as well as the Thames Water network is, however, a residual risk managed by the design of the site drainage and regular inspection and maintenance of the public and private sewer network. Appropriate mitigation measures are discussed in Table 7.1. The flood risk associated with this source may also increase over time due to the effects of climate change.

Flood Risk from Surface Water Flooding

Surface Water Flood Mapping

5.17 The Surface Water Flood Maps (Figure 5.3) show that the site is at a 'very low' risk of surface water flooding from extreme rainfall. The mapping shows that flooding of the railway line to the north of the site, and of Burghley Road to the east of the site, originates from a series of ponds associated with Hampstead Heath located approximately 1.0 km northwest of the site. Flooding on the railway line and Burghley Road is minimal during medium and high chance events, with depths generally remaining below 300 mm, and exceeding 900 mm only during low chance events.

Critical Drainage Area

5.18 The site is located within a Critical Drainage Area which has been assigned due to surface water flooding and the residual risk from reservoir inundation from an extreme pluvial event. The steep gradient causes relatively fast flows down York Rise towards the railway line. It is evident due to local topography that surface water will flow towards high risk areas rather than affecting the site, which as noted above remains unaffected by all modelled extreme rainfall events.

Flood Risk

5.19 Based on the EA surface water flood maps the site is considered to be at a low risk of surface water flooding. Appropriate flood resilient and resistant design as noted in Table 7.1, is proposed for the residual risk of surface water flooding of the site.

Flood Risk from Water Mains

5.20 Thames Water potable water supply assets are included in Appendix A. A potable water main (125 mm in diameter) supplies Ingestre Road immediately north of the site. A water hydrant is located on the northern boundary of the site on Ingestre Road.

5.21 Flood risk from this source is considered to be a residual risk with the main threat being from internal pipe work during any building works. Flooding from this source poses a residual risk to the proposed development.

Flood History

5.22 A review of the SFRA and PFRA have no records of any historic flood events, from all sources, impacting the site.

5.23 Mapping within Camden's SFRA shows Ingestre Road to have been affected by flooded in 2002, however, it is unclear if the site was affected during this event. Given the fact the site is not shown to lie within any surface water flood zones it is anticipated that if this flooding did impact the site it was very localised and of minimal depths.

Flood Risk Summary

5.24 In summary, the risk of flooding from all sources is generally considered to be low, however, a number of mitigation measures are recommended to address and manage the residual risk from these forms of flooding in Table 7.1.

6.0 DRAINAGE STRATEGY

Requirements for Drainage

6.1 The NPPF states that flood risk should not be increased elsewhere by the development, therefore, adequate drainage from the proposed new buildings should be provided. In accordance with best practice, all events up to and including the 30 year event will be kept below ground, whilst making a 30% inclusion for climate change. Further to this the 1 in 100 year event (with a 40% inclusion for climate change in line with national guidance) should be kept on the site with no flooding of buildings.

6.2 Best practice requires that where feasible site drainage should utilise sustainable drainage techniques (SUDS). In accordance with the SUDS hierarchy, infiltration forms of SUDS (permeable paving, soakaways, swales) should be used where viable, followed by attenuation systems (ponds/belowground storage) with traditional discharge to surface water sewers and then combined sewers being a last resort.

6.3 Camden Council require that developments meet the requirements of The London Plan. The London Plan Sustainable Design and Construction Supplementary Planning Guidance (Mayor of London, 2014) states that equivalent site greenfield runoff rates should be targeted where possible and where they are not proposed a full justification as to why they cannot be achieved should be provided with runoff rates reduced as low as possible. In such instances a 50% reduction in existing runoff rates should be achieved as an absolute minimum.

6.4 This remains relevant within Policy SI13 of the Draft New London Plan (Mayor of London, 2017).

Potential for Infiltration Systems

6.5 The underlying bedrock geology, London Clay Formation, is impermeable and thus there is not the potential for infiltration systems on site. This is compounded by the fact that there are no available places to position soakaways 5.0 m from buildings and adoptable roads, as per Building Regulations standards.

Existing Surface Water Drainage

6.6 Existing brownfield flows for the site (which is currently 94% impermeable) are summarised in Table 6.1 with calculations shown in Appendix D.

Rainfall Event	Existing Brownfield Flow Rate (l/s)
1 year (15 minute)	26.06
30 year (15 minute)	63.89
100 year (15 minute)	82.38

Table 6.1: Brownfield Runoff Rates from the Site for Various Rainfall Events

6.7 Existing greenfield flows for the permeable area of the site (currently 6% permeable) are summarised in Table 6.2 with calculations shown in Appendix E.

Rainfall Event	Greenfield Runoff Rate (l/s)
Q1 year	0.05
Q30 year	0.1
Q100 year	0.2

Table 6.2: Greenfield Runoff Rates from the Site for Various Rainfall Events

Proposed Surface Water Drainage

Proposed Greenfield Runoff Rates

6.8 Estimated greenfield runoff rates (based on the proposed impermeable area) are summarised in Table 6.3 with calculations shown in Appendix F.

Rainfall Event	Greenfield Runoff Rate (l/s)
Q1 year	0.8
Q30 year	2.0
Q100 year	2.9

Table 6.3: Greenfield Runoff Rates from the Site for Various Rainfall Events – Based on Proposed Development Area

Proposed Surface Water Drainage Strategy

6.9 In order to retain as much surface water on site as possible the following SUDS measures will be incorporated into the scheme:

- Approximately 549.0 m^2 of blue roofs, attenuating rainfall from the entire roof area (approximately 904.0 m^2);
- A total of 141.0 m^2 of geo cellular attenuation across the site providing approximately 53.0 m^3 of storage, comprised of:
  - 85.0 m^2 of geo cellular attenuation to the rear of the site, 400 mm in depth with 800 mm cover to provide 32.0 m^3 of storage;
  - 56.0 m^2 of geo cellular attenuation at the front of the site, 400 mm in depth with 800 mm cover to provide 21.0 m^3 of storage.

6.10 It is proposed to restrict runoff rates from the blue roof to 2.5 l/s through introduction of an appropriate flow control device, to be designed by the relevant manufacturer (most likely as a syphonic drainage feature).

6.11 Given the space restrictions on site the geo cellular attenuation will be split across two locations (Figure 6.1). A tank, measuring approximately 85.0 m^2 (34.0 m x 2.5 m) will be located at the rear of the development below the landscaped courtyards. The tank will be

400mm in thickness, with 800 mm cover, providing approximately 32.0 m^3 of storage. The tank at the rear of the development will drain approximately 560.0 m^3 of impermeable site area. A tank approximately 56.0 m^2 (L shaped measuring 23.0 m x 3.0 m at the maximum points) will be located at the front of the development, adjacent to Ingestre Road. The tank will be 400mm in depth, with 800 mm cover, providing approximately 32.0 m^3 of storage. The tank at the front of the development will drain approximately 373.0 m^3 of impermeable site area. The roots of the trees adjacent to the tanks will require capping to ensure they do not interfere with the geo cellular storage structures.

6.12 Micro Drainage calculations for these two attenuation tanks are include in Appendices G and H.

6.13 It is proposed to restrict run off from the geo cellular storage tank at the front of the site to 2.5 l/s, and from the geo cellular storage tank at the front of the site to 3.5 l/s through introduction of appropriate flow control devices (hydro brakes or similar).

6.14 Combined with the outflow from the blue roof at 2.5 l/s the overall surface water runoff rate from the site will be restricted to 8.5 l/s. Although the greenfield run off rate for the 1 in 1 year event is below 1.0 l/s (as shown in Table 6.2) the attenuation will be restricted to 8.5 l/s, providing approximately a 67 % betterment on the current 1 in 1 year rate (26.06 l/s), due to space constraints on site.

6.15 Based on the above proposals surface water on site will be attenuated before being released via the existing connection to the Thames Water Combined Sewers. The blue roof and attenuation tank to the rear of the site will connect to the Thames Water Sewers in Hambrook Court. The attenuation tank at the front of the site will connect to the combined sewer beneath Ingestre Road via an assumed existing connection. A CCTV survey will be carried out at the detailed design stage to determine fully the existing points of connection to be reused as part of the development and to confirm any necessary diversions to existing private drainage.

6.16 Impermeable areas and greenfield calculations inputted into Micro Drainage have been calculated from the site boundary shown in Figure 3.1.

6.17 A summary of the potential SUDS options which led to the above drainage strategy is included in Table 6.4.

SUDS Option	Suitability/Included in the Scheme?	Comments
Soakaways	X	Not suitable for use given the underlying geology and space constraints of the site.
Porous paving (storage)	X	Not suitable for use given the constraints of the site.

SUDS Option	Suitability/Included in the Scheme?	Comments
Rainwater Harvesting	*	Not included in the client and architect design proposals at present.
Swales	X	Not suitable for use given the constraints of the site.
Attenuation Ponds (above ground storage)	X	Not suitable for use given the constraints of the site.
Below ground storage in cellular systems	✓	Attenuation tanks providing 53.0 m^3 of storage are included within the scheme.
Green Roofs/Brown Roofs/Blue Roofs	✓	549.0 m^2 of blue roof is included in the scheme.

Table 6.4: SUDS Options

Key:

✓ *Suitable for use and included in the scheme*

* *Possibly suitable for use – not included in the client and architect design proposal at present – should be considered further as part of the detailed design*

X Unlikely to be suitable for use

6.18 In summary, SuDS measures have been implemented where possible within the bounds of the scheme. Overall there will be a significant reduction in peak runoff rates achieved compared to the existing scenario. Runoff rates from the site will be restricted to 8.5 l/s (approximately a 67% betterment on the current rate based on the 1 in 1 year event) through the introduction of appropriate flow control devices (hydro brakes or similar).

6.19 It is to be noted that the proposed drainage strategy will reduce the runoff from the site to greater than a 50 % betterment in line with the London Plan, reducing the risk of surface water flooding in areas surrounding the site. Significant restrictions on space on site, including provision of trees to be placed along the site frontage to enhance the public realm, means that achieving greenfield runoff rates is not feasible.

Outline Surface Water Drainage Maintenance Schedule

6.20 The following maintenance schedule for the proposed SUDS should be adhered to in order to ensure efficient operation and to prevent failure.

Drainage Feature	Maintenance	Maintenance Period
Manholes	Check free from silt and debris and water discharging freely through. Jet/clear out as necessary.	Every 6 months As required
Drainage Pipework	CCTV inspection/condition survey Sewer jetting	Every 5 years Every 2 years
Geo-cellular Storage	Inspection of silt traps, manholes, pipework, pre-treatment devices, and inlets Removal of unwanted sediment /debris (if required)	Monthly for the first year then every 6 months thereafter As required
Blue Roof	Check free from silt and debris and water discharging freely through. Remove any debris from roof ensuring it is not simply flushed down rainwater pipes. Inspect the waterproofing system visible at all upstands, to ensure it is firmly adhered to the detail this it is waterproofing. Cut back tree limbs that overhang the roof to give a 1.0 m clearance outside the roof edge in order to significantly reduce the blockage of fallen leaves. Ensure that all rainwater pipes are free from blockages and that water flows freely through them.	Every 6 months As required Every 6 months Every 6 months Every 6 months

Table 6.5: SuDS Maintenance Schedule

Proposed Foul Water Drainage Strategy

6.21 Foul water flows from the site will be designed to drain to both the combined sewer located on Ingestre Road at the front of the site and to the combined sewer within Hambrook Court to the rear of the site primarily via gravity. Due to a lack of sewer invert levels, ground levels from the topographic survey and cover levels have been used to inform drainage design. However appropriate drainage surveys will be required at the detailed design stage to ensure the proposed strategy is suitable.

6.22 Given that the proposals include a gym and associated changing facilities, and a laundry room, in the basement a pumped connection will be required to discharge the remainder of the foul water flows from the basement.

6.23 Foul water flows from the site will increase with peak flows anticipated to be approximately 6.28 l/s, compared to the existing scenario of 1.38 l/s, a net foul water increase to the system of 4.90 l/s.

6.24 A Thames Water Pre Development Enquiry (Appendix B) confirms there is sufficient capacity in the sewer network to accommodate this increase.

Drainage Assessment

6.25 Calculations included with this report have been carried out so that following development, the critical 1 in 100 year event is kept below ground with no above ground flooding, whilst making a 40% inclusion for climate change.

6.26 There will be a net foul water increase to the Thames Water sewer system of 4.90 l/s.

6.27 A Thames Water Pre Development Enquiry (Appendix B) confirms that there is sufficient capacity in the public sewer network for the foul water flows from the new development. After detailing the constraints of the site and the proposed SUDS Thames Water agreed 9.0 l/s as an appropriate discharge rate for surface water (Appendix C). Given that the run off rate has been reduced to 8.5 l/s it has been confirmed by Thames Water that there is enough capacity in the sewer for discharge from the site.

6.28 All new on site drainage will be separated until the point of connection to the public sewer in order to meet Thames Water requirements. To inform the detailed design of the drainage, a drainage survey will be carried out (with CCTV if necessary) to determine if there are any existing points of connection that can be reused as part of the development and to confirm any necessary diversions to any existing private drainage crossing the site.

6.29 Regular inspection and maintenance of highway drainage, public and private drainage by Camden Council, Thames Water, and site management respectively, will minimise the residual risks associated with surface water/sewers.

7.0 MITIGATION MEASURES

7.1 Table 7.1 sets out appropriate mitigation measures to minimise the identified flood risks.

Type of Flooding	Issue	Mitigation Measures	Justification	Residual Risk *
Flooding from surface and foul water – sewer blockage/surcharging and intense rainfall	Blockages or surcharges in the site drainage or the public sewer network in the site vicinity may result in flooding of the site.	• Routine inspection and maintenance of the site and public drainage systems by the site owner and Thames Water. • Monitor flood risk throughout the life of the development in order to confirm the risk posed to the scheme over time. • A drainage survey should be undertaken to confirm the route and condition of any existing site drainage (if necessary) to inform the need for any upgrades to the network and diversion of any existing assets. • The detailed design should confirm if necessary that the drainage (below ground) serving the site is appropriately sized and any necessary upgrades to the current drainage is undertaken and agreed with Thames Water and building control as necessary.	These measures will ensure flood risk from these sources is minimised.	Low
Flooding from water mains (internal water supply system)	Flooding of the water supply and distribution system may result in flooding of the building.	• Routine inspection of the site and public water supply and distribution system by the site owner and Thames Water.	Will ensure the risk of flooding is minimised.	Low
Flooding from water mains (external water supply system)	Flooding may result if the customer supply main, on the northern site border on Ingestre Road, is damaged	• Ensure there is no damage to the customer supply main during construction. • Design and construction of water supply systems to current best practice standards. • Routine inspection and maintenance of assets by Thames Water.	Will ensure the risk of flooding is minimised.	Low
Artificial Water Bodies	Breach of reservoir embankments and overland flow in the unlikely event of a failure. Flooding from this source is considered to pose residual risk to the proposed development.	• Consider as part of a basic flood warning and evacuation plan. • External areas will be profiled so as any runoff will be directed away from the building and into the roads. • Floor levels/thresholds of the proposed buildings will be raised as high as reasonably practicable	These measures will ensure flood risk from these sources is minimised.	Low
Flooding from Surface Water	EA mapping indicates that the site is at ‘very low’ risk of flooding as a result of extreme rainfall and runoff from overland flow. Residual risks remain associated with events in excess of those modelled/the drainage system design capacity.	• External areas will be profiled so as any runoff will be directed away from the building and into the roads. • Floor levels/thresholds of the proposed buildings will be raised as high as reasonably practicable. • Inclusion of sustainable drainage to ensure attenuation is provided to ensure the site or surrounding area does not flood during the 100 year plus 40% climate change event.	Will ensure the consequences of any flooding is minimised.	Low
Flooding from perched groundwater	Perched groundwater may be present, given the scheme will include a basement.	• Incorporate appropriate waterproofing into substructure design and any below ground services; • Consider the need for dewatering during construction as part of the detailed design.	Will ensure the risk of flooding is minimised.	Low

Table 7.1: Mitigation Measures

*Following adoption of the mitigation measures

8.0 RESIDUAL FLOOD RISKS AND IMPACTS TO SURROUNDING AREAS

Residual Risks

8.1 A number of residual risks have been identified, associated with failure of reservoirs, public sewers, site drainage and water supply pipes, groundwater and intense rainfall.

8.2 As long as reservoir embankments, public sewer networks and the site drainage/water supply infrastructure are regularly inspected and maintained by the EA, Thames Water and site management respectively then the residual risk will be minimised.

Impact to Flood Risk of Surrounding Areas

8.3 Given the low flood risk present on site and the drainage improvements proposed, it is considered that the development of the site will not increase the risk of flooding in other areas, surrounding the site.

9.0 CONCLUSIONS AND RECOMMENDATIONS

9.1 Based on our understanding of the site setting and the development proposals, it is considered that the risk of flooding from all sources is generally low. The mitigation measures provided in Table 7.1 should be adhered to in order to ensure the risk of flooding posed to the site remains low, without significantly increasing the risk of flooding elsewhere.

9.2 We recommend that the assessment of residual risks of flooding should be reviewed by site owners as new flood risk information becomes available, and the flood risk associated with adjacent sewers may also increase over time in the area due to climate change.

9.3 SUDS measures have been implemented where possible within the bounds of the scheme. Overall there will be a significant reduction in peak runoff rates achieved compared to the existing scenario. Runoff rates from the site will be restricted to 8.5 l/s (approximately a 67% betterment over the existing 1 in 1 year event) through the introduction of appropriate flow control devices (hydro brakes or similar).

9.4 SUDS measures will include 549.0 m^2 of blue roofs along with a total of 141.0 m^2 of geo cellular attenuation providing approximately 53.0 m^3 of storage split across two cellular storage tanks on site.

9.5 After detailing the constraints of the site and the proposed SUDS Thames Water agreed 9.0 l/s as an appropriate discharge rate for surface water (Appendix C). Given that the run off rate has been reduced to 8.5 l/s it has been confirmed by Thames Water that there is enough capacity in the sewer for discharge from the site.

9.6 Surface water flows from the site will be designed to drain to both the combined sewer located on Ingestre Road at the front of the site and to the combined sewer within Hambrook Court to the rear of the site. Due to a lack of sewer invert levels ground levels from the topographic survey and standard cover levels have been used to inform drainage design. However appropriate drainage surveys will be required at the detailed design stage to ensure the proposed strategy is suitable. Should sewer invert levels not be as assumed, a pumped connection may be required.

9.7 Foul water flows from the site will increase with peak flows anticipated to be approximately 6.28 l/s, compared to the existing scenario of 1.38 l/s, a net foul water increase to the system of 4.90 l/s. A Thames Water Pre Development Enquiry (Appendix B) confirms there is sufficient capacity in the sewer network to accommodate this increase.

9.8 All new on site drainage will be separated until the point of connection to the public sewer in order to meet Thames Water requirements. To inform the detailed design of the drainage, a drainage survey will be carried out (with CCTV if necessary) to determine if there are any existing points of connection that can be reused as part of the development and to confirm any necessary diversions to any existing private drainage crossing the site.

9.9 Regular inspection and maintenance of highway drainage, public and private drainage by Camden Council, Thames Water, and site management respectively, will minimise the residual risks associated with surface water/sewers.

10.0 REFERENCES

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vi. London Borough of Camden. (2010). *London Borough of Camden Local Development Framework*. Camden Council.

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viii. London Borough of Camden. (2017). *Camden Local Plan*. Camden Council.

ix. Mouchel. (2008). *Strategic Flood Risk Assessment for North London*.

x. Mayor of London. (2014). *London Plan Sustainable Design and Construction Supplementary Planning Guidance*. Mayor of London.

xi. Mayor of London. (2016). London Sustainable Drainage Action Plan.

xii. Mayor of London. (2017). The Draft New London Plan.

11.0 DISCLAIMER

11.1 The copyright of this report is vested in Create Consulting Engineers Ltd and the Client, Four Quarters (Ingestre Road) Ltd. The Client, or his appointed representatives, may copy the report for purposes in connection with the development described herein. It shall not be copied by any other party or used for any other purposes without the written consent of Create Consulting Engineers Ltd or the Client.

11.2 Create Consulting Engineers Ltd accepts no responsibility whatsoever to other parties to whom this report, or any part thereof, is made known. Any such other parties rely upon the report at their own risk.

11.3 The flood risk assessment addresses the flood risk posed to and from the proposed development, the extent of which is shown by the site boundary, as indicated by the location plan attached with this report.

11.4 This report has been undertaken with the assumption that the site will be developed in accordance with the above proposals without significant change. The conclusions resulting from this study are not necessarily indicative of future conditions or operating practices at or adjacent to the site.

11.5 Create Consulting Engineers Ltd has endeavoured to assess all information provided to them during this appraisal. The report summarises information from a number of external sources and cannot offer any guarantees or warranties for the completeness or accuracy or information relied upon. Information from third parties has not been verified by Create Consulting Engineers Ltd unless otherwise stated in this report.

FIGURES

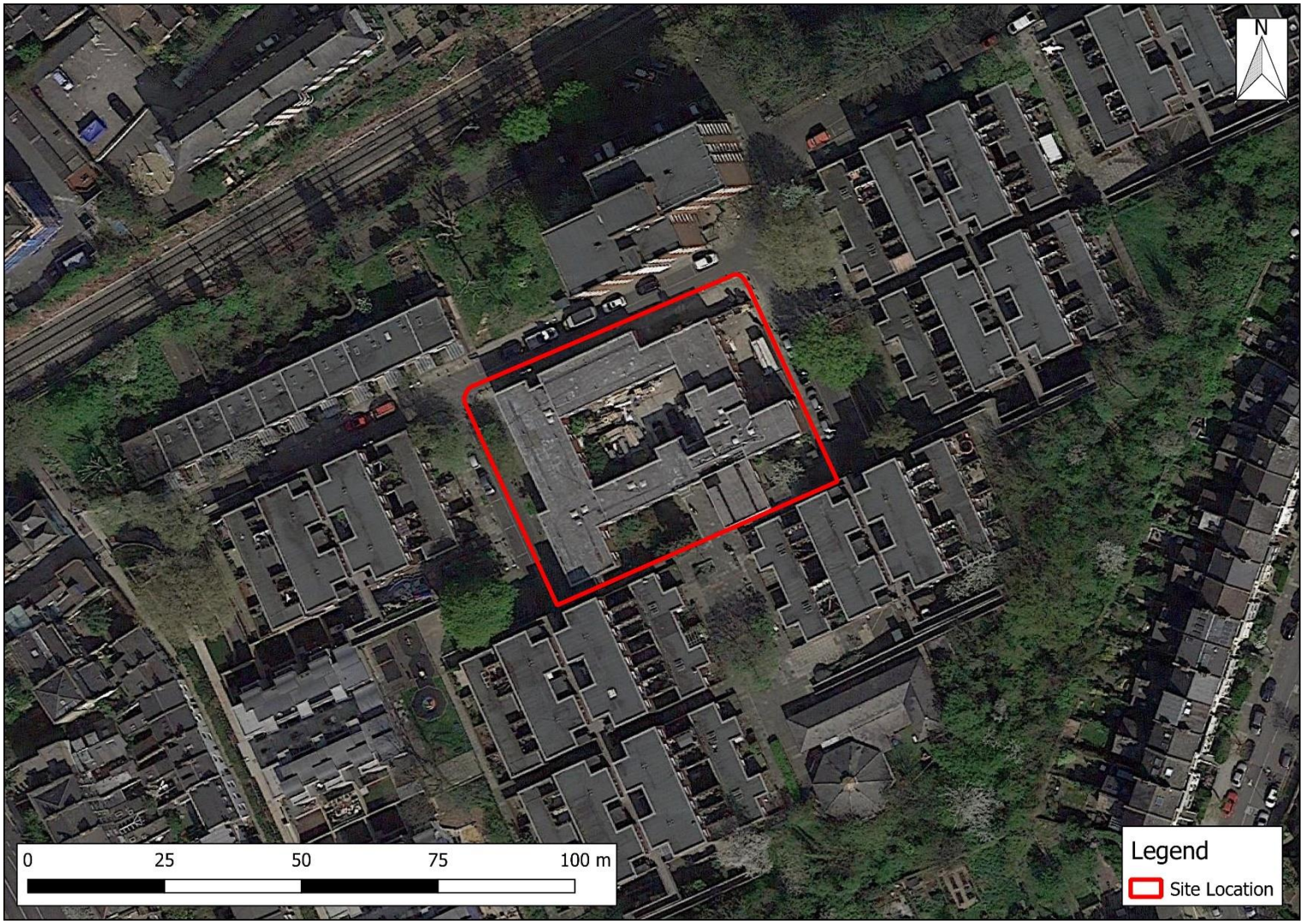


Figure 3.1: Site Location and Boundary Plan

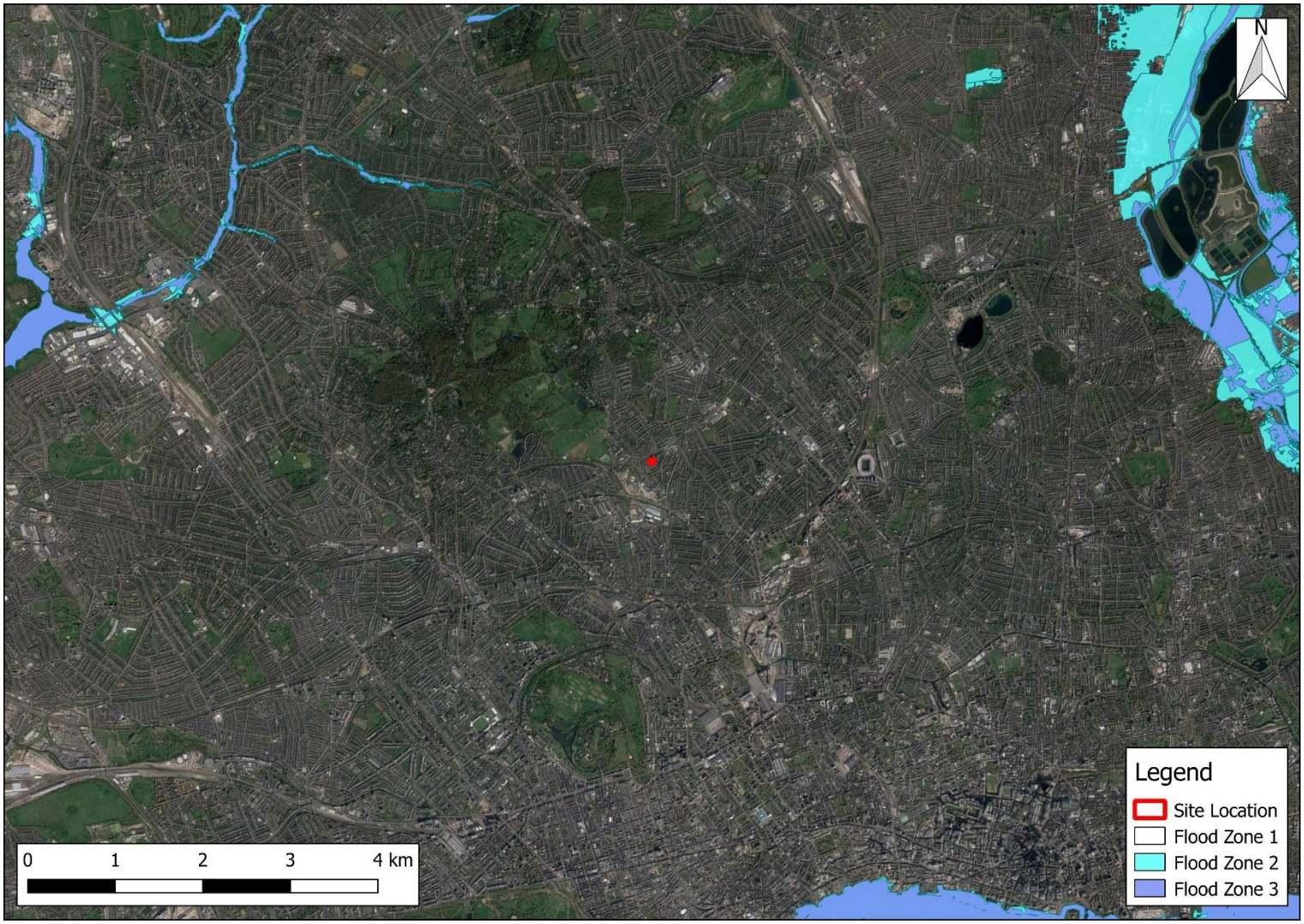


Figure 5.1: Risk of Flooding from Fluvial / Tidal Sources

Source: WMS Layer (www.data.gov.uk)

Figure 5.2: Risk of Flooding from Reservoirs

Source: WMS Layer (www.data.gov.uk)

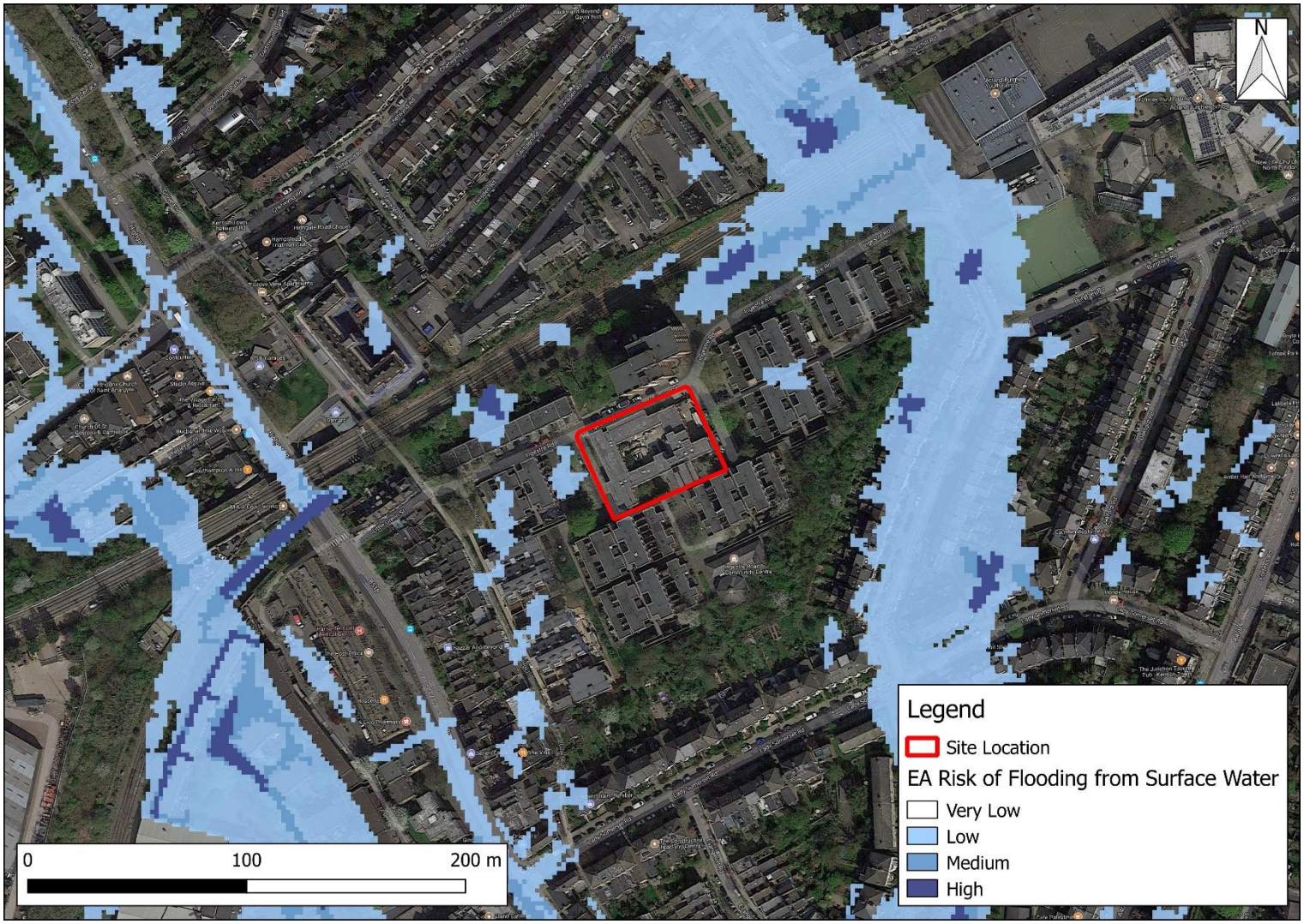


Figure 5.3: Environment Agency Risk of Flooding from Surface Water

Source: WMS Layer (www.data.gov.uk)

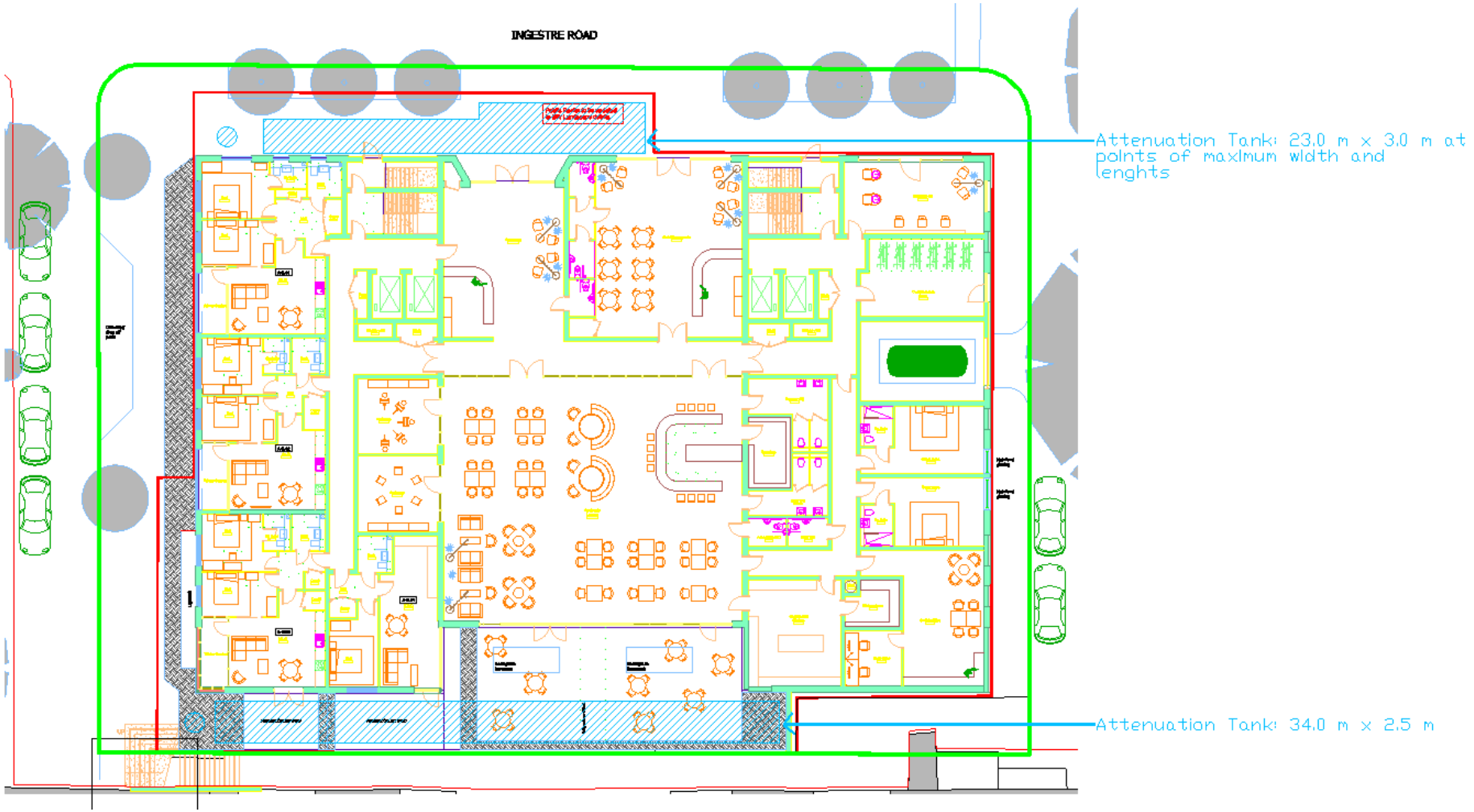


Figure 6.1: Location of Geocellular Attenuation Tanks

APPENDICES

APPENDIX A

Asset location search

Property Searches

Create Consulting Engineers Ltd
15Princes Street
NORWICH
NR3 1AF

Search address supplied Ingestre Road
London
NW5 1UX

Your reference P17-1282

Our reference ALS/ALS Standard/2017_3612612

Search date 17 July 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

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

Asset location search

Search address supplied: Ingestre Road, London, NW5 1UX

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 search provides 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.

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 0 800 316 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

Property Searches

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

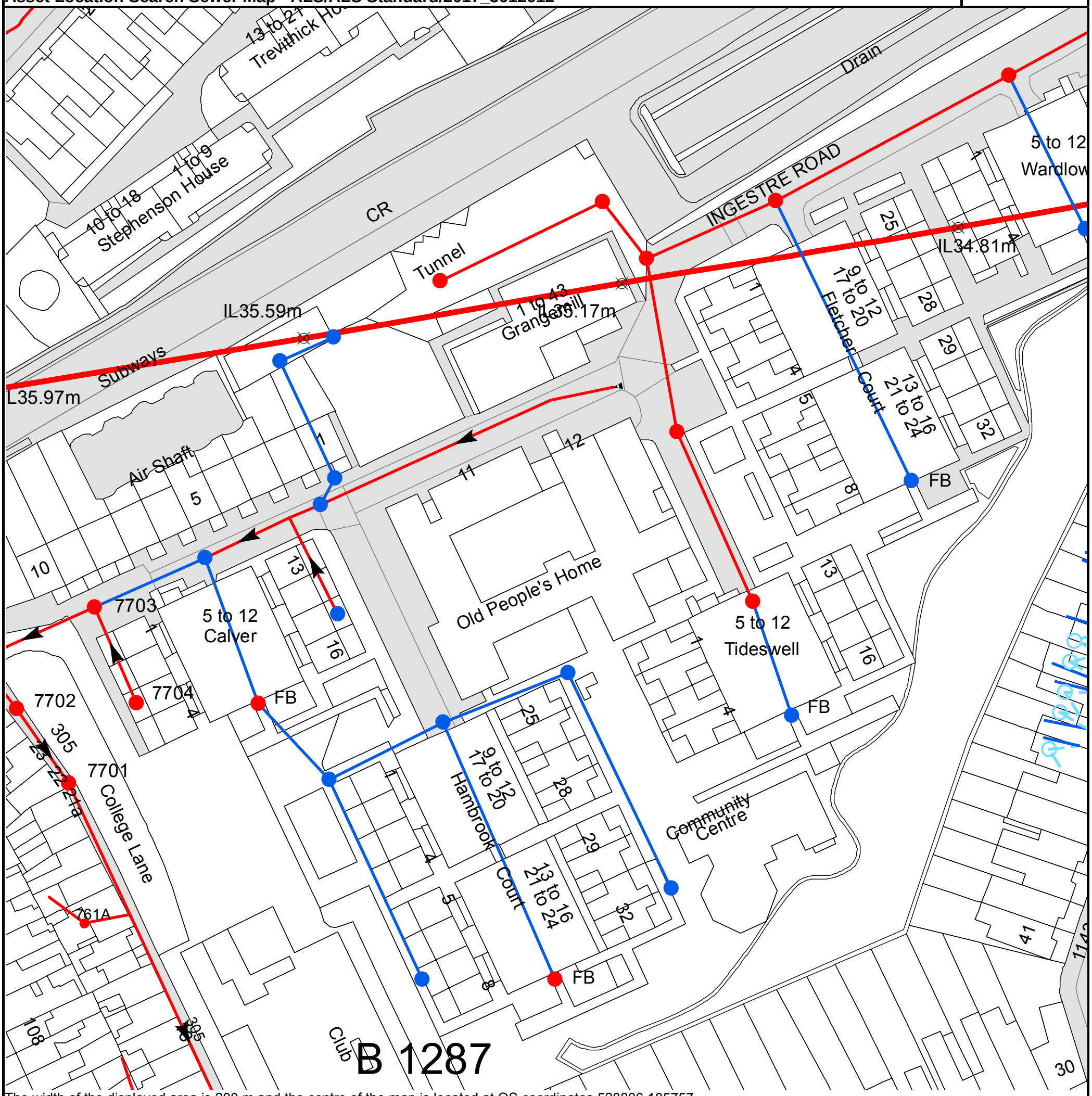
Clean Water queries

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_3612612



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 528806,185757

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
87AB	n/a	n/a
86AD	n/a	n/a
87AC	n/a	n/a
87AD	n/a	n/a
87AE	n/a	n/a
87AF	n/a	n/a
87AI	n/a	n/a
87BA	n/a	n/a
97BH	n/a	n/a
97CB	n/a	n/a
97CE	n/a	n/a
76AC	n/a	n/a
8602	n/a	n/a
761A	n/a	n/a
7701	41.71	40.61
77AJ	n/a	n/a
77BD	n/a	n/a
7702	42.33	41.25
7706	n/a	n/a
7704	n/a	n/a
77BC	n/a	n/a
7703	n/a	n/a
77AF	n/a	n/a
77AI	n/a	n/a
77BA	n/a	n/a
77AH	n/a	n/a
77BB	n/a	n/a
78AB	n/a	n/a
88AB	n/a	n/a
88AC	n/a	n/a
8803	n/a	n/a
88AE	n/a	n/a
98AB	n/a	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.

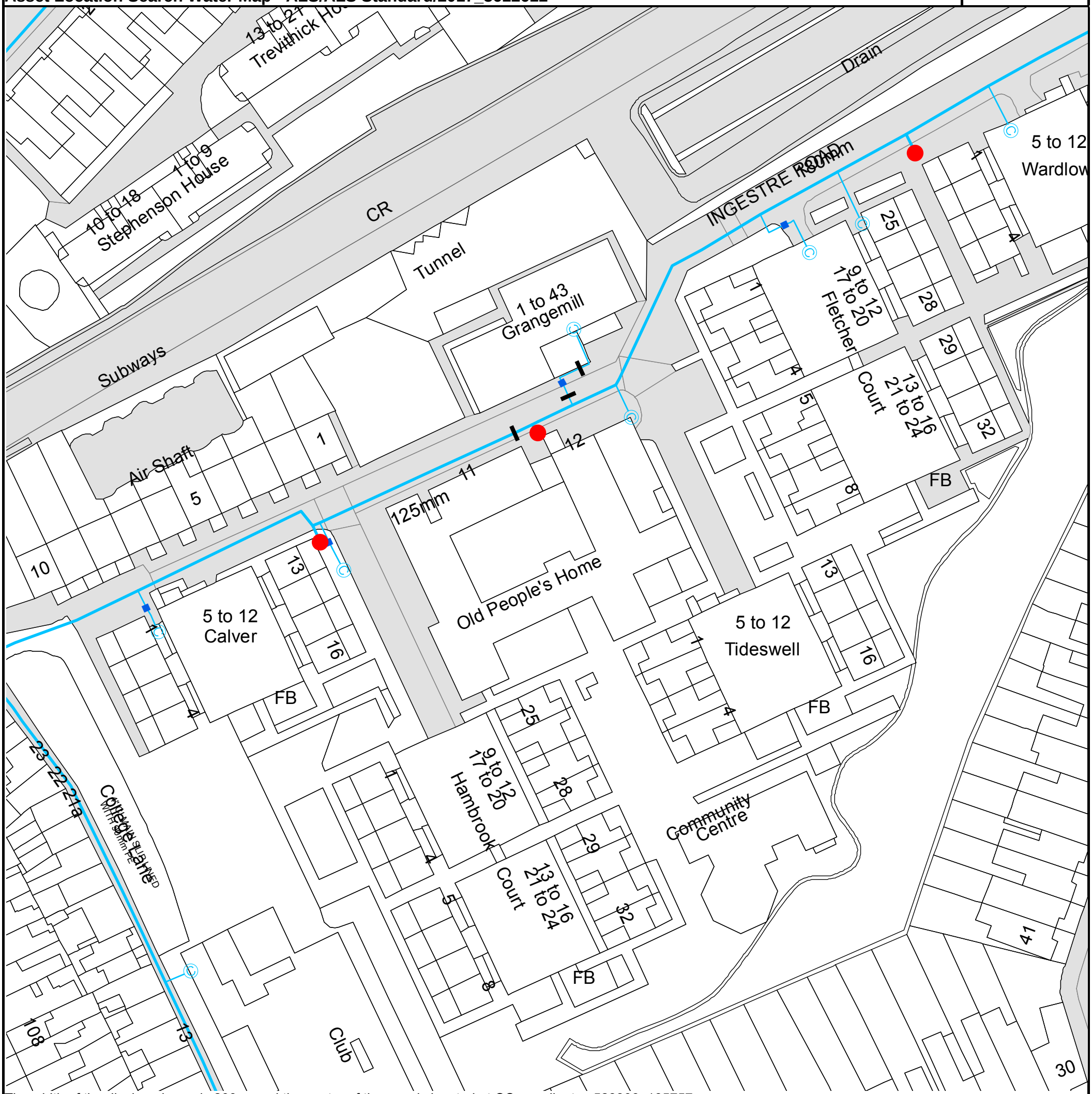
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.

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_3612612



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 528806, 185757.

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.

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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

Sewer Flooding History Enquiry

Property Searches

Create Consulting Engineers Ltd

Princes Street

Search address supplied Ingestre Road
London
NW5 1UX

Your reference P 17-1282

Our reference S FH/SFH Standard/2017_3612613

Received date **17 July 2017**

Search date **17 July 2017**

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

Sewer Flooding
History Enquiry

Property Searches

Search address supplied: Ingestre Road,London,NW5 1UX

This search is recommended to check for any sewer flooding in a specific address or area

TWUL, trading as Property Searches, are responsible in respect of the following:-

(i) any negligent or incorrect entry in the records searched;

(ii) any negligent or incorrect interpretation of the records searched;

(iii) and any negligent or incorrect recording of that interpretation in the search report

(iv) compensation payments

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

Sewer Flooding
History Enquiry

Property Searches

History of Sewer Flooding

Is the requested address or area at risk of flooding due to overloaded public sewers?

The flooding records held by Thames Water indicate that there have been no incidents of flooding in the requested area as a result of surcharging public sewers.

For your guidance:

- A sewer is "overloaded" when the flow from a storm is unable to pass through it due to a permanent problem (e.g. flat gradient, small diameter). Flooding as a result of temporary problems such as blockages, siltation, collapses and equipment or operational failures are excluded.
- "Internal flooding" from public sewers is defined as flooding, which enters a building or passes below a suspended floor. For reporting purposes, buildings are restricted to those normally occupied and used for residential, public, commercial, business or industrial purposes.
- "At Risk" properties are those that the water company is required to include in the Regulatory Register that is presented annually to the Director General of Water Services. These are defined as properties that have suffered, or are likely to suffer, internal flooding from public foul, combined or surface water sewers due to overloading of the sewerage system more frequently than the relevant reference period (either once or twice in ten years) as determined by the Company's reporting procedure.
- Flooding as a result of storm events proven to be exceptional and beyond the reference period of one in ten years are not included on the At Risk Register.
- Properties may be at risk of flooding but not included on the Register where flooding incidents have not been reported to the Company.
- Public Sewers are defined as those for which the Company holds statutory responsibility under the Water Industry Act 1991.
- It should be noted that flooding can occur from private sewers and drains which are not the responsibility of the Company. This report excludes flooding from private sewers and drains and the Company makes no comment upon this matter.
- For further information please contact Thames Water on Tel: 0800 316 9800 or website www.thameswater.co.uk

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

APPENDIX B

Miss Jessica Jordan
Create Consulting Engineers
15 Princes Street
Norwich
NR3 1AF

Your account number
DS6043232

Developer.services@thameswater.co.uk

0800 009 3921

Mon – Fri 9am-5pm,

05/01/2018

Pre Development Enquiry

Site Address: Ingestre Road, London, NW5 1UX, OS grid ref. 528689, 185814.

Proposed Development: Redevelopment of the existing care home to increase max capacity to 70 beds. Foul Water to be discharged by gravity to combined sewer in Ingestre Rd. Surface Water to be attenuated and discharged by gravity into combined sewer in Ingestre Road at 21l/s. Exist run-off for 1:1 21.19l/s, 1:30 51.95l/s, 1:100 66.99l/s.

Dear Miss Jordan,

I write in relation to the Pre-Development application submitted, we have completed the assessment of the foul water flows and surface water run-off based on the information submitted in your application with the purpose of assessing sewer capacity within the existing Thames Water sewer network.

Foul Water

From the information you have provided, we can confirm that the existing combined sewer network does have sufficient capacity to accommodate the proposed foul water discharge from the proposed development.

Surface Water

Please note that discharging surface water to the public sewer network should only be considered after all other methods of disposal have been investigated and proven to not be viable. In accordance with the Building Act 2000 Clause H3.3, positive connection to a public sewer will only be consented when it can be demonstrated that the hierarchy of disposal methods have been examined and proven to be impracticable. The disposal hierarchy being: 1st Soakaways; 2nd Watercourses; 3rd Sewers.

Only when it can be proven that soakage into the ground or a connection into the adjacent watercourse is not possible would we consider a restricted discharge into the public surface water sewer network.

We would encourage techniques such as green roofs and/or permeable paving that restricts surface water discharge from your site.

When redeveloping an existing site, policy 5.13 of the London Plan and Policy 3.4 of the Supplementary Planning Guidance (Sustainable Design And Construction) states that every attempt should be made to use flow attenuation and SUDS/storage to reduce the surface water discharge from the site as much as possible.

If they are consulted as part of any planning application, Thames Water Planning team would ask to see why it is not practicable to attenuate the flows to Greenfield run-off rates i.e. 5l/s/hectare of the total site area or if the site is less than hectare in size then the flows should be reduced by 95% of existing flows. Should the policy above be followed, we would envisage no capacity concerns with regards to surface water for this site.

Please note that the Local Planning authority may comment on surface water discharge under the planning process.

Please Note

All connection requests are subject to a full Section 106 (Water Industry Act 1991) application before the Company can confirm approval to the connection itself. Please also note that capacity in the public sewerage system cannot be reserved.

Note on trunk sewers: Connecting directly to Trunk sewers can be complex and dangerous, which means we often refuse permission. In this case, you will need to find an alternative sewer or method of discharge. Please contact the Sewer Connections team through our Helpdesk on 0800 009 39 21 for further information.

If Thames Water permits a connection to the trunk sewer, we will insist on carrying out the connection ourselves under Section 107 of the Water Industry Act. We would advise for you to apply as soon as possible.

The discharge of non-domestic effluent is not permitted until a valid trade effluent consent has been issued by Thames Water. If anything other than domestic sewage is discharged into the public sewers without the above agreement an offence is committed and the applicant will be liable to the penalties contained in Section 109(1) (WIA 1991).

Applicants should contact Trade Effluent prior to seeking a connection approval, to discuss trade effluent consent and conditions of discharge. A Trade Effluent reference number should be obtained and included in the relevant box of the attached application form. The address for Trade Effluent is - Thames Water Utilities Limited, Waste Water Quality, Crossness Sewage Treatment Works, Belvedere Road, Abbeywood, London. SE2 9AQ. Alternatively you can telephone them on 020 8507 4321.

The views expressed by Thames Water in this letter are in response to this pre development enquiry at this time and do not represent our final views on any future planning applications made in relation to this site.

Yours sincerely,

Artur Jaroma
Developer Services

APPENDIX C

Claire Seymour

From: Artur Jaroma <artur.jaroma@thameswater.co.uk>
Sent: 07 June 2018 10:20
To: Elen Wyatt
Subject: RE: RE: IRef:1015998222 RE: Ingestre Road Pre Development Enquiry DS6043232

Dear Elen

Apologies for a late response.

Unfortunately, Thames Water would not support revised sw discharge rate.
Planning Team are happy to accept the risk with the previously quoted total surface water discharge rate of 9l/s.
You will have to liaise with your Local Planning Authority to discuss your drainage strategy and receive their acceptance.
Please note, Thame Water will be prepared to accept the agreed concept for surface water discharges, and if necessary undertake any preventing measures against hydraulic incapacity in the existing sewer network.

Kind Regards

Artur Jaroma
Developer Services – Sewer Adoptions Engineer
Office: 0203 577 8082
artur.jaroma@thameswater.co.uk

Clearwater Court, Vastern Road, Reading, RG1 8DB
Find us online at developers.thameswater.co.uk

From: Elen Wyatt [mailto:Elen.Wyatt@createconsultingengineers.co.uk]
Sent: 05 June 2018 10:29
To: Artur Jaroma
Subject: RE: RE: IRef:1015998222 RE: Ingestre Road Pre Development Enquiry DS6043232

Hi Artur,

In regard to below emails re. Ingestre Road I was wondering when we can please expect to receive a reply?

Many thanks,

Elen Wyatt
Flood Risk Consultant
Create Consulting Engineers Ltd

From: DEVELOPER.SERVICES@THAMESWATER.CO.U [mailto:DEVELOPER.SERVICES@THAMESWATER.CO.UK]
Sent: 31 May 2018 17:03

To: Elen Wyatt
Subject: RE: RE: IRef:1015998222 RE: Ingestre Road Pre Development Enquiry DS6043232

Elen

I'm yet to receive a feedback from our planning team. I have just informed them of the new proposed rate. They potentially may want to contact local authority, to understand whether they would support this based on the flooding history in the vicinity.

I'll forward you the response shorty after receiving the comments.

Many thanks

Artur Jaroma
Developer Services – Sewer Adoptions Engineer
Office: 0203 577 8082
artur.jaroma@thameswater.co.uk

Clearwater Court, Vastern Road, Reading, RG1 8DB
Find us online at developers.thameswater.co.uk

Original Text

From: Elen Wyatt <Elen.Wyatt@createconsultingengineers.co.uk>
To: 'DEVELOPER.SERVICES@THAMESWATER.CO. <DEVELOPER.SERVICES@THAMESWATER.CO.UK>
CC:
Sent: 29.05.18 11:56:06
Subject: RE: IRef:1015998222 RE: Ingestre Road Pre Development Enquiry DS6043232

Dear Arthur,

Since my previous email dated 23rd May we have received updated plans for the site at Ingestre Road and have thus had to update our drainage strategy.

A blue roof is still included in the scheme, releasing at a rate of 2.5 l/s. Changes to the basement plan, and previously discussed constraints of the site means the minimum we are able to have the attenuation tank release at is now 11.0 l/s. Given this, the total release rate from the site into the Thames sewer network will be 13.5 l/s.

Although this does not quite provide the 50% betterment requested, it is a significant improvement on the existing scenario. Would you be willing to accept a release rate of 13.5 l/s given this significant improvement and consideration of the drainage hierarchy as requested?

Many thanks,

Elen Wyatt
Flood Risk Consultant
Create Consulting Engineers Ltd

From: Elen Wyatt
Sent: 23 May 2018 15:26
To: 'DEVELOPER.SERVICES@THAMESWATER.CO.U' <DEVELOPER.SERVICES@THAMESWATER.CO.UK>
Subject: RE: IRef:1015998222 RE: Ingestre Road Pre Development Enquiry DS6043232

Dear Artur,

Thank you for raising your concerns. We have revaluated the drainage strategy following these comments.

A blue roof is now included in the scheme, which will release at a rate of 2.5 l/s. Due to the constraints of the site the minimum we are able to have the attenuation tank release at is 6.5 l/s. Given this, the total release rate from the site into the Thames sewer network will be 9.0 l/s.

This provides a 58% betterment on the existing runoff rate of 21.19 l/s. Given this significant improvement, and over a 50% betterment on the existing, would you be willing to accept a release rate of 9.0 l/s?

These calculations are all based on the latest plans. Should these change, and thus the surface water drainage strategy change, we will revaluate and be in touch with our revised proposal.

Many thanks,

Elen Wyatt
Flood Risk Consultant
Create Consulting Engineers Ltd

From: DEVELOPER.SERVICES@THAMESWATER.CO.U [mailto:DEVELOPER.SERVICES@THAMESWATER.CO.UK]
Sent: 16 May 2018 11:59
To: Elen Wyatt <Elen.Wyatt@createconsultingengineers.co.uk>
Subject: IRef:1015998222 RE: Ingestre Road Pre Development Enquiry DS6043232

Elen

Thank you for providing additional information.

Can you explore other sustainable techniques e.g. blue/green roof, rainwater harvesting please?

Due to the existence of the combined sewer only and history of hydraulic flooding in this area, I would like the developer to exhaust all options of the drainage hierarchy.

Kind Regards

Artur Jaroma

Developer Services – Sewer Adoptions Engineer

Office: 0203 577 8082

artur.jaroma@thameswater.co.uk

Clearwater Court, Vastern Road, Reading, RG1 8DB

Find us online at developers.thameswater.co.uk

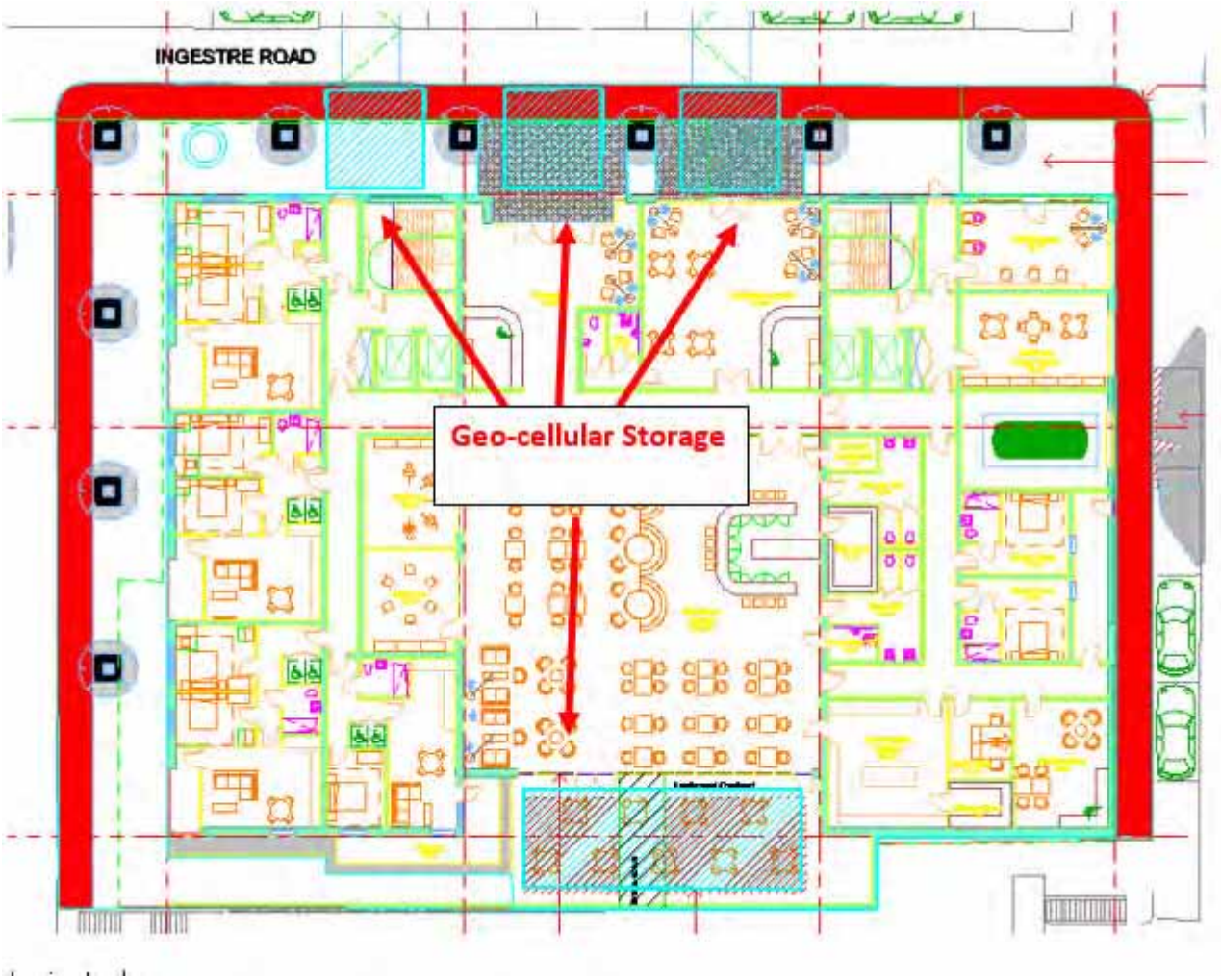
Original Text

From: Elen Wyatt <Elen.Wyatt@createconsultingengineers.co.uk>
To: 'DEVELOPER.SERVICES@THAMESWATER.CO. <DEVELOPER.SERVICES@THAMESWATER.CO.UK>
CC:
Sent: 14.05.18 16:02:48
Subject: Ingestre Road Pre Development Enquiry

Hi Artur,

With regards to the predevelopment enquiry for Ingestre Road (attached) you have stated that the “Thames Water Planning team would ask to see why it is not practicable to attenuate the flows to Greenfield run-off rates”.

Due to the nature of the local area the council have requested that trees are placed along the site. As a result we are very restricted in terms of places we can provide attenuation on the site (see image below). Unfortunately due to the location of existing services along the pavement the only feasible locations for attenuation (without providing a pumped solution below the basement) are shown in the figure below.



Given the constraints on the site would you accept a release rate of 21 l/s?

Many thanks,

Elen Wyatt
Flood Risk Consultant

Create Consulting Engineers Ltd
109-112 Temple Chambers|3-7 Temple Avenue|London|EC4Y 0HP
T 020 7822 2300

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APPENDIX D

Location : **Ingestre Road**

M5-60 : 21 mm

r : 0.425

Wallingford Method - maps

\\cre001-net01\company data\Reference\Technical Library\wallingford

For different durations,

From Table 1

Duration, D	Z1			
15 min	0.65	**M5-15:**	Z1 x M5-60	13.65 mm
30 min	0.82	**M5-30:**	Z1 x M5-60	17.22 mm
60 min	1	**M5-60:**	Z1 x M5-60	21.00 mm
6hr	1.51	**M5-360:**	Z1 x M5-60	31.71 mm

For different return intervals,

From Table 2*

		Z2	
Duration, D	M1	M30	M100
15 min	0.62	1.52	1.96
30 min	0.62	1.53	2.00
60 min	0.64	1.54	2.03
6 hr	0.68	1.51	1.97

Average point intensity, API = I/(D/60)

	D min	Calculation	I mm	API mm/hr
M 1-15	15	M5-15*Z2(M1)	8.46	33.85
M 1-30	30	M5-30*Z2(M1)	10.68	21.35
M 1-60	30	M5-360*Z2(M1)	13.44	26.88
M1-360	360	M5-360*Z2(M1)	21.56	3.59
M 30-15	15	M5-15*Z2(M30)	20.75	82.99
M 30-30	30	M5-30*Z2(M30)	26.35	52.69
M 30-60	60	M5-60*Z2(M30)	32.34	32.34
M30-360	360	M5-360*Z2(M30)	47.88	7.98
M 100-15	15	M5-15*Z2(M100)	26.75	107.02
M 100-30	30	M5-30*Z2(M100)	34.44	68.88
M100-60	60	M5-60*Z2(M100)	42.63	42.63
M100-360	360	M5-360*Z2(M100)	62.47	10.41

Peak Runoff

Q=2.78CiA Rational Method, SUDS Manual Section 4.3.3

where: (1) C = Cv Cr

Cv = 1 **

Cr = 1.3 constant value for design purposes

therefore , C = 1.3

(2) i = API, defined above

(3) A = areas measured for subcatchments

Q=2.78CiA

Table 1

Rainfall Duration D

Minutes					Hours					
r	5	10	15	30	1	2	4	6	10	24
0.12	0.22	0.34	0.45	0.67	1.00	1.48	2.17	2.75	3.70	6.00
0.15	0.25	0.38	0.48	0.69	1.00	1.42	2.02	2.46	3.32	4.90
0.18	0.27	0.41	0.51	0.71	1.00	1.36	1.86	2.25	2.86	4.30
0.21	0.29	0.43	0.54	0.73	1.00	1.33	1.77	2.12	2.62	3.60
0.24	0.31	0.46	0.56	0.75	1.00	1.30	1.71	2.00	2.40	3.35
0.27	0.33	0.48	0.58	0.76	1.00	1.27	1.64	1.88	2.24	3.10
0.30	0.34	0.49	0.59	0.77	1.00	1.25	1.57	1.78	2.12	2.84
0.33	0.35	0.50	0.61	0.78	1.00	1.23	1.53	1.73	2.04	2.60
0.36	0.36	0.51	0.62	0.79	1.00	1.22	1.48	1.67	1.90	2.42
0.39	0.37	0.52	0.63	0.80	1.00	1.21	1.46	1.62	1.82	2.28
0.42	0.38	0.53	0.64	0.81	1.00	1.20	1.42	1.57	1.74	2.16
0.45	0.39	0.54	0.65	0.82	1.00	1.19	1.38	1.51	1.68	2.03

Table 2 - England and Wales

Growth Factor Z2

M5 rainfall	M1	M2	M3	M4	M5	M10	M20	M50	M100	M30 interpolated
5.00	0.62	0.79	0.89	0.97	1.02	1.19	1.36	1.56	1.79	1.25
10.00	0.61	0.79	0.90	0.97	1.03	1.22	1.41	1.65	1.91	1.49
15.00	0.62	0.80	0.90	0.97	1.03	1.24	1.44	1.70	1.99	1.53
20.00	0.64	0.81	0.90	0.97	1.03	1.24	1.45	1.73	2.03	1.54
25.00	0.66	0.82	0.91	0.97	1.03	1.24	1.44	1.72	2.01	1.53
101.92 30.00	0.68	0.83	0.91	0.97	1.03	1.22	1.42	1.70	1.97	1.51
40.00	0.70	0.84	0.92	0.97	1.02	1.19	1.38	1.64	1.89	1.47
50.00	0.72	0.85	0.93	0.98	1.02	1.17	1.34	1.58	1.81	1.42
75.00	0.76	0.87	0.93	0.98	1.02	1.14	1.28	1.47	1.64	1.34
100.00	0.78	0.88	0.94	0.98	1.02	1.13	1.25	1.40	1.54	1.30
150.00	0.78	0.88	0.94	0.98	1.01	1.12	1.21	1.33	1.45	1.25
200.00	0.78	0.88	0.94	0.98	1.01	1.11	1.19	1.30	1.40	1.23

* The rainfall depths from cells E8-E11 are compared with the depths given in cells J29-J40 and Z2 interpolated accordingly for each return period

** Cv varies between 0.6 (rapidly draining soils) and 0.9 (heavy clay) with an average of 0.75 taken if ground conditions not known.

2.78*C= **3.614**

		Contributing Impermeable Area Ha	
	i	Site	Per hectare
	mm/hr	0.213	1
M 1-15	33.85	**26.06**	122.34
M 1-30	21.35	16.44	77.17
M 1-60	26.88	20.69	77.17
M1-360	3.59	2.77	12.99
M 30-15	82.99	**63.89**	299.93
M 30-30	52.69	40.56	190.43

		Contributing Impermeable Area Ha	
	i	Site	Per hectare
	mm/hr	0.213	1
M 30-60	32.34	24.89	190.43
M30-360	7.98	6.14	28.84
M 100-15	107.02	**82.38**	386.76
M 100-30	68.88	53.02	248.93
M 100-60	42.63	32.82	248.93
M100-360	10.41	8.01	37.63

APPENDIX E

IoH 124 Calculation of Greenfield Runoff Rate

Date: 22/06/2018
By: JJ

OS Location 528689E 185814N

SAAR	641	mm	See Wallingford Map
Site area =	50	ha	Always assume 50ha and prorata for specific site
	0.5	km^2	
Soil WRA Class	4		See Wallingford Map
Soil Type SPR Value	0.45		Conversion to SPR

$Qbar_{rural} = 0.00108 \times (AREA)^{0.89} \times (SAAR)^{1.17} \times (SOIL)^{2.17}$

Qbar-50ha = 0.198 m^3/s

From Regional Growth Curve Factor

Region: 6

Return period	1	2	5	10	25	30	50	100	500
Growth Factor	0.85	0.88	1.28	1.62	2.14	2.24	2.62	3.19	4.49

Q_1 50ha =	0.168 m^3/s	=	168.43 l/s	=	3.369	l/s/ha
Q_2 50ha =	0.174 m^3/s	=	174.38 l/s	=	3.488	l/s/ha
Q_5 50ha =	0.254 m^3/s	=	253.64 l/s	=	5.073	l/s/ha
Q_{10} 50ha =	0.321 m^3/s	=	321.01 l/s	=	6.420	l/s/ha
Q_{25} 50ha =	0.424 m^3/s	=	424.05 l/s	=	8.481	l/s/ha
Q_{30} 50ha =	0.444 m^3/s	=	443.86 l/s	=	8.877	l/s/ha
Q_{50} 50ha =	0.519 m^3/s	=	519.16 l/s	=	10.383	l/s/ha
Q_{100} 50ha =	0.632 m^3/s	=	632.11 l/s	=	12.642	l/s/ha
Q_{500} 50ha =	0.890 m^3/s	=	889.71 l/s	=	17.794	l/s/ha

Factored for Development Impermeable Area

Site area = 0.014 ha

Q_{bar} site =	0.000 m^3/s	=	0.1 l/s	=	4.0	l/s/ha
Q_1 site =	0.000 m^3/s	=	0.0 l/s	=	3.4	l/s/ha
Q_2site =	0.000 m^3/s	=	0.0 l/s	=	3.5	l/s/ha
Q_5site =	0.000 m^3/s	=	0.1 l/s	=	5.1	l/s/ha
Q_{10} site =	0.000 m^3/s	=	0.1 l/s	=	6.4	l/s/ha
Q_{25} site =	0.000 m^3/s	=	0.1 l/s	=	8.5	l/s/ha
Q_{30} site =	0.000 m^3/s	=	0.1 l/s	=	8.9	l/s/ha
Q_{50} site =	0.000 m^3/s	=	0.1 l/s	=	10.4	l/s/ha
Q_{100} site =	0.000 m^3/s	=	0.2 l/s	=	12.6	l/s/ha
Q_{500} site =	0.000 m^3/s	=	0.2 l/s	=	17.8	l/s/ha

Note: For greenfield site, the critical duration is generally not relevant and the prediction of the peak rate of runoff using IH124 does not require consideration of storm duration.

APPENDIX F

IoH 124 Calculation of Greenfield Runoff Rate

Date: 22/06/2018
By: JJ

OS Location 528689E 185814N

SAAR	641	mm	See Wallingford Map
Site area =	50	ha	Always assume 50ha and prorata for specific site
	0.5	km^2	
Soil WRA Class	4		See Wallingford Map
Soil Type SPR Value	0.45		Conversion to SPR

$Qbar_{rural} = 0.00108 \times (AREA)^{0.89} \times (SAAR)^{1.17} \times (SOIL)^{2.17}$

Qbar-50ha = 0.198 m^3/s

From Regional Growth Curve Factor

Region: 6

Return period	1	2	5	10	25	30	50	100	500
Growth Factor	0.85	0.88	1.28	1.62	2.14	2.24	2.62	3.19	4.49

Q_1 50ha =	0.168 m^3/s	=	168.43 l/s	=	3.369	l/s/ha
Q_2 50ha =	0.174 m^3/s	=	174.38 l/s	=	3.488	l/s/ha
Q_5 50ha =	0.254 m^3/s	=	253.64 l/s	=	5.073	l/s/ha
Q_{10} 50ha =	0.321 m^3/s	=	321.01 l/s	=	6.420	l/s/ha
Q_{25} 50ha =	0.424 m^3/s	=	424.05 l/s	=	8.481	l/s/ha
Q_{30} 50ha =	0.444 m^3/s	=	443.86 l/s	=	8.877	l/s/ha
Q_{50} 50ha =	0.519 m^3/s	=	519.16 l/s	=	10.383	l/s/ha
Q_{100} 50ha =	0.632 m^3/s	=	632.11 l/s	=	12.642	l/s/ha
Q_{500} 50ha =	0.890 m^3/s	=	889.71 l/s	=	17.794	l/s/ha

Factored for Development Impermeable Area

Site area = 0.23 ha

Q_{bar} site =	0.001 m^3/s	=	0.9 l/s	=	4.0	l/s/ha
Q_1 site =	0.001 m^3/s	=	0.8 l/s	=	3.4	l/s/ha
Q_2site =	0.001 m^3/s	=	0.8 l/s	=	3.5	l/s/ha
Q_5site =	0.001 m^3/s	=	1.2 l/s	=	5.1	l/s/ha
Q_{10} site =	0.001 m^3/s	=	1.5 l/s	=	6.4	l/s/ha
Q_{25} site =	0.002 m^3/s	=	2.0 l/s	=	8.5	l/s/ha
Q_{30} site =	0.002 m^3/s	=	2.0 l/s	=	8.9	l/s/ha
Q_{50} site =	0.002 m^3/s	=	2.4 l/s	=	10.4	l/s/ha
Q_{100} site =	0.003 m^3/s	=	2.9 l/s	=	12.6	l/s/ha
Q_{500} site =	0.004 m^3/s	=	4.1 l/s	=	17.8	l/s/ha

Note: For greenfield site, the critical duration is generally not relevant and the prediction of the peak rate of runoff using IH124 does not require consideration of storm duration.

APPENDIX G

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

Half Drain Time : 76 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	45.849	0.249	0.0	2.5	2.5	13.3	O K
30 min Summer	45.912	0.312	0.0	2.5	2.5	16.6	O K
60 min Summer	45.946	0.346	0.0	2.5	2.5	18.4	O K
120 min Summer	45.941	0.341	0.0	2.5	2.5	18.2	O K
180 min Summer	45.921	0.321	0.0	2.5	2.5	17.1	O K
240 min Summer	45.897	0.297	0.0	2.5	2.5	15.8	O K
360 min Summer	45.845	0.245	0.0	2.5	2.5	13.0	O K
480 min Summer	45.802	0.202	0.0	2.5	2.5	10.7	O K
600 min Summer	45.766	0.166	0.0	2.5	2.5	8.8	O K
720 min Summer	45.738	0.138	0.0	2.5	2.5	7.3	O K
960 min Summer	45.703	0.103	0.0	2.5	2.5	5.5	O K
1440 min Summer	45.678	0.078	0.0	2.0	2.0	4.2	O K
2160 min Summer	45.662	0.062	0.0	1.5	1.5	3.3	O K
2880 min Summer	45.654	0.054	0.0	1.2	1.2	2.9	O K
4320 min Summer	45.644	0.044	0.0	0.8	0.8	2.4	O K
5760 min Summer	45.639	0.039	0.0	0.7	0.7	2.1	O K
7200 min Summer	45.635	0.035	0.0	0.6	0.6	1.9	O K
8640 min Summer	45.632	0.032	0.0	0.5	0.5	1.7	O K
10080 min Summer	45.630	0.030	0.0	0.4	0.4	1.6	O K
15 min Winter	45.884	0.284	0.0	2.5	2.5	15.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	150.535	0.0	15.5	23
30 min Summer	97.157	0.0	20.0	36
60 min Summer	59.609	0.0	24.6	60
120 min Summer	35.314	0.0	29.1	94
180 min Summer	25.660	0.0	31.7	128
240 min Summer	20.345	0.0	33.5	162
360 min Summer	14.664	0.0	36.3	226
480 min Summer	11.616	0.0	38.3	288
600 min Summer	9.689	0.0	39.9	346
720 min Summer	8.351	0.0	41.3	402
960 min Summer	6.601	0.0	43.5	510
1440 min Summer	4.732	0.0	46.8	744
2160 min Summer	3.388	0.0	50.3	1108
2880 min Summer	2.670	0.0	52.8	1472
4320 min Summer	1.907	0.0	56.6	2204
5760 min Summer	1.501	0.0	59.4	2936
7200 min Summer	1.246	0.0	61.7	3648
8640 min Summer	1.070	0.0	63.5	4336
10080 min Summer	0.940	0.0	65.1	5056
15 min Winter	150.535	0.0	17.3	24

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	45.954	0.354	0.0	2.5	2.5	18.8	O K
60 min Winter	45.995	0.395	0.0	2.5	2.5	21.0	O K
120 min Winter	45.987	0.387	0.0	2.5	2.5	20.6	O K
180 min Winter	45.959	0.359	0.0	2.5	2.5	19.1	O K
240 min Winter	45.924	0.324	0.0	2.5	2.5	17.2	O K
360 min Winter	45.846	0.246	0.0	2.5	2.5	13.1	O K
480 min Winter	45.781	0.181	0.0	2.5	2.5	9.6	O K
600 min Winter	45.732	0.132	0.0	2.5	2.5	7.0	O K
720 min Winter	45.702	0.102	0.0	2.5	2.5	5.4	O K
960 min Winter	45.682	0.082	0.0	2.1	2.1	4.4	O K
1440 min Winter	45.664	0.064	0.0	1.5	1.5	3.4	O K
2160 min Winter	45.652	0.052	0.0	1.1	1.1	2.7	O K
2880 min Winter	45.645	0.045	0.0	0.9	0.9	2.4	O K
4320 min Winter	45.637	0.037	0.0	0.6	0.6	2.0	O K
5760 min Winter	45.633	0.033	0.0	0.5	0.5	1.7	O K
7200 min Winter	45.629	0.029	0.0	0.4	0.4	1.6	O K
8640 min Winter	45.627	0.027	0.0	0.4	0.4	1.4	O K
10080 min Winter	45.625	0.025	0.0	0.3	0.3	1.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	97.157	0.0	22.4	36
60 min Winter	59.609	0.0	27.5	62
120 min Winter	35.314	0.0	32.6	100
180 min Winter	25.660	0.0	35.5	138
240 min Winter	20.345	0.0	37.6	176
360 min Winter	14.664	0.0	40.6	244
480 min Winter	11.616	0.0	42.9	302
600 min Winter	9.689	0.0	44.7	356
720 min Winter	8.351	0.0	46.3	400
960 min Winter	6.601	0.0	48.7	512
1440 min Winter	4.732	0.0	52.4	744
2160 min Winter	3.388	0.0	56.3	1108
2880 min Winter	2.670	0.0	59.2	1472
4320 min Winter	1.907	0.0	63.4	2196
5760 min Winter	1.501	0.0	66.6	2920
7200 min Winter	1.246	0.0	69.1	3672
8640 min Winter	1.070	0.0	71.1	4440
10080 min Winter	0.940	0.0	72.9	4984

Rainfall Details

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

Time Area Diagram

Total Area (ha) 0.055

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.018	4	8	0.018	8	12	0.018

Model Details

Storage is Online Cover Level (m) 46.800

Cellular Storage Structure

Invert Level (m) 45.600 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	56.0	0.0	0.401	0.0	0.0
0.400	56.0	0.0	1.200	0.0	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0084-2500-0400-2500
Design Head (m)	0.400
Design Flow (l/s)	2.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	84
Invert Level (m)	45.600
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.400	2.5
Flush-Flo™	0.133	2.5
Kick-Flo®	0.293	2.2
Mean Flow over Head Range	-	2.1

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	2.5	1.200	4.1	3.000	6.4	7.000	9.6
0.200	2.4	1.400	4.4	3.500	6.8	7.500	9.9
0.300	2.2	1.600	4.7	4.000	7.3	8.000	10.3
0.400	2.5	1.800	5.0	4.500	7.7	8.500	10.6
0.500	2.8	2.000	5.3	5.000	8.1	9.000	10.9
0.600	3.0	2.200	5.5	5.500	8.5	9.500	11.2
0.800	3.4	2.400	5.7	6.000	8.9		
1.000	3.8	2.600	5.9	6.500	9.3		

APPENDIX H

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

Half Drain Time : 82 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	47.048	0.248	0.0	3.5	3.5	20.0	O K
30 min Summer	47.111	0.311	0.0	3.5	3.5	25.1	O K
60 min Summer	47.149	0.349	0.0	3.5	3.5	28.2	O K
120 min Summer	47.148	0.348	0.0	3.5	3.5	28.1	O K
180 min Summer	47.131	0.331	0.0	3.5	3.5	26.8	O K
240 min Summer	47.109	0.309	0.0	3.5	3.5	25.0	O K
360 min Summer	47.062	0.262	0.0	3.5	3.5	21.2	O K
480 min Summer	47.021	0.221	0.0	3.5	3.5	17.8	O K
600 min Summer	46.986	0.186	0.0	3.5	3.5	15.0	O K
720 min Summer	46.958	0.158	0.0	3.5	3.5	12.7	O K
960 min Summer	46.920	0.120	0.0	3.5	3.5	9.7	O K
1440 min Summer	46.891	0.091	0.0	2.9	2.9	7.4	O K
2160 min Summer	46.873	0.073	0.0	2.2	2.2	5.9	O K
2880 min Summer	46.863	0.063	0.0	1.7	1.7	5.1	O K
4320 min Summer	46.852	0.052	0.0	1.3	1.3	4.2	O K
5760 min Summer	46.846	0.046	0.0	1.0	1.0	3.7	O K
7200 min Summer	46.841	0.041	0.0	0.8	0.8	3.3	O K
8640 min Summer	46.838	0.038	0.0	0.7	0.7	3.0	O K
10080 min Summer	46.835	0.035	0.0	0.6	0.6	2.8	O K
15 min Winter	47.081	0.281	0.0	3.5	3.5	22.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	150.535	0.0	23.0	23
30 min Summer	97.157	0.0	29.7	36
60 min Summer	59.609	0.0	36.6	62
120 min Summer	35.314	0.0	43.4	96
180 min Summer	25.660	0.0	47.3	130
240 min Summer	20.345	0.0	50.0	164
360 min Summer	14.664	0.0	54.0	228
480 min Summer	11.616	0.0	57.1	292
600 min Summer	9.689	0.0	59.5	350
720 min Summer	8.351	0.0	61.5	406
960 min Summer	6.601	0.0	64.9	518
1440 min Summer	4.732	0.0	69.7	750
2160 min Summer	3.388	0.0	75.0	1108
2880 min Summer	2.670	0.0	78.8	1472
4320 min Summer	1.907	0.0	84.3	2204
5760 min Summer	1.501	0.0	88.6	2936
7200 min Summer	1.246	0.0	91.9	3672
8640 min Summer	1.070	0.0	94.7	4400
10080 min Summer	0.940	0.0	97.0	5144
15 min Winter	150.535	0.0	25.8	24

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	47.153	0.353	0.0	3.5	3.5	28.5	O K
60 min Winter	47.197	0.397	0.0	3.5	3.5	32.0	O K
120 min Winter	47.194	0.394	0.0	3.5	3.5	31.8	O K
180 min Winter	47.170	0.370	0.0	3.5	3.5	29.9	O K
240 min Winter	47.139	0.339	0.0	3.5	3.5	27.4	O K
360 min Winter	47.069	0.269	0.0	3.5	3.5	21.7	O K
480 min Winter	47.006	0.206	0.0	3.5	3.5	16.6	O K
600 min Winter	46.957	0.157	0.0	3.5	3.5	12.6	O K
720 min Winter	46.923	0.123	0.0	3.5	3.5	9.9	O K
960 min Winter	46.896	0.096	0.0	3.0	3.0	7.8	O K
1440 min Winter	46.875	0.075	0.0	2.2	2.2	6.0	O K
2160 min Winter	46.861	0.061	0.0	1.6	1.6	4.9	O K
2880 min Winter	46.853	0.053	0.0	1.3	1.3	4.2	O K
4320 min Winter	46.844	0.044	0.0	0.9	0.9	3.5	O K
5760 min Winter	46.838	0.038	0.0	0.7	0.7	3.1	O K
7200 min Winter	46.835	0.035	0.0	0.6	0.6	2.8	O K
8640 min Winter	46.832	0.032	0.0	0.5	0.5	2.5	O K
10080 min Winter	46.830	0.030	0.0	0.5	0.5	2.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	97.157	0.0	33.3	36
60 min Winter	59.609	0.0	41.0	62
120 min Winter	35.314	0.0	48.6	102
180 min Winter	25.660	0.0	53.0	140
240 min Winter	20.345	0.0	56.0	178
360 min Winter	14.664	0.0	60.5	246
480 min Winter	11.616	0.0	63.9	308
600 min Winter	9.689	0.0	66.7	362
720 min Winter	8.351	0.0	68.9	412
960 min Winter	6.601	0.0	72.6	516
1440 min Winter	4.732	0.0	78.1	752
2160 min Winter	3.388	0.0	84.0	1116
2880 min Winter	2.670	0.0	88.2	1500
4320 min Winter	1.907	0.0	94.5	2196
5760 min Winter	1.501	0.0	99.2	2888
7200 min Winter	1.246	0.0	103.0	3648
8640 min Winter	1.070	0.0	106.1	4320
10080 min Winter	0.940	0.0	108.7	5008

Rainfall Details

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

Time Area Diagram

Total Area (ha) 0.082

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.027	4	8	0.027	8	12	0.027

Model Details

Storage is Online Cover Level (m) 48.000

Cellular Storage Structure

Invert Level (m) 46.800 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	85.0	0.0	0.401	0.0	0.0
0.400	85.0	0.0	1.200	0.0	0.0

Hydro-Brake® Optimum Outflow Control

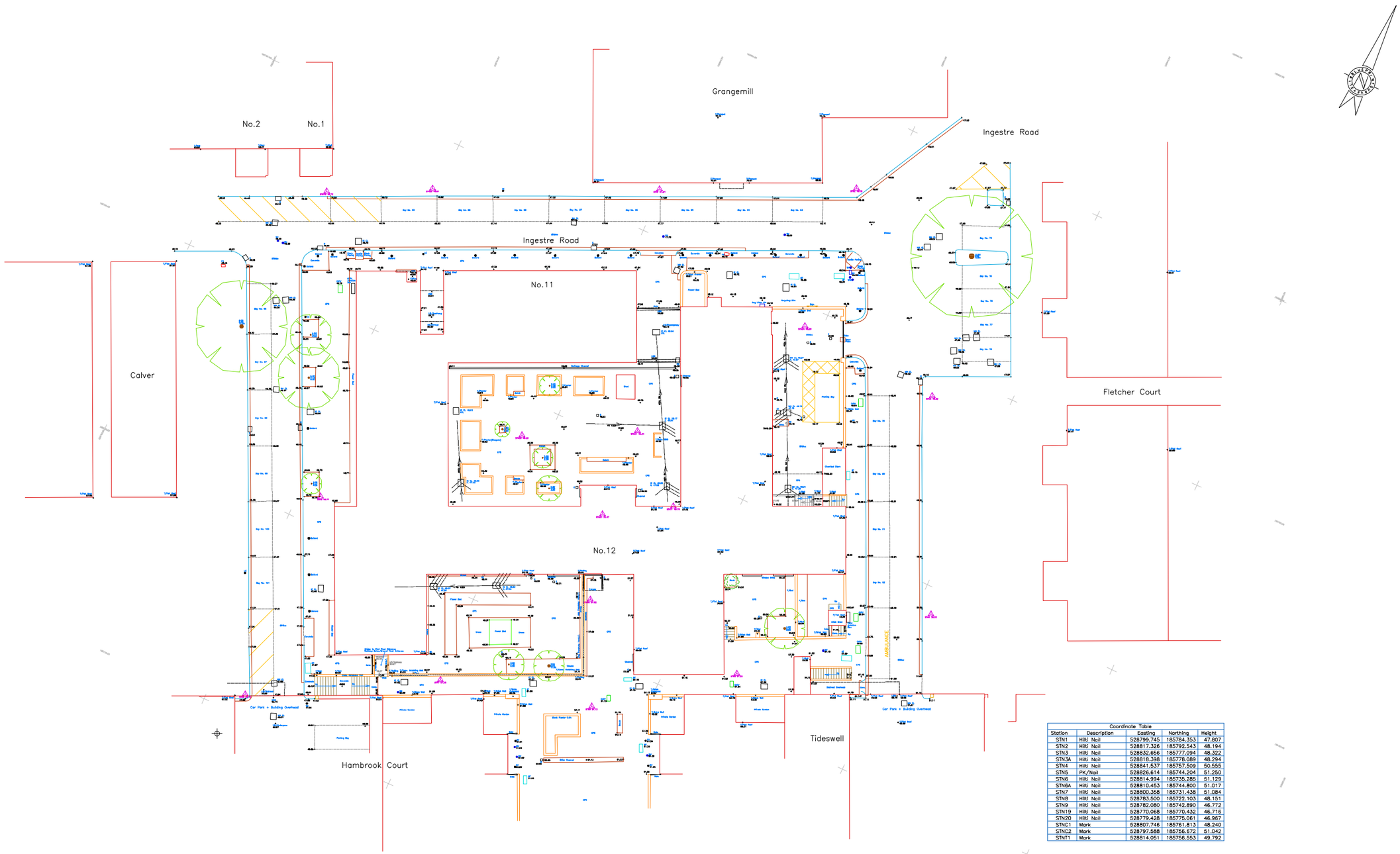
Unit Reference	MD-SHE-0097-3500-0400-3500
Design Head (m)	0.400
Design Flow (l/s)	3.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	97
Invert Level (m)	46.800
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.400	3.5
Flush-Flo™	0.149	3.5
Kick-Flo®	0.302	3.1
Mean Flow over Head Range	-	2.9

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	3.2	1.200	5.8	3.000	9.0	7.000	13.5
0.200	3.4	1.400	6.3	3.500	9.6	7.500	14.0
0.300	3.1	1.600	6.7	4.000	10.3	8.000	14.5
0.400	3.5	1.800	7.0	4.500	10.8	8.500	14.9
0.500	3.9	2.000	7.4	5.000	11.4	9.000	15.4
0.600	4.2	2.200	7.7	5.500	12.0	9.500	15.8
0.800	4.8	2.400	8.1	6.000	12.5		
1.000	5.3	2.600	8.4	6.500	13.1		

PLANS



Coordinate Table				
Station	Description	Easting	Northing	Height
STN1	Hilti Nail	528799.745	185784.353	47.807
STN2	Hilti Nail	528817.326	185792.543	48.194
STN3	Hilti Nail	528832.656	185777.094	48.322
STN3A	Hilti Nail	528818.398	185778.089	48.294
STN4	Hilti Nail	528841.537	185757.509	50.555
STN5	Pk/Nail	528826.614	185744.204	51.250
STN6	Hilti Nail	528814.994	185735.285	51.129
STN6A	Hilti Nail	528810.453	185744.800	51.017
STN7	Hilti Nail	528800.358	185731.438	51.084
STN8	Hilti Nail	528783.500	185722.103	48.151
STN9	Hilti Nail	528782.080	185742.890	46.772
STN19	Hilti Nail	528770.068	185770.432	46.716
STN20	Hilti Nail	528779.428	185775.061	46.967
STNC1	Mark	528807.746	185761.813	48.240
STNC2	Mark	528797.588	185756.672	51.042
STNT1	Mark	528814.061	185756.553	49.792

Revision History:

Site Legend:

AB	Air Brick	GV	Gas Valve	SYL	Single Yellow Line	RWP	Rain Water Pipe
ACU	Air Conditioning Unit	IC	Inspection Cover	TCB	Telephone Call Box	SA	Spring of Arch
ASP	Artificial Stone Paving	IL	Invert level	TP	Telegraph Pole	SCH	Suspended Ceiling Height
BT	British Telecom	LP	Lamp Post	TW	Top of Wall	SD	Sliding Door
CL	Cover Level	MKR	Marker (Service)	TF	Top of Fence	SP	Soil Pipe
DYL	Double Yellow Line	MP	Metal Post	UTL	Unable To Lift	SVP	Soil and Vent Pipe
EL	Electricity	OH	Overhead	VP	Vent Pipe	USB	Underside of Beam
FAI	Fresh Air Inlet	OST	Oil Storage Tank	WV	Water Valve	WP	Waste Pipe
FB	Flower Bed	PB	Post Box	CP/	Concrete Post	WST	Water Storage Tank
FH	Fire Hydrant	PL	Pavement Light	WP/	Wooden Post		
G	Gully	RE	Rodding Eye	/CB	Close Boarded Fence		
		RS	Road Sign	/IW	Interwoven Panel		
		SNP	Street Name Plate	/VB	Vertical Board		

Building Legend:

CA	Centre of Arch	RSD	Roller Shutter Door
CH	Ceiling Height		
CWT	Cold Water Tank		
DH	Door Head		
ESP	Electricity Switch Panel		
F	Frame Height		
GDH	Glazed Door Height		
GRL	Glazed Roof Light		
HWT	Hot Water Tank		

Levels:

Level data has been obtained with Kinematic GPS corrections via the Ordnance Survey's network, OS Net.

Project: 12 Ingestre Road. London. NW5 1UX

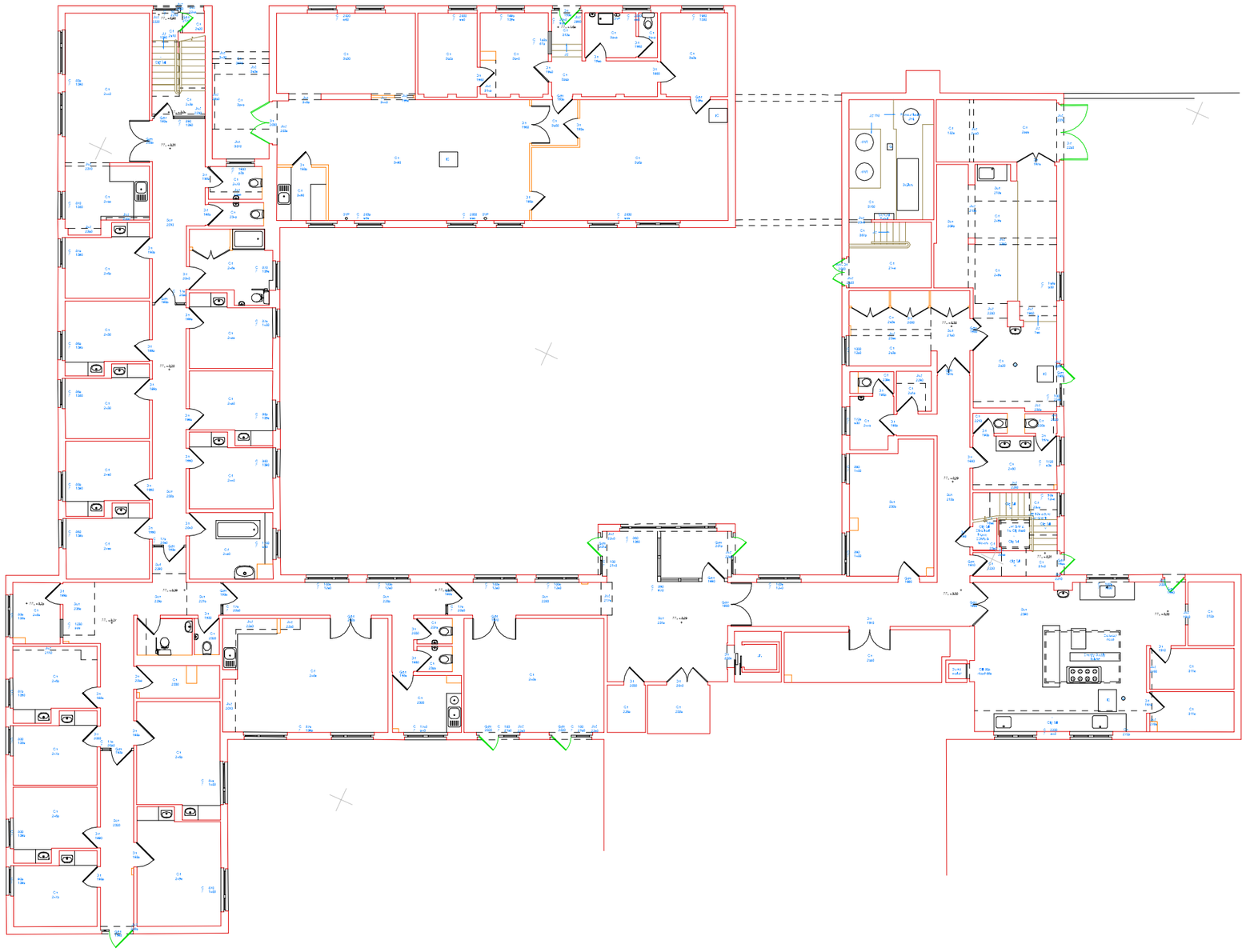
Drawing Title: Site Survey

Scale: 1:200 @ A1

Date: April 2013

Drawing No: 01 of 03

Blueprint Surveys Ltd
Land and Measured Building Surveys
Tel: 0844 5610758
E Mail: admin@blueprintsurveys.co.uk



Revision History:

Site Legend:

AB	Air Brick
ACU	Air Conditioning Unit
ASP	Artificial Stone Paving
BT	British Telecom
CL	Cover Level
DYL	Double Yellow Line
EL	Electricity
FAI	Fresh Air Inlet
FB	Flower Bed
FH	Fire Hydrant
G	Gully
GV	Gas Valve
IC	Inspection Cover
IL	Invert level
LP	Lamp Post
MKR	Marker (Service)
MP	Metal Post
OH	Overhead
OST	Oil Storage Tank
PB	Post Box
PL	Pavement Light
RE	Rodding Eye
RS	Road Sign
SNP	Street Name Plate
SYL	Single Yellow Line
TCB	Telephone Call Box
TP	Telegraph Pole
TW	Top of Wall
TF	Top of Fence
UTL	Unable To Lift
VP	Vent Pipe
WV	Water Valve
CP/	Concrete Post
WP/	Wooden Post
/CB	Close Boarded Fence
/IW	Interwoven Panel
/VB	Vertical Board

Building Legend:

CA	Centre of Arch
CH	Ceiling Height
CWT	Cold Water Tank
DH	Door Head
ESP	Electricity Switch Panel
F	Frame Height
GDH	Glazed Door Height
GRL	Glazed Roof Light
HWT	Hot Water Tank
RSD	Roller Shutter Door
RWP	Rain Water Pipe
SA	Spring of Arch
SCH	Suspended Ceiling Height
SD	Sliding Door
SP	Soil Pipe
SVP	Soil and Vent Pipe
USB	Underside of Beam
WP	Waste Pipe
WST	Water Storage Tank

Levels:

Level data has been obtained with Kinematic GPS corrections via the Ordnance Survey's network, OS Net.

Project: 12 Ingestre Road. London. NW5 1UX

Drawing Title: Lower Ground Floor Plan

Scale: 1:100 @ A1

Date: April 2013

Drawing No: 02 of 03

Blueprint Surveys Ltd
Land and Measured Building Surveys
Tel: 0844 5610758
E Mail: admin@blueprintsurveys.co.uk