61 REDINGTON ROAD

HAMPSTEAD

SURFACE FLOW AND FLOODING BASEMENT IMPACT ASSESSMENT

MR & MRS BURNS

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Authorisation and Version Control

Water Environment was commissioned by Mr & Mrs Burns to investigate the risks and assess the consequences of flooding on the site at 61 Redington Road as well as to develop a Sustainable Drainage Strategy for the proposed development.

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NON-TECHNICAL SUMMARY

The proposed development is located at number 61 Redington Road, Hampstead, as shown on the location plan below.

The current property is arranged over four floors, including a lower ground floor, and is currently sub-divided into three separate residential properties. The proposed development involves internally refitting the property, which would be returned to a main dwelling with a single one-bedroom flat at lower ground floor. The proposals involve the excavation of the lower ground floor by approximately 1.3m at the rear and approximately 2m to the front. The lower ground floor will also be extended to the rear (horizontally) by approximately 4m. The excavation extends a further approximately 3.5m for the proposed terrace area.

The following assessments are presented within this report:

- Surface Flow and Flooding Desk Study
- Surface Flow and Flooding Basement Impact Screening
- Surface Flow and Flooding Basement Impact Assessment Scoping
- Additional Evidence/Assessments
    - Flood Risk Assessment
    - Surface Water Drainage and SuDS Assessment
- Surface Flow and Flooding Basement Impact Assessment

This assessment does not include consideration of Groundwater Flow or Land Stability, which will be provided by others and, together with this report, will provide an overarching Basement Impact Assessment in accordance with Camden Basement guidance. The assessment is prepared by Water Environment Limited. Water Environment staff are skilled in the assessment of flood risk and groundwater, and are members of the Institution of Civil Engineers (ICE) and the Institute of Water and Environmental Management (CIWEM). All Water Environment Directors and Associates are Chartered Members of the ICE or CIWEM or both.

A Flood Risk Assessment has been conducted and concluded that there are no significant risks of flooding to the site from any source, and that the proposed development will not affect the risk of flooding elsewhere.

The Basement Impact Assessment (BIA) has identified negligible flood risk for the proposed development.

The assessment has identified the following potential hydrological impacts:

- Potential change in runoff rates due to an increase in the proportion of hard paved surfaces on the site. This requires a SuDS strategy to ensure there is no impact on downstream runoff flows or water quality.
- Potential changes in runoff due to climate change over the lifetime of the development. This requires a SuDS strategy to ensure there is no impact on downstream runoff flows or water quality.

A SuDS assessment has been conducted and concluded that, although surface water runoff rates will increase following development without mitigation, they can be attenuated to current, present day rates and discharged to existing connections. The detailed design of the drainage system should be undertaken in accordance with the recommendations in this BIA.

The BIA concludes that subject to compliance with recommendations detailed herein, the residual impacts on the wider hydrological environment are negligible.

ABBREVIATIONS

Acronym	Definition
AOD	Above Ordnance Datum
BGL	Below Ground Level
BGS	British Geological Survey
BIA	Basement Impact Assessment
DEFRA	Department for Environment Food and Rural Affairs
DTM	Digital Terrain Model
EA	Environment Agency
FEH	Flood Estimation Handbook
FRA	Flood Risk Assessment
LASOO	Local Authority SuDS Officer Organisation
LBC	London Borough of Camden
LiDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NPPF	National Planning Policy Framework
PFRA	Preliminary Flood Risk Assessment
PPG	Planning Practice Guidance
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan

1 INTRODUCTION

General Information

1.1 The purpose of this assessment is to consider the effect on surface flow and flooding of the proposed basement extension at 61 Redington Road in Hampstead, London, NW3 7RP.

1.2 The existing property at 61 Redington Road is arranged over four floors including an existing lower ground floor (the basement). The property contains three separate residential units, each unit arranged over two or more floors. The proposal is to convert the building to form one family dwelling and a self-contained flat at lower ground floor level. This will involve excavation at basement level to increase floor to ceiling height, and rear extensions to enhance the appearance of the rear elevation.

1.3 As a result of the proposals, the current lower ground floor extent will increase, and will extend further below ground.

Scope of Study

1.4 The approach follows the procedure adopted by the London Borough of Camden (LBC) for the assessment of basements and lightwells. This report covers the 'Surface Flow and Flooding' elements of the basement impact assessment and is divided into four stages: Desk Study; Screening; Scoping; and Impact Assessment. The structure of this assessment is guided by Camden Basement guidance[1] and the Basement Impact Assessment (BIA) pro forma.

1.5 Whilst this report does include consideration of geology and below ground flows as part of the overall assessment of flood risk, the formal 'Subterranean (groundwater) Flow' and 'Land Stability' sections of the BIA will be completed by others.

1.6 The study includes a Flood Risk Assessment (FRA) and Sustainable Drainage Systems (SuDS) Assessment as part of the report. The scope of the FRA (see Chapter 3) and SuDS Assessment (see Chapter 6) is as follows:

- To provide a flood risk assessment for the site compliant with the guidelines set out in the National Planning Policy Framework (NPPF) and associated Planning Practice Guidance (PPG);
- To assess the risk and implications of flooding on the site including flooding from tidal, fluvial, groundwater, surface water runoff and artificial sources;
- To provide advice on the site design that will ensure safe operation of the site in any flood event;
- To consider the pre- and post-development drainage systems and calculate pre- and post-development runoff rates and volumes based on standard methodologies; and
- To provide advice and guidance on the management of surface water runoff at the site to ensure the risk of surface water flooding on the site and on nearby sites does not increase post-development.

Authors

1.7 Water Environment Limited has over 18 years of experience of consulting engineering in the water sector including flood risk assessment and drainage system design. Water Environment

[1] London Borough of Camden, Camden Planning Guidance: Basements, January 2021

staff are skilled in the assessment of flood risk and groundwater, and are members of the Institution of Civil Engineers (ICE) and the Institute of Water and Environmental Management (CIWEM). All Water Environment Directors and Associates are Chartered Members of the ICE or CIWEM or both.

1.8 Water Environment Limited is supplying the assessment covering Surface Water and Flooding for the Basement Impact Assessment.

Sources of Information

1.9 Baseline data have been drawn from the following sources:

- Current and historical Ordnance Survey mapping;
- Geological mapping and hydrogeological data taken from the British Geological Survey Geology of Britain, BGS Hydro and open data Web Map Services;
- Site ground investigation undertaken on 28th February 2022 by Ground and Water;
- Hydrological information from the Flood Estimation Handbook (FEH) web service;
- Flood risk mapping from the UK government Environmental Open Data Web Map Services and environmental information from DEFRA's Magic Map;
- LiDAR ground level information data from the Environment Agency;
- LBC Strategic Flood Risk Assessment[2] (SFRA), Preliminary Flood Risk Assessment[3] (PFRA) and Floods in Camden Report[4];
- LBC Planning Guidance (CPG) Basements[5], Local Plan Policy A5 and Camden Geological, Hydrogeological and Hydrological Study[6] (GHHS); and
- LBC Audit Process Terms of Reference.

[2] URS, London Borough of Camden SFRA, July 2014
[3] Drain London/London Borough of Camden, Preliminary Flood Risk Assessment, v0.2, April 2011
[4] London Borough of Camden, Floods in Camden Report of the Floods Scrutiny Panel, June 2003
[5] London Borough of Camden, Camden Planning Guidance: Basements, January 2021
[6] London Borough of Camden, Camden geological, hydrogeological and hydrological study – Guidance for subterranean development, Issue 01, November 2010

2 DESCRIPTION OF DEVELOPMENT

Location

2.1 The proposed development is located on Redington Road in Hampstead. The property is located on the western side of the road opposite the junction with Templewood Avenue as shown in Figure 1.

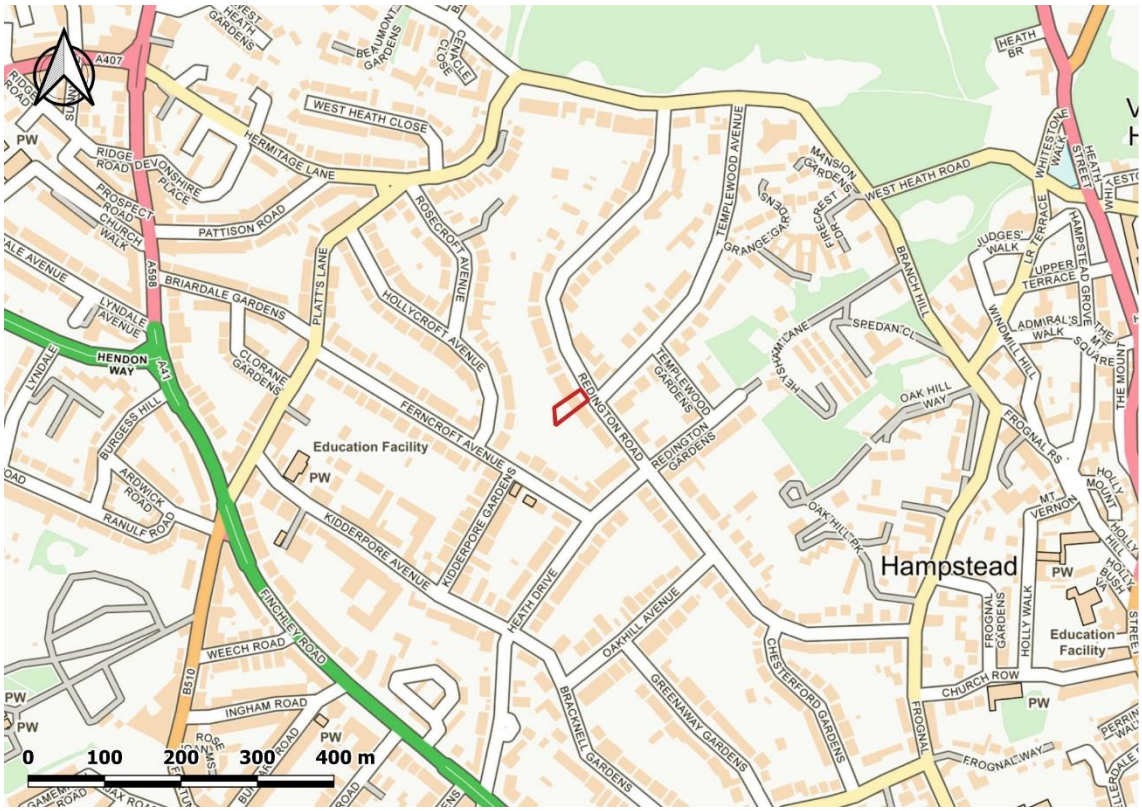

Figure 1: Location of proposed development

2.2 The site is located to the west of Hampstead. The red line boundary coincides with the property boundary, and the site is bounded by other residential properties on all sides, with Redington Road to the front (northeast).

Existing Site

2.3 The site is currently occupied by the property at 61 Redington Road. The existing accommodation is arranged over four floors, including lower ground floor, and is currently subdivided into three separate residential properties.

2.4 MIJA Survey Limited undertook a topographic survey of the site in December 2021. The survey shows that the site slopes away from the road with maximum site levels of 98.89m AOD in the northern corner. Spot levels at the drive entrances show that there is a slope up to the property boundary from the road of around 100 mm before levels fall away.

2.5 The garage driveway falls to a lower ground level of 96.34m AOD, which is approximately 1.4m below the driveway entrance level of 97.83m AOD. There is a slot drain at the garage entrance to collect surface water runoff. The driveway is enclosed by retaining walls, and the remainder of the front garden is at a level of between 98.47m AOD and 98.89m AOD. The front garden is mostly gravel and paving.

2.6 The survey shows steps leading up into the property at ground floor level with the top step at 98.81m AOD. Paving leads along the north-western edge of the property, providing access to the rear garden, at a level falling from 98.29m AOD to 96.75m AOD. A rainwater downpipe directs roof runoff into a gully.

2.7 To the rear of the property, ground levels fall from 96.56m AOD at the rear of the house to 95.86m AOD in the southern corner of the garden. The majority of the rear garden is laid to lawn, however there is an area of paving adjacent to the house on the southern side. Steps lead down from this paving to the lower-ground floor level.

2.8 The building survey indicates that at present the lower ground floor finished floor level varies from 96.14m AOD to the rear and 97.03m AOD to the front of the building. The ground floor level is 98.95m AOD, with first and second floor at 102.27m AOD and 105.42m AOD respectively.

Proposed Development

2.9 The proposed development involves an internal refit of the building such that the property would be sub-divided into two- a main family dwelling and single flat. The flat would be fully contained within the basement; with access from the side of the house at lower-ground floor level (95.85m AOD). The proposed development reduces the number of residential units on site from three to two.

2.10 The proposals include extension of the basement to the rear and would deepen the basement such that the finished floor levels would be 95.40m AOD to the rear and 95.40m AOD to the front. This would require a lowering of the existing basement by approximately 800mm, with the final base of the structure being at approximately 94.80m AOD.

2.11 The footprint of the building would also be extended to the rear at lower ground floor, with the first and second floors being extended over the existing building footprint.

3 DESK STUDY – SURFACE FLOW AND FLOODING

Geology

3.1 According to the 1:50,000 scale BGS mapping, the site appears to be located above the Claygate Member. The lower boundary of the Bagshot Sand lies uphill, 100m to the northwest, while the lower boundary of the Claygate Member is 100m to the southeast. The geology beneath the Claygate Member is London Clay. The geology is shown in Figure 2.

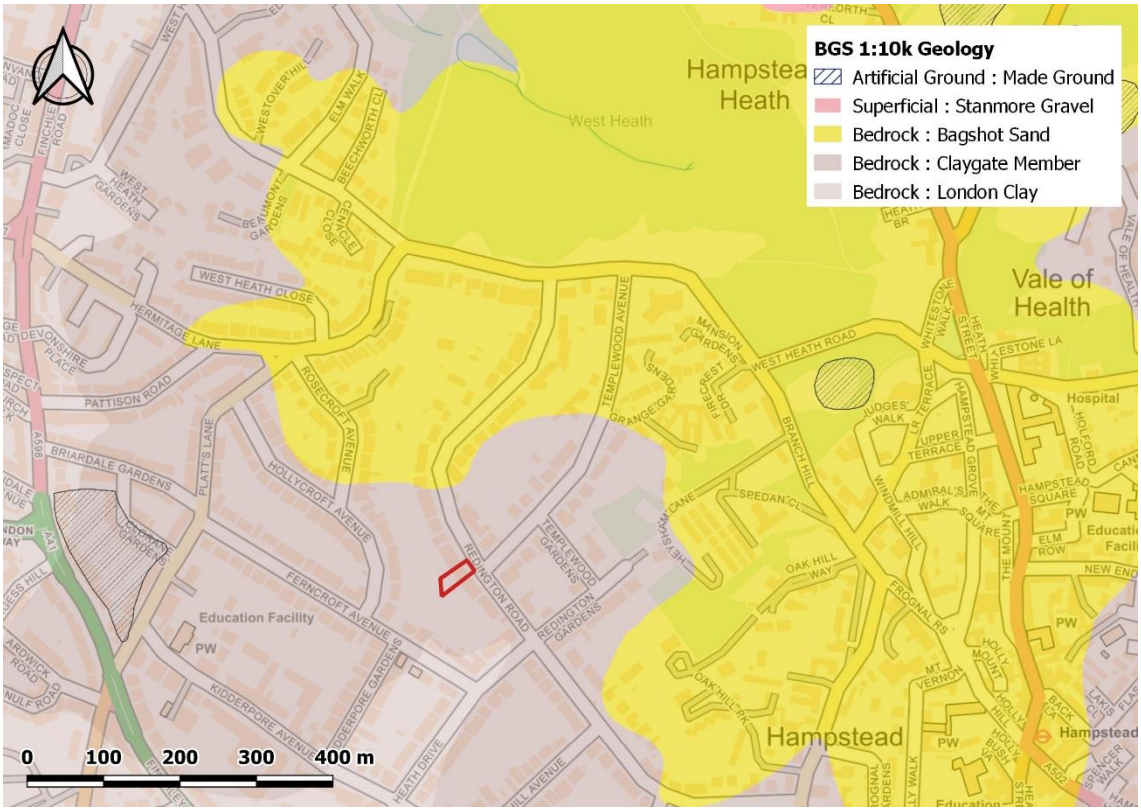

Figure 2: British Geological Survey Recorded Geology

3.2 There are no recorded superficial deposits at the site or nearby.

3.3 Whilst the BGS mapping provides an excellent resource for understanding the likely geology and general geological sequence within an area, this is not intended to be site specific and therefore on-site ground investigation is necessary to provide further information on the geology encountered directly beneath the site.

3.4 A site ground investigation was undertaken on 28th February 2022 and comprised of one borehole and two window samples. The ground investigation found that the geology at the site was Made Ground over London Clay, and did not encounter the Claygate Member at the site location. A 300mm thick layer of Head Deposits was encountered. The borehole did not encounter the deeper formations at the end depth of 8.45m BGL. All sub-surface strata were classified as CLAY.

Hydrogeology

3.5 The BGS 1:625,000 hydrogeological mapping defines the Bagshot Sand (as part of the Bracklesham/Barton Group) as a moderately productive aquifer, and the Claygate Member (as part of the Thames Group) as rock with essentially no groundwater.

3.6 The GHHS Figure 8 indicates that the site lies over a Secondary A Aquifer. The extent of this aquifer is defined by the areas where the Claygate Member and Bagshot Sand are the shallowest rock formations. The Claygate Member is defined as "Clay, Silt and Sand" and may be permeable in locations where the sand is dominant. According to the GHHS, Hampstead is one of these locations.

3.7 According to DEFRA's Magic Map, the Secondary A Aquifer is a minor bedrock aquifer with medium vulnerability (the aquifer has high vulnerability to the north and east). The Aquifer is not designated as a groundwater body under the Water Framework Directive (WFD), and there are no associated groundwater Source Protection Zones (SPZ).

3.8 No groundwater was encountered during the site ground investigation, which was undertaken following a month in which 153% of the average February rainfall was recorded across the UK[7]. The borehole and trial pits found that the site is located over London Clay. Despite published geological and hydrogeological mapping, the Claygate Member and Bagshot Sand were not encountered during the site specific ground investigation. Seepage was noted within the borehole in the London Clay at around 6m BGL, and within a foundation excavation trial pit at around 0.7m BGL, but these are not considered to form part of any groundwater body.

Historical Records of Flooding

3.9 According to the available datasets, the site is not recorded as having flooded in the past from any source.

Flooding from Rivers and the Sea

3.10 The site is located within Flood Zone 1. The nearest fluvial watercourse with associated Flood Zone Mapping is the River Brent, located nearly 3km to the north-west. This is also the nearest classified river under the WFD.

3.11 The closest surface watercourses to the site are the stream on West Heath, which flows in a northerly direction and is located 600m north of the site, and the streams that feed Hampstead Ponds, which flow east and then south, from a point 1.2km to the north-east of the site. The catchment watersheds for these watercourses pass along West Heath Road, approximately 300m north of the site, and along Hampstead Grove and Holly Hill, west of Heath Street, approximately 700m east of the site. The site is therefore not at risk of flooding from these streams.

3.12 According to the Flood Estimation Handbook (FEH) web mapping service, the site lies towards the head of the natural catchment that reaches 0.5km^2 in size at West Hampstead fire station. The site is approximately 750m north of this location. Nineteenth century historical mapping from Vision of Britain shows a stream rising slightly to the west of this location, south of Mill Lane near where Sumatra Road now lies. The watershed is a further 300m north of the site.

3.13 Although Figure 11 of the GHHS shows the head of a historical tributary of the Tyburn running along the south side of the current location of Redington Road, there is not currently any watercourse at this location. The site lies close to the watershed of this catchment and is not at significant risk of flooding from this source.

3.14 The natural drainage catchments were extracted by analysing the Environment Agency 2m LiDAR for the area and are presented in Figure 3. The analysis agrees well with Figure 14 of the GHHS (for the Golders Hill Chain and Hampstead Chain catchments) and confirms the assessment that

[7] https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/summaries/uk_monthly_climate_summary_202202a.pdf

there is no risk of flooding from fluvial sources due to the location of the site close to the natural catchment watershed for the area.

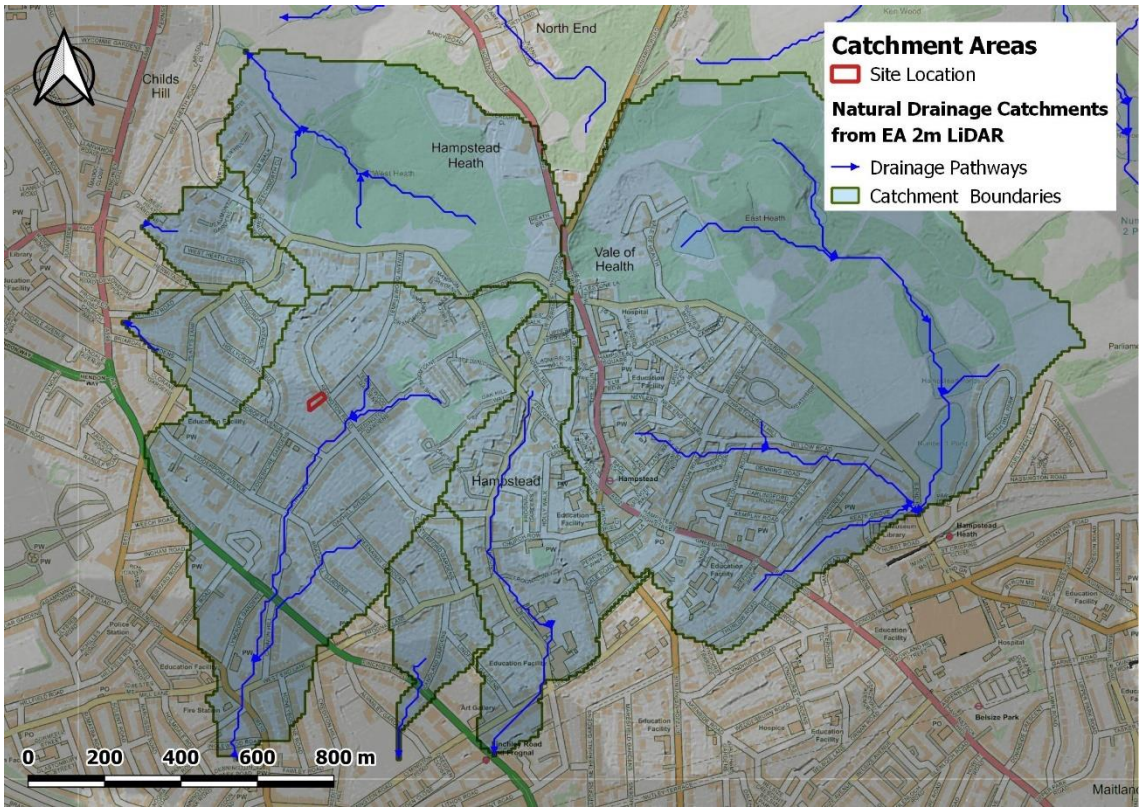

Figure 3: Hampstead Area Catchment Analysis

3.15 The site is not at risk of flooding from rivers or the sea.

Flooding from Surface Water

3.16 Flooding from surface water arises during intense rainfall events when flood waters are unable to infiltrate into the ground or discharge into local ditches or artificial drainage infrastructure. In an urban environment, the risk of flooding from surface water and from overloaded sewers is closely related, and both are included in the relevant surface water flooding datasets. Flooding events are typically of short duration (unless there is a drainage system blockage), but can be severe.

3.17 According to the GHHC Figure 15 historical mapping figure, the site is not recorded as being on a road that has flooded in the past or is at potential risk of surface water flooding. Templewood Avenue and Templewood Gardens are recorded to have flooded in 2002, however, Redington Road was not flooded, and this is consistent with the gradients in the area which would direct flow towards the natural valley base as shown in Figure 3. The site is not in a Critical Drainage Area.

3.18 The Gov.UK Risk of Flooding from Surface Water (RoFSW) map, presented in Figure 4, shows that the site, including Redington Road, is not at risk of flooding from surface water in the 0.1% annual exceedance rainfall event. Whilst flooding is shown within roads to the south of the site, including Templewood Gardens and to the rear of properties on Templewood Avenue, and at the junction of Redington Road and Redington Gardens, due to local topography the site itself is not shown to be at risk.

3.19 Access to land at less than 0.1% annual chance of flooding is available north along Redington Road or Templewood Avenue, and in multiple directions thereafter including east into Hampstead.

3.20 Taking account of all sources of information, it is concluded that the site is not at significant risk of flooding from surface water.

Figure 4: Gov.UK Risk of Flooding from Surface Water map

Flooding from Sewers

3.21 Sewer flooding generally results in localised short term flooding caused by intense rainfall events overloading the capacity of sewers. Typically, flooding would be expected to be similar and scale and hydraulics to surface water flooding.

3.22 Thames Water has confirmed that there have been no records of flooding at 61 Redington Road as a result of surcharging public sewers. The asset location information indicates that there is a public combined sewer running south-east along Redington Road, at a depth of 5.32m at the junction with Templewood Avenue. The invert level of this pipe is 91.98m AOD, over 3.4m below the lower ground floor finished floor level in the proposed extension of 95.40m AOD. A surcharge depth of at least 3.5m would be required to present a risk of flooding to the basement from sewers.

3.23 The proposed development is not at significant risk of flooding from sewers.

Flooding from Groundwater

3.24 The site ground investigation found that the site is located on Made Ground over a thin layer of Silt Head Deposits over London Clay. The geology at the site is generally impermeable. Groundwater was not encountered although seepage was observed at shallow depths in the London Clay. The site investigation was undertaken following prolonged heavy rainfall in the

preceding month, with three named storms passing in the preceding week. The seepage is not likely to be the result of the presence of a significant body of groundwater.

3.25 The proposed basement is not at significant risk of flooding due to groundwater within the sub-surface strata. However, as recommended in the geotechnical report, the basement should be protected from ingress of perched groundwater from the surrounding unproductive strata, which is a standard precaution in basement construction.

3.26 The site lies around 100m from the potential spring line that occurs at the base of the Bagshot Sand. The site is downhill in relation to the potential spring line, and therefore groundwater emerging from the base of the Bagshot Sand could be expected to pass the site. However, slopes in the area are such that this would generally be expected to flow overland without ponding, either being collected into highway or local drainage, or following the pathways indicated by the RoFSW map.

3.27 The proposed development is not at significant risk of flooding from groundwater.

Flooding from Other Sources

3.28 According to the Gov.UK long term reservoir flood extents, presented in Figure 5, the site is not at risk of flooding as a result of reservoir failure on either a dry day or in combination with fluvial flooding.

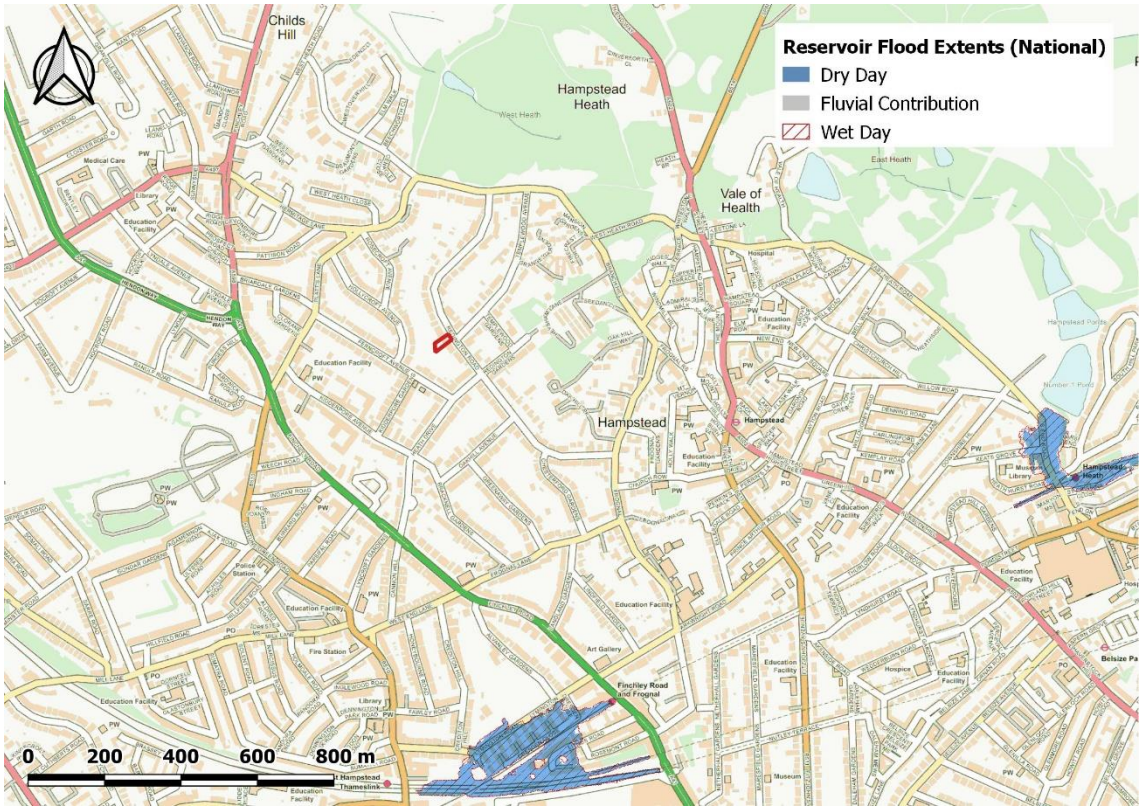

Figure 5: Gov.UK Risk of Flooding from Reservoirs map

3.29 The site lies outside the catchment areas of the various ponds on Hampstead Heath as shown in Figure 3. In addition, with the exception of the pond at Vale of Health, all of the ponds lie at a lower elevation than the general site level of 95m AOD. The Vale of Health pond is at 105m AOD, however any overtopping would pass east towards Hampstead Ponds and would not flow towards the site.

3.30 Likewise, there is a waterbody in the area surrounded by Whitestone Walk, Heath Street and West Heath Road that contains a waterbody (Whitestone Pond). This is at a level of 133m AOD, and is located on the watershed. The LiDAR analysis suggests that if this pond overtopped water would flow west to the West Heath catchment, or potentially east towards Vale of Health. The LiDAR suggests it is extremely unlikely this pond would discharge southwest towards the site, due to the watershed on the south side of West Heath Road, however if it did, the flow path would travel down Heysham Lane and Redington Gardens, crossing Redington Road 100m southeast of the site, where ground levels are around 3m lower. Due to the local gradients, it is not considered that the site is at significant risk of flooding from Whitestone Pond.

3.31 There are no other surface waterbodies in the area that could present a risk of flooding due to overtopping or embankment failure.

3.32 There are no other sources of flooding that present a risk to the site.

Climate Change

3.33 The projected impacts of climate change are likely to cause long term variations in the probability and risk of flooding. Risk of flooding from groundwater is generally likely to be reduced due to reduced winter rainfall and a move to more intense summer storms which cannot infiltrate into the ground, but risks from other sources are likely to increase. This will affect the site in terms of the likelihood of flooding from surface water and this has been taken into consideration throughout this assessment in accordance with the latest government guidance.

Impact on Flood Risk Elsewhere

3.34 In order for there to be a potential impact on the risk of flooding elsewhere, there must be a shared pathway between any potential off-site receptor and the proposed development site. Since the site is not at significant risk of flooding from rivers, surface water, sewers, groundwater or artificial waterbodies, there is no evidence of any pathway for a direct impact on flood risk elsewhere to occur as a result of development occupying flood storage or obstructing flood flows.

3.35 The only means for impacts on flood risk to occur is therefore where the source of flooding could be affected by the proposed development. In this case, the only sources that could be affected are surface water during intense rainfall event by increasing rates and volumes of direct runoff, or the creation of a groundwater flood risk due to obstruction of groundwater movement.

3.36 There is a potential for peak surface water runoff flows and volumes of runoff from the site to increase where proposed development increases the impermeable areas on the site or reduces the critical drain time. According to the topographic survey, the existing impermeable area on the site is 366m^2, formed of 241m^2 roof area and 125m^2 paved area. Following the proposed development, the combined area of roof and lightwell will occupy 304m^2. The driveway will remain, with a reduced area of 47m^2 due to the proposed change in the location of the garage entrance. The paving to the side of the house will be extended across the front of the property and to a ground level terrace area to the rear of the property, occupying 101m^2, and a lower-ground level terrace is proposed, occupying a total area of 58m^2. Consequently, the total area of impermeable surfaces on the site will increase to 510m^2, an increase of 39%.

3.37 It is a requirement of CBC policy that all development includes sustainable drainage systems (SuDS) to ensure that rates of runoff from the site are not increased following development. As a result of compliance with this policy, there will be no adverse impact on the sewer network or downstream flood risk as a result of the proposals. In addition, national policy dictates that development should consider the effects of future climate change within the proposals.

3.38 The proposed development is not expected to generate any additional risk of groundwater flooding, since the increased depth of the basement does not result in any change in the strata that the basement would occupy. Both the existing basement and proposed basement extension are expected to be wholly within London Clay. Further, the site ground investigation found no evidence of significant groundwater flows in the sub-surface strata.

Summary of Flood Risk

3.39 The site is not at significant risk of flooding from any source.

3.40 The proposed basement extension will not increase the risk of groundwater flooding elsewhere due to the underlying ground conditions on site, which consist of non-water bearing strata, as shown by the site ground investigation.

3.41 There is a risk that the development could affect the risk of flooding downstream due to increased rates of runoff arising from increased proportions of man-made surfaces on the site and the future effects of climate change. It is therefore necessary to undertake a drainage assessment for the proposed development.

4 SCREENING – SURFACE FLOW AND FLOODING

Surface Water and Flooding

Question	Response	Details
1. Is the site within the catchment of the ponds chains on Hampstead Heath?	No	As detailed within Paragraph 3.14 and Figure 3
2. As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route?	No	The site drainage will not materially alter following development. The number of bedrooms will reduce following development from 9 to 6 and therefore foul flows to existing connections are expected to reduce.
3. Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?	Yes	The proportion of hard surfaces is anticipated to increase following development. In addition, there is an anticipated increase in runoff rates due to climate change.
4. Will the proposed basement result in changes to the profile of the inflows (instantaneous and long-term) of surface water being received by adjacent properties or downstream watercourses?	Yes	The increase in hard surfaces proposed on the site could result in changes to the surface water runoff profiles from the site.
5. Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	No	The site drainage will not materially alter following development. Foul flows to the combined sewer will reduce.
6. Is the site in an area identified to have surface water flood risk according to either the Local Flood Risk Management Strategy or the Strategic Flood Risk Assessment or is it at risk from flooding, for example because the proposed basement is below the static water level of nearby surface water feature.	No	No

Non-Technical Summary of Screening Process

4.1 The screening process identifies the following issues to be carried forward to scoping for further assessment:

- Potential change in runoff rates due to an increase in the proportion of hard paved surfaces on the site. This requires a SuDS strategy to ensure there is no impact on downstream runoff flows or water quality.
- Potential changes in runoff due to climate change over the lifetime of the development. This requires a SuDS strategy to ensure there is no impact on downstream runoff flows or water quality.

4.2 The other potential concerns considered within the screening process have been demonstrated to be not applicable or not significant when applied to the proposed development.

5 SCOPING – SURFACE FLOW AND FLOODING

5.1 The following issues have been brought forward from the Screening process for further assessment:

- Potential change in runoff rates due to an increase in the proportion of hard paved surfaces on the site.
- Potential changes in runoff due to climate change over the lifetime of the development.

5.2 The proposed development will increase the impermeable areas on the site. The site drainage will not materially alter following development. However, in accordance with current policy, new development should consider increases in runoff both due to increases in hard surfaces, and accounting for climate change over the lifetime of the development.

5.3 A SuDS assessment has therefore been completed to address these two issues.

6 SUDS ASSESSMENT

Policy

6.1 Camden policy only requires a full SuDS strategy at planning application stage for major developments and / or development located in a local flood risk zone. The Camden Water and Flooding CPG states that:

> *"All developments must not increase the risk of flooding [and] Developments are required to utilise Sustainable Drainage Systems (using the drainage hierarchy) to achieve greenfield runoff rates, where feasible"*

6.2 Flood risk assessments are required for; sites over 1ha, major applications in areas at high risk of flooding, and basement developments on streets with a risk of flooding, where historic watercourses are present, or where there is an elevated risk of groundwater flooding. The proposed development does not fall into any of these categories. However, under the Basements CPG, an assessment of the impact on local drainage and flooding is required.

6.3 The Basements CPG states:

> *"The Council will require an adequate drainage plan and has a preference for the use of Sustainable Urban Drainage Systems (SUDS). Only where this cannot be achieved should surface/ground water be discharged to combined sewers."*

Site Runoff Characteristics

6.4 Greenfield runoff rates in the 100 year return period event, for the entire site, are 1.4 l/s, calculated using the IH124 calculation method.

6.5 Due to the site slope, approximately 43% of the current site area to the rear of the property is prevented from leaving the site by the ground profile and the presence of boundary treatments as shown in the topographic survey. Where runoff does pass the boundary, this is at greenfield rates or higher due to the paved area. Following development, the site area discharging in this direction will reduce to approximately 34%. Runoff in this direction will reduce by around 20% due to the reduction in area.

6.6 For the remainder of the site, surface water is assumed to be positively drained. Currently, hard surfaces make up 68% (366m^2) of the site drained area of 539m^2. The gravel area is assumed to be permeable and thus discharges at greenfield rates. The peak runoff rate to the road for the critical storm (5min duration) in the 100 year event is 19.6 l/s.

6.7 In the proposed case, the drained area increases to 606m^2, of which 84% (510m^2) is hard paved. For the critical storm, the peak runoff rate in the 100 year event is 24.6 l/s, which increases to 34.4 l/s when including an allowance of 40% for future climate change. This represents an increase of 5.0 l/s (26%) at present day, and 14.8 l/s (76%) in the future due to the impact of climate change.

Sustainable Drainage Principles

6.8 The aim of SuDS is to emulate natural drainage processes such that watercourses and storage areas receive the hydrological profiles under which they evolved, and that water quality in local ecosystems is protected or improved. The best practice guide states that SuDS will:

- Reduce the impact of additional urbanisation on the frequency and size of floods;
- Protect or enhance river and groundwater quality;

- Be sympathetic to the needs of the local environment and community; and
- Encourage natural groundwater recharge.

6.9 Figure 6 shows the hierarchy of SuDS techniques. The SuDS techniques that are proposed to manage surface water for the development will be discussed in relation to this hierarchy.

	SUDS Technique	Flood Reduction	Pollution Reduction	Landscape & Wildlife
Most Sustainable	**Green roofs**	✓	✓	✓
	Basins and ponds 1. Constructed wetlands 2. Balancing ponds 3. Detention basins 4. Retention ponds	✓	✓	✓
	Filter strips and swales	✓	✓	✓
	Infiltration devices 5. Soakaways 6. Infiltration trenches and basins	✓	✓	✓
	Permeable surfaces and filter drains 7. Gravelled areas 8. Solid paving blocks 9. Porous paviors	✓	✓	
Least Sustainable	**Tanked systems** 10. Over-sized pipes/tanks 11. Box storage systems	✓		

Figure 6: SuDS Hierarchy[8]

6.10 Living roofs are not feasible for the development due to the pitched roof construction. In order to provide source control and retain rainwater on site for reuse, it is strongly recommended that any associated landscaped areas are designed as bioretention areas, tree pits and /or rain gardens to retain and utilise rainfall. Water butts should be installed on rainwater downpipes.

6.11 Basins, ponds, filter strips and swales are not suitable for use within the development due to a lack of available space.

6.12 The ground investigation indicates that the sub-surface geology is made up of London Clay which is not considered to be suitable for infiltration devices (e.g. soakaways) generally. However, it would be beneficial to undertake infiltration testing and a more detailed geological investigation post-planning to determine whether it would be possible to allow paved areas to infiltrate to ground.

6.13 Table 1 includes a summary of potential SuDS options for the site, with reference to the SuDS hierarchy.

[8] http://www.sustainabledrainagecentre.co.uk/suds-hierarchy_c2236.aspx Retrieved 02/11/2016

Table 1: Summary of proposed SuDS with reference to SuDS hierarchy

SUDS Technique	Practicable	Proposed	Notes
Green roofs, bioretention areas, tree pits	✓	✓	Pitched roof construction is not suitable for green roofs. Bioretention areas and tree pits should be incorporated where possible
Basins and ponds	×	×	Insufficient space available on the site
Filter strips and swales	×	×	Insufficient space available on the site
Infiltration devices	×	×	Ground conditions not considered to be suitable
Permeable surfaces and filter drains	✓	✓	Paved areas should be formed of permeable block paving with a suitable porous sub-base (subject to infiltration testing)
Tanked systems	✓	✓	Attenuation tanks to be used to provide additional attenuation storage where necessary.

Discharge Strategy

6.14 The discharge hierarchy should be considered and the relevant Planning Practice Guidance states:

> *"Generally the aim should be discharge surface runoff as high up the following hierarchy of drainage options as reasonably practicable:*
>
> *1. Into the ground (infiltration);*
>
> *2. To a surface water body;*
>
> *3. To a surface water sewer, highway drain or another drainage system;*
>
> *4. To a combined sewer."*

6.15 The proposed drainage strategy should discharge water falling on paved areas to the ground if it is found to be feasible. This is subject to infiltration testing at the post-planning stage. Unfortunately, the site investigation available currently suggests that ground conditions are such that this is not likely to be possible, although the infiltration capacity of London Clay is highly locally variable. The only alternative option is to discharge at attenuated rates to existing connections, namely the Thames Water combined sewer. There is no need to apply to Thames Water for a connection to the existing on-site private demarcation chamber, since there is no increase in the number of properties on the development.

Proposed Surface Water Drainage System

6.16 Surface water runoff from the roof should initially be collected into water butts for use in irrigating garden areas, in accordance with the drainage hierarchy set out in the Camden Water and Flooding CPG.

6.17 The ground conditions on the site should be tested to determine whether it is feasible to discharge surface water from proposed paved areas directly to ground. This would remove the need to pump surface water from the rear terrace to the surface water collection system and would reduce the attenuation burden.

6.18 As a minimum, the final discharge from the site should be limited to the present-day existing 100 year return period runoff rate, where it is reasonably practicable to do so. For the critical storm, this means attenuating the calculated peak flow of 34.4 l/s down to 19.6 l/s (taking into account climate change over the lifetime of the development). This would require $3m^3$ of attenuation storage.

6.19 Management and maintenance of the SuDS should follow the manufacturers guidance and the CIRIA SuDS Guide. This will be finalised in the detailed drainage design of the site. It is typical that this is conditioned as part of granting planning permission.

7 IMPACT ASSESSMENT – SURFACE FLOW AND FLOODING

7.1 The BIA has concluded there is negligible risk of flooding from any source affecting the site.

7.2 Without adequate mitigation, surface water runoff rates will increase following development; however, they can be attenuated to current, present day rates and discharged to existing connections, with a storage requirement of 3m^3. The detailed design of the drainage system should consider the use of bioretention areas within the landscaping to prevent runoff, as well as consider the potential for infiltration through the base of permeable paved surfaces. All paved areas should be of permeable construction, and water butts should be installed on all downpipes.

7.3 Subject to the recommendations above and detailed in Chapter 6, the assessment considers that the proposed development, through provision of a suitable SuDS strategy and adequate mitigation, would not increase peak runoff rates downstream and would not result in increased pressure on the wider drainage area infrastructure. There is potential at detailed design stage to provide betterment to the existing site conditions and reduce pressure on the wider area.

7.4 The BIA has concluded there are no likely impacts to the wider hydrological environment as a result of the proposed development.

APPENDIX A: DESK STUDY REFERENCES

Ordnance Survey mapping

- https://explore.osmaps.com/
- https://www.visionofbritain.org.uk/

BGS Geological mapping and hydrogeological data

- http://mapapps.bgs.ac.uk/geologyofbritain/home.html
- http://mapapps2.bgs.ac.uk/geoindex/home.html?layer=BGSHydroMap
- https://www2.bgs.ac.uk/research/groundwater/datainfo/hydromaps/home.html

Site ground investigation undertaken on 28th February 2022 by Ground and Water

Hydrological information from the Flood Estimation Handbook (FEH) web service

- https://fehweb.ceh.ac.uk/

UK government Environmental Open Data and Magic Map

- https://environment.data.gov.uk/spatialdata/flood-map-for-planning-rivers-and-sea-flood-zone-3/
- https://environment.data.gov.uk/spatialdata/flood-map-for-planning-rivers-and-sea-flood-zone-2/
- https://environment.data.gov.uk/spatialdata/risk-of-flooding-from-surface-water-extent-1-percent-annual-chance/
- https://environment.data.gov.uk/spatialdata/risk-of-flooding-from-surface-water-extent-0-1-percent-annual-chance/
- https://environment.data.gov.uk/spatialdata/reservoir-flood-extents-wet-day/
- https://environment.data.gov.uk/DefraDataDownload/?Mode=survey

URS, London Borough of Camden SFRA, July 2014

Drain London/London Borough of Camden, Preliminary Flood Risk Assessment, v0.2, April 2011

London Borough of Camden, Floods in Camden Report of the Floods Scrutiny Panel, June 2003

London Borough of Camden, Camden Planning Guidance: Basements, January 2021

London Borough of Camden, Camden geological, hydrogeological and hydrological study – Guidance for subterranean development, Issue 01, November 2010

APPENDIX B: SITE SPECIFIC DATA

The following data for the site and surrounding area have been obtained:

- Site Investigation
- Thames Water Asset Location Data

2 The Long Barn,
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PRELIMINARY SUMMARY

CLIENT	Vincent and Rymill Limited
SITE ADDRESS	61 Redington Road, London Borough of Camden, London NW3 7RP.
REPORT REFERENCE	GWPR4656/PS/March 2022 Conditions and limitations of this preliminary summary can be viewed within Appendix A.
ENGINEER	Aubyn Shortland, Ground and Water Limited
ANTICIPATED GEOLOGY AND HYDROGEOLOGY	The British Geological Survey (BGS) maps and DEFRA online maps for the area suggest that the site was located on the Claygate Member of the London Clay Formation, classified as a Secondary A Bedrock Aquifer, overlying the London Clay Formation, classified as Unproductive Bedrock Strata. Based on this, it was anticipated that groundwater was perched on top of the London Clay Formation, within the Claygate Member of the London Clay Formation, localised in granular bands. The main groundwater table though is expected below the unproductive aquifer.
INVESTIGATION LOCATIONS AND SCOPE OF WORKS	Site works were undertaken on the 28th of February 2022 and comprised the drilling of 1No. windowless sampler borehole (WS01) to 8.45m bgl. Standard Penetration Tests conducted at 1.00m intervals. A further 2No. hand-held window sampler trial holes (WS02 – WS03) were undertaken to 3.10m – 3.30m bgl, where technical refusal was met due to the stiffness of the underlying soils. A total of 2No. combined groundwater and ground-gas monitoring standpipes were installed within WS01 and WS02. The installations and backfill information can be viewed below.

Combined Ground-gas and Groundwater Monitoring Well Construction

Trial Hole	Type of Installation	Depth of Installation (m bgl)	Thickness of slotted piping with gravel filter pack (m)	Depth of plain piping with bentonite seal (m bgl)	Response Zone (m bgl)	Piping internal diameter (mm)
WS01	Standpipe	5.00	4.00	1.00	1.00 – 5.00	50
WS02	Standpipe	3.00	2.00	1.00	1.00 – 3.00	50

Site works also included the hand excavation of 3No. trial pit foundation exposures (TP/FE01 - TP/FE03), to discover the base of the existing foundations schemes. TP/FE01 was excavated on the north - eastern facing external wall and TP/FE02 - TP/FE03 were excavated on south-western facing external walls.

The trial holes were undertaken at varying levels across the site, the relative ground levels in respect to metres above ordnance datum (m AOD) for each trial hole can be seen tabulated below.

Trial Hole Ground Levels

Trial Hole	Ground Level (m AOD)
WS01	98.55
WS02	96.50
WS03	96.28
TP/FE01	98.57
TP/FE02	96.57
TP/FE03	96.57

A trial hole location plan is provided in Figure 1. Detailed foundation exposure diagrams can be seen within Figure 2 - Figure 4.

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PRELIMINARY SUMMARY

A selection of soil samples was taken for laboratory chemical and geotechnical testing. Upon completion of the site works all trial holes and/or trial pits were backfilled and made good/reinstated in relation to the surrounding area.

GROUND CONDITIONS ENCOUNTERED

A summary of the ground conditions encountered within all trial holes can be viewed below. Trial hole logs can be viewed within Appendix B.

Summary of Strata Encountered (WS01 – WS03)

Strata	Top Depth (m AOD)	Base Depth (m AOD)	Thickness (m)
MADE GROUND: Dark brown clayey gravelly fine to coarse SAND. Gravel was angular to subrounded fine to coarse fragments of flint (80%) and brick (20%).	98.55	97.95	0.60
MADE GROUND: Dark brown gravelly sandy CLAY. Sand was fine to coarse. Gravel was angular to sub-rounded fine to coarse fragments of brick (30% - 70%), flint (30% - 60%) and concrete (10%).	96.28 - 96.50	95.08 - 95.60	0.90 – 1.20
HEAD DEPOSITS: Orangish brown with greyish brown mottling slightly gravelly silty CLAY. Gravel was sub-angular to sub-rounded fine to coarse flint.	97.95	97.65	0.30
LONDON CLAY FORMATION: Orangish brown with light greyish brown mottling silty CLAY.	95.08 - 97.65	>93.20 - 94.18	1.00 - 3.90
LONDON CLAY FORMATION: Yellowish brown and dark grey silty CLAY.	94.18	>93.18	>1.00
LONDON CLAY FORMATION: Dark grey silty CLAY.	93.75	>90.10	>3.65

Summary of Strata Encountered (TP/FE01 – TP/FE03)

Strata	Top Depth (m AOD)	Base Depth (m AOD)	Thickness (m)
MADE GROUND: Dark brown gravelly sandy CLAY. Sand was fine to coarse. Gravel was angular to subrounded fine to coarse fragments of brick (40% - 80%), concrete (40%), flint (20% - 40%) and carbonaceous material (10%).	96.57 - 98.57	>95.57- 97.87	0.40 - >1.00
LONDON CLAY FORMATION: Orangish brown with light greyish brown mottling silty CLAY.	96.17 - 97.87	>95.57 - >97.21	>0.60

IN-SITU STRENGTH TESTING (SPTs)

An interpretation of the in-situ geotechnical testing results for WS01 is given in the table below.

Interpretation of In-situ Geotechnical Testing Results

Strata	SPT "N" Blow Counts	Equivalent Undrained Shear Strength (Cu) (kPa)	Cohesive Soil Type (Cu)	Trial Hole/s
London Clay Formation	8	40	Low (upper boundary)	WS01/5.00 – 5.45m bgl
	10 – 13	50 – 65	Medium	WS01/1.00 – 3.45m bgl WS01/6.00 – 6.45m bgl
	15 – 110	15 – 22	High	WS01/4.00 – 4.45m bgl WS01/7.00 – 8.45m bgl

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ROOTS

Fresh roots were noted to proven depths of between 95.28m – 97.05m AOD within WS01 – WS03 and TP/FE01 & TP/FE03. Fresh roots were noted to an unproven depth of 95.57m AOD in TP/FE02.

Dead/decayed roots were noted at a depth of 93.28m AOD within WS03. Given these roots were dead/decayed, they were not anticipated to be up taking water from the soils and therefore were not considered to pose a risk to the serviceability of potential foundations. Geotechnical testing should be reviewed to update/confirm.

The depth of root penetration can be seen tabulated below.

Summary of Root Depth

Trial Hole	Fresh Roots		Decayed Roots	
	(m bgl)	(m AOD)	(m bgl)	(m AOD)
WS01	1.50	97.05	95.50	-
WS02	1.00	95.50	-	-
WS03	1.00	95.28	3.00	93.28
TP/FE01	1.00	97.57	-	-
TP/FE02	>1.00	>95.57	-	-
TP/FE03	0.20	96.37	-	-

It should be noted that roots may be found to greater depths at other locations on the site, particularly close to trees and/or trees that have been removed both within the site and its close environs.

GROUNDWATER

No groundwater strikes were noted in the trial holes during the investigation; however, a slight seepage was noted within WS01 at 92.55m AOD (6.00m bgl) anticipated to be perched water within sandy/silty bands of the London Clay Formation. Further perched water was noted within TP/FE03 at 95.87m AOD (0.70m bgl).

Further perched water was likely to be found within the Made Ground and underlying strata where silty/sandy/gravelly bands are noted, especially after periods of intense or prolonged rainfall.

ANTICIPATED VOLUME CHANGE POTENTIAL

The following volume change potential was anticipated based on a physical and visual appraisal of the soils encountered and was subject to confirmation of results of geotechnical classification testing:

- **Head Deposits:** Likely to have **low to medium** volume change potential in accordance with NHBC Standards Chapter 4.2 and BRE240.
- **London Clay Formation:** Likely to have **medium to high** volume change potential in accordance with NHBC Standards Chapter 4.2 and BRE240.

GENERAL FOUNDATION RECOMMENDATION

At the time of reporting, March 2022, it was understood the proposed development comprised the full footprint extension of the existing basement structure. The development would also include the construction of a new gable with parapet. The specific layout and depth of the basement was currently unknown.

- Made Ground was noted to a proven depth of between 95.08m – 97.95AOD within WS01 - WS02 and TP/FE01 & TP/FE03. The depth of Made Ground was not proven within TP/FE02 and reached an unproven depth of >95.57m AOD.

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As a result of the inherent variability Made Ground, these materials are usually unpredictable in terms of bearing capacity and settlement characteristics. Foundations should, therefore, be taken through any Made Ground and either into, or onto a suitable underlying natural stratum of adequate bearing characteristics.

- The Head Deposits were likely to have medium volume change potential in accordance with BRE240 and NHBC Standards Chapter 4.3. Bedrock soils of the London Clay Formation were likely to have high volume change potential in accordance with NHBC Standards Chapter 4.2 and BRE240.

  Foundations should be designed in accordance with the volume change potential classification, confirmed from geotechnical testing. Heave protection measures are also recommended for the slab to account for heave resulting from soil removal.

- The London Clay Formation was generally classified as having generally medium - high undrained shear strengths. A soft spot (SPT N value ≤8) was identified from 93.10m – 93.55m AOD (local level: 5.00m – 5.45m bgl) within the London Clay Formation, which should be considered in the final design, dependant on basement dimensions and required bearing capacities.

  The loads of proposed foundations should not exceed the bearing capacity of the soils they are founding upon, nor should >25mm of load-induced settlement occur. Bearing capacity and settlement analysis shall be undertaken as part of the final report.

- Fresh roots were noted to proven depths of between 95.28m – 97.05m AOD within WS01 – WS03 and TP/FE01 & TP/FE03. Fresh roots were noted to an unproven depth of 95.57m AOD in TP/FE02. Dead/decayed roots were noted at a depth of 93.28m AOD within WS03. Roots may be encountered at greater depths within the vicinity of trees.

  Foundations must not be placed within root penetrated and/or desiccated soils with volume change potential. It is recommended that foundations are taken at least 300mm into non-root penetrated strata if soils have volume change potential, or into soils of no volume change potential. The influence of trees on or surrounding the site will need to be taken into account in final design (NHBC Standards Chapter 4. 2) (tree rings).

- No groundwater strikes were noted in the trial holes during the investigation. Perched water seepage was noted at 92.55m AOD (6.00m bgl) within WS01 and at 95.87m AOD (0.70m bgl) within TP/FE03.

  Any groundwater or surface water ingress must be prevented from entering excavations. Excavations must be kept dry and either concreted or blinded as soon after excavation as possible. If water were allowed to accumulate on the formation for even a short time not only would an increase in heave occur resulting from the soil increasing in volume by taking up water, but also the shear strength and hence the bearing capacity would also be reduced,

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PRELIMINARY SUMMARY	
	and this could result in increased settlements. Perched water may be recorded within excavations, especially after a period of prolonged rainfall. Instability issues may arise within the foundation trenches, in case of perched water being present. Retaining wall foundations constructed at a depth of 95.05m AOD (3.50m bgl) on the soils of the London Clay Formation at this depth can be designed based on a presumed safe bearing capacity of ~100kN/m^2. Retaining wall foundations constructed at a depth of 93.05m AOD (5.00m bgl) on the soils of the London Clay Formation at this depth can be designed based on a presumed safe bearing capacity of ~80kN/m^2. Retaining wall foundations constructed at a depth of 92.05m AOD (6.00m bgl) on the soils of the London Clay Formation at this depth can be designed based on a presumed safe bearing capacity of ~130kN/m^2. This was based on trial hole records, in-situ testing, inspection of samples recovered and referral to BS 8004:2015 *Code of Practice for Foundations* and based on a 5m long by 1m wide foundation and a maximum settlement of 25mm. Settlement/heave is likely to be moderate.
GEOTECHNICAL CONSIDERATIONS	A number of geotechnical considerations should be considered during the design and construction of the basement, which will be discussed further within the finalised report. The main risks associated with the project are detailed below: • Ground movement around the excavation; • Retaining wall design; • Temporary works; • Groundwater ingress; • Heave following overburden pressure release; • Flooding (perched water, surface water, sewer, combined).
LABORATORY TESTING	A number of samples were sent to the laboratory for geotechnical and chemical testing. The results were not available at the time of writing the preliminary summary and will be included within the final report. Black staining and a hydrocarbon odour was noted within the 3.00m bgl sample. A programme of chemical laboratory testing was scheduled for this sample to confirm any potential contamination.
Figure 1	**Trial Hole Location Plan**
Figure 2	**Trial Pit Foundation Exposure 01**
Figure 3	**Trial Pit Foundation Exposure 02**
Figure 4	**Trial Pit Foundation Exposure 03**
Appendix A	**Conditions and Limitations**
Appendix B	**Trial Hole Logs**
This preliminary information may be subject to amendment in the final report and no liability can be accepted for any actions based on this preliminary information.	

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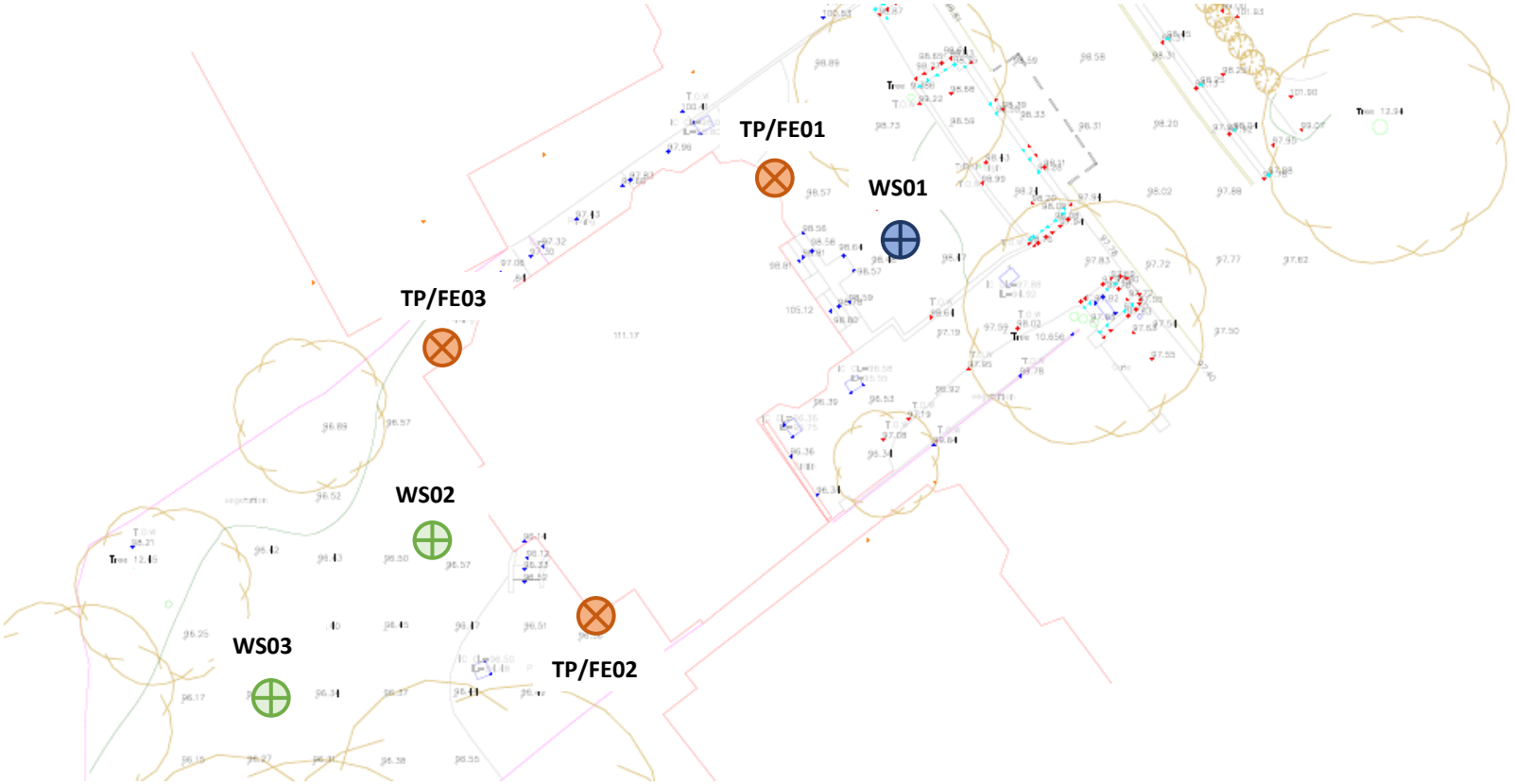
Figures:



Site boundary

Hand Excavated Trial Pit

Windowless Sampler Borehole

Window Sampler Borehole

NTS

61 Redington Road, London Borough of Camden, London NW3 7RP	
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Figure 1 – Trial Hole Location Plan	**GWPR4656**

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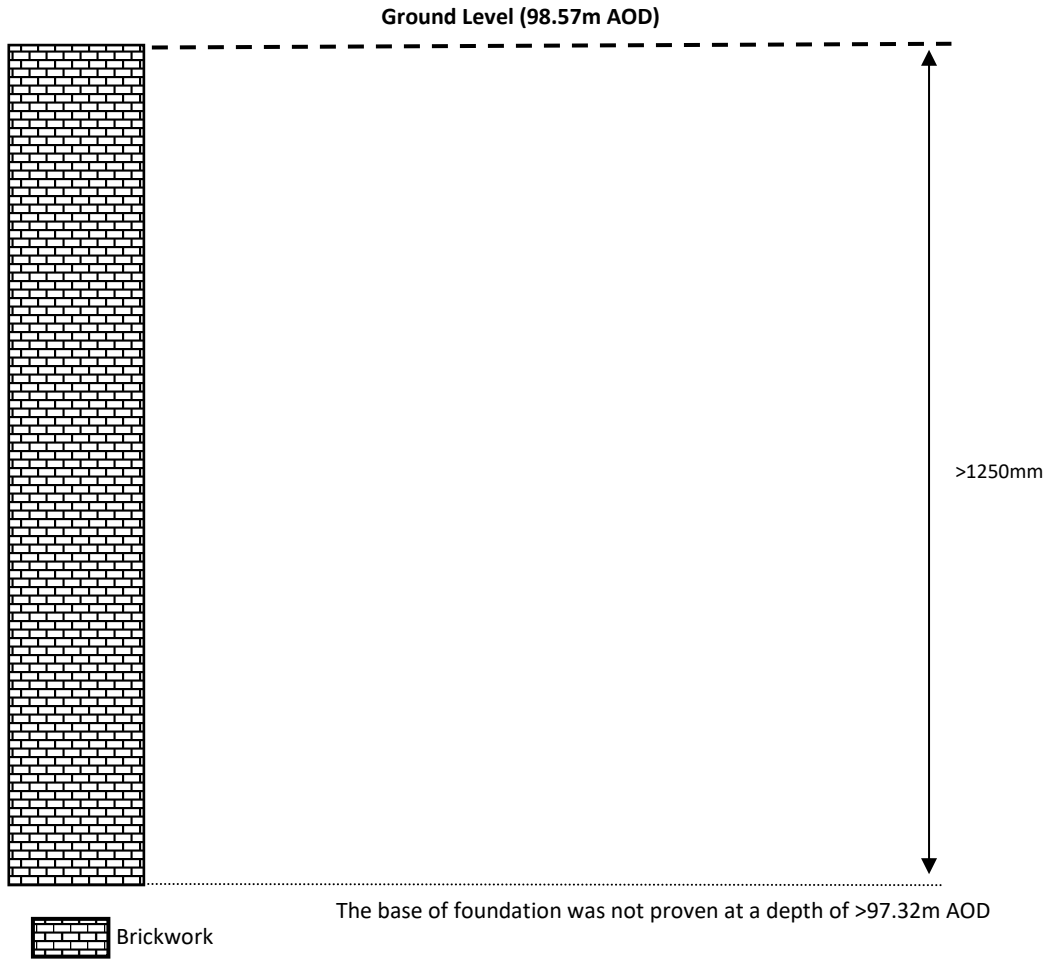

MADE GROUND (98.57m – 97.87m AOD): Dark brown gravelly sandy CLAY. Sand was fine to coarse. Gravel was angular to subrounded fine to coarse fragments of brick (50%), flint (40%) and carbonaceous material (10%).

LONDON CLAY FORMATION (97.87m - >97.27m AOD): Orangish brown with light greyish brown mottling silty CLAY.

NOT TO SCALE

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Vincent and Rymill Limited	**March 2022**
Figure 2 – TP/FE01	**GWPR4656**

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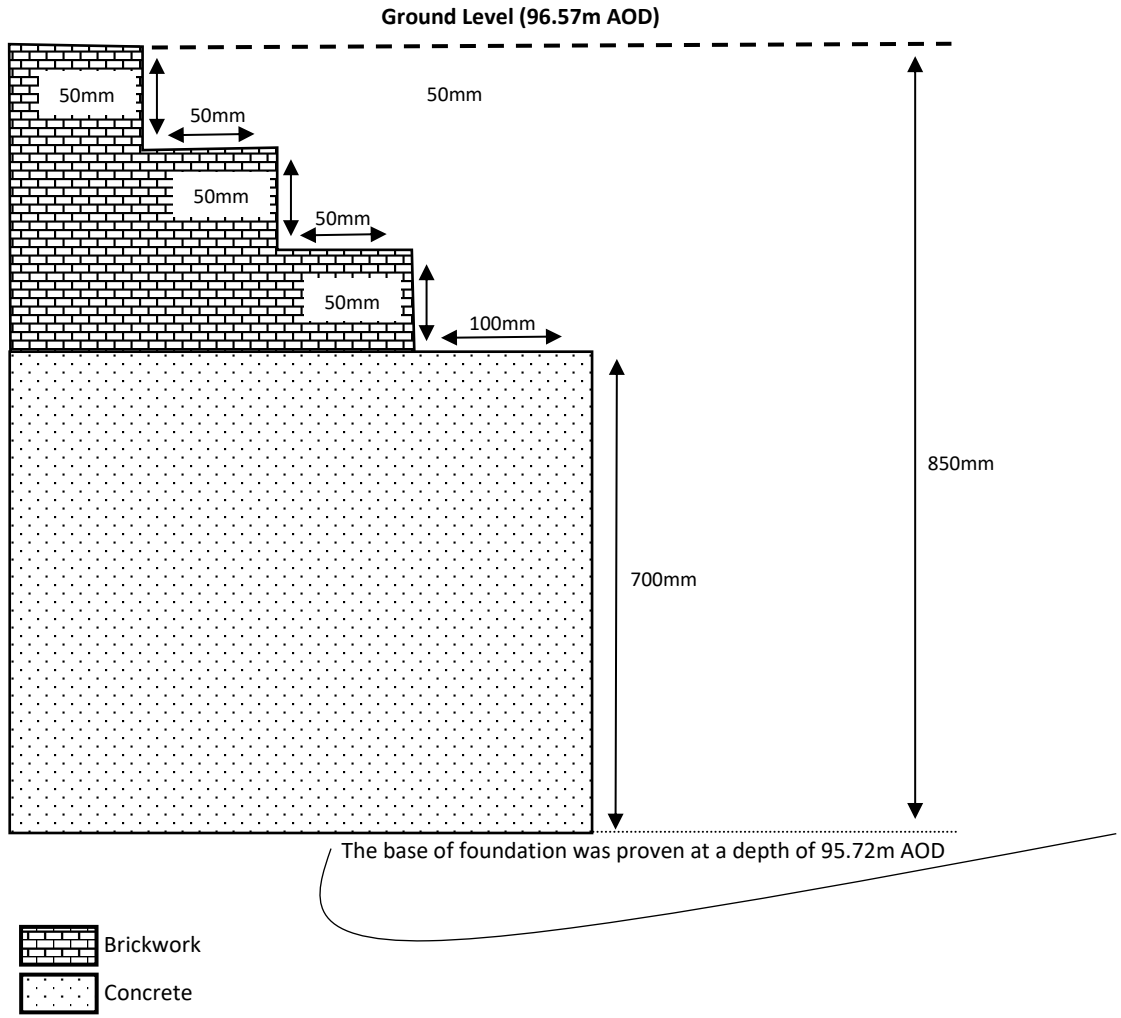

MADE GROUND (96.57m – >95.57m AOD): Dark brown gravelly sandy CLAY. Sand was fine to coarse. Gravel was angular to sub-rounded fine to coarse fragments of concrete (40%), brick (40%) and flint (20%).

NOT TO SCALE

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Figure 3 – TP/FE02	**GWPR4656**

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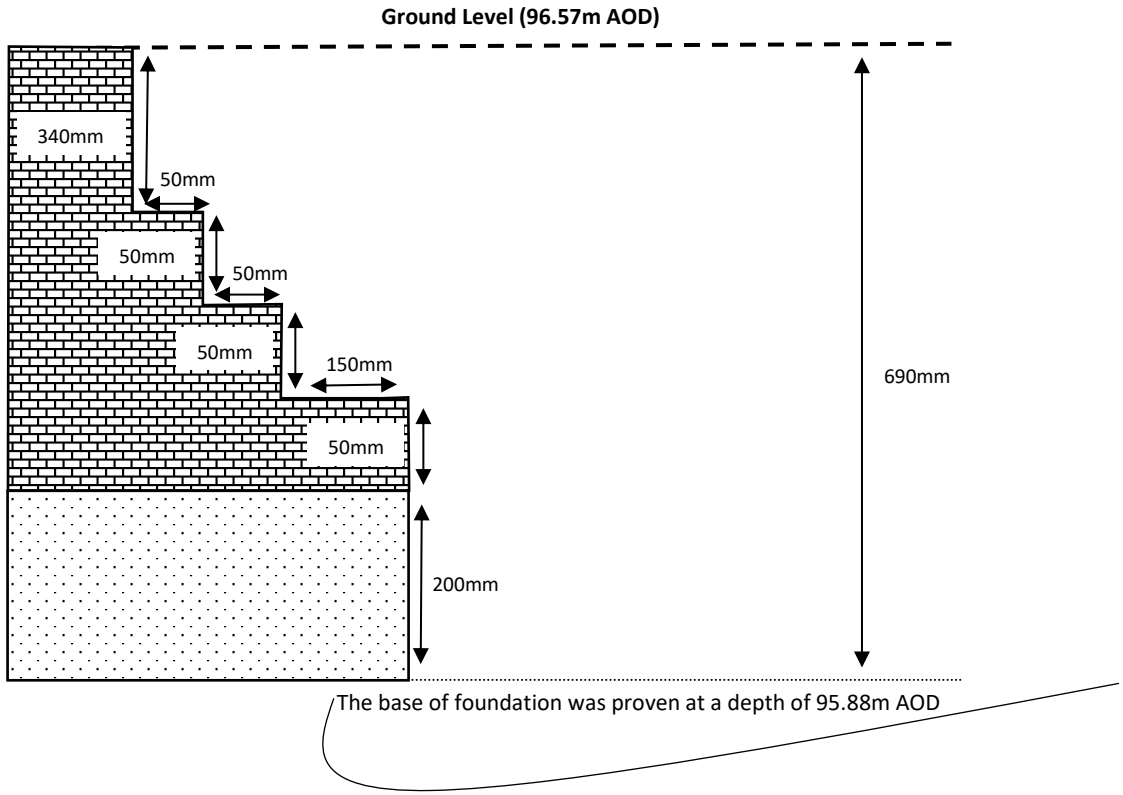

MADE GROUND (96.57m – 96.17m AOD): Dark brown gravelly sandy CLAY. Sand was fine to coarse. Gravel was angular to sub-rounded fine to coarse fragments of brick (80%) and flint (20%).

LONDON CLAY FORMATION (96.17m - >95.57m AOD): Orangish brown with light greyish brown mottling silty CLAY.

NOT TO SCALE

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Figure 4 – TP/FE03	**GWPR4656**

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APPENDIX A:
Conditions and Limitations

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The ground is a product of continuing natural and artificial processes. As a result, the ground will exhibit a variety of characteristics that vary from place to place across a site, and also with time. Whilst a ground investigation will mitigate to a greater or lesser degree against the resulting risk from variation, the risks cannot be eliminated.

The report has been prepared on the basis of information, data and materials which were available at the time of writing. Accordingly any conclusions, opinions or judgements made in the report should not be regarded as definitive or relied upon to the exclusion of other information, opinions and judgements.

The investigation, interpretations, and recommendations given in this report were prepared for the sole benefit of the client in accordance with their brief; as such these do not necessarily address all aspects of ground behaviour at the site. No liability is accepted for any reliance placed on it by others unless specifically agreed in writing.

Any decisions made by you, or by any organisation, agency or person who has read, received or been provided with information contained in the report ("you" or "the Recipient") are decisions of the Recipient and we will not make, or be deemed to make, any decisions on behalf of any Recipient. We will not be liable for the consequences of any such decisions.

Current regulations and good practice were used in the preparation of this report. An appropriately qualified person must review the recommendations given in this report at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.

Any Recipient must take into account any other factors apart from the Report of which they and their experts and advisers are or should be aware. The information, data, conclusions, opinions and judgements set out in the report may relate to certain contexts and may not be suitable in other contexts. It is your responsibility to ensure that you do not use the information we provide in the wrong context.

This report is based on readily available geological records, the recorded physical investigation, the strata observed in the works, together with the results of completed site and laboratory tests. Whilst skill and care has been taken to interpret these conditions likely between or below investigation points, the possibility of other characteristics not revealed cannot be discounted, for which no liability can be accepted. The impact of our assessment on other aspects of the development required evaluation by other involved parties.

The opinions expressed cannot be absolute due to the limitations of time and resources within the context of the agreed brief and the possibility of unrecorded previous in ground activities. The ground conditions have been sampled or monitored in recorded locations and tests for some of the more

2 The Long Barn,
Norton Farm, Selborne Road,
Alton, Hampshire GU34 3NB

0333 600 1221
enquiries@groundandwater.co.uk

groundandwater.co.uk

common chemicals generally expected. Other concentrations of types of chemicals may exist. It was not part of the scope of this report to comment on environment/contaminated land considerations.

The conclusions and recommendations relate to 61 Redington Road, London Borough of Camden, London NW3 7RP.

Trial hole is a generic term used to describe a method of direct investigation. The term trial pit, borehole or window sampler borehole implies the specific technique used to produce a trial hole.

The depth to roots and/or of desiccation may vary from that found during the investigation. The client is responsible for establishing the depth to roots and/or of desiccation on a plot-by-plot basis prior to the construction of foundations. Where trees are mentioned in the text this means existing trees, recently removed trees (approximately 15 years to full recovery on cohesive soils) and those planned as part of the site landscaping.

2 The Long Barn,
Norton Farm, Selborne Road,
Alton, Hampshire GU34 3NB

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APPENDIX B:
Trial Hole Logs

Percussion Drilling Log

Project Name: 61 Redington Road	Client: Vincent and Rymill Limited	Date: 28/02/2022
Location: London Borough of Camden, London NW3 7RP	Contractor:	
Project No. : GWPR4656	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS01	WLS	98.55m AoD	AS	1:50	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	D					MADE GROUND: Dark brown clayey gravelly fine to coarse SAND. Gravel was angular to sub-rounded fine to coarse fragments of flint (80%) and brick (20%).
		0.50	D		0.60	97.95		
		0.80	D					Orangish brown with greyish brown mottling slightly gravelly silty CLAY. Gravel was sub-angular to sub-rounded fine to coarse flint. (HEAD DEPOSITS)
		1.00	D		0.90	97.65		Orangish brown with light greyish brown mottling silty CLAY. (LONDON CLAY FORMATION)
		1.00	SPT	N=10 (1,1/2,2,3,3)				
		1.50	D					
		2.00	D					
		2.00	SPT	N=12 (1,2/3,3,3,3)				
		2.50	D					
		3.00	D					
		3.00	SPT	N=10 (2,2/2,2,3,3)				
		3.50	D					
		4.00	D					
		4.00	SPT	N=15 (2,2/3,4,4,4)				
		4.50	D					
		5.00	D		4.80	93.75		Dark grey silty CLAY. (LONDON CLAY FORMATION)
		5.00	SPT	N=8 (2,2/2,2,2,2)				
		5.50	D					
		6.00	D					
		6.00	SPT	N=13 (2,2/3,3,3,4)				
		6.50	D					
		7.00	D					
		7.00	SPT	N=20 (4,4/5,5,5,5)				
		7.50	D					
		8.00	D					
		8.00	SPT	N=22 (4,5/5,5,6,6)				
					8.45	90.10		End of Borehole at 8.450m

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

Fresh roots noted to a depth of 1.50m bgl. Groundwater seepage was encountered at 6.00m bgl.

Percussion Drilling Log

Project Name: 61 Redington Road	Client: Vincent and Rymill Limited	Date: 28/02/2022
Location: London Borough of Camden, London NW3 7RP	Contractor:	
Project No. : GWPR4656	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS02	WS	96.50m AoD	AS	1:50	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	D					MADE GROUND: Dark brown gravelly sandy CLAY. Sand was fine to coarse. Gravel was angular to sub-rounded fine to coarse fragments of brick (70%) and flint (30%).
		0.50	D					
		0.80	D					
		1.00	D		0.90	95.60		Orangish brown with light greyish brown mottling silty CLAY. (LONDON CLAY FORMATION)
		1.50	D					
		2.00	D					
		2.50	D					
		3.00	D					
		3.30	D		3.30	93.20		End of Borehole at 3.300m

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

Fresh roots were noted to a depth of 1.00m bgl. No groundwater strikes were encountered.

Percussion Drilling Log

Project Name: 61 Redington Road	Client: Vincent and Rymill Limited	Date: 28/02/2022
Location: London Borough of Camden, London NW3 7RP	Contractor:	
Project No. : GWPR4656	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS03	WS	96.28m AoD	AS	1:50	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	D					MADE GROUND: Dark brown gravelly sandy CLAY. Sand was fine to coarse. Gravel was angular to sub-rounded fine to coarse fragments of flint (60%), brick (30%) and concrete (10%).
		0.50	D					
		0.80	D					
		1.00	D					
					1.20	95.08		Orangish brown with light greyish brown mottling silty CLAY. (LONDON CLAY FORMATION)
		1.50	D					
		2.00	D					
					2.10	94.18		Yellowish brown and dark grey silty CLAY. (LONDON CLAY FORMATION)
		2.50	D					
		3.00	D					*Black staining with hydrocarbon odour noted.*
					3.10	93.18		End of Borehole at 3.100m

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

Fresh roots were noted to a depth of 1.00m bgl. Dead/decayed roots were noted to a depth of 3.00m bgl. Black staining and a hydrocarbon odour was noted within the 3.00m bgl sample.

Trial Pit Log

Project Name: 61 Redington Road	Client: Vincent and Rymill Limited	Date: 28/02/2022
Location: London Borough of Camden, London NW3 7RP	Contractor:	
Project No. : GWPR4656	Crew Name:	Equipment:

Location Number	Location Type	Level	Logged By	Scale	Page Number
TP/FE01	TP	98.57m AoD	AS	1:25	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	D					MADE GROUND: Dark brown gravelly sandy CLAY. Sand was fine to coarse. Gravel was angular to sub-rounded fine to coarse fragments of brick (50%), flint (40%) and carbonaceous material (10%).
		0.50	D					
					0.70	97.87		
		0.80	D					Orangish brown with light greyish brown mottling silty CLAY. (LONDON CLAY FORMATION)
		1.00	D					
					1.30	97.27		End of Borehole at 1.300m

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks

Remarks

Fresh roots were noted to a depth of 1.00m bgl. No groundwater strikes were observed.

Trial Pit Log

Project Name: 61 Redington Road	Client: Vincent and Rymill Limited	Date: 28/02/2022
Location: London Borough of Camden, London NW3 7RP	Contractor:	
Project No. : GWPR4656	Crew Name:	Equipment:

Location Number	Location Type	Level	Logged By	Scale	Page Number
TP/FE02	TP	96.57m AoD	AS	1:25	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	D					MADE GROUND: Dark brown gravelly sandy CLAY. Sand was fine to coarse. Gravel was angular to sub-rounded fine to coarse fragments of concrete (40%), brick (40%) and flint (20%).
		0.50	D					
		0.80	D					
		1.00	D		1.00	95.57		End of Borehole at 1.000m

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks

Remarks

Fresh roots were noted to an unproven depth of >1.00m bgl. No groundwater strikes were observed.

Trial Pit Log

Project Name: 61 Redington Road	Client: Vincent and Rymill Limited	Date: 28/02/2022
Location: London Borough of Camden, London NW3 7RP	Contractor:	
Project No. : GWPR4656	Crew Name:	Equipment:

Location Number	Location Type	Level	Logged By	Scale	Page Number
TP/FE03	TP	96.57m AoD	AS	1:25	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	D					MADE GROUND: Dark brown gravelly sandy CLAY. Sand was fine to coarse. Gravel was angular to sub-rounded fine to coarse fragments of brick (80%) and flint (20%).
		0.50	D		0.40	96.17		Orangish brown with light greyish brown mottling silty CLAY. (LONDON CLAY FORMATION)
		0.80	D					
		1.00	D		1.00	95.57		End of Borehole at 1.000m

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks

Remarks

Fresh roots were noted to a depth of 0.20m bgl. Perched water was observed at 0.70m bgl.

Asset location search

Property Searches

Water Environment Ltd
Coppergate Mews
6Brighton Road
LONDON
KT6 5NE

Search address supplied 61
Redington Road
London
NW3 7RP

Your reference 22021 61 Redington Road

Our reference ALS/ALS Standard/2022_4590753

Search date 17 February 2022

Knowledge of features below the surface is essential for every development

The benefits of this knowledge not only include ensuring due diligence and avoiding risk, but also being able to ascertain the feasibility of any development.

Did you know that Thames Water Property Searches can also provide a variety of utility searches including a more comprehensive view of utility providers' assets (across up to 35-45 different providers), as well as more focused searches relating to specific major utility companies such as National Grid (gas and electric).

Contact us to find out more.

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

0800 009 4540

Asset location search

Property Searches

Search address supplied: 61, Redington Road, London, NW3 7RP

Dear Sir / Madam

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

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

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

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

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

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

Contact Us

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0800 009 4540, 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 0800 316 9800. The Customer Centre can also arrange for a full flow and pressure test to be carried out for a fee.

For your guidance:

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

Payment for this Search

A charge will be added to your suppliers account.

Further contacts:

Waste Water queries

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

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

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

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

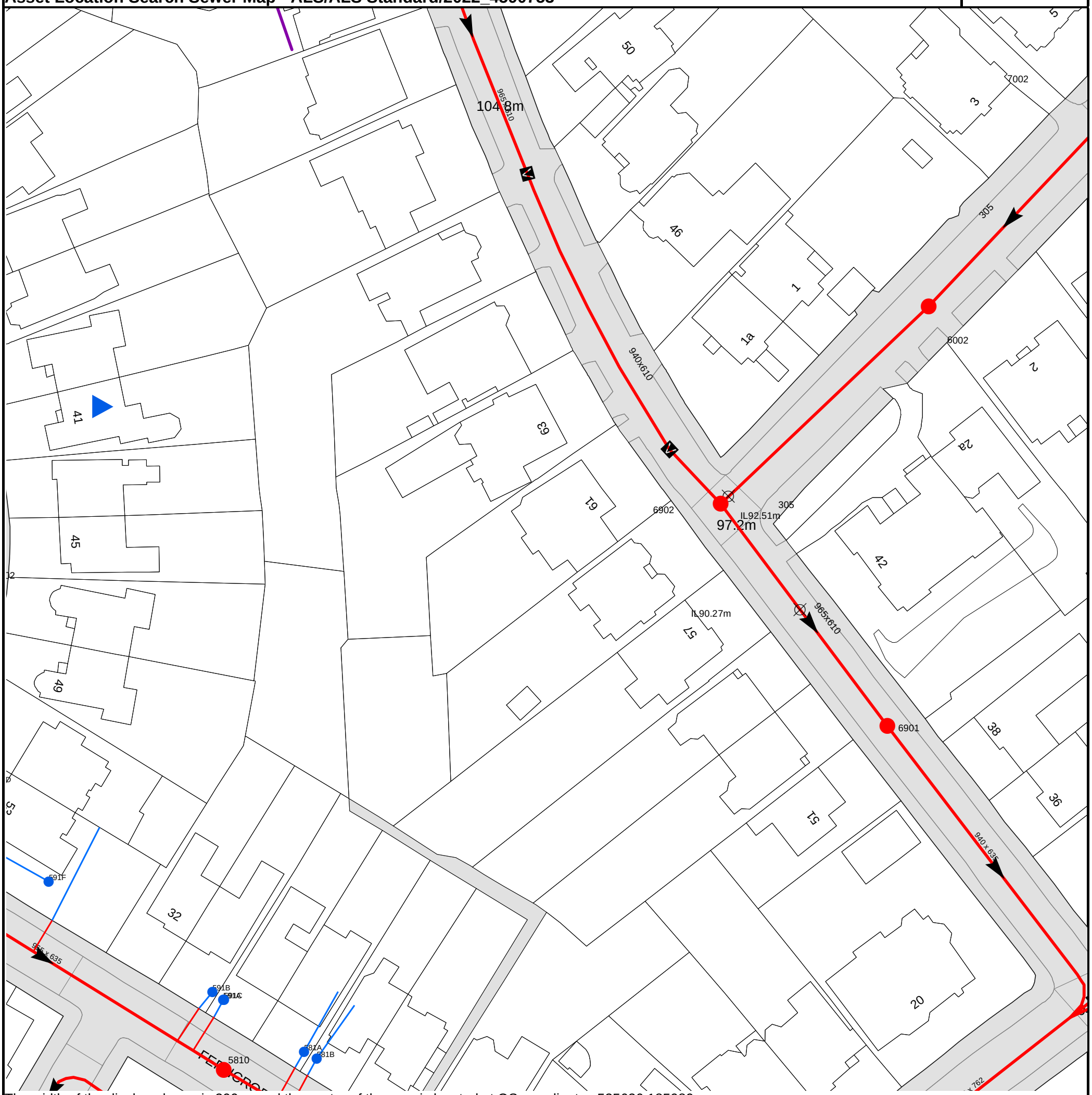
Clean Water queries

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

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

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

Asset Location Search Sewer Map - ALS/ALS Standard/2022_4590753



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 525626,185989

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
591B	n/a	n/a
591A	n/a	n/a
5810	90.28	83.69
591C	n/a	n/a
581A	n/a	n/a
581B	n/a	n/a
6902	97.3	91.98
6901	94.97	89.34
6002	98.22	93.36
591F	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.

Asset Location Search - Sewer Key

Public Sewer Types (Operated and maintained by Thames Water)

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

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

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

- Storm Sewer
- Sludge Sewer
- Foul Trunk Sewer
- Surface Trunk Sewer
- Combined Trunk Sewer
- Foul Rising Main
- Surface Water Rising Main
- Combined Rising Main
- Vacuum
- Thames Water Proposed
- Vent Pipe
- Gallery

Other Sewer Types (Not operated and maintained by Thames Water)

- Sewer
- Culverted Watercourse
- Proposed
- Decommissioned Sewer
- Content of this drainage network is currently unknown
- Ownership of this drainage network is currently unknown

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
- Meter
- Dam Chase
- Vent
- Fitting

Operational Controls

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

- Ancillary
- Drop Pipe
- Control Valve
- 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.

- Inlet
- Outfall
- Undefined End

Other Symbols

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

- Change of Characteristic Indicator
- Public / Private Pumping Station
- Invert Level
- Summit

Areas

Lines denoting areas of underground surveys, etc.

- Agreement
- Chamber
- Operational Site

Ducts or Crossings

- Casement

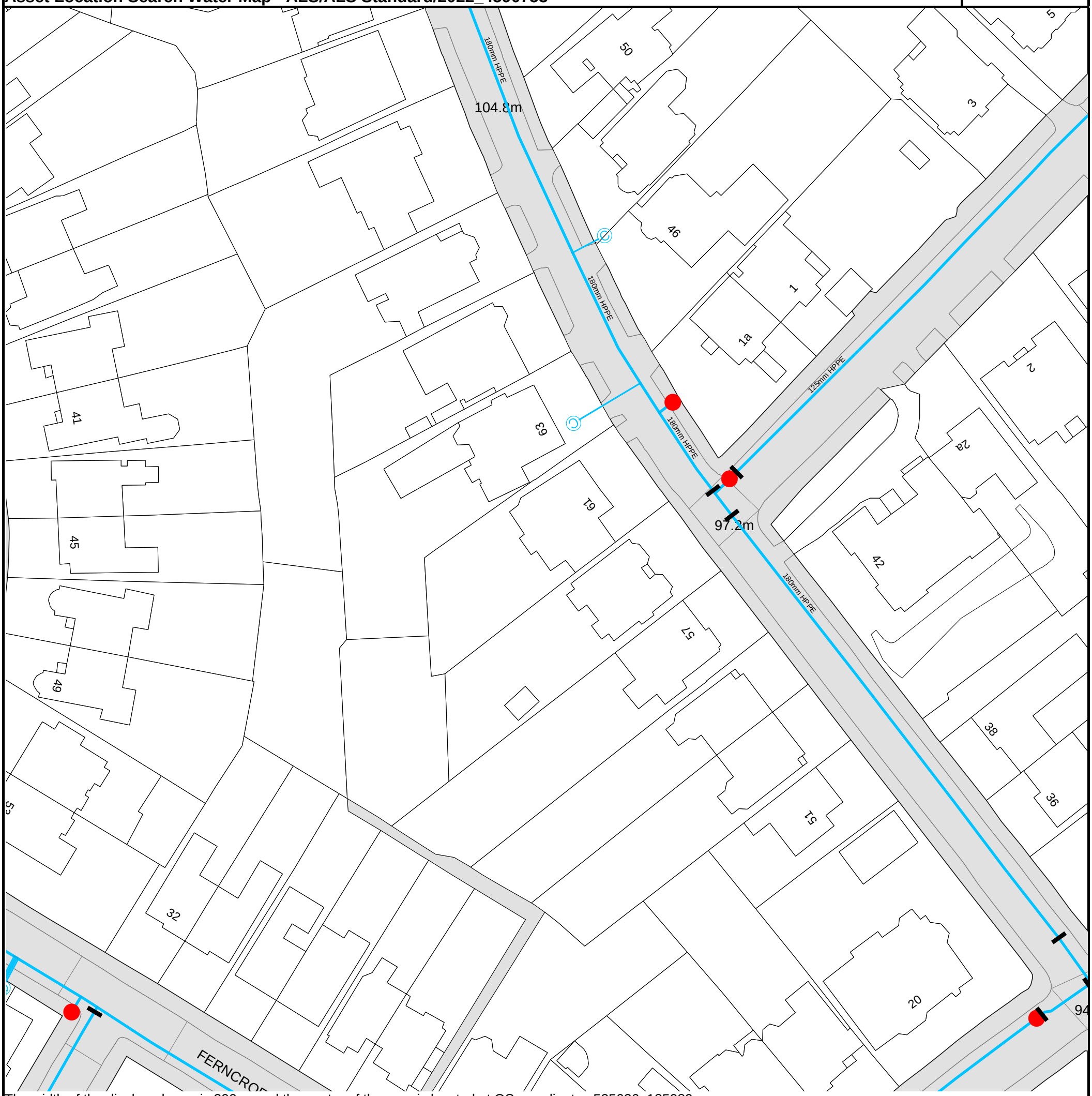
Ducts may contain high voltage cables. Please check with Thames Water.

- Conduit Bridge
- Subway
- Tunnel

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.
2) All measurements on the plan are metric.
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate the 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 indicates that data is unavailable.
6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimeters. 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, please contact Property Searches on 0800 009 4540.

Asset Location Search Water Map - ALS/ALS Standard/2022_4590753



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 525626, 185989.

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.

Asset Location Search - Water Key

Water Pipes (Operated & Maintained by Thames Water)

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

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.

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

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

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

Casement: Ducts may contain high voltage cables. Please check with Thames Water.

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

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

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

Terms and Conditions

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

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

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

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

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

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

Ways to pay your bill

Credit Card	**BACS Payment**	**Telephone Banking**	**Cheque**
Call **0800 009 4540** quoting your invoice number starting CBA or ADS / OSS	Account number **90478703** Sort code **60-00-01** A remittance advice must be sent to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW.** or email **ps.billing@thameswater.co.uk**	By calling your bank and quoting: Account number **90478703** Sort code **60-00-01** and your invoice number	Made payable to '**Thames Water Utilities Ltd**' Write your Thames Water account number on the back. Send to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW** or by DX to **151280 Slough 13**

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

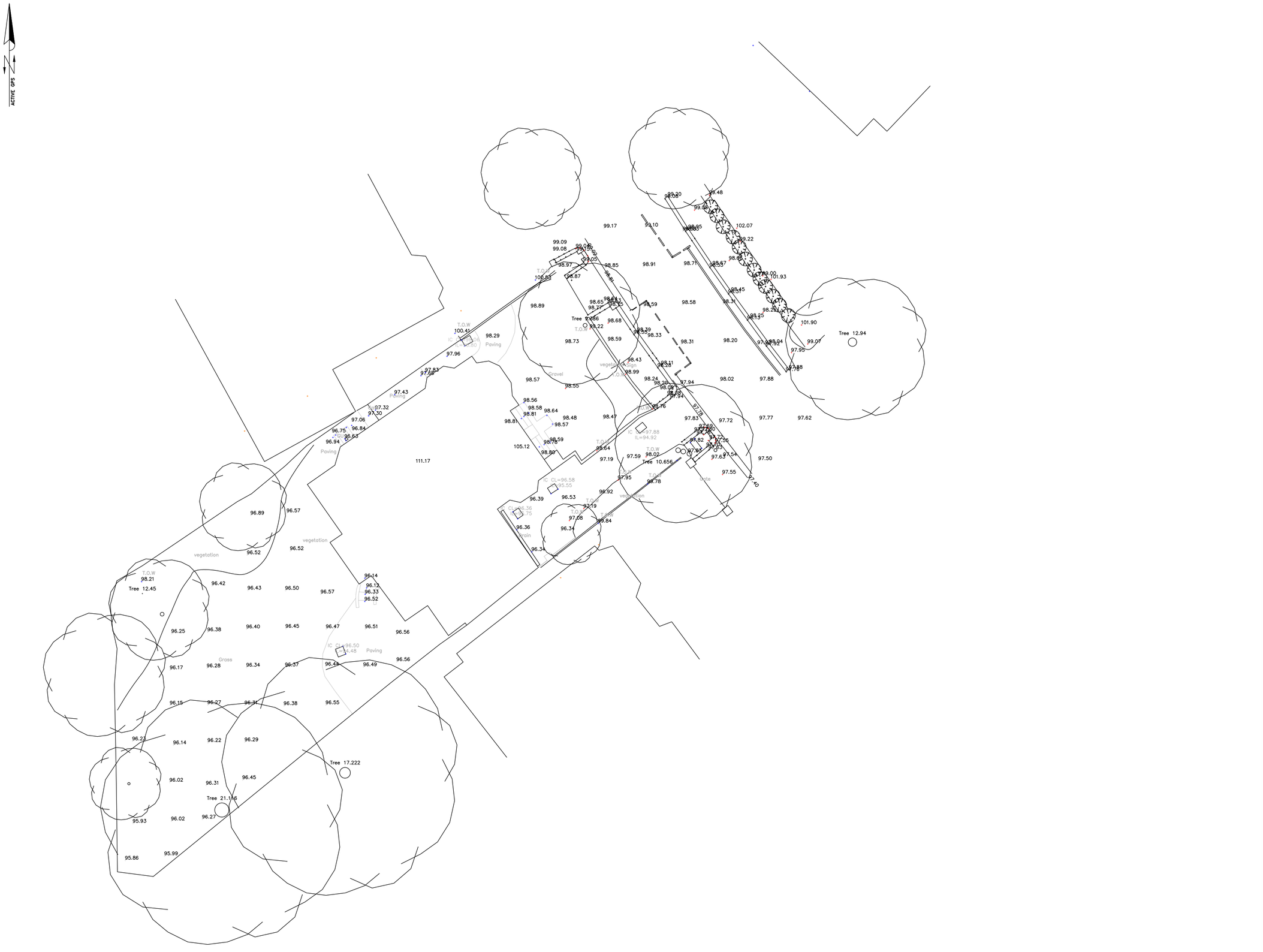
APPENDIX C: EXISTING AND PROPOSED DRAWINGS

Topographic Survey and Existing Floor Plans and Elevations

- Mija Survey Drawing No. 15000_01A (Topographic Survey)
- Mija Survey Drawing No. 15000_02B (Floor Plans)
- Mija Survey Drawing No. 15000_03B (Elevations)

Proposed Plans and Elevations

- Ashby Design No. 552/22/FUL/PL10.03 (Lower Ground Floor and Ground Floor Comparison Plans)
- Ashby Design No. 552/22/FUL/PL10.01 (Proposed Sections A-A & B-B)



Abbreviations

AV	Air Valve	TBM	Temp. Bench Mark
ACU	Air Conditioning Unit	TP	Telegraph Pole
BB	Belisha Beacon	TL	Traffic Light
BK	Brick	TT	Tactile Paving
BO	Bollard	UTL	Unable To Lift
BS	Bus Stop	V	Vent
BT	British Telecom cover	VP	Vent Pipe
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CLF	Chain Link Fence	WM	Water Meter
CO	Column	WSC	Water Stop Cock
CONC	Concrete	WV	Water Valve
CP	Catch Pit		
CPS	Concrete Paving Slabs	**Levels**	
CTV	Cable Television Cover	ACL	Arch Crown Level
DK	Drop Kerb	ASL	Arch Spring Level
EC	Electric Cover	CL	Cover Level
EP	Electricity Pole	CPL	Coping Level
ER	Earthing Rod	DCL	Door Cill Level
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FE	Fire Escape	EL	Eaves Level
FH	Fire Hydrant	FFL	Finished Floor Level
FHR	Fire Hose Reel	FL	Floor Level
FP	Flag Pole	IL	Invert Level
GC	Gas Cover	PL	Parapet Level
GP	Gate Post	RL	Ridge Level
GU	Gully	SSL	Structural Slab Level
GV	Gas Valve	TFL	Top of Fence Level
IC	Inspection Cover	TTL	Top of Tree Level
IR	Iron Railings	TWL	Top of Wall Level
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KO	Kerb Outlet	UBXL	Underside of Boxing Level
LB	Litter Bin	UDL	Underside of Duct Level
LL	Low Level	UJL	Underside of Joist Level
LLF	Larch Lap Fence	UPL	Underside of Pipe Level
LP	Lamp Post	URSJL	Underside of RSJ Level
LW	Light Well	USL	Generic Underside Level
MB	Multi-Bole	WCL	Window Cill Level
MH	Manhole	WHL	Window Head Level
MK	Marker		
MT	Meter	**Heights**	
OH	Overhead	AC	Arch Crown
PM	Parking Meter	AS	Arch Spring
PB	Post Box	DC	Floor to Door Cill
P/R	Post & Rail	DH	Door Cill to Head
PT	Post	HT	Height
P/W	Post & Wire	UBX	Underside of Boxing
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RSJ	Rolled Steel Joist	URSJ	Underside of RSJ
RWP	Rain Water Pipe	US	Generic Underside
SC	Stop Cock	WC	Floor to Window Cill
TCB	Telephone Call Box	WH	Window Cill to Head

Notes

Spot Level +20.00
Arch
Gate
Contours 25.50
Hedge
Foul Pipe
Storm Pipe
Top of Bank / Bottom of Bank
DATUM 12.34 Datum Point
Photo Point
Panoramic Photo Point
ID ▲ N=YYY.YYY E=XXXX.XXX H=ZZZ.ZZZ Survey Station
ID N=YYY.YYY E=XXXX.XXX H=ZZZ.ZZZ Scan Target

Grid & Datum

Survey Grid
The Survey Grid is in relation to Ordnance Survey Network.

Survey Datum
The Survey is based on Ordnance Survey Datum (Newlyn).

Trees

All trees sizes and heights are approximate and species have been identified to the best of the Surveyors knowledge. Where guaranteed tree species becomes important, the services of an Arborist should be employed.

Notation : Diameter of Trunk / Height / Spread

Trees with bole diameters below the specified minimum size may have not been Surveyed.

Individual tree canopies are shown in a separate layer named RCB_CANOPY, which for presentation purposes has been turned off.

Drainage

Where drainage covers have been lifted, data has been recorded for each individual manhole from the surface and connections to other manholes, pipes or gullys are assumed. Where information is required by accessing the manhole or tracing to other manholes then a services trace will be needed.

Rev	Notes	Date	CAD
A	Scale bar added	23.03.22	

Client
Griggs

Drawing Title
TOPOGRAPHICAL SURVEY

Project
61_
Redington Road
,Hamstead

Scale Bar
Scale in Metres 1:200 @ A2

Surveyor: R.A | Checked: P.C. | Status: FINAL
Issue Date: 14/12/21 | CNG Ref: 15000_01 | Rev: A

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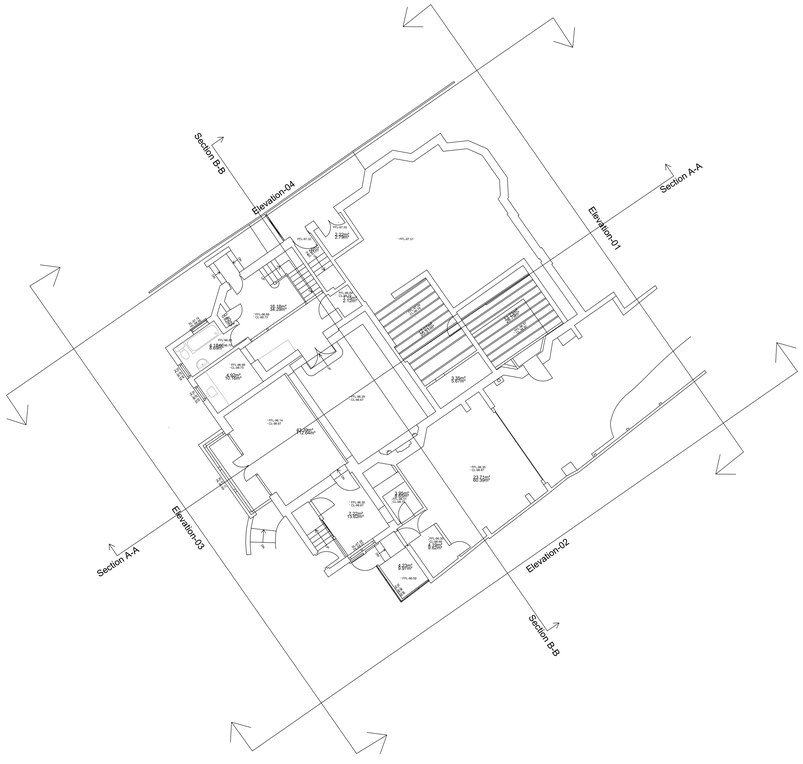
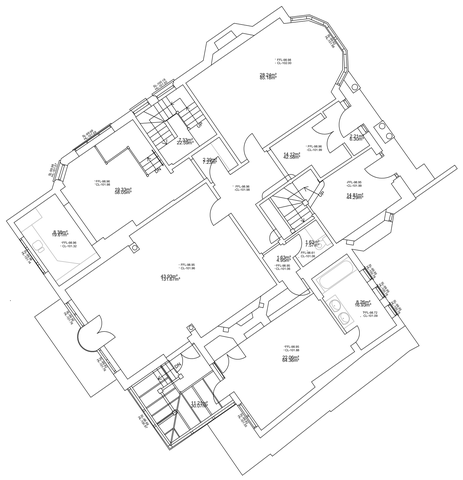
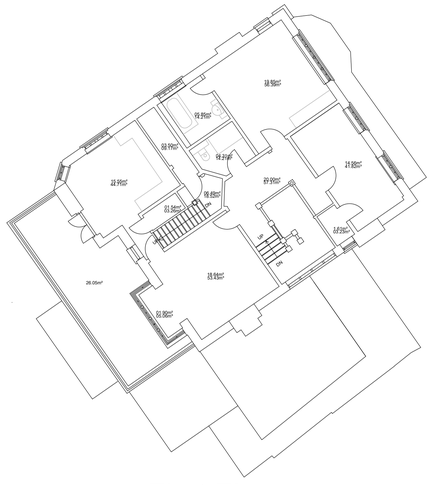
Office 8-9 Riverside Business Centre, Kings Lynn, PE30 2HD
info@mijaSurvey.com | www.mijaSurvey.uk



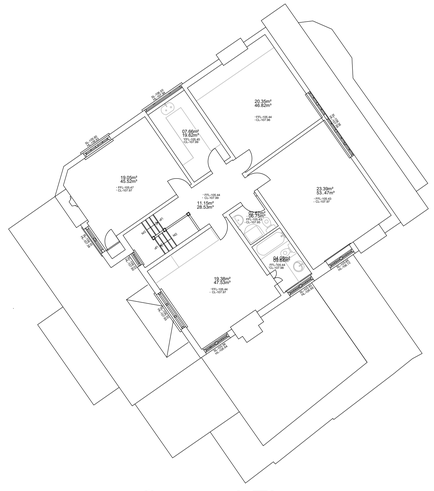
Lower Ground Floor



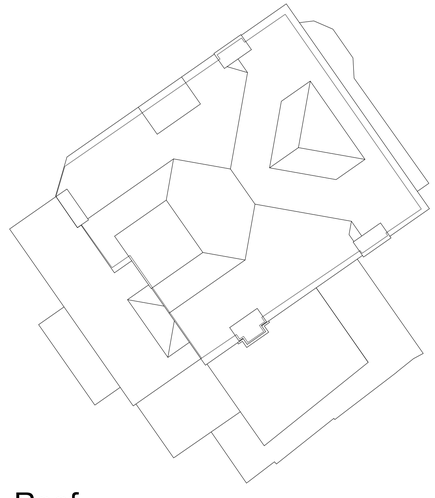
Ground Floor



First Floor



Second Floor



Roof

0m 1m 2m 3m 4m 5m 6m 7m 8m 9m 10m

Abbreviations

AV	Air Valve	TBM	Temp. Bench Mark
ACU	Air Conditioning Unit	TP	Telegraph Pole
BB	Belisha Beacon	TL	Traffic Light
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CO	Column	WSC	Water Stop Cock
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CPS	Concrete Paving Slabs	**Levels**	
CTV	Cable Television Cover	ACL	Arch Crown Level
DK	Drop Kerb	ASL	Arch Spring Level
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RE	Rodding Eye	UD	Underside of Duct
RET	Retaining	UJ	Underside of Joist
RS	Road Sign	UP	Underside of Pipe
RSJ	Rolled Steel Joist	URSJ	Underside of RSJ
RWP	Rain Water Pipe	US	Generic Underside
SC	Stop Cock	WC	Floor to Window Cill
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Notes

Spot Level +20.00
Arch
Gate
Contours 25.50
Hedge

Foul Pipe
Storm Pipe
Top of Bank
Bottom of Bank

DATUM
Datum Point E=XXXX.XXX N=YYYY.YYY H=ZZZ.ZZZ Survey Station
12.24
Photo Point
Panoramic Photo Point
ID E=XXXX.XXX N=YYYY.YYY H=ZZZ.ZZZ Scan Target

Grid & Datum

Survey Grid
The Survey Grid is in relation to Ordnance Survey Network.

Survey Datum
The Survey is based on Ordnance Survey Datum (Newlyn).

Line Type

Building
Wall
Beam
Fence
Stud Wall
Door
Window
Kitchen/Surface
Furniture
Roof Line
Balustrade

Symbology

10.00 Ceiling Height (m)
10.00f False Ceiling Height (m)
11.79 Beam Height (m)
SL=10.78 Sill Level (m)
HL=10.78 Head Level (m)
+10.00m Finished Floor Level (m)
Direction Arrow (Up)
Denotes Slope Direction

Abbreviations

AH	Access Hatch	RL	Roof Light
BR	Boiler	RWP	Rain Water Pipe
CB	Cupboard	SL	Sky Light
HW	Hot Water Tank	SP	Soil Vent Pipe
RAD	Radiator		

Rev	Notes	Date	CAD
A	Scale Bar added.	23.03.22	
B	Roof Plan added	27.03.22	

Client
MJS Projects(March Ltd)

Drawing Title
MEASURED BUILDING SURVEY

Project
61_Redington Road,Hamstead

Scale Bar
Scale in Metres 1:100 @ A0

Surveyor: R.A. | Checked: P.C. | Status: FINAL
Issue Date: 20/12/21 | CNG Ref: 15000_02 | Rev: B

MIJA SURVEY LTD
ENGINEERING SERVICES

Mija Survey Ltd
Office 8-9 Riverside Business Centre, Kings Lynn, PE30 2HD
info@mijasurvey.com | www.mijasurvey.uk

Datum - 93m

Elevation-01

Datum - 93m

Elevation-02

Datum - 93m

Elevation-03

Datum - 93m

Elevation-04

Abbreviations

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Rev	Notes	Date	CAD
A	Scale Bar added.	23.03.22	
B	Brick arches added over windows	27.03.22	

Client
MJS Projects(March Ltd)

Drawing Title
MEASURED BUILDING SURVEY

Project
61_Redington Road,Hamstead

Scale Bar
Scale in Metres 1:100 @ A0

Surveyor: R.A. | Checked: P.C. | Status: FINAL
Issue Date: 20/12/21 | CNG Ref: 15000_03 | Rev: B

MIJA SURVEY LTD
ENGINEERING SERVICES

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info@mijasurvey.com | www.mijasurvey.uk

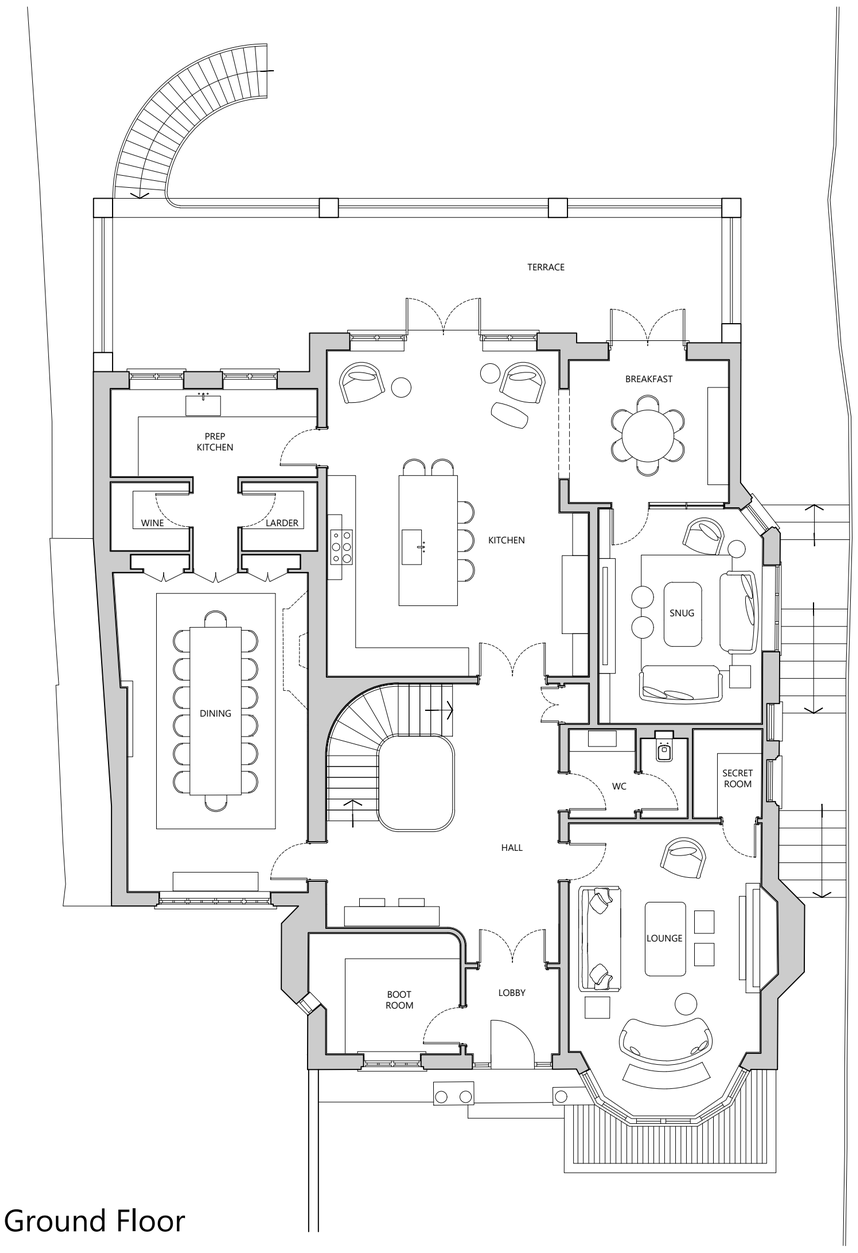
0m 1m 2m 3m 4m 5m 6m 7m 8m 9m 10m

61 Redington Road, Hampstead

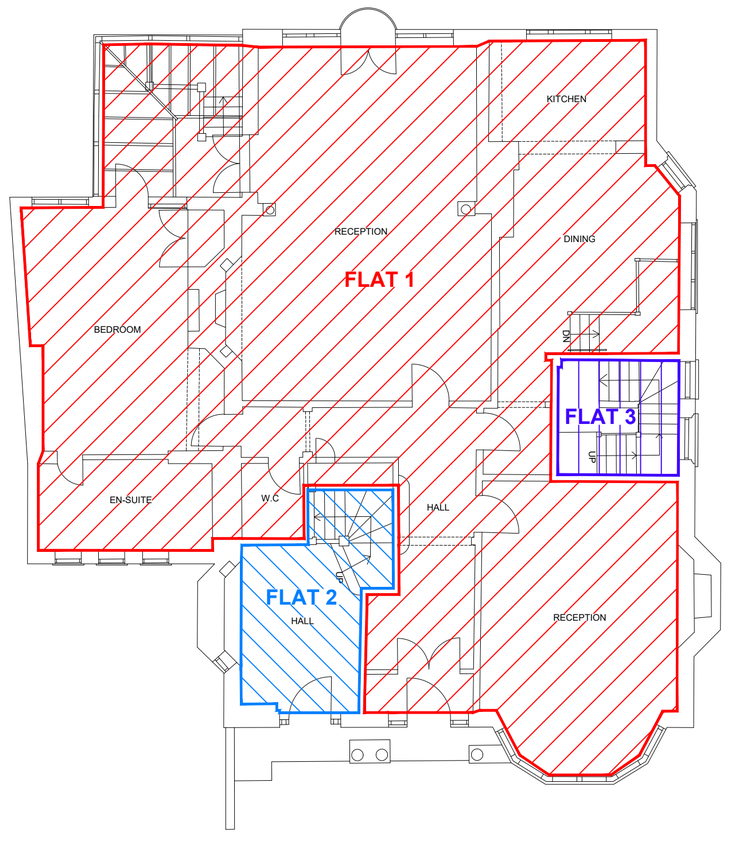
PLANNING

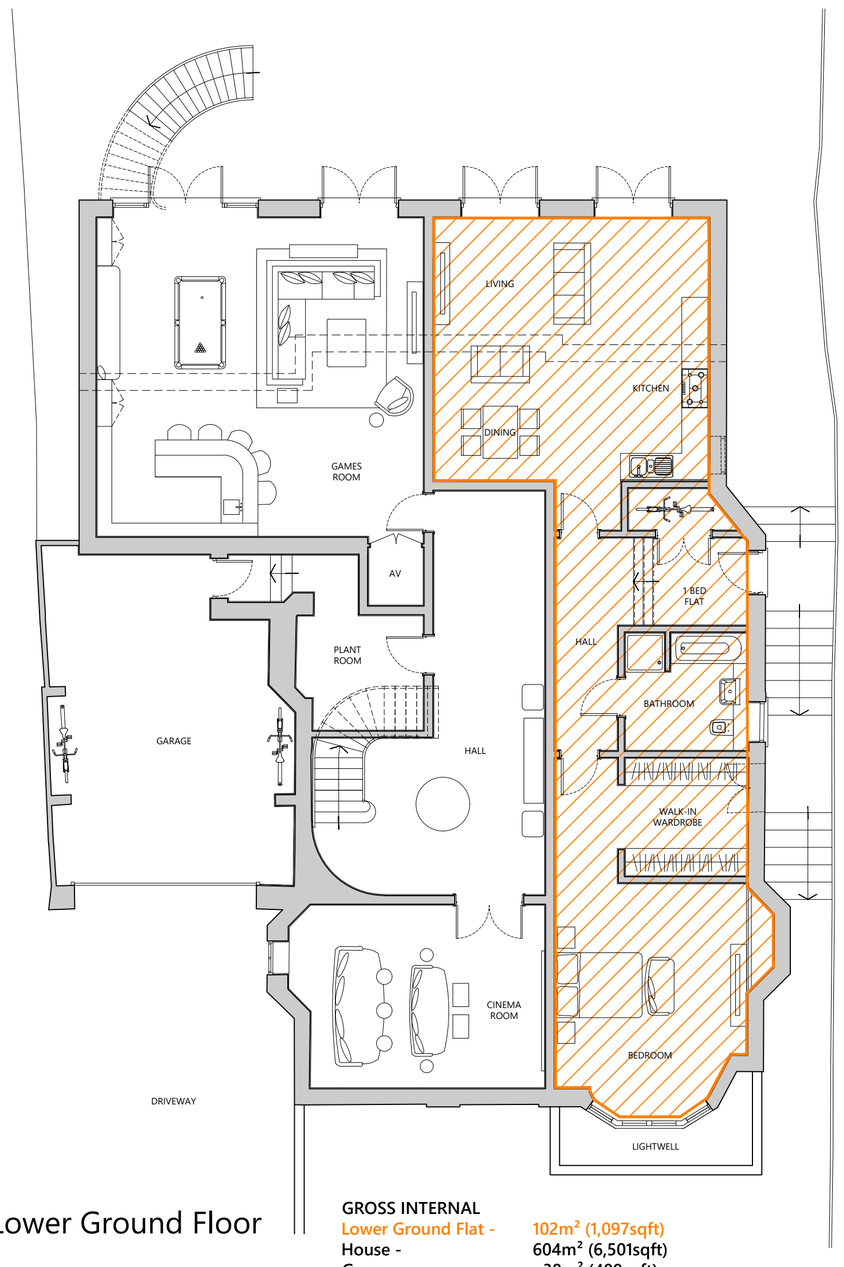
0m 2m 4m 6m 8m 10m

SCALE 1:100

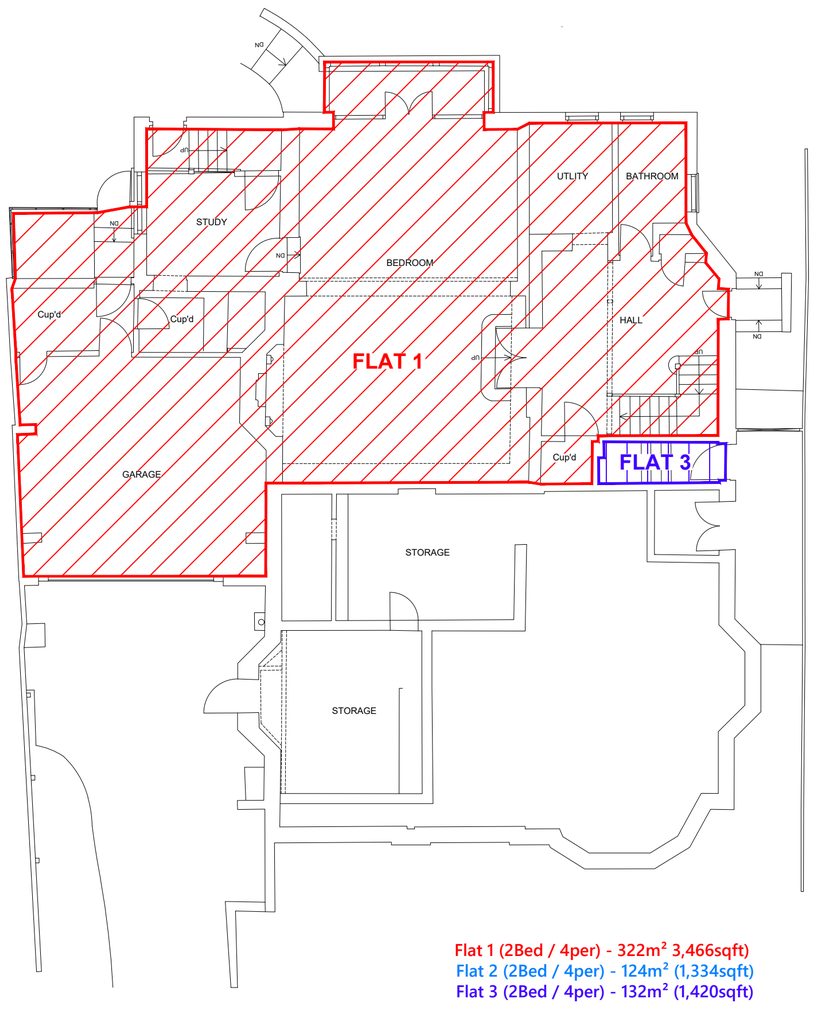


Ground Floor





Lower Ground Floor



GROSS INTERNAL

Lower Ground Flat - 102m² (1,097sqft)
House - 604m² (6,501sqft)
Garage - 38m² (409sqft)

Flat 1 (2Bed / 4per) - 322m² 3,466sqft)
Flat 2 (2Bed / 4per) - 124m² (1,334sqft)
Flat 3 (2Bed / 4per) - 132m² (1,420sqft)

Lower Ground & Ground Floor Comparison Plans

ASHBY DESIGN
13 Arm & Sword Lane
Old Hatfield - Herts - AL9 5EH
www.AshbyDesign.co.uk
01707 270 077

Project: 61 Redington Road, Hampstead
Title: Lower Ground & Ground Floor Comparison Plans
Scale: 1:100 @ A1 | Date: April 23' | Drawn: APM | Checked: LS
Drawing No.: 552/22/FUL/PL10.03 | Revision: -

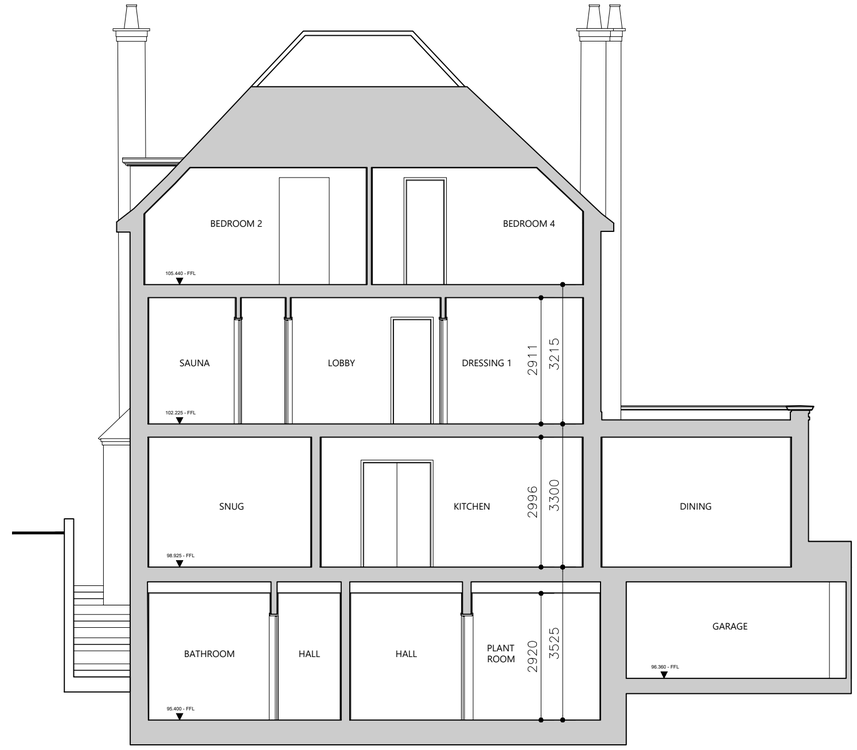
61 Redington Road, Hampstead

PLANNING

0m 2m 4m 6m 8m 10m

SCALE 1:100

Section A-A



Section B-B

Proposed Sections A-A & B-B

ASHBY DESIGN
13 Arm & Sword Lane
Old Hatfield - Herts - AL9 5EH
www.AshbyDesign.co.uk
01707 270 077

Project
61 Redington Road,
Hampstead

Title
Proposed Sections A-A & B-B

Scale	Date	Drawn	Checked
1:100 @ A2	April 23'	APM	LS

Drawing No.
552/22/FUL/PL10.02

Revision
-

APPENDIX D: CALCULATIONS

The following calculations have been referenced within the body of this report:

- D21 Runoff Calculations

WATER | ENVIRONMENT
6 Coppergate Mews• 103 Brighton Road• Surbiton• London• KT6 5NE
Tel: 020 8545 9720
Email: contact@waterenvironment.co.uk• web: www.waterenvironment.co.uk

D21 RUNOFF CALCULATIONS | COVER SHEET

Job No.	22023	
Job Name	61 Redington Road	
Engineer	Agnes Gannon	FdM
Checked By	Fiona de Mauny	FdM
Date	04/05/2023	

Site Characteristics

Site Area (ha) 0.094

	Overall		Discharging from site			
Existing Pervious Surfaces (ha)	0.0574	61%	0.0173	32%	β	30%
Existing Impervious Surfaces (ha)	0.0366	39%	0.0366	68%	α	100%
Total:	0.094	Total:	0.0539			

	Overall		Discharging from site			
Proposed Pervious Surfaces (ha)	0.043	46%	0.0096	16%	β	22%
Proposed Impervious Surfaces (ha)	0.051	54%	0.051	84%	α	100%
Proposed Green Roof	0	0%	0	0%	γ	0%
Total:	0.094	Total:	0.0606			

Peak Rate of Runoff

Existing Site	BROWNFIELD	
Detailed Modelling Used?	No	e.g. Microdrainage, HydroCAD, Multiple Catchments
Runoff Calculation Method (Existing)	Wallingford/Modified Rational	Calculation Sheets Attached
Runoff Calculation Method (Proposed)	Wallingford/Modified Rational	Calculation Sheets Attached
Allowance for Future Climate Change	To 2115 UE 40%	
Surface Water Management Strategy	Attenuated on Site	

	1yr	30yr	100yr		
Existing Discharge Rate	**6.6**	**15.5**	**19.6**	l/s	
IoH Greenfield Discharge Rate (full site)	**0.4**	**1.0**	**1.4**	l/s	
Detailed modelling output/FEH:				l/s	
Limiting Discharge Rate	6.6	15.5	19.6	l/s	
Post-Development Discharge Rate	8.2	19.4	24.6	l/s	
Including Climate Change	11.5	27.2	34.4		
Detailed modelling output:				l/s	
Proposed Discharge Rate	6.6	15.5	19.6	l/s	
Bespoke Limiting Discharge Rate	6.6	6.6	6.6		
Design discharge rate:	**6.6**	**15.5**	**19.6**	l/s	Existing Rates
Minimum Storage Required	**1.0**	**2.4**	**3.0**	m^3	

WATER | ENVIRONMENT
6 Coppergate Mews• 103 Brighton Road• Surbiton• London• KT6 5NE
Tel: 020 8545 9720
Email: contact@waterenvironment.co.uk• web: www.waterenvironment.co.uk

IH124 : Greenfield Peak Runoff

22023	61 Redington Road	
Calculations By: FdM	Checked By: FdM	Date: 04/05/2023

Catchment Area	AREA	ha	0.094
Standard average annual rainfall 1941 - 1970	SAAR	mm	660
Soil Index (from FSR or Wallingford Procedure WRAP maps)*	SOIL		0.47

*SOIL is the SPR for the soil type, and for larger sites is a weighted sum of the individual soil classes for the site, where:

$$SOIL = \frac{0.1A_{SOIL1} + 0.3A_{SOIL2} + 0.37A_{SOIL3} + 0.47A_{SOIL4} + 0.53A_{SOIL5}}{AREA}$$

For smaller sites, use the SPR for the local soil type, as follows:

SOIL TYPE	1	2	3	4	5	
AREA	0	0	0	0.094	0	**SOIL:**
SPR	0.1	0.3	0.37	0.47	0.53	**0.47**

$QBAR = 0.00108 . (0.01AREA)^{0.89}. SAAR^{1.17}. SOIL^{2.17}$

* The site area is less than 50ha. Since the IoH124 methodology is not calibrated for sites less than 50ha in area, the calculation should be undertaken based on a 50ha site area and proportionately adjusted based on the ratio of the site size to 50ha.

$QBAR_{50ha}$	l/s	225.33
QBAR/ha	l/s/ha	4.51
$QBAR_{site}$	l/s	**0.42**

Hydrological Area	fig 4.2	6

Return Period (years)	Growth Factor (table 4.3)	Discharge rate l/s
1	0.85	**0.36**
2	0.88	0.37
10	1.62	0.69
30	2.3	**0.97**
50	2.62	1.11
100	3.19	**1.35**

Figures and table references from CIRIA C753 The SUDS Manual © CIRIA 2015

WATER | ENVIRONMENT
6 Coppergate Mews• 103 Brighton Road• Surbiton• London• KT6 5NE
Tel: 020 8545 9720
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22023	61 Redington Road	
Calculations By: FdM	Checked By: FdM	Date: 04/05/2023

Catchment Area	AREA	ha	0.094
Drained Area	AREA	ha	0.0539
Standard average annual rainfall 1941 - 1970	SAAR	mm	660
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SOIL TYPE	1	2	3	4	5
AREA	0	0	0	0.094	0
SPR	0.1	0.3	0.37	0.47	0.53

SOIL: 0.47

$QBAR = 0.00108 . (0.01AREA)^{0.89}. SAAR^{1.17}. SOIL^{2.17}$

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$QBAR_{50ha}$	l/s	225.33
QBAR/ha	l/s/ha	4.51
$QBAR_{site}$	l/s	**0.24**

Hydrological Area	fig 4.2	6

Return Period (years)	Growth Factor (table 4.3)	Discharge rate l/s
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2	0.88	0.21
10	1.62	0.39
30	2.3	**0.56**
50	2.62	0.64
100	3.19	**0.77**

Figures and table references from CIRIA C753 The SUDS Manual © CIRIA 2015

WATER | ENVIRONMENT
6 Coppergate Mews• 103 Brighton Road• Surbiton• London• KT6 5NE
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Email: contact@waterenvironment.co.uk• web: www.waterenvironment.co.uk

Wallingford Procedure : Existing Peak Runoff

22023	61 Redington Road	
Calculations By: FdM	Checked By: FdM	Date: 04/05/2023

Site Characteristics

Site Area	AREA	ha	0.094
Drained Catchment Area	AREA	ha	0.0539
Approximate Longest Drainage Path	L	m	25
Difference in Ground Levels	ΔH	m	0.25
Slope	Slope (S)		1: 100
Permeable Surfaces (Rational Method runoff coefficient = 0.4)		ha	32%
Impermeable Surfaces (Rational Method runoff coefficient = 0.95)		ha	68%
Area Weighted Rational Method Runoff Coefficient			0.773

Site parameters from The Wallingford Procedure for Europe: Best Practice Guide to urban drainage modelling, HR Wallingford, July 2000 (CD)

60minute, 5 year return period rainfall	M5-60	mm	20
Ratio of M5-60 to 2day, 5 year return period rainfall	r	-	0.40

Time of Concentration

Recommended Tc Method: SCS: Sheet Flow
Tc Method Choice: SCS: Sheet Flow

Sheet Flow

Surface Description			Paving or Brick
Slope			Shallow
Roughness Coefficient	(Manning's n)		0.018
Flow Length, L		m	25
M2-24hr		mm	37.70
Land Slope		m/m	0.01000
Tc		hr	0.05

Time of Concentration	T_c	min	3.0
Critical Storm Duration (minimum 5min)	T_{crit}	min	5.0

Critical Storm Rainfall and Runoff

$Z1_{TC}$	0.38	*Wallingford Procedure Figure 3.6
M5-T_{crit}	7.7	
C	0.773	

Discharge Rate
Q = 2.78CiA

Return Period (years)	Z2*	Depth (mm)	Intensity (mm/hr)	Discharge Rate l/s
1	0.62	4.7	56.7	**6.57**
2	0.79	6.1	72.7	8.42
10	1.20	9.2	110.6	12.82
30	1.45	11.1	133.6	**15.48**
50	1.60	12.2	146.8	17.02
100	1.84	14.1	169.1	**19.60**

*Wallingford Procedure Table 3.2

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Wallingford Procedure : Developed Peak Runoff

22023	61 Redington Road	
Calculations By: FdM	Checked By: FdM	Date: 04/05/2023

Site Characteristics

Site Area	AREA	ha	0.094
Drained Catchment Area	AREA	ha	0.0606
Approximate Longest Drainage Path	L	m	25
Difference in Ground Levels	ΔH	m	0.25
Slope	Slope (S)		1: 100
Permeable Surfaces (Rational Method runoff coefficient = 0.4)		ha	16%
Impermeable Surfaces (Rational Method runoff coefficient = 0.95)		ha	84%
Green Roof of gradient of up to 15°, and depth of 20-40mm , c=		0.7 *	0%
Area Weighted Rational Method Runoff Coefficient			0.86

*in line with Table 10.1 of CIRIA C644

Site parameters from The Wallingford Procedure for Europe: Best Practice Guide to urban drainage modelling, HR Wallingford, July 2000 (CD)

60minute, 5 year return period rainfall	M5-60	mm	20
Ratio of M5-60 to 2day, 5 year return period rainfall	r	-	0.40

Time of Concentration

Recommended Tc Method: SCS: Sheet Flow
Tc Method Choice: SCS: Sheet Flow

Sheet Flow

Surface Description			Paving or Brick
Slope			Shallow
Roughness Coefficient	(Manning's n)		0.018
Flow Length, L		m	25
M2-24hr		mm	37.70
Land Slope		m/m	0.01000
Tc		hr	0.05

Time of Concentration	T_c	min	3.0
Critical Storm Duration (minimum 5min)	T_{crit}	min	5.0

Critical Storm Rainfall and Runoff

$Z1_{TC}$	0.38	*Wallingford Procedure Figure 3.6
M5-T_{crit}	7.7	
C	0.863	

Discharge Rate
Q = 2.78CiA

Return Period (years)	Z2*	Depth (mm)	Intensity (mm/hr)	Discharge Rate l/s	Future Rate l/s
1	0.62	4.7	56.7	**8.24**	**11.53**
2	0.79	6.1	72.7	**10.57**	14.79
10	1.20	9.2	110.6	**16.08**	22.51
30	1.45	11.1	133.6	**19.42**	**27.19**
50	1.60	12.2	146.8	**21.34**	29.88
100	1.84	14.1	169.1	**24.58**	**34.41**

*Wallingford Procedure Table 3.2

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MRM 100 year Event Storage Calculator

22023	61 Redington Road	
Calculations By: FdM	Checked By: FdM	Date: 04/05/2023

Site Parameters

Drained Catchment Area	AREA	ha	0.0606
Approximate Longest Drainage Path	L	m	25
Difference in Ground Levels	ΔH	m	0.25
Slope	Slope (S)		1: 100
Permeable Surfaces (Rational Method runoff coefficient = 0.4)		ha	16%
Impermeable Surfaces (Rational Method runoff coefficient = 0.95)		ha	84%
Green Roof of gradient of up to 15°, and depth of 20-40mm , c=		0.7 *	0%
Area Weighted Rational Method Runoff Coefficient			0.86

*in line with the FLL Guidelines on Planning, Execution and Upkeep of Green Roof Sites, 2002

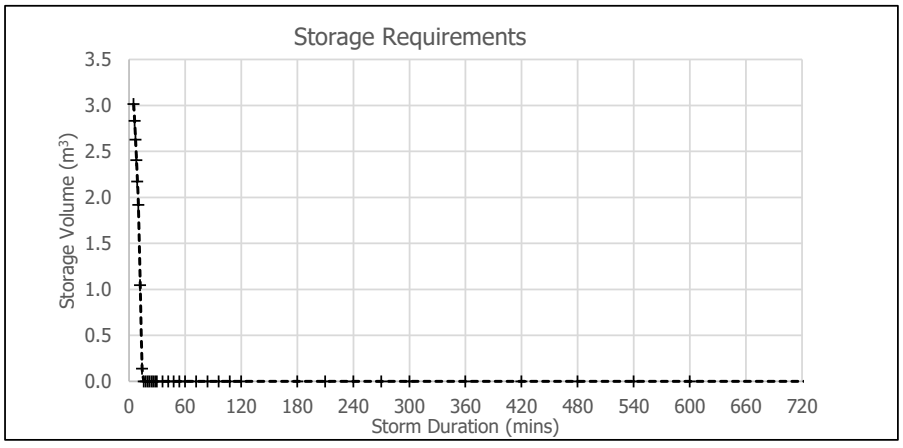
Site parameters from The Wallingford Procedure for Europe: Best Practice Guide to urban drainage modelling, HR Wallingford, July 2000 (CD)

60minute, 5 year return period rainfall	M5-60	mm	20
Ratio of M5-60 to 2day, 5 year return period rainfall	r	-	0.40
Time of Concentration	T_c	min	3.0

Maximum Storm Runoff Storage Volume (modified rational method)

	5	
T_d	5.0	min
$Z1_{TD}$	0.38	*Wallingford Procedure Figure 3.6
M5-T_d	7.7	mm
C	0.86	
$Z2_{100}$	1.85	*Wallingford Procedure Table 3.2
M100-T_d	14.2	mm
Intensity	170.6	mm/hr
Q_d	24.8	l/s
$Q_{d,climate\ change}$	34.7	l/s
$Q_{limiting\ discharge}$	19.6	l/s

Maximum storage required	m^3	3.0



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MRM 30 year Event Storage Calculator

22023	61 Redington Road	
Calculations By: FdM	Checked By: FdM	Date: 04/05/2023

Site Parameters

Drained Catchment Area	AREA	ha	0.0606
Approximate Longest Drainage Path	L	m	25
Difference in Ground Levels	ΔH	m	0.25
Slope	Slope (S)		1: 100
Permeable Surfaces (Rational Method runoff coefficient = 0.4)		ha	16%
Impermeable Surfaces (Rational Method runoff coefficient = 0.95)		ha	84%
Green Roof of gradient of up to 15°, and depth of 20-40mm , c=		0.7 *	0%
Area Weighted Rational Method Runoff Coefficient			0.86

*in line with the FLL Guidelines on Planning, Execution and Upkeep of Green Roof Sites, 2002

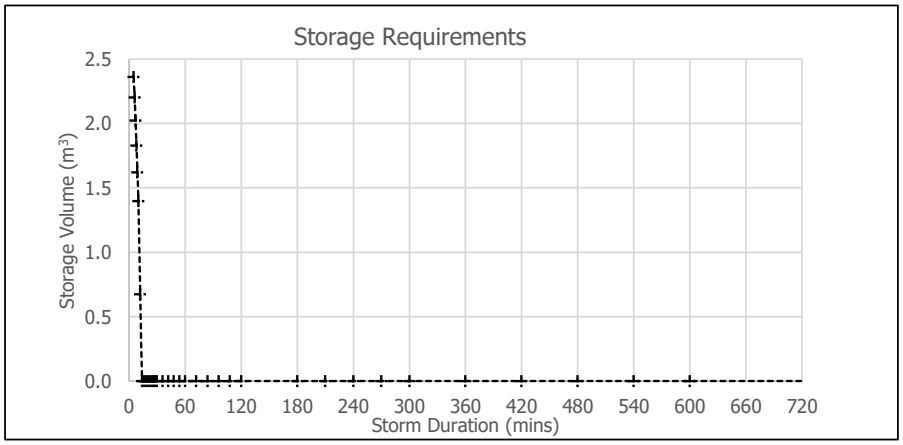
Site parameters from The Wallingford Procedure for Europe: Best Practice Guide to urban drainage modelling, HR Wallingford, July 2000 (CD)

60minute, 5 year return period rainfall	M5-60	mm	20
Ratio of M5-60 to 2day, 5 year return period rainfall	r	-	0.40
Time of Concentration	T_c	min	3.0

Maximum Storm Runoff Storage Volume (modified rational method)

T_d	5.0	min
$Z1_{TD}$	0.38	*Wallingford Procedure Figure 3.6
M5-T_d	7.7	mm
C	0.86	
$Z2_{30}$	1.46	*Wallingford Procedure Table 3.2
M30-T_d	11.2	mm
Intensity	134.4	mm/hr
Q_d	19.5	l/s
$Q_{d,climate\ change}$	27.3	l/s
$Q_{limiting\ discharge}$	15.5	l/s

Maximum storage required	m^3	2.4



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MRM 1 year Event Storage Calculator

22023	61 Redington Road	
Calculations By: FdM	Checked By: FdM	Date: 04/05/2023

Site Parameters

Drained Catchment Area	AREA	ha	0.0606
Approximate Longest Drainage Path	L	m	25
Difference in Ground Levels	ΔH	m	0.25
Slope	Slope (S)		1: 100
Permeable Surfaces (Rational Method runoff coefficient = 0.4)		ha	16%
Impermeable Surfaces (Rational Method runoff coefficient = 0.95)		ha	84%
Green Roof of gradient of up to 15°, and depth of 20-40mm , c=		0.7 *	0%
Area Weighted Rational Method Runoff Coefficient			0.86

*in line with the FLL Guidelines on Planning, Execution and Upkeep of Green Roof Sites, 2002

Site parameters from The Wallingford Procedure for Europe: Best Practice Guide to urban drainage modelling, HR Wallingford, July 2000 (CD)

60minute, 5 year return period rainfall	M5-60	mm	20
Ratio of M5-60 to 2day, 5 year return period rainfall	r	-	0.40
Time of Concentration	T_c	min	3.0

Maximum Storm Runoff Storage Volume (modified rational method)

T_d	5.0	min
$Z1_{TD}$	0.38	*Wallingford Procedure Figure 3.6
M5-T_d	7.7	mm
C	0.86	
$Z2_1$	0.61	*Wallingford Procedure Table 3.2
M1-T_d	4.7	mm
Intensity	56.5	mm/hr
Q_d	8.2	l/s
$Q_{d,climate\ change}$	11.5	l/s
$Q_{limiting\ discharge}$	6.6	l/s

Maximum storage required	m^3	1.0