STM environmental

ENVIRONMENTAL CONSULTING , SOFTWARE & TRAINING

FLOOD RISK ASSESSMENT

Site Address

99 Atbara Road
Teddington
TW11 9PA

Client

Jamie McDaid

Date

28/06/2023

1 Document Control

FLOOD RISK ASSESSMENT

Site Address:	99 Atbara Road Teddington TW11 9PA
National Grid Reference:	517093, 170941
STM Reference:	FRA-2023-000041
Version No:	1.0
Prepared for:	Jamie McDaid
Date:	28/06/2023
Report Author:	Tom Sagar (BSc) **Junior Flood Risk and Drainage Consultant**
Authorised by:	Matthew Ashdown (BSc) **Senior Flood Risk and Drainage Consultant**

Contents

2 Abbreviations

Abbreviation	Description
STM	STM Environmental Consultants Limited
BGS	British Geological Survey
EA	Environment Agency
OS	Ordnance Survey of Great Britain
FRA	Flood Risk Assessment
NPPF	National Planning Policy Framework
FWD	Floodline Warning Direct
FRMS	Flood Risk Management Strategy
RUT	Richmond Upon Thames
SWMP	Surface Water Management Plan
SFRA	Strategic Flood Risk Assessment
CDA	Critical Drainage Area
AEP	Annual Exceedance Probability
CC	Climate Change
SuDS	Sustainable Urban Drainage Systems
GWSPZ	Groundwater Source Protection Zone
LLFA	Lead Local Flood Authority
mbgl	metres below ground level
DCLG	Department for Communities and Local Government
PPGPS	Planning practice guidance and Planning system

3 Disclaimer

This report and any information or advice which it contains, is provided by STM Environmental Consultants Ltd (STM) and can only be used and relied upon by Jamie McDaid (Client). Any party other than the Client using or placing reliance upon any information contained in this report, do so at their own risk.

STM has exercised such professional skill, care and diligence as may reasonably be expected of a properly qualified and competent consultant when undertaking works of this nature. However, STM gives no warranty, representation or assurance as to the accuracy or completeness of any information, assessments or evaluations presented within this report.

4 Executive Summary

SECTION	SUMMARY
Location	99 Atbara Road, Teddington, TW11 9PA Grid Reference: 517093 , 170941
Area	377 m^2
Proposed Development	The proposed development is to demolish the existing residential bungalow and construct a new 2-storey residential dwelling with a loft space.
Flood Zone	The site is located in Flood Zone 3a.
Topography	The ground level at the site ranges from 6.34mAOD to 6.91mAOD. The site has an area of lower lying land running through the middle of the site. The ground level in the area of the proposed development has an elevation of approximately 6.88mAOD.
Sequential and Exception Tests	Development is “non-minor” and more vulnerable and located within flood zone 2 and 3, as such we believe the sequential and exception may be required. LLFA to decided; It should be noted that the proposal provides significant improvement to the existing scenario by offering an area of safe refuge within the dwelling and future flood resilience and protection measures. As such we believe this should be viewed in a pragmatic manner by the LPA and the tests should not be applied in this instance.
Main Sources of Flooding	The River Thames is the main source of flooding, located 360m NE.
Flood Defences	The area benefits from the Teddington weir as it mitigates the impact of tidal flooding.
Records of Historic Flooding	The historic mapping shows that flooding occurred approximately 60m NE of the site on the following dates: 01/1998, 01/1947, 01/2000, and 12/2002.
Fluvial (River) and Tidal (Sea) Flood Risk	High – During the 1% AEP +17% CC, the site and proposal witness a maximum flood level of 7.08 mAOD with a depth of 0.52m. During the 0.1% AEP Scenario the proposed witnesses a depth of 1.43m to a maximum flood level of 8.28 mAOD.
Pluvial (Surface Water) Flood Risk	Low – The EA long-term flood risk mapping shows the site remains dry during all modelled pluvial events.
Flood Risk from Artificial (Canals and Reservoirs) Sources	There are five reservoirs located within 5km upstream of the site. Queen Elizabeth II, Knight Reservoir, Bessborough Reservoir, Stains Hill East Reservoir and Island Barn Reservoir. The EA's reservoir flood risk map indicates that the site does lie within an area that is at risk of reservoir flooding. The site is at risk from flooding from the reservoirs listed above.
Groundwater Flood Risk	Low to Medium – According to the BGS, the site is potentially susceptible to groundwater flooding for development below ground level. A groundwater flood incident has been identified within the vicinity of the site.

SECTION	SUMMARY
Development Impacts on Local Flood Risk	The development will increase the sites impermeable area and built up area by 44m^2 and as such, it may have a negative impact on local flood risk unless mitigation measures are introduced.
Proposed Flood Risk Mitigation Measures	• CFS will be utilised to compensate for the larger development. • The existing garage will be retrofitted to become a floodable structure. The combination of both mitigation measures, results in a positive storage capacity for the site of +1.92m^3. • Finished floor levels will be 300mm above the max flood depth for the 1% AEP + 17%CC scenario to a minimum height of 7.38mAOD; • Construction will utilise flood resistant materials and services will be placed as high as practicable to reduce impact of flooding; • Occupants will sign up for EA Emergency Flood Warning Direct Service; • Safe egress to Flood Zone 1 is accessibly by heading South west on Atbara Road for 200m and turning right onto Kingston Road. • The new development is safer due to access to upper floors, which the prior single storey development did not allow.
Surface Water Management (SuDS)	SuDS would reduce current surface water run off rates however given the small size of the site (377m^2), there is limited potential for implementation. Consideration should be given to rainwater harvesting and permeable paving where possible.
Conclusions	Based on the information reviewed and taking into account the proposed mitigation measures, it is considered that overall flood risk to the proposed development is acceptable and that the new development will not only provide betterment to the site but also increase storage potential of the floodplain. As such, the development is would be considered to be in general compliance with local planning policy and the NPPF.

5 Introduction

STM Environmental Consultants Limited (STM) were appointed by Jamie McDaid (Client) to provide a Flood Risk Assessment (FRA) at a site located at 99 Atbara Road, Teddington, TW11 9PA.

6 Development Proposal

The FRA is required to support a planning application to demolish an existing residential bungalow and construct a 2-storey residential dwelling with a loft space.

Further details including drawings of the development plans are available in Appendix 2.

7 Report Aims and Objectives

The purpose of this report is to establish the flood risk to the site from all potential sources and, where possible, to propose suitable mitigation methods to reduce any risks to an acceptable level. It aims to make an assessment of whether the development will be safe for its lifetime, taking into account climate change and the vulnerability of its users, without increasing flood risk elsewhere.

The FRA assesses flood risk to the site from tidal, fluvial, surface water, groundwater, sewers and artificial sources. The FRA has been produced in accordance with the National Planning Policy Framework (NPPF) and its supporting guidance.

8 Summary of Data Review Undertaken

The following research has been undertaken as part of the FRA:

- Desktop assessment of topographical, hydrological and hydrogeological settings through review of the information sourced from the British Geological Survey (BGS), the Environment Agency (EA) and the Ordnance Survey (OS);
- Review of publicly available flood risk mapping provided by the EA;
- Review of the Preliminary Flood Risk Assessment (PFRA) and Level 1 Strategic Flood Risk Assessment (SFRA) produced by the LLFA outlining flood risk from various sources within the borough.

9 Legislative and Policy Context

9.1 Legislative Context

The Flood and Water Management Act was introduced in 2010. The Act defines the role of lead local flood authority (LLFA) for an area. All LLFA are required to develop, maintain, apply and monitor a strategy for local flood risk management in its area, called “local flood risk management strategy”.

Alongside the Act, Flood Risk Regulations (2009) outline the roles and responsibilities of the various authorities, which include preparing Flood Risk Management Plans and identifying how significant flood risks are to be mitigated.

9.2 Policy Context

9.2.1 National Planning Policy Framework (NPPF)

The NPPF (updated July 2021) sets out the government’s planning policies for England and how these are expected to be applied. It also provides a set of guidelines and philosophy with which local planning authorities (LPAs) can build their own unique policies to appropriately regulate development within their jurisdictions.

Section 14 entitled “Meeting the challenge of climate change, flooding and coastal change” deals specifically with flood risk.

Paragraph 159 states that “Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere”.

In addition, Paragraph 161 outlines that “All plans should apply a sequential, risk-based approach to the location of development – taking into account all sources of flood risk and the current and future impacts of climate change – so as to avoid, where possible, flood risk to people and property. They should do this, and manage any residual risk, by:

- applying the sequential test and then, if necessary, the exception test as set out below;
- safeguarding land from development that is required, or likely to be required, for current or future flood management;
- using opportunities provided by new development and improvements in green and other infrastructure to reduce the causes and impacts of flooding, (making as much use as possible of natural flood management techniques as part of an integrated approach to flood risk management);
- where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, seeking opportunities to relocate development, including housing, to more sustainable locations”.

The NPPF then states in Paragraph 163 that “if it is not possible for development to be located in areas with a lower risk of flooding (taking into account wider sustainable development objectives), the exception test may have to be applied. The need for the exception test will depend on the potential vulnerability of the site and of the development proposed, in line with the Flood Risk Vulnerability Classification”.

It further states that when determining any planning application, LPAs should "ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment[55]. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:

- within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;
- development is appropriately flood resilient and resistant;
- it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;
- any residual risk can be safely managed; and
- safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

Applications for minor development and changes of use should not be subject to the Sequential or Exception Tests but should still meet the requirements for site-specific flood risk assessments set out in footnote 55.

Footnote 55 states: "A site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use."

The NPPF also lays out requirements for how LPAs should deal with planning applications in coastal areas. They should ensure that should they "reduce risk from coastal change by avoiding inappropriate development in vulnerable areas or adding to the impacts of physical changes to the coast."

Developments in Coastal Change Management Areas should only be considered appropriate where it is demonstrated that:

- it will be safe over its planned lifetime and will not have an unacceptable impact on coastal change;
- the character of the coast including designations is not compromised;
- the development provides wider sustainability benefits;
- the development does not hinder the creation and maintenance of a continuous signed and managed route around the coast.

9.2.2 Local Planning Policy – Richmond upon Thames

Policy LP 21 of the Richmond upon Thames Local Plan:

- "All developments should avoid, or minimise, contributing to all sources of flooding, including fluvial, tidal, surface water, groundwater and flooding from sewers, taking account of climate change and without increasing flood risk elsewhere. Unacceptable developments and land uses will be refused in line with national policy and guidance [and] the Council's Strategic Flood Risk Assessment (SFRA)".

- **Sustainable drainage**

The Council will require the use of Sustainable Drainage Systems (SuDS) in all development proposals. Applicants will have to demonstrate that their proposal complies with the following:

1. A reduction in surface water discharge to greenfield run-off rates wherever feasible.

2. Where greenfield run-off rates are not feasible, this will need to be demonstrated by the applicant, and in such instances, the minimum requirement is to achieve at least a 50% attenuation of the site's surface water runoff at peak times based on the levels existing prior to the development. [4]

Also relevant are the London Plan (2020) policies S1 12 'Flood Risk Management'; Policy SI 13 'Sustainable Drainage' and the London Regional Flood Risk Appraisal (2018).

9.3 EA Standing Advice on Flood Risk

The Environment Agency's standing advice lays out the process that must be followed when carrying out flood risk assessments for developments.

Flood Risk Assessments are required for developments within one of the Flood Zones. This includes developments:

- in Flood Zone 2 or 3 including minor development and change of use more than 1 hectare (ha) in Flood Zone 1;
- less than 1 ha in Flood Zone 1, including a change of use in development type to a more vulnerable class (for example from commercial to residential), where they could be affected by sources of flooding other than rivers and the sea (for example surface water drains, reservoirs);
- in an area within Flood Zone 1 which has critical drainage problems as notified by the Environment Agency.

10 Site Description and Environmental Characteristics

10.1 Site Location and Area

The site is located at 99 Atbara Road, Teddington, TW11 9PA and is centred at national grid reference 517093 , 170941. The site has an area of 377m^2.

A site location map and aerial photo are shown below. Photographs of the site are available in Appendix 1.

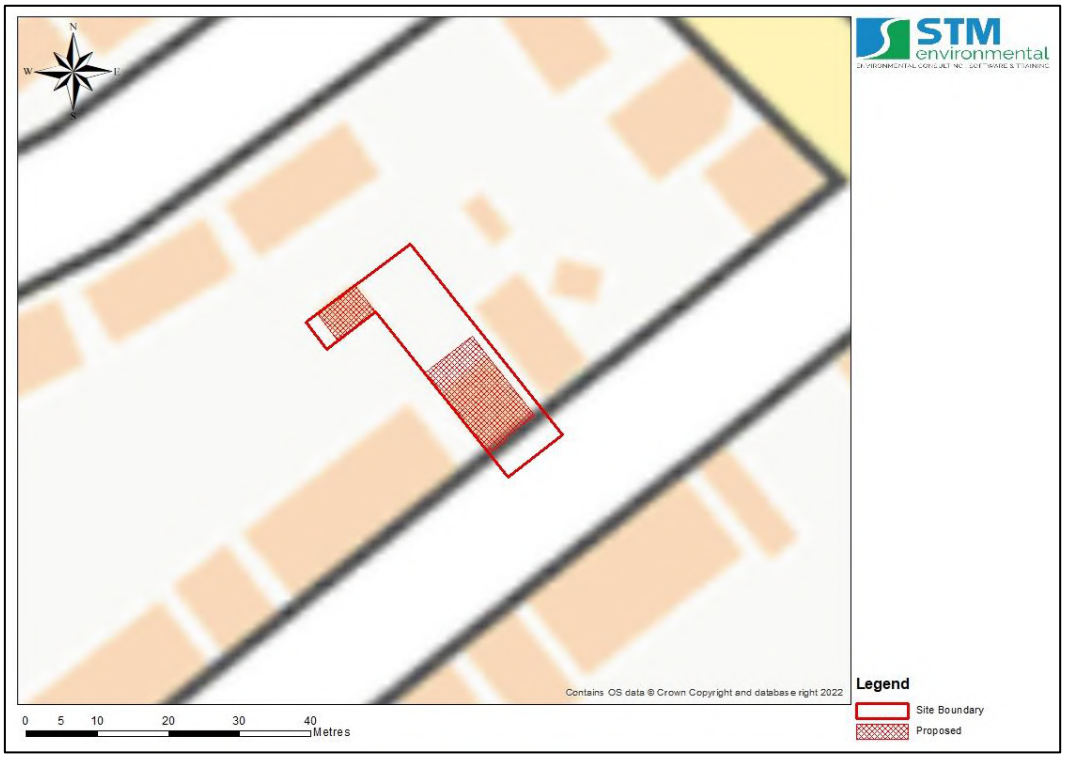


Figure 1: Site Location Map

Figure 2: Site Aerial Map

10.2 Site Access

The site will be accessed via Atbara Road.

10.3 Local Planning Authority

The site falls within the jurisdiction of Richmond upon Thames in terms of the planning process.

10.4 Lead Local Flood Authority

Richmond Upon Thames is also the Lead Local Flood Authority (LLFA).

10.5 Flood Zone

For planning purposes, the site is located in Flood Zone 3a as defined by the EA and LLFA.

10.6 Site and Surrounding Land Uses

10.6.1 Site Current Land Use

The site is currently a single storey residential dwelling.

10.6.2 Surrounding Land Uses

A description of the current and surrounding land uses of the site is given in Table 1 below.

Table 1: Summary of surrounding land uses

Boundary	Land Use Description	
	Immediately Adjacent (Within 0 – 25m)	**General Local Area (Within 25 – 250m)**
Northern	Residential	Residential
Eastern	Residential	Residential
Southern	Residential	Residential
Western	Residential	Residential

10.7 Hydrology

The nearest main watercourse is the River Thames which is located 360m North East.

10.8 Geology

Data from the British Geological Survey indicates that the underlying superficial geology is characterised as Kempton Park Gravel Formation (Sand and Gravel). The underlying bedrock geology is characterized as London Clay formation (Clay and silt).

10.9 Hydrogeology

The site lies upon a Principle, free draining superficial aquifer and an unproductive, poorly draining bedrock aquifer.

Appendix 3 provides BGS mapping showing the hydrogeology at the site location.

10.10 Topography

A LIDAR DTM map showing the topography of the site and surrounding area is available in Appendix 3. A topographic survey was available, site levels were assessed using this (see below).

The ground level at the site ranges from 6.34mAOD to 6.91mAOD. The site has an area of lower lying land running through the middle of the site. The ground level in the area of the proposed development has an elevation of approximately 6.88mAOD.

11 The Sequential and Exception Tests

11.1 The Sequential Test

The Sequential Test aims to steer developments and redevelopments to areas of lower flood risk. The test compares the proposed development site with other available sites, in terms of flood risk, to aid the steering process. The Sequential Test is not required if the proposed development is a minor development or if it involves a change

of use unless the development is a caravan, camping chalet, mobile home or park home site.

Based on Government Guidance, Minor Development means:

- minor non-residential extensions: industrial/commercial/leisure etc extensions with a footprint less than 250 square metre.
- alterations: development that does not increase the size of buildings eg alterations to external appearance.
- householder development: For example; sheds, garages, games rooms etc within the curtilage of the existing dwelling, in addition to physical extensions to the existing dwelling itself. This definition excludes any proposed development that would create a separate dwelling within the curtilage of the existing dwelling eg subdivision of houses into flats.

With regard to residential and commercial developments, major development, as defined by the Town and Country Planning (Development Management Procedure) means one or more of the following:

- c(i) - the number of dwelling houses to be provided is 10 or more; or
- c(ii) - the development is to be carried out on a site having an area of 0.5 hectares or more and it is not known whether the development falls within sub-paragraph (c)(i);
- the provision of a building or buildings where the floor space to be created by the development is 1,000 square metres or more;
- or development carried out on a site having an area of 1 hectare or more.

The development is located partially within flood zone 3a and completely within Flood Zone 2; it is considered to be “non-minor” as it is an redevelopment (alteration) that increases the build footprint, as such the Sequential Test may be required by the LLFA.

Although the development does involve the increase in building footprint within the flood plain, the development provides a significant opportunity to improve the current sites flood resilience and resistance to future flood risk events and provides an overall betterment to the flood plains storage area when taking into account the proposed mitigation measures that will be introduce as part of the proposed development.

As such we believe that this development should be viewed with a pragmatic approach by the LPA authority. A sequential test would be unjustified to be applied to this small windfall improvement development scheme.

11.2 The Exception Test

Where the Sequential Test is undertaken and alternative sites of lower flood risk are not available, then the proposed development may require an Exception Test in order to be granted planning permission. Where the exception test is required, it should be applied as soon as possible to all local development document allocations for developments and all planning applications other than for minor developments. All three elements of the exception test have to be passed before development is allocated or permitted. For the exception test to be passed:

- It must demonstrate that the development provides wider sustainability benefits to the community that outweigh the flood risk, informed by an SFRA, where one has been prepared;
- The development should be on developed land or on previously developed land;
- A flood risk assessment must demonstrate that the development will be safe without increasing flood risk elsewhere, and where possible will reduce the overall flood risk.

The requirements for an Exception Test are given in Table 2 and are defined in terms of Flood Zone and development vulnerability classification.

Table 2: NPPF Flood Zone vulnerability compatibility (source: NPPF).

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a	Exception Test required	✗	Exception Test required	✓	✓
Zone 3b	Exception Test required	✗	✗	✗	✓

Key:

✓ Development is appropriate

✗ Development should not be permitted.

Based on the development being "more vulnerable" and is partially located within Flood Zone 3a and Flood Zone 2, the Exception Test may be required by the LLFA.

However, as the proposal provides significant improvement to the existing scenario by offering an area of safe refuge within the dwelling and predominantly being located within flood zone 2, we believe the exception test should not be applied.

12 Site Specific Flood Risk Analysis

The PFRA and Level 1 SFRA produced by the LLFA and maps from the EA provide information regarding historic flooding events and incidents as well as predictions of flood extents and depths during extreme rainfall events.

12.1 Fluvial (River) and Tidal (Sea) Flood Risk

12.1.1 Mechanisms for Fluvial Flooding

Fluvial, or river flooding, occurs when excessive rainfall over an extended period of time or heavy snow melt causes a river to exceed its capacity. The damage from a fluvial flood can be widespread as the overflow may affect downstream tributaries,

overtopping defences and flooding nearby inhabited areas. Fluvial flooding consists of two main types:

- Overbank flooding – this occurs when water rises steadily and overflows over the edges of a river or stream;
- Flash flooding – this is characterized by an intense, high velocity torrent of water that occurs in an existing river channel with little to no notice. Flash floods are very dangerous and destructive not only because of the force of the water, but also the hurtling debris that is often swept up in the flow.

12.1.2 Definition of EA Modelled Fluvial Flood Risk Zones

Fluvial flood risk is assessed using flooding maps produced by the Environment Agency. These maps use available historic data and hydraulic modelling to define zones of flood risk. The maps allow a site to be defined in terms of its flood zone (e.g. 1, 2, 3) and in terms of the overall flood risk (very low, low, medium or high). It is important to note that existing flood defences are not taken into account within the models or the maps. The EA fluvial flood zones are defined as follows:

- Flood zone 1: Less than 1 in 1000 (0.1%) annual probability of flooding;
- Flood zone 2: Between 1 in 100 (1%) and 1 in 1000 (0.1%) annual probability of flooding;
- Flood zone 3: Greater than 1 in 100 (1%) annual probability of fluvial flooding.

Flood zone 3 is split into two sub-categories (3a and 3b) by LLFAs depending on whether the land is considered to be a functional flood plain (i.e. an important storage area for flood waters in extreme events).

- Flood zone 3a: Greater than 1 in 100 (1%) annual probability of fluvial flooding and/or greater than 1 in 200 (0.5%) annual probability of tidal flooding;
- Flood zone 3b: Functional flood plain (definition specific to the LLFA). Less than a 1 in 20 (5%) annual probability of fluvial and/or tidal flooding.

12.1.3 Main Potential Sources of Local Fluvial Flooding

The nearest potential source of fluvial flooding to the site is the River Thames.

12.1.4 Records of Historic Fluvial Flooding Incidents

The EA's historic and recorded flood outline maps show the locations and extents of historic flooding. These maps indicate that there has been historic flooding at or in the vicinity of the site. Copies of these maps are available in Appendix 4. The historic mapping shows that flooding occurred approximately 60m NE of the site on the following dates: 01/1998, 01/1947, 01/2000, and 12/2002.

The Historic Flood Map which is available as part of the EA Product 4 data in Appendix 11 indicates that the last time the borough suffered a significant fluvial flooding event was in 2002. The flood extent outline did not impact the site.

12.1.5 Designated Fluvial Flood Risk Zone for the Site

The site is considered to be located within Flood Zone 3a as defined by the Environment Agency and the LLFA indicating that it has a 1% annual probability of fluvial flooding. The proposal is predominately located within Flood Zone 2.

12.1.6 Mechanisms for Tidal Flooding

Tidal flooding may be described simply as the inundation of low-lying coastal areas by the sea, or the overtopping or breaching of sea defences. Tidal flooding may be caused by seasonal high tides, storm surges and where increase in water level above the astronomical tide level is created by strong on shore winds or by storm driven wave action.

12.1.7 Definition of EA Tidal Flood Risk Zones

As with fluvial flood risk, tidal flood risk is assessed using flooding maps produced by the Environment Agency. The difference is in the probability return periods used to define tidal flood zones. The EA tidal Flood Zones are defined as:

- Flood zone 1: Less than 1 in 1000 (0.1%) annual probability of flooding;

- Flood zone 2: Between 1 in 200 (0.5%) and 1 in 1000 (0.1%) annual probability of tidal flooding;
- Flood zone 3: Greater 1 in 200 (0.5%) annual probability of tidal flooding.

12.1.8 Potential Sources of Tidal Flooding

The site has potential for tidal flooding if the Teddington Weir were to overtop.

12.1.9 Records of Historic Tidal Flooding Incidents

There are no recorded incidents of tidal flooding on or in the vicinity of the site, see Appendix 4.

12.1.10 Designated Tidal Flood Risk Zone for the Site

The site is considered to be located within Flood Zone 3a as defined by the Environment Agency and the LLFA indicating that it has a 0.5% annual probability of tidal flooding.

12.1.11 Flood Defences

The EA's flood defence map which is available in Appendix 7 shows that the site does benefit from flood defences that are located in the vicinity of the site. The defences are located down river and include a high wall and the Teddington weir which mitigates the impact of tidal flooding upon the site.

12.1.12 Peak River Flow Climate Change Allowances

The EA's climate change allowances for peak river flow maps show that the site is considered to be in the London Management catchment. The climate change allowances for this catchment are available in Appendix 11.

In flood zones 2 or 3a for:

- essential infrastructure – use the higher central allowance
- highly vulnerable – use central allowance (development should not be permitted in flood zone 3a)

- more vulnerable – use the central allowance
- less vulnerable – use the central allowance
- water compatible – use the central allowance

In flood zone 3b for:

- essential infrastructure – use the higher central allowance
- highly vulnerable – development should not be permitted
- more vulnerable – development should not be permitted
- less vulnerable – development should not be permitted
- water compatible – use the central allowance

The central allowance for more vulnerable developments indicates that a climate change allowance of 17% should be used within the London Management catchment.

The modelled data provides the 1% AEP + 15% CC and 1% AEP +25% CC which has been used in this assessment. These scenarios have been used to extrapolate the 1% AEP +17% CC event.

12.1.13 Climate Change - EA Modelled Predictions of Fluvial and Tidal Flood Levels and Extents

The EA Product 6 dataset which is presented in Appendix 11 provides modelled flood levels and flows for model node points close to the site. These are summarised in Table 3 below.

Table 3: EA modelled expected flood depths (m) for different scenarios.

Node	Easting	Northing	Topo (mAOD)	Undefended			
				1% AEP		0.1% AEP	
			LiDAR DTM	Depth (m)	Level (mAOD)	Depth (m)	Level (mAOD)
0	517106	170940	6.76	0.01	6.77	1.1	7.86
1	517089	170925	6.93	0	N/A	0.86	7.79
2	517097	170934	6.82	0	N/A	0.99	7.81
3	517094	170937	6.71	0	N/A	1.03	7.74
4	517092	170945	6.72	0	N/A	1.07	7.79
5	517086	170941	6.58	0	N/A	0.99	7.57
6	517086	170947	6.54	0	N/A	1.04	7.58
7	517083	170951	6.46	0	N/A	1.05	7.51
8	517077	170958	6.85	0	N/A	1.29	8.14
9	517070	170953	6.79	0	N/A	1.25	8.04

Node	Easting	Northing	Topo (mAOD)	**Defended**								
				1% AEP*	0.1% AEP		1% AEP + 15% CC		Extrapolated 1% AEP + 17%CC		1% AEP + 25%CC	
			LiDAR DTM	Level	Depth (m)	Level (mAOD)	Depth (m)	Level (mAOD)	Depth (m)	Level (mAOD)	Depth (m)	Level (mAOD)
0	517106	170940	6.76	6.56	1.23	7.99	0.44	7.00	0.52	7.08	0.59	7.35
1	517089	170925	6.93	6.56	0.99	7.92	0.44	7.00	0.52	7.08	0.42	7.35
2	517097	170934	6.82	6.56	1.12	7.94	0.44	7.00	0.52	7.08	0.57	7.35
3	517094	170937	6.71	6.56	1.15	7.86	0.44	7.00	0.52	7.08	0.57	7.35
4	517092	170945	6.72	6.56	1.21	7.93	0.44	7.00	0.52	7.08	0.59	7.35
5	517086	170941	6.58	6.56	1.12	7.71	0.44	7.00	0.52	7.08	0.51	7.35
6	517086	170947	6.54	6.56	1.17	7.71	0.44	7.00	0.52	7.08	0.59	7.35
7	517083	170951	6.46	6.56	1.24	7.7	0.44	7.00	0.52	7.08	0.49	7.35
8	517077	170958	6.85	6.56	1.43	8.28	0.00	0.00	0.52	7.08	0.78	7.35
9	517070	170953	6.79	6.56	1.39	8.18	0.00	0.00	0.52	7.08	0.93	7.35

*The 1% AEP level does not impact the nodes on site; however the modelled level data provided indicates a flood level of 6.56mAOD surrounding the site and partially within the site.

The ground level at the site ranges from 6.39mAOD to 6.97mAOD.

During the 1% AEP (defended), the flood level is indicated at 6.56mAOD and partially impacts the site. The majority of the site and proposal remains dry.

During the 1% AEP +15% CC, the site and proposal witness a maximum flood level of 7.06mAOD.

During the 1% AEP +25% CC, the site and proposal witness a maximum flood level of 7.35mAOD.

In order to establish the 17% CC central allowance scenario, the flood level data was extrapolated using both the 15% CC and 25% CC scenarios against the 1%AEP flood level. The workings are explained below:

Formula

% CC Flood Depth = 1% AEP + CC% Flood level - 1% AEP Flood Level

1% CC Flood Depth = % CC Flood Depth ÷ %CC

17% CC Flood depth = 1% Flood Depth * 17

25% CC Extrapolation Example:

25% CC Flood Depth = 7.35mAOD – 6.56mAOD

25% CC Flood Depth = 0.79m

1% = 0.79 ÷ 25

1% = 0.03

17% CC Flood depth = 0.03 * 17

17% CC Flood depth = 0.54m

The average of the two extrapolated values were calculated and were used as the flood depth for the 17% CC scenario. This equates to a flood depth of 0.52m and a corresponding flood level of 7.08mAOD.

During the extrapolated event of 1% AEP + 17% CC, the site witnesses a max flood depth of 0.52m to a level of 7.08mAOD

12.1.14 Long Term Fluvial/Tidal Flood Risk Considering Flood Defences

The EA's long term flood risk maps give an indication of the actual risk associated with flooding after taking into account the effect of any flood defences in the area. Copies of maps for the site which are available in Appendix 9 indicate that the long-term risk from fluvial flooding to the site is low.

12.2 Pluvial (Surface Water) Flood Risk

A pluvial, or surface water flood, is caused when heavy rainfall creates a flood event independent of an overflowing water body. Surface water flooding occurs when high intensity rainfall leads to run-off which flows over the ground surface, causing ponding in low-lying areas when the precipitation rate or overland flow rate is greater than the rate of infiltration, or return into watercourses. Surface water flooding can be exacerbated when the underlying soil and geology is saturated (as a result of prolonged precipitation or a high-water table) or when the drainage network has insufficient capacity.

12.2.1 Mechanisms of Pluvial Flooding

The chief mechanisms for surface water flooding can be divided into the following categories:

- Runoff from higher topography;
- Localised surface water runoff – as a result of localised ponding of surface water;
- Sewer Flooding – areas where extensive and deep surface water flooding is likely to be influenced by sewer flooding. Where the sewer network has reached capacity, and surcharged, this will exacerbate the flood risk in these areas;
- Low Lying Areas – areas such as underpasses, subways and lowered roads beneath railway lines are more susceptible to surface water flooding;

- Railway Cuttings –railway infrastructure cut into the natural geological formations can cause extra surface run off and pooling disrupting service and potentially affecting adjacent structures;
- Railway Embankments – discrete surface water flooding locations along the up-stream side of the raised network rail embankments where water flows are interrupted and ponding can occur;
- Failure of artificial sources (i.e. man-made structures) such as such as canals and reservoirs.

12.2.2 Main Potential Sources of Local Pluvial Flooding

The main potential source of pluvial flooding to the site is considered to be surface water ponding and flooding associated with reservoirs and canals in the area.

12.2.3 Records of Historic Pluvial Flooding Incidents

Examination of the LLFA's Level 1 SFRA revealed no evidence of pluvial flooding on or in the vicinity of the site. A map showing the location of surface water flooding incidents is available in Appendix 4 .

12.2.4 Surface Water Flood Risk from Artificial Sources (Reservoirs and Canals)

An examination of OS mapping and the EA's mapping revealed that there are significant reservoirs in the area of the site. There are five reservoirs located within 5km upstream of the site. Queen Elizabeth II, Knight Reservoir, Bessborough Reservoir, Stains Hill East Reservoir and Island Barn Reservoir.

The EA's reservoir flood risk map indicates that the site does lie within an area that is at risk of reservoir flooding. The site is at risk from flooding from the reservoirs listed above.

12.2.5 Sewer Flooding

Examination of the LLFA's Level 1 SFRA revealed some evidence of sewer flooding in the vicinity of the site. With 1 recorded incident of sewer flooding in the TW11 postcode.

A map showing recorded incidents of sewer flooding is available in Appendix 4.

12.2.6 Peak Rainfall Climate Change Allowances

The EA's climate change allowances for peak rainfall maps show that the site is considered to be in the London Management Catchment. The climate change allowances for this catchment are available in Appendix 6.

Development with a lifetime beyond 2100:

Design your development so that for the upper end allowance in the 1% annual exceedance probability event:

- there is no increase in flood risk elsewhere
- your development will be safe from surface water flooding

Development with a lifetime of between 2061 and 2100:

For development with a lifetime between 2061 and 2100 take the same approach but use the central allowance for the 2070s epoch (2061 to 2125).

Development with a lifetime up to 2060:

For development with a lifetime up to 2060, take the same approach but use the central allowance for the 2050s epoch (2022 to 2060).

The upper end allowance for the 1% annual exceedance probability event indicates a climate change allowance of 40% should be used for pluvial flooding.

12.2.7 Climate Change - Modelled Predictions of Surface Water Run-off Flooding

Mapping of the predicted extent and depth of surface water flooding for the 1 in 100-year, and 1 in 1000-year rainfall return periods provided by the EA are available in Appendix 6.

The maps show that the site would remain dry during both precipitation events.

12.2.8 Long Term Surface Water Flood Risk

The EA's long term flood risk maps which are available in Appendix 9 indicate that the long term risk of flooding from surface water is considered to be very low.

12.3 Risk of Flooding from Multiple Sources (ROFMS)

The Environment Agency provides a map which gives an indication of the overall flood risk to a site from fluvial, tidal and surface water sources after considering the presence of flood defences. This map indicates that there is between 3.3% - 1% chance of flooding at the site in any year and 1% - 0.1% chance of flooding for the proposed at any given year. A copy of the map is presented in Appendix 8.

12.4 Groundwater Flood Risk

Groundwater flooding occurs when water rises from an underlying aquifer (i.e. at the location of a spring) to such a level where it intersects the ground surface and inundates the surrounding land. Groundwater flooding tends to occur after long periods of intense precipitation, in often low-lying areas where the water table is likely to be at a shallow depth. Groundwater flooding is known to occur in areas underlain by principal aquifers, although increasingly it is also being associated with more localised floodplain sands and gravels. A high groundwater table also has the potential to exacerbate the risk of surface water and fluvial flooding by reducing rainfall infiltration capacity, and to increase the risk of sewer flooding through sewer/groundwater interactions.

12.4.1 Historic Records of Groundwater Flooding

Examination of the LLFA's Level 1 SFRA revealed 1 record of groundwater flooding at or within 500m of the site. No specified location of incident, only that it occurred within the TW11 postcode.

A map showing the locations of historic groundwater flooding incidents is available in Appendix 4.

12.4.2 Susceptibility to Groundwater Flooding

The Groundwater Flood Susceptibility Map provided by BGS and presented in Appendix 10 indicates that the site has potential for groundwater flooding to occur in a property situated below ground level. The Groundwater Depth map also provided by BGS indicates that the groundwater level may be at approximately 3mbgl.

12.5 Critical Drainage Area

A Critical Drainage Area (CDA) may be defined as "a discrete geographic area (usually a hydrological catchment) where multiple and interlinked sources of flood risk (surface water, groundwater, sewer, main river and/or tidal) cause flooding in one or more Local Flood Risk Zones during severe weather thereby affecting people, property or local infrastructure". A CDA is defined in the Town and Country Planning (General Development Procedure) (Amendment) (No. 2) (England) Order 2006 as "an area within Flood Zone 1 which has critical drainage problems and which has been notified to the local planning authority by the Environment Agency".

The site is located within a Critical Drainage Area. The site is located within the Group8_007 Hampton Wick CDA according to the Richmond SWMP.

13 Potential Impacts of the Development on Local Flood Risk

13.1 Changes to Impermeable Area and Building Footprint

Changes in ground cover arising from the development are presented in Table 4 and Table 5 below.

Table 4: Existing and proposed site ground cover.

	Impermeable Area (m^2)	Permeable Area (m^2)	Total Area (m^2)
Existing	116	261	377
Proposed	160	217	377

Table 5: Break down of existing and proposed site uses

Use	Existing (m^2)	Proposed (m^2)	Difference (m^2)
Building	107	151	44
Impermeable Paving	9	9	0
Garden/ soft Landscaping	261	217	44
Total	377	377	-

As the development will increase the impermeable and built up area by 44m^2, it is considered possible that it will negatively impact the flood flow and surface water runoff rates without mitigation.

13.2 Impacts on Flood Storage and Flood Flow Routes

The development will increase the site's built up area by 44m^2, it is likely to have an impact on local flood storage without mitigation.

During the 1% AEP plus 17% CC the proposal has the potential to cause 22.88m^3 of flood plain storage displacement.

As the development does involve the redesign of buildings at the site it has potential to alter flood flow paths. However, given the location at the far extent of the flood plain, these impacts are likely to be negligible.

The mitigation measures discussed below will reduce the impact.

14 Flood Risk Mitigation Measures

14.1 SuDS

Planning practice guidance (PPG) which is prepared by the Ministry of Housing, Communities and Local Government (DCLG) states that developers and Local Authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage techniques.

As such, the developer has the option to implement a SuDS strategy in line with the drainage hierarchy as outlined in Table 6 below to reduce surface water discharges from the site.

Table 6: SuDS Options

- Store rainwater for later use;
- Use infiltration techniques, such as porous surfaces in non-clay areas;
- Attenuate rainwater in ponds or open water features for gradual release;
- Attenuate rainwater by storing in tanks or sealed water features for gradual release;
- Discharge directly to a water course;
- Discharge rainwater directly to a surface water sewer/drain;
- Discharge to a combined sewer.

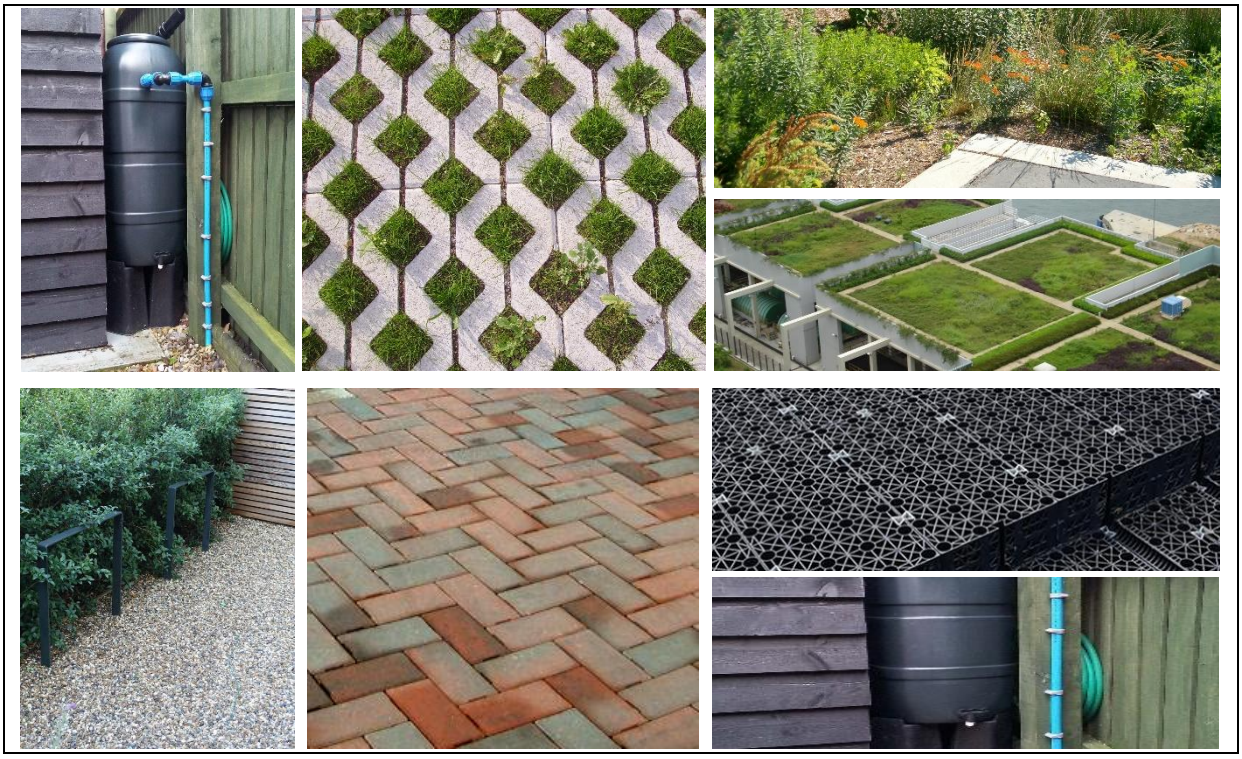


Figure 3: Surface water storage facilities and potential SuDS features - rainwater harvesting, on-site tank storage, rain garden soak-away and green roofs. (Source: UK SuDS Manual)

Given the nature of the development and the size of the site, it is considered that there are good opportunities for implementing bespoke infiltration SuDS. Measures such as rainwater harvesting, infiltration (soakaways, permeable paving, rain gardens) or

attenuation storage tanks should be considered. A full SuDS strategy is outside the scope of works of this FRA.

14.2 Flood Resilience

Flood resilient construction uses methods and materials that reduce the impact from a flood, ensuring that structural integrity is maintained, and the drying out and cleaning required, following inundation and before reoccupation, is minimised.

14.2.1 Finished Floor Levels

The FFL of the existing development is 7.15mAOD.

For **vulnerable developments**, the EA's Standing Advice states that the finished floor level of the lowest habitable room in any building, Finished Floor Levels (FFL) should be a minimum of 300mm above one of the following, whichever is higher;

- Average Ground level; Or
- Estimated flood level 1% AEP plus CC; Or
- The Adjacent roadway;

During the 1% AEP + 17% CC, the site floods to a maximum level of 7.08mAOD. The FFL of the proposal should therefore be raised 300mm above this to approximately 7.38mAOD. It should be noted that the proposed FFL is higher than the existing and therefore is providing further improvements to the site.

14.2.2 Compensatory Flood Storage (CFS)

All new development within Flood Zone 3 must not result in a net loss of flood storage capacity. Where possible, opportunities should be sought to achieve an increase in the provision of floodplain storage.

Where proposed development results in a change in building footprint, the developer must ensure that it does not impact upon the ability of the floodplain to store water, and should seek opportunities to provide a betterment with respect to floodplain storage.

During the 1 % AEP + 17% CC scenario the development will displace approximately 22.88m^3 of flood plain storage due to the increase in building footprint of 44m^2.

The prosed mitigation measures (see below) combined will reduce this displacement to +1.98m^3.

The first mitigation measure is to retrofit the garage to make it a floodable structure by allowing water entry. By allowing flood waters to easily enter and exit the existing garage during the time of a flood event will increase the flood plain storage capacity. It will provide compensational storage on a level for level basis, as it is currently situated within the flood plain, at the same elevation as the proposed.

Further Compensatory Flood Storage will be achieved by removing a section of the existing garden and grading the garden downwards towards the patio. Indicative mapping outlining the area of CFS is available in Appendix 14.

The workings are explained below:

Total garage storage capability:

Area of garage = 31m^2

Flood depth for 17% CC (0.52) x 31 = 16.12m^3

22.88m^3 – 16.12m^3 = **Updated flood plain displacement value 6.76m^3**

Storage obtained from CFS:

Topographic survey levels; 6.76mAOD – 6.38mAOD = 0.38m

Area of garden to be lowered = 46m^2

0.38 x 46= 17.48m^3

17.48 / 2 = 8.74m^3 (50% gradient)

Total storage Net Gain = +**1.98m^3** (8.74m^3 - 6.76m^3)

The proposed mitigation measures increase the flood plain storage capacity by approximately +1.98m^3 predominately on a level for level basis. Therefore, the mitigations measures stated provide an increased storage capacity of the flood plain, providing betterment to the surrounding area and reduce local flood risk.

14.2.3 Flood Resilience Construction Measures

In terms of achieving resilience, there are two main strategies, whose applicability is dependent on the water depth the property is subjected to. These are:

- Water Exclusion (Flood Resistance) Strategy - should be employed where predicted flood depths are less than 0.3m and are likely to be for short duration. Emphasis is placed on minimising water entry and giving occupants time to relocate ground floor contents, maintaining structural integrity, and on using materials and construction techniques to facilitate drying and cleaning;
- Water Entry (Flood Resilience) Strategy - Flood resilience measures are designed to allow water in but to limit damage and allow rapid re-occupancy. Resilience measures should be employed where flood depths are greater than 0.6m and where it is likely that structural damage will occur due to excessive water pressure.

Given that flood depths greater than 0.6m are predicted in extreme scenarios, the water entry strategy is considered most applicable for this site.

Water Entry Strategy:

There are a range of options for implementing the Water Entry Strategy including:

- Use materials with either good drying and cleaning properties, or, sacrificial materials that can easily be replaced;
- Designing for water to drain away;
- Designing access to all spaces to permit drying and cleaning;
- Raising the level of electric wiring, appliances and utility metres (0.1m above flood level);
- Ground supported floors with concrete slabs coated with impermeable membrane;
- Tank basements, cellars and ground floors with water resistant membranes;
- Plastic water resistant internal doors.

Flood resilience design and measures that will be implemented are outlined below. Water-resistant and resilient materials will be utilized throughout the construction to minimize the flood risk and potential impacts.

Floor construction:

- Use of resilient flooring materials as ceramic tiles or stone floor finishes;
- Use of a concrete slab 150mm thick;
- Use of ceramic tiles or stone floor finishes is recommended;
- Maintain existing under floor ventilation by UPVC telescopic vents above 400 mm to external face of extension;
- Damp proof membrane of impermeable polythene at least 1200 gauge;
- Avoid the use of MDF carpentry.

Wall construction:

- Include in the external face of the extension a damp – proof course, 250 mm above ground level, to prevent damp rising through the wall;
- Use rigid closed – cell material for insulation above the DPC;
- Spread hardcore over the site within the external walls of the building to such thickness as required to raise the finished surface of the site concrete. The hardcore should be spread until it is roughly level and rammed until it forms a compact bed for the oversite concrete. This hardcore bed will be 100 mm thick and composed by well compacted inert material, blinded with fine inert material.

Doors:

- Seal doors around edges and openings. UPVC or composite material will be used with passive protection meaning that minimal intervention will be required in the event of flooding.

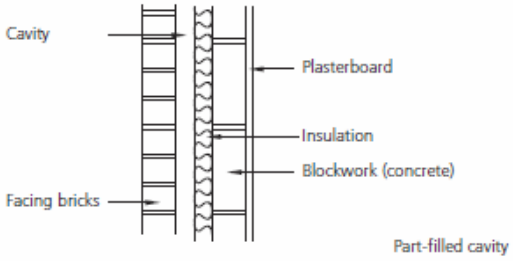
Underground drainage:

- Avoid use of metal for any underground piping;

- Use closed cell insulation for pipes that are below the predicted flood level;
- Provide non – return valves for the drainage system to prevent back water flow;
- Use UPVC or clay pipework for fouls and surface water drainage.

Figure 4: Cavity External Walls

Figure 6.10 Cavity External Walls – Part-filled cavity with sacrificial plasterboard



Part-filled cavity

- External face consisting of engineering bricks up to required level for flood protection (up to d.p.c.). Other external facing materials can be used above this level, but ensure transition is watertight.
- Rigid insulation
- Internal cement based render, preferably with lime content. Composition depends on masonry; the following mix is effective:

  1 cement : 6 sand: 1 lime on concrete blocks.
- Stainless steel wall ties should be used to minimise corrosion and consequent staining.
- Sacrificial plasterboard can be used, but it needs to be removed between ground floor to flood level. The board should be laid horizontally to make removal easier.

As well as the above the following flood resilience features should be applied as part of the development:

- Electrical sockets should be installed above flood level for the ground floor;
- Utility services such as fuse boxes, meters, main cables, gas pipes, phone lines and sockets will be positioned as high as practicable;
- All external openings for pipes or vents below 400mm to be sealed around pipe or vent with expanding foam and mastic.

14.3 Emergency Plan

14.3.1 Assessment of Danger to People

The dangers associated with flood water to people are possible injury and/or death. This can occur as a result of drowning or being carried along by the waters into hard objects or vice versa. The risk to life is largely a function of the depth and velocity of

the floodwater as it crosses the floodplain. Fast flowing deep water that contains debris would represent the greatest hazard.

The assessment of danger to people from walking in floodwater is described in the Flood Risks to People guidance documents (FD2321_TR1 and FD2321_TR2) by DEFRA/EA.

Danger can be estimated by the simple formula:

$$HR = d \times (v + 0.5) + DF$$

where, HR = (flood) hazard rating; d = depth of flooding (m); v = velocity of floodwaters (m/sec); and DF = debris factor.

The scoring methodology and calculation matrix for this is summarised in Appendix 13.

The EA Product 4 data indicates that the maximum depth of flooding at the site in the 1 in 100 plus 35% climate change event would be 1.35m. This equates to a Flood Hazard Rating (HR) score of 1.5 indicating that the flood waters would constitute danger for most. The flood hazard rating would therefore be high.

The use of a flood emergency plan is therefore sufficient for the proposed development. The key elements of the emergency plan are described below.

14.3.2 EA Flood Warnings Direct Service Subscription

The occupants will subscribe to the EA Flood Warnings Direct Service which is a free service offered by the EA providing flood warnings direct to people by telephone, mobile, email, SMS text message and fax. The EA aims to provide 2 hours' notice of flood, day or night, allowing timely evacuation of the site.

The agency operates a 24-hour telephone service on 0345 988 1188 that provides frequently updated flood warnings and associated floodplain information. In addition, this information can also be found at https://fwd.environment-agency.gov.uk/app/olr/home along with recommendations on what steps should be taken to prepare for floods, what to do when warnings are issued, and how best to cope with the aftermath of floods.

14.3.3 Access and Safe Egress

Safe egress to Flood Zone 1 is available by heading South west on Atbara Road for 200m and turning right onto Kingston Road. Approximately a 4 minute walk. Directions of this route are presented in Appendix 12 .

14.3.4 Safe Refuge

The proposed development will replace a single-storey dwelling with a 2-storey dwelling with a loft conversion, therefore providing sufficient safe refuge internally.

15 Conclusions and Recommendations

This assessment has considered the potential risks to the application site associated with flooding from fluvial, tidal, surface water, artificial and groundwater sources and the potential impacts of climate change.

A review of LLFA's PFRA and SFRA as well as data provided by the EA was undertaken. The main findings of the review and assessment are provided below:

- The main sources of potential flooding to the site are fluvial from the River Thames;
- The EA define the site as being within Flood Zone 3a;
- The finished floor level will be set at 7.38mAOD, 300mm above the 1% AEP +17% CC scenario flood level;

- Development is “non-minor” and more vulnerable and located within flood zone 2 and 3, as such we believe the sequential and exception may be required. LLFA to decided;
- The garage will be retrofitted to become a floodable structure; Level for level Compensatory Flood Storage will be achieved by removing a section of the existing garden steps and grading the garden downwards towards the patio;
- These measures increase the sites flood plains storage capacity by approximately 1.98m^3;
- EA mapping indicates that the site does benefit from flood defences, these include the Teddington weir which mitigates tidal flooding upon the site;
- No record of fluvial, tidal, surface water or artificial flooding incidents were identified at or in the vicinity of the site;
- The site is within a CDA. It is in an area that has had a 1 sewage flooding incidents within the TW11 postcode;
- 1 record of groundwater flooding incidents were identified within the TW11 postcode;
- There is good opportunity for implementing SuDS mitigation measures. Consideration should be given to use of Measures such as rainwater harvesting, infiltration (soakaways, permeable paving, rain gardens) or attenuation storage tanks should be considered;
- Flood resilient materials and construction methods will be used so as to ensure that the impacts of any potential flooding are minimised as much as possible;
- Occupants will subscribe to the EA Flood Warnings Direct Service;
- Safe egress routes to Flood Zone 1 are easily accessible, by heading South west on Atbara Road for 200m and turning right onto Kingston Road;
- In the event that evacuation is not possible, safe refuge is available in the upper floors of the building which are accessible via an internal staircase.
- The development will result in an increase of impermeable area of the site however with the adoption of the suggested recommendations implemented the impact would be greatly reduced and may even benefit the wider floodplain.

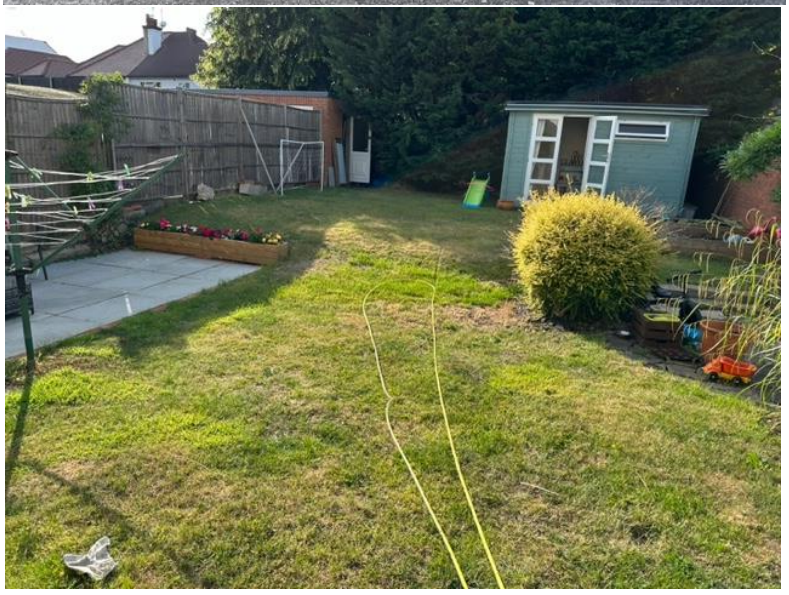
- It should be noted that the proposed development will greatly benefit the site and surrounding area, it improves the safety of its occupants by allowing safe refuge and provides further improvements to the flood plain storage capacity.

16 References

1. Communities and Local Government - National Planning Policy Framework NPPF, July, 2021.
2. Communities and Local Government - Planning Practice Guidance: Flood Risk and Coastal Change, Updated 06 March 2014.
3. Strategic Flood Risk Assessment, Richmond Upon Thames, 2022;
4. Local Plan, Richmond Upon Thames, 2011
5. Surface Water Management Plan, Richmond Upon Thames, 2022;
6. CIRIA, Defra, Environment Agency – UK SuDS Manual, 2015.
7. Greater London Authority – London Sustainable Drainage Action Plan, 2015.
8. London Plan (2021) - Mayor of London
9. London Regional Flood Risk Appraisal (2018) - Mayor of London

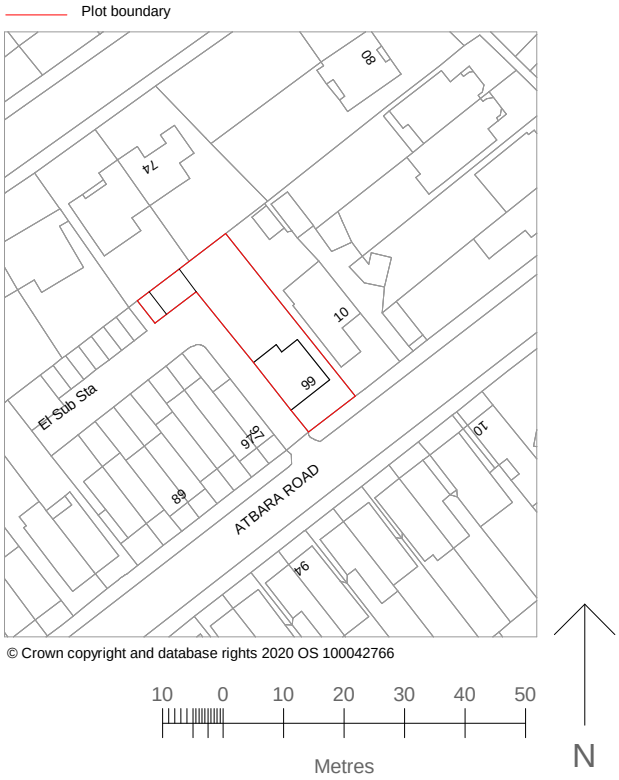
17 Appendices

17.1 Appendix 1 – Site Photographs



17.2 Appendix 2 – Development Plans

See next page.



Location Map

1 : 1250

Extension Plans. Ealing Cross, 85 Uxbridge Rd, London W5 5BW	99 Atbara Road, Teddington TW11 9PA PROJECT ADDRESS:	Jamie & Beverley McDaid CLIENT:		
		12.05.2023 Date:	1:100 Scale (@ A4)	Rev. Date / Rev.
		Drawn by: GB	AR-R00-EX-101	
New 4 Bed House PROJECT:	LOCATION MAP DRAWING TITLE:	Checked by:	DRAWING NUMBER:	

Development

Property boundary

Site Plan

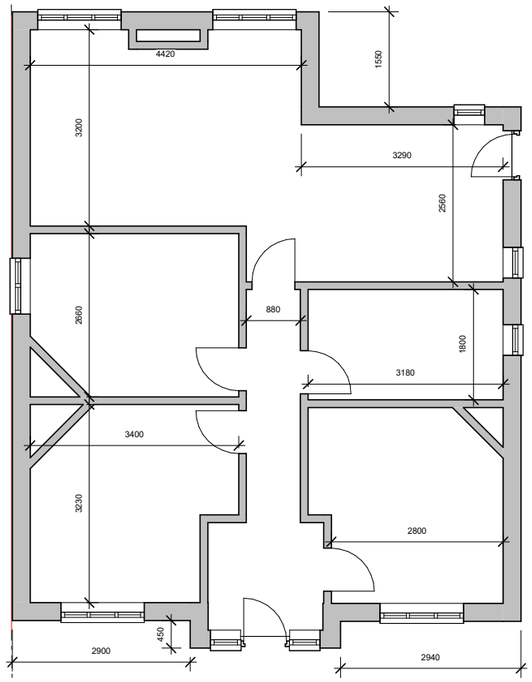
1 : 500

10 0 10 20 30 40 50

Metres

N

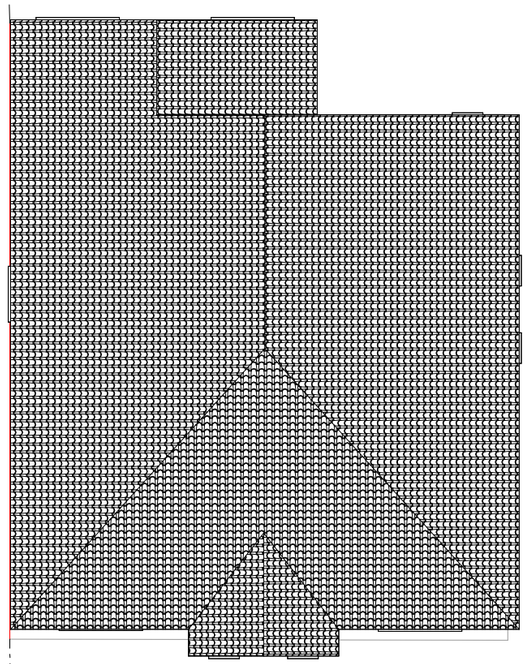
Extension Plans 16 Shakespeare Road W7 1LR	99 Atbara Road, Teddington TW11 9PA	Jamie & Beverley McDaid	
	PROJECT ADDRESS:	CLIENT:	
		Date: 22/09/2023	Scale (@ A4) / Rev. Date / Rev.
		Drawn by: LG	AR-R00-PR-101
PROJECT: New 4 Bed House	DRAWING TITLE: SITE PLAN	Checked by: JH	DRAWING NUMBER:



Boundary
Outline

GF Lvl

1 : 100



ROOF PLAN

1 : 100

0 1 2 3 4 5m 1:100

PROGRAMME:

REVISION NOTES:

REV:	DATE:	DESCRIPTION:

GENERAL NOTES:

1. All Dimensions are in millimetres unless otherwise stated
2. All work to be carried out in accordance with the current edition of the building regulations 1991 (including amendments) and all relevant british standards/codes of practice.
3. The Contractor is responsible for the correct setting out of the works on site, all dimensions to be checked prior to fabrication of materials and commencement of works.
4. This Drawing is to be read in conjunction with all relevant drawings and specifications
5. Exact SVP and Boiler position to be determined onsite by contractor
6. Steels imbedded into ceiling may be charged additionally by your contractor
7. All proposed materials are to be similar in appearance to that of the existing house, unless otherwise
8. Skylights mustn't protrude past the roof slope by more than 150mm
9. Glazing which exceeds 25% of the added floor area will result in extra charges for S.A.P Calculations

EXTENSION PLANS

Extension Plans. 16 Shakespeare Road W7 1LR

CLIENT: Jamie & Beverley McDaid

PROJECT: New 4 Bed House

PROJECT ADDRESS: 99 Atbara Road,
Teddington
TW11 9PA

DRAWING TITLE: EXISTING FLOOR PLANS

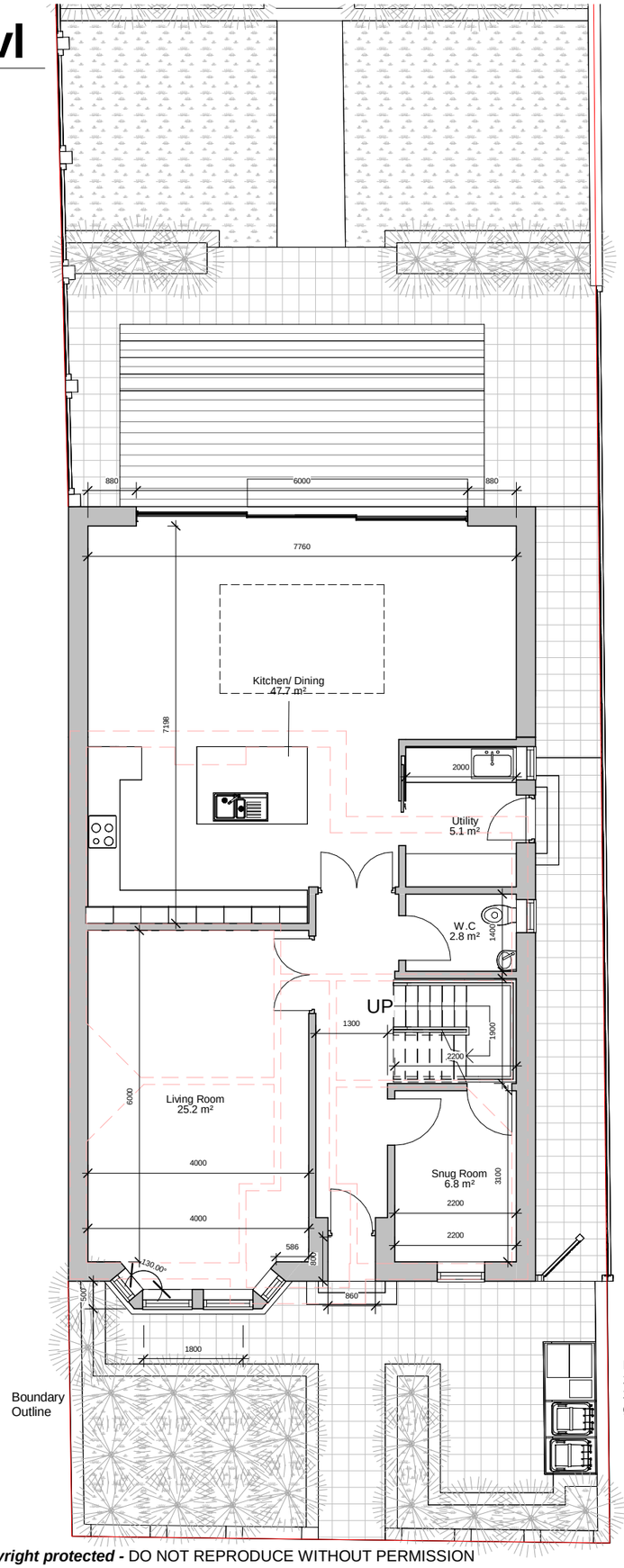
DRAWN BY:	CHECKED BY:
LG	JH

DATE:	Rev:	Rev. DATE:
22/09/2023		

SCALE@A3:	DRAWING No:
1:100	HR-R00-EX-102

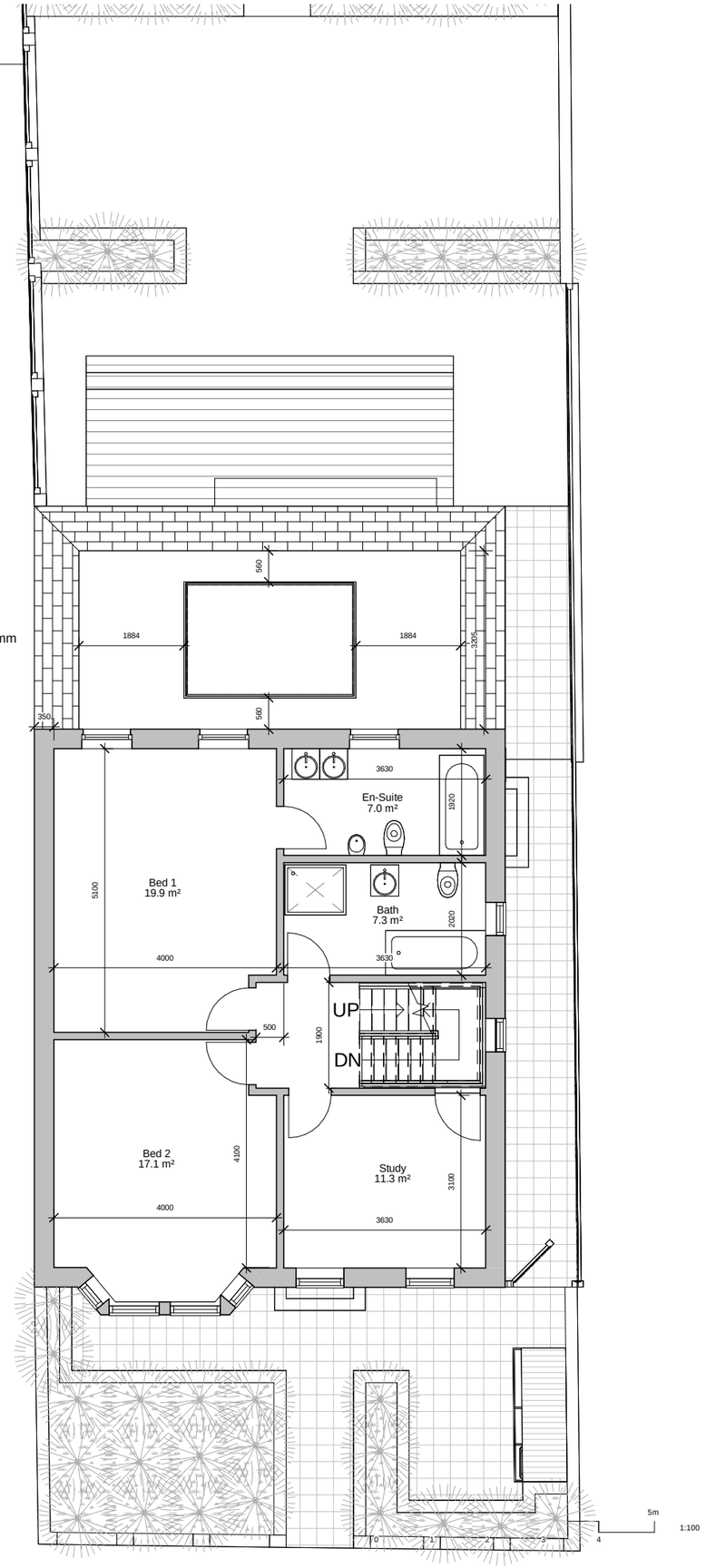
GF Lvl

1 : 100



FF Lvl

1 : 100



PROGRAMME:

KEY:

	Neighbouring context	**RWP**	Rain Water Pipe
	Existing walls	**SVP**	Soil Vent Pipe
	Proposed walls		Boundary line
	Proposed rooflight		Existing removed
MH	Manhole		Existing beam
B	Boiler		1.2 m head height
EM	Electric Meter		1.5 m head hieght
GM	Gas Meter		Ridge line

REVISION NOTES:

REV:	DATE:	DESCRIPTION:

GENERAL NOTES:

1. All Dimensions are in millimetres unless otherwise stated
2. All work to be carried out in accordance with current building regulations and all relevant british standards/codes of practice.
3. The Contractor is responsible for the correct setting out of the works on site, all dimensions to be checked prior to fabrication of materials and commencement of works.
4. This Drawing is to be read in conjunction with all relevant drawings and specifications
5. Exact SVP and Boiler position to be determined onsite by contractor
6. A 'macerator toilet' would be required for a certain designs if the toilet location is away from existing SVP
7. Steels imbedded into ceiling may be charged additionally by your contractor
8. All proposed materials are to be similar in appearance to that of the existing house, unless otherwise stated.
9. Skylights must not protrude past the roof slope by more than 150mm
10. Glazing which exceeds 25% of the added floor area will result in extra charges for S.A.P Calculations
11. Windows on a side elevation at first floor level or above must be obscured glazing and non openable below 1.7m
12. Load-bearing partitions and/or posts are shown in a rough position. The exact position is to be confirmed by a structural engineer prior to construction.

EXTENSION PLANS

Extension Plans. Ealing Cross, 85 Uxbridge Rd, London W5 5BW

CLIENT: Jamie & Beverley McDaid

PROJECT: New 4 Bed House

PROJECT ADDRESS: 99 Atbara Road, Teddington TW11 9PA

DRAWING TITLE: PROPOSED FLOOR PLANS

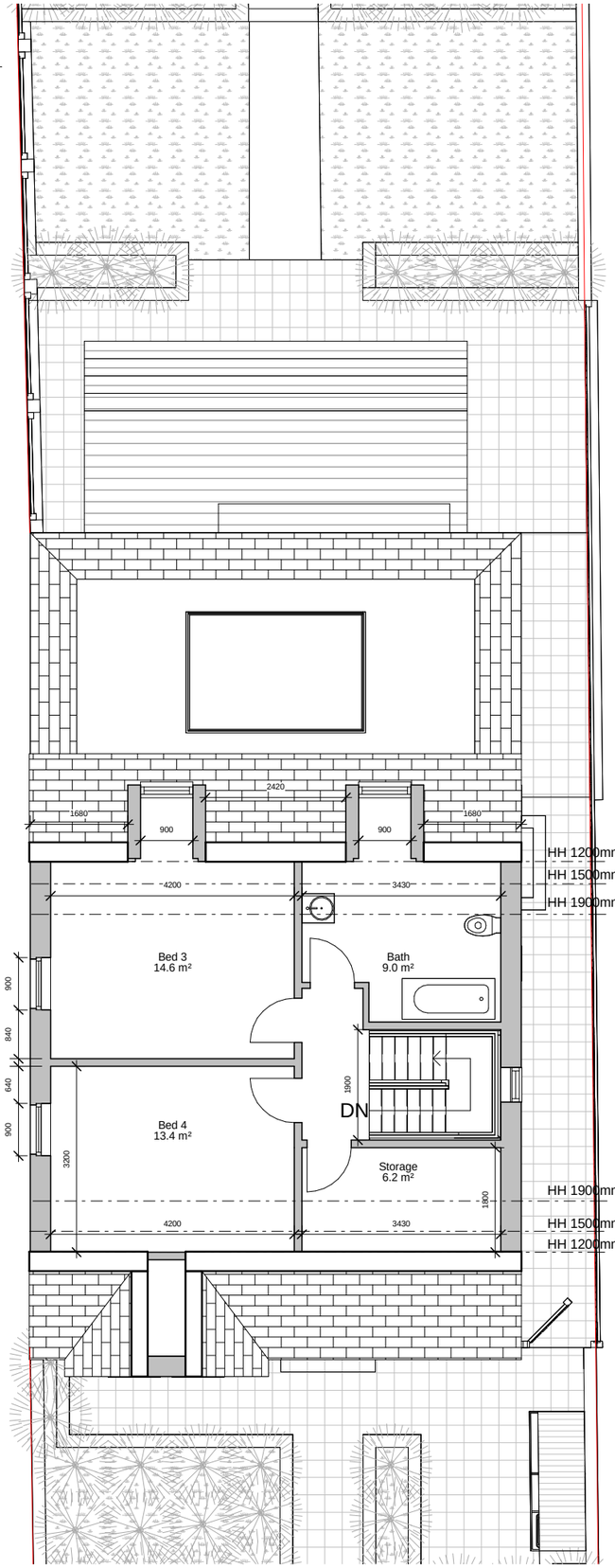
DRAWN BY: LG | **CHECKED BY:** JH

DATE: 22/09/2023 | **Rev:** | **Rev. DATE:**

SCALE@A3: 1:100 | **DRAWING No:** AR-R02-PR-102

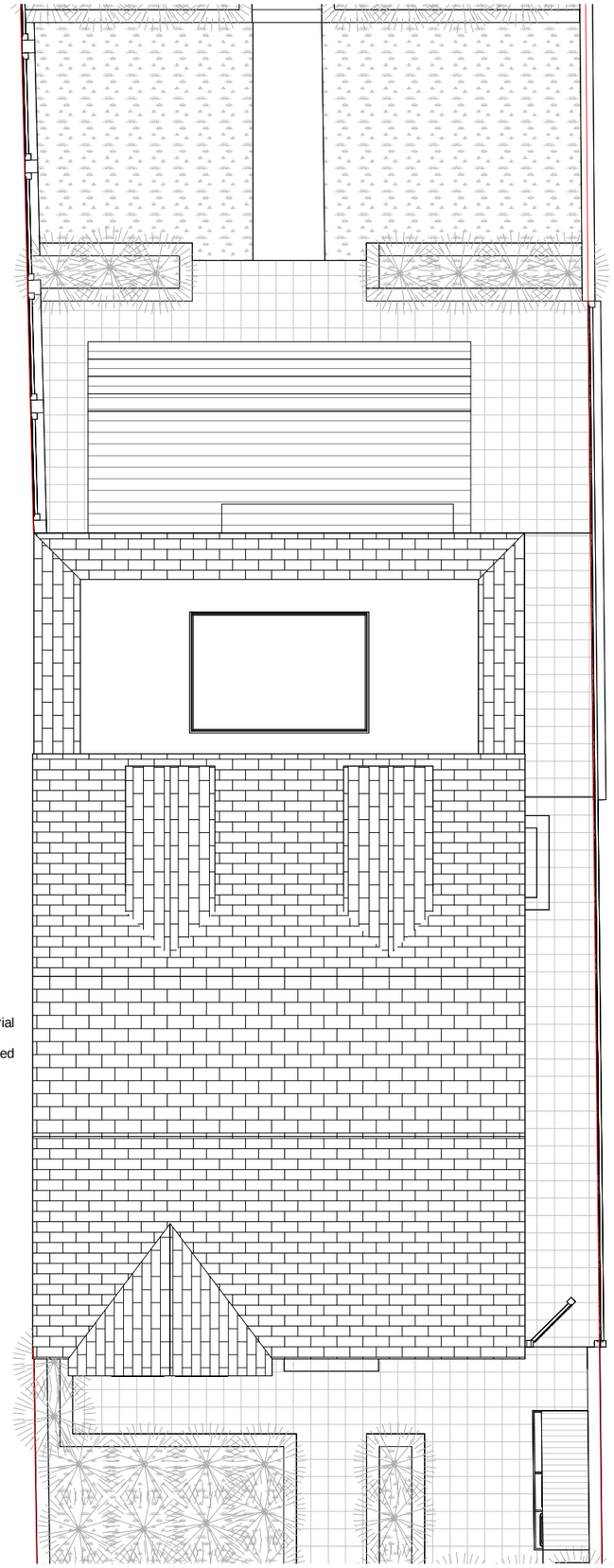
Loft Lvl

1 : 100



ROOF PLAN

1 : 100



Roof material to be gray slate with red ridge tiles

5m
0 1 2 3 4 1:100

PROGRAMME:

KEY:

	Neighbouring context	**RWP**	Rain Water Pipe
	Existing walls	**SVP**	Soil Vent Pipe
	Proposed walls		Boundary line
	Proposed rooflight		Existing removed
MH	Manhole		Existing beam
B	Boiler		1.2 m head height
EM	Electric Meter		1.5 m head hieght
GM	Gas Meter		Ridge line

REVISION NOTES:

REV:	DATE:	DESCRIPTION:

GENERAL NOTES:

1. All Dimensions are in millimetres unless otherwise stated
2. All work to be carried out in accordance with current building regulations and all relevant british standards/codes of practice.
3. The Contractor is responsible for the correct setting out of the works on site, all dimensions to be checked prior to fabrication of materials and commencement of works.
4. This Drawing is to be read in conjunction with all relevant drawings and specifications
5. Exact SVP and Boiler position to be determined onsite by contractor
6. A 'macerator toilet' would be required for a certain designs if the toilet location is away from existing SVP
7. Steels imbedded into ceiling may be charged additionally by your contractor
8. All proposed materials are to be similar in appearance to that of the existing house, unless otherwise stated.
9. Skylights must not protrude past the roof slope by more than 150mm
10. Glazing which exceeds 25% of the added floor area will result in extra charges for S.A.P Calculations
11. Windows on a side elevation at first floor level or above must be obscured glazing and non openable below 1.7m
12. Load-bearing partitions and/or posts are shown in a rough position. The exact position is to be confirmed by a structural engineer prior to construction.

EXTENSION PLANS

Extension Plans. Ealing Cross, 85 Uxbridge Rd, London W5 5BW

CLIENT: Jamie & Beverley McDaid

PROJECT: New 4 Bed House

PROJECT ADDRESS: 99 Atbara Road, Teddington TW11 9PA

DRAWING TITLE: PROPOSED FLOOR PLANS 2

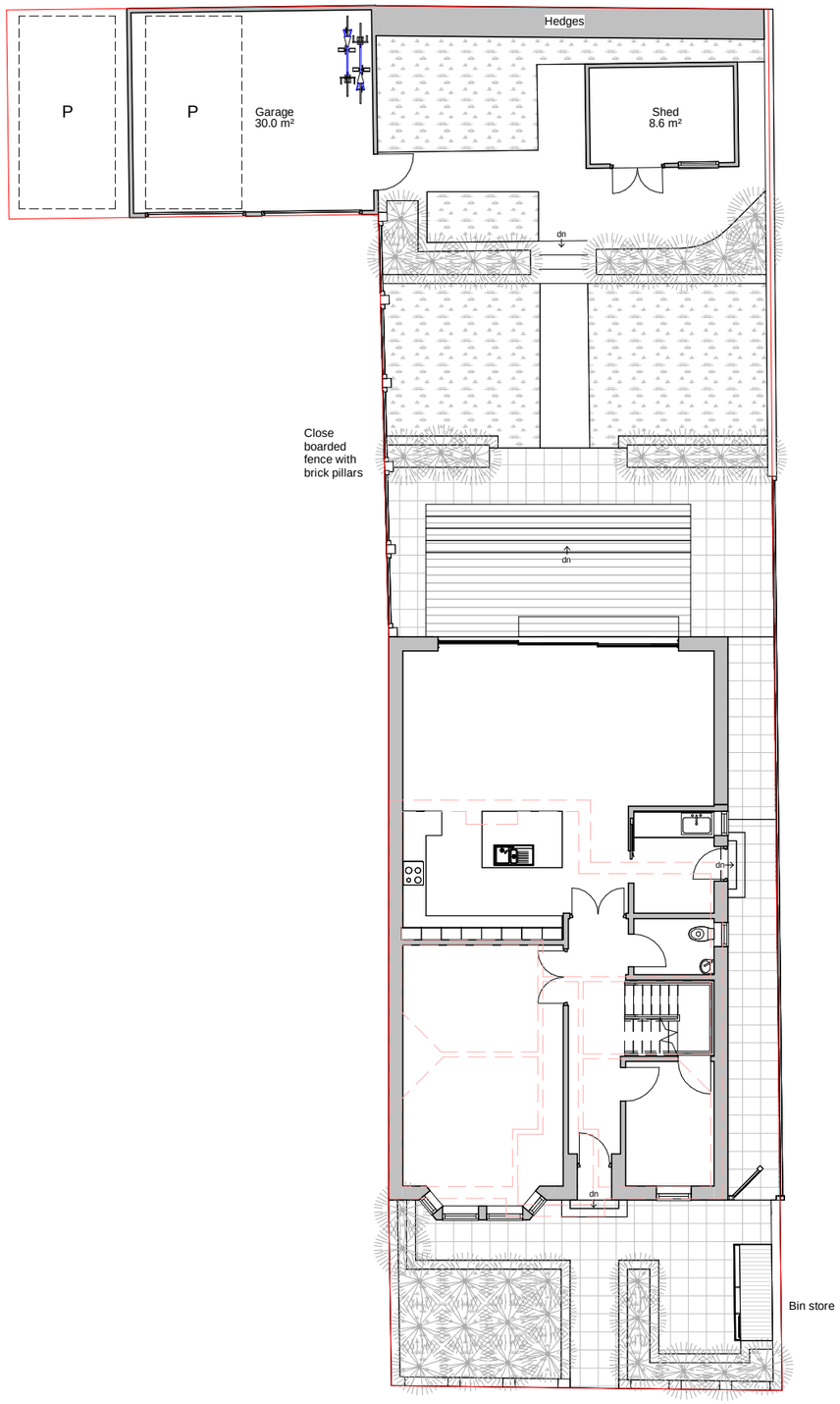
DRAWN BY: LG | **CHECKED BY:** JH

DATE: 22/09/2023 | **Rev:** | **Rev. DATE:**

SCALE@A3: 1:100 | **DRAWING No:** AR-R02-PR-103

Full Plan

1 : 150



PROGRAMME:

KEY:

	Neighbouring context	**RWP**	Rain Water Pipe
	Existing walls	**SVP**	Soil Vent Pipe
	Proposed walls		Boundary line
	Proposed rooflight		Existing removed
MH	Manhole		Existing beam
B	Boiler		1.2 m head height
EM	Electric Meter		1.5 m head hieght
GM	Gas Meter		Ridge line

REVISION NOTES:

REV:	DATE:	DESCRIPTION:

GENERAL NOTES:

1. All Dimensions are in millimetres unless otherwise stated
2. All work to be carried out in accordance with current building regulations and all relevant british standards/codes of practice.
3. The Contractor is responsible for the correct setting out of the works on site, all dimensions to be checked prior to fabrication of materials and commencement of works.
4. This Drawing is to be read in conjunction with all relevant drawings and specifications
5. Exact SVP and Boiler position to be determined onsite by contractor
6. A 'macerator toilet' would be required for a certain designs if the toilet location is away from existing SVP
7. Steels imbedded into ceiling may be charged additionally by your contractor
8. All proposed materials are to be similar in appearance to that of the existing house, unless otherwise stated.
9. Skylights must not protrude past the roof slope by more than 150mm
10. Glazing which exceeds 25% of the added floor area will result in extra charges for S.A.P Calculations
11. Windows on a side elevation at first floor level or above must be obscured glazing and non openable below 1.7m
12. Load-bearing partitions and/or posts are shown in a rough position. The exact position is to be confirmed by a structural engineer prior to construction.

EXTENSION PLANS

Extension Plans. Ealing Cross, 85 Uxbridge Rd, London W5 5BW

CLIENT: Jamie & Beverley McDaid

PROJECT: New 4 Bed House

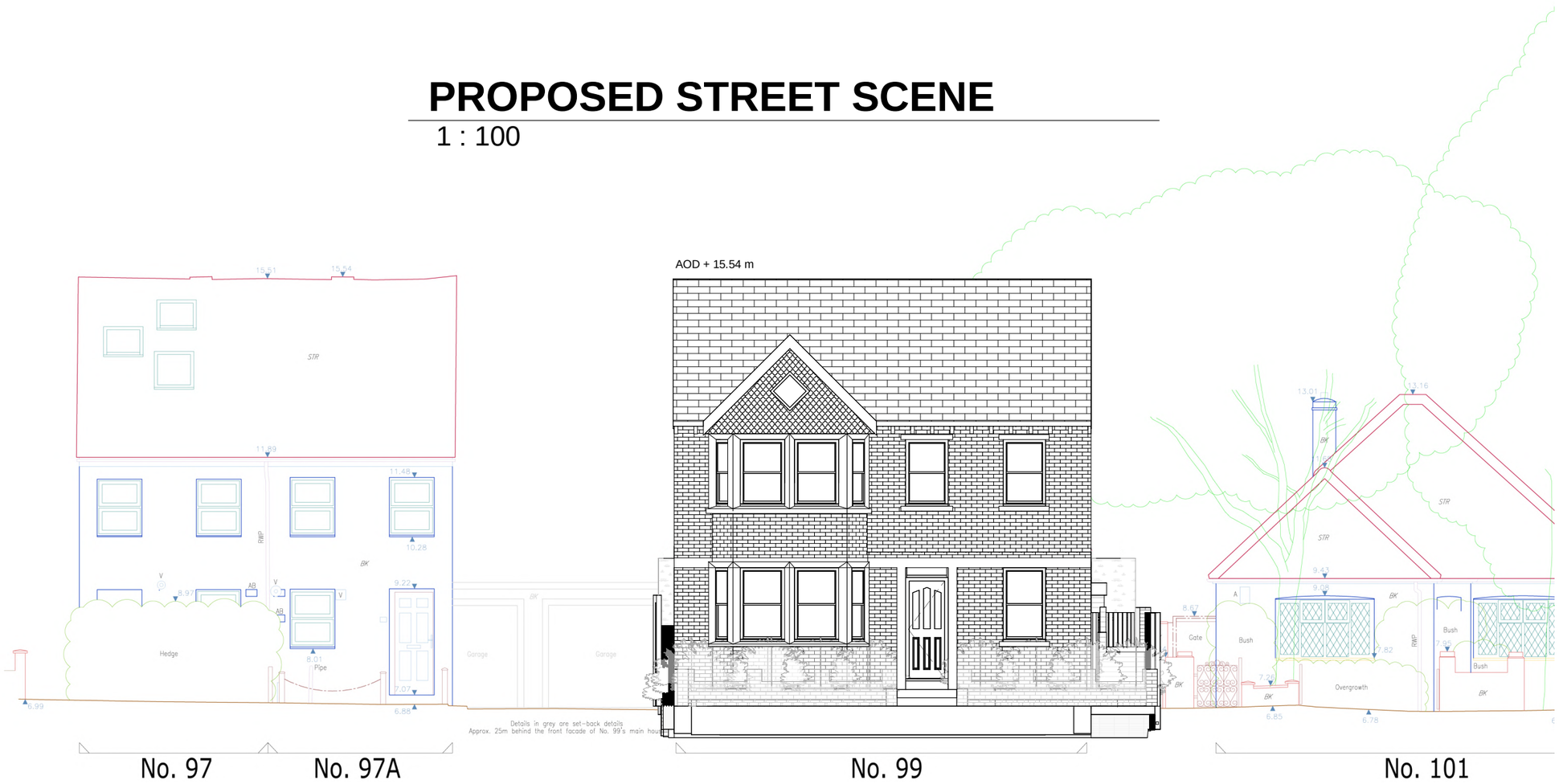
PROJECT ADDRESS: 99 Atbara Road,
Teddington
TW11 9PA

DRAWING TITLE: FULL PLAN

DRAWN BY:	LG	**CHECKED BY:**	JH
DATE:	22/09/2023	**Rev:**	**Rev. DATE:**
SCALE@A3:	1:150	**DRAWING No:**	AR-R02-PR-104

PROPOSED STREET SCENE

1 : 100



5m
0 1 2 3 4 1:100

PROGRAMME:

KEY:

	Neighbouring context	**RWP**	Rain Water Pipe
	Existing walls	**SVP**	Soil Vent Pipe
	Proposed walls		Boundary line
	Proposed rooflight		Existing removed
MH	Manhole		Existing beam
B	Boiler		1.2 m head height
EM	Electric Meter		1.5 m head hieght
GM	Gas Meter		Ridge line

REVISION NOTES:

REV:	DATE:	DESCRIPTION:

GENERAL NOTES:

1. All Dimensions are in millimetres unless otherwise stated
2. All work to be carried out in accordance with current building regulations and all relevant british standards/codes of practice.
3. The Contractor is responsible for the correct setting out of the works on site, all dimensions to be checked prior to fabrication of materials and commencement of works.
4. This Drawing is to be read in conjunction with all relevant drawings and specifications
5. Exact SVP and Boiler position to be determined onsite by contractor
6. A 'macerator toilet' would be required for a certain designs if the toilet location is away from existing SVP
7. Steels imbedded into ceiling may be charged additionally by your contractor
8. All proposed materials are to be similar in appearance to that of the existing house, unless otherwise stated.
9. Skylights must not protrude past the roof slope by more than 150mm
10. Glazing which exceeds 25% of the added floor area will result in extra charges for S.A.P Calculations
11. Windows on a side elevation at first floor level or above must be obscured glazing and non openable below 1.7m
12. Load-bearing partitions and/or posts are shown in a rough position. The exact position is to be confirmed by a structural engineer prior to construction.

EXTENSION PLANS

Extension Plans. Ealing Cross, 85 Uxbridge Rd, London W5 5BW

CLIENT: Jamie & Beverley McDaid

PROJECT: New 4 Bed House

PROJECT ADDRESS: 99 Atbara Road,
Teddington
TW11 9PA

DRAWING TITLE: PROPOSED STREET SCENE

DRAWN BY: LG | **CHECKED BY:** JH

DATE: 22/09/2023 | **Rev:** | **Rev. DATE:**

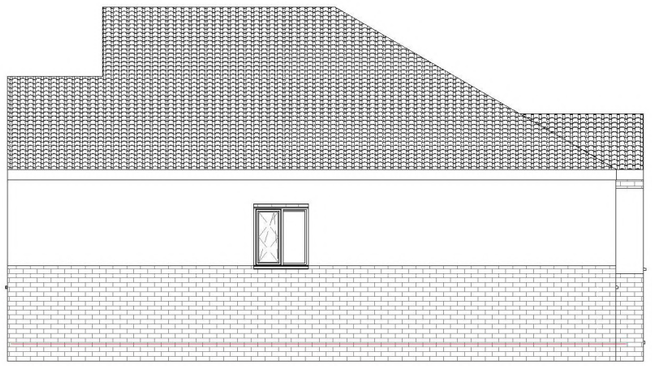
SCALE@A3: 1:100 | **DRAWING No:** AR-R02-PR-107

RH ELEVATION

1 : 100

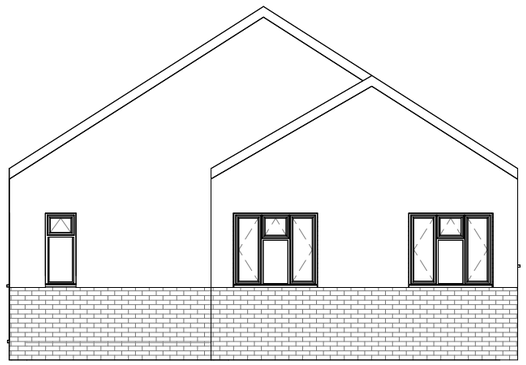
FRONT ELEVATION

1 : 100



LH ELEVATION

1 : 100



REAR ELEVATION

1 : 100

5m
0 1 2 3 4 1:100

PROGRAMME:

REVISION NOTES:

REV:	DATE:	DESCRIPTION:

GENERAL NOTES:

1. All Dimensions are in millimetres unless otherwise stated
2. All work to be carried out in accordance with the current edition of the building regulations 1991 (including amendments) and all relevant british standards/codes of practice.
3. The Contractor is responsible for the correct setting out of the works on site, all dimensions to be checked prior to fabrication of materials and commencement of works.
4. This Drawing is to be read in conjunction with all relevant drawings and specifications
5. Exact SVP and Boiler position to be determined onsite by contractor
6. Steels imbedded into ceiling may be charged additionally by your contractor
7. All proposed materials are to be similar in appearance to that of the existing house, unless otherwise
8. Skylights mustn't protrude past the roof slope by more than 150mm
9. Glazing which exceeds 25% of the added floor area will result in extra charges for S.A.P Calculations

EXTENSION PLANS

Extension Plans. 16 Shakespeare Road W7 1LR

CLIENT: Jamie & Beverley McDaid

PROJECT: New 4 Bed House

PROJECT ADDRESS: 99 Atbara Road, Teddington TW11 9PA

DRAWING TITLE: EXISTING ELEVATIONS

DRAWN BY: LG	**CHECKED BY:** JH
DATE: 22/09/2023	**Rev:** **Rev. DATE:**
SCALE@A3: 1:100	**DRAWING No:** HR-R00-EX-103

FRONT ELEVATION

1 : 100

RH ELEVATION

1 : 100

5m

0 1 2 3 4 1:100

PROGRAMME:

KEY:

	Neighbouring context	**RWP**	Rain Water Pipe
	Existing walls	**SVP**	Soil Vent Pipe
	Proposed walls		Boundary line
	Proposed rooflight		Existing removed
MH	Manhole		Existing beam
B	Boiler		1.2 m head height
EM	Electric Meter		1.5 m head hieght
GM	Gas Meter		Ridge line

REVISION NOTES:

REV:	DATE:	DESCRIPTION:

GENERAL NOTES:

1. All Dimensions are in millimetres unless otherwise stated
2. All work to be carried out in accordance with current building regulations and all relevant british standards/codes of practice.
3. The Contractor is responsible for the correct setting out of the works on site, all dimensions to be checked prior to fabrication of materials and commencement of works.
4. This Drawing is to be read in conjunction with all relevant drawings and specifications
5. Exact SVP and Boiler position to be determined onsite by contractor
6. A 'macerator toilet' would be required for a certain designs if the toilet location is away from existing SVP
7. Steels imbedded into ceiling may be charged additionally by your contractor
8. All proposed materials are to be similar in appearance to that of the existing house, unless otherwise stated.
9. Skylights must not protrude past the roof slope by more than 150mm
10. Glazing which exceeds 25% of the added floor area will result in extra charges for S.A.P Calculations
11. Windows on a side elevation at first floor level or above must be obscured glazing and non openable below 1.7m
12. Load-bearing partitions and/or posts are shown in a rough position. The exact position is to be confirmed by a structural engineer prior to construction.

EXTENSION PLANS

Extension Plans. Ealing Cross, 85 Uxbridge Rd, London W5 5BW

CLIENT: Jamie & Beverley McDaid

PROJECT: New 4 Bed House

PROJECT ADDRESS: 99 Atbara Road, Teddington TW11 9PA

DRAWING TITLE: PROPOSED ELEVATIONS

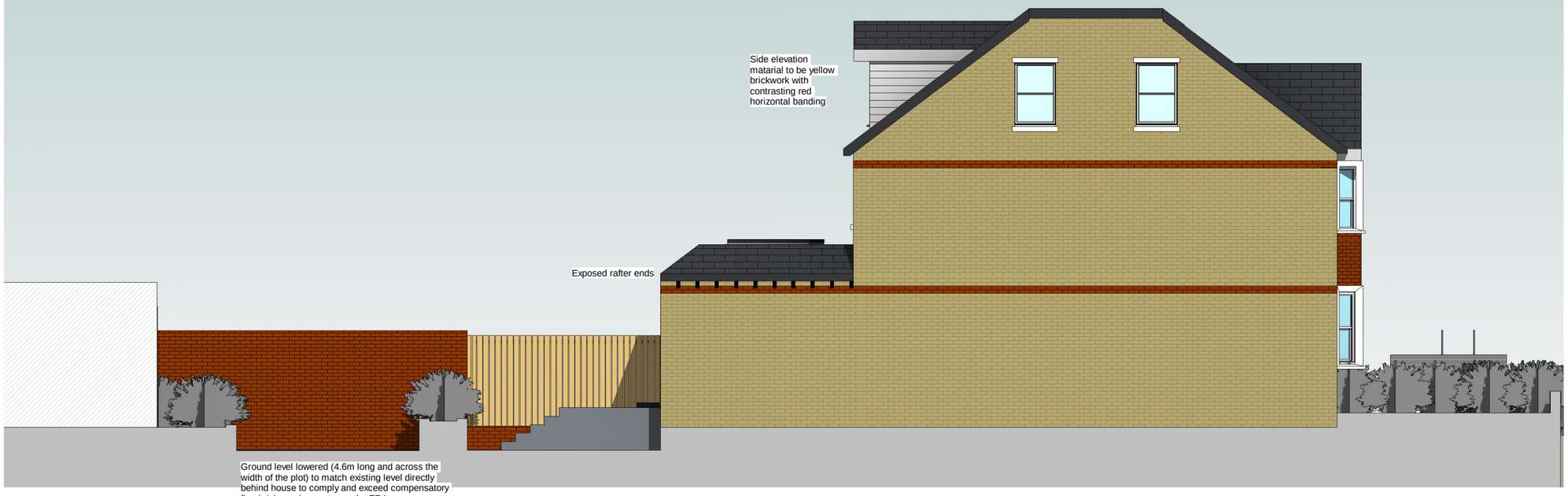
DRAWN BY:	LG	**CHECKED BY:**	JH
DATE:	22/09/2023	**Rev:**	**Rev. DATE:**
SCALE@A3:	1:100	**DRAWING No:**	AR-R02-PR-105

REAR ELEVATION

1 : 100

LH ELEVATION

1 : 100



PROGRAMME:

KEY:

	Neighbouring context	**RWP**	Rain Water Pipe
	Existing walls	**SVP**	Soil Vent Pipe
	Proposed walls		Boundary line
	Proposed rooflight		Existing removed
MH	Manhole		Existing beam
B	Boiler		1.2 m head height
EM	Electric Meter		1.5 m head hieght
GM	Gas Meter		Ridge line

REVISION NOTES:

REV:	DATE:	DESCRIPTION:

GENERAL NOTES:

1. All Dimensions are in millimetres unless otherwise stated
2. All work to be carried out in accordance with current building regulations and all relevant british standards/codes of practice.
3. The Contractor is responsible for the correct setting out of the works on site, all dimensions to be checked prior to fabrication of materials and commencement of works.
4. This Drawing is to be read in conjunction with all relevant drawings and specifications
5. Exact SVP and Boiler position to be determined onsite by contractor
6. A 'macerator toilet' would be required for a certain designs if the toilet location is away from existing SVP
7. Steels imbedded into ceiling may be charged additionally by your contractor
8. All proposed materials are to be similar in appearance to that of the existing house, unless otherwise stated.
9. Skylights must not protrude past the roof slope by more than 150mm
10. Glazing which exceeds 25% of the added floor area will result in extra charges for S.A.P Calculations
11. Windows on a side elevation at first floor level or above must be obscured glazing and non openable below 1.7m
12. Load-bearing partitions and/or posts are shown in a rough position. The exact position is to be confirmed by a structural engineer prior to construction.

EXTENSION PLANS

Extension Plans. Ealing Cross, 85 Uxbridge Rd, London W5 5BW

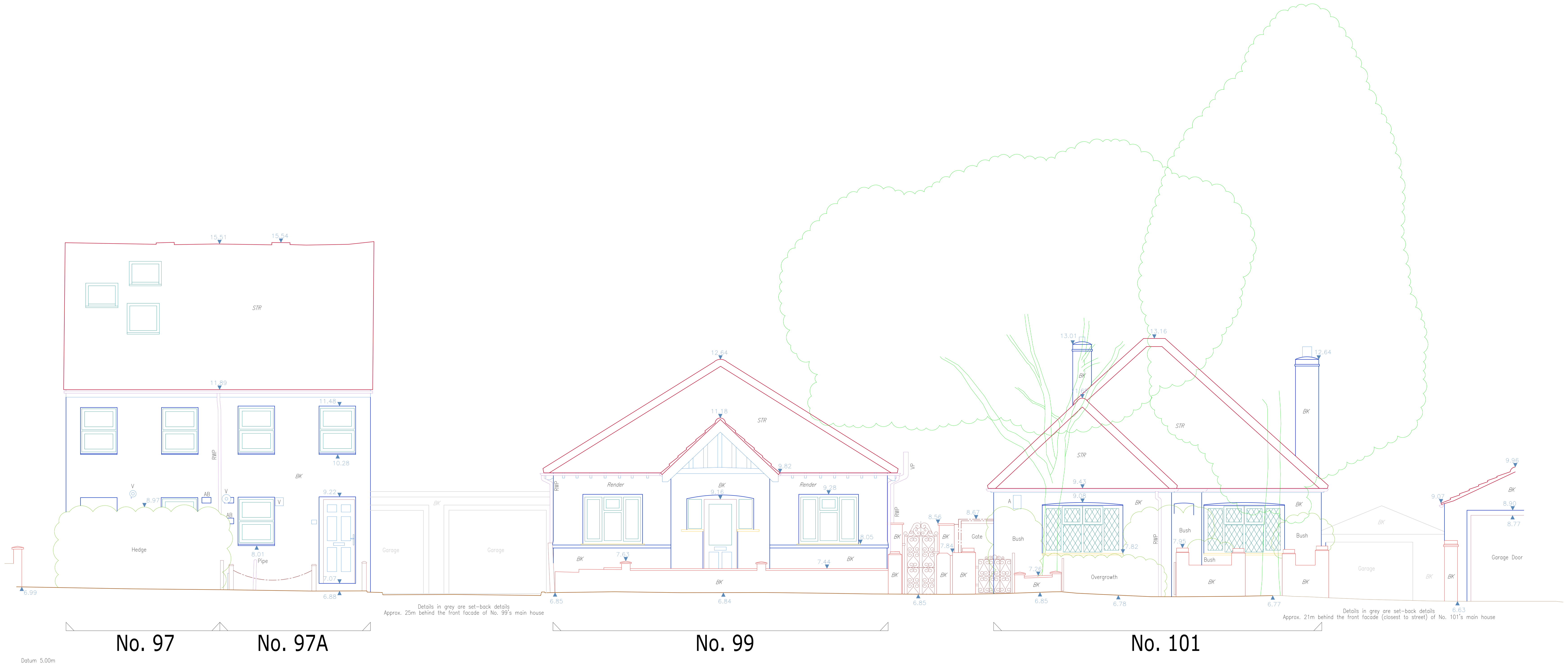
CLIENT: Jamie & Beverley McDaid

PROJECT: New 4 Bed House

PROJECT ADDRESS: 99 Atbara Road, Teddington TW11 9PA

DRAWING TITLE: PROPOSED ELEVATIONS

DRAWN BY:	LG	**CHECKED BY:**	JH
DATE:	22/09/2023	**Rev:**	**Rev. DATE:**
SCALE@A3:	1:100	**DRAWING No:**	AR-R02-PR-106



Street Scene Elevation

Scale Bar
0 1 2 3 4
metres

Abbreviations

A	Alarm Box	L	Light
AB	Air Brick	RWP	Rain Water Pipe
ACU	Air Conditioning Unit	STR	Sloping Tiled Roof
BK	Brick	SVP	Soil Vent Pipe
CO	Column	TB	Telecoms Box
GM	Gas Meter	V	Vent
HR	Handrail	VP	Vent Pipe
JB	Junction Box	WP	Waste Pipe

Survey Datum

Ordnance Datum Newlyn (ODN) - GPS Derived Orthometric Heights related to OSGM15

Location Plan

Rev	Notes	Date	By
A	Added set-back details	13/07/23	LW

CURA SURVEYS
MEASURED SURVEYS SPECIALISTS

Registered Address: 12 John Prince's Street, London, United Kingdom, W1G 0JR
Website: curasurveys.co.uk
Telephone: 0203 488 5858
Mobile: 07403 697 410
Email: enquiry@curasurveys.co.uk

Regulated by RICS

Client: Jamie McDaid

Drawing Title: Street Scene Elevation

Project: 99 Atbara Road
Teddington TW11 9PA

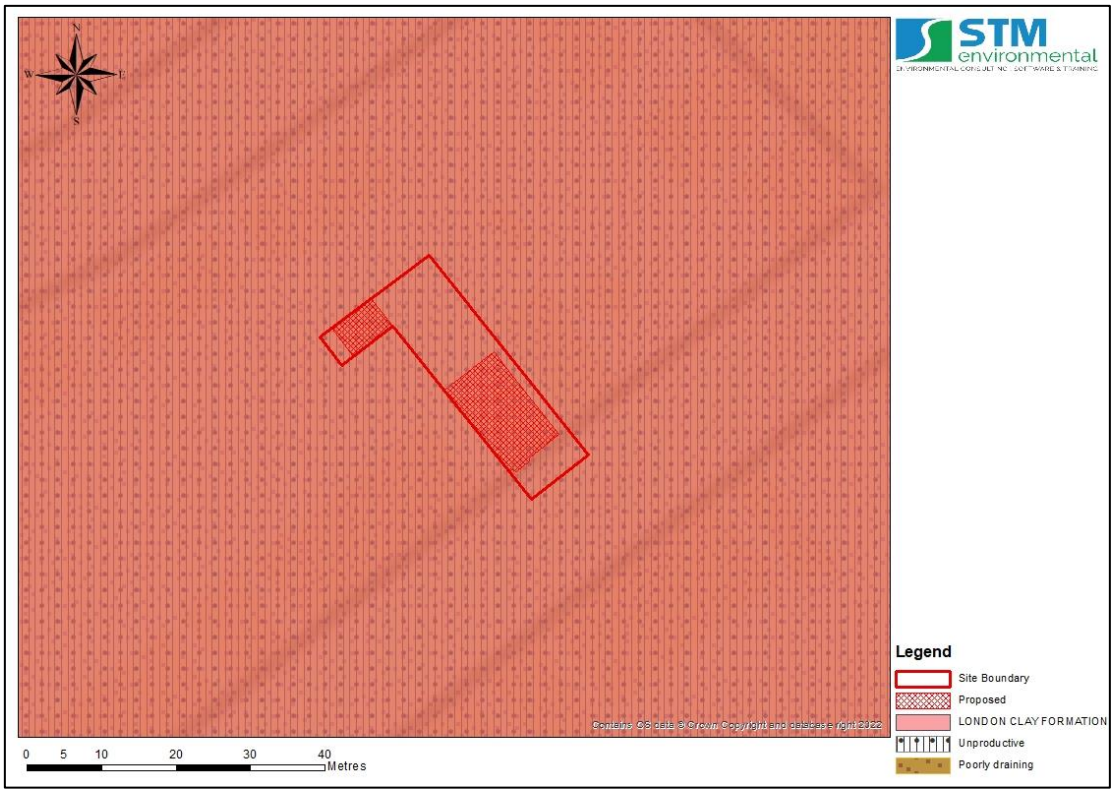
Surveyed: MG | Checked: LW | Status: FINAL | Size: A0 | Scale: 1:50

Date: Jul 2023 | Ref No: 2391_01 | Sheet: 01 of 01

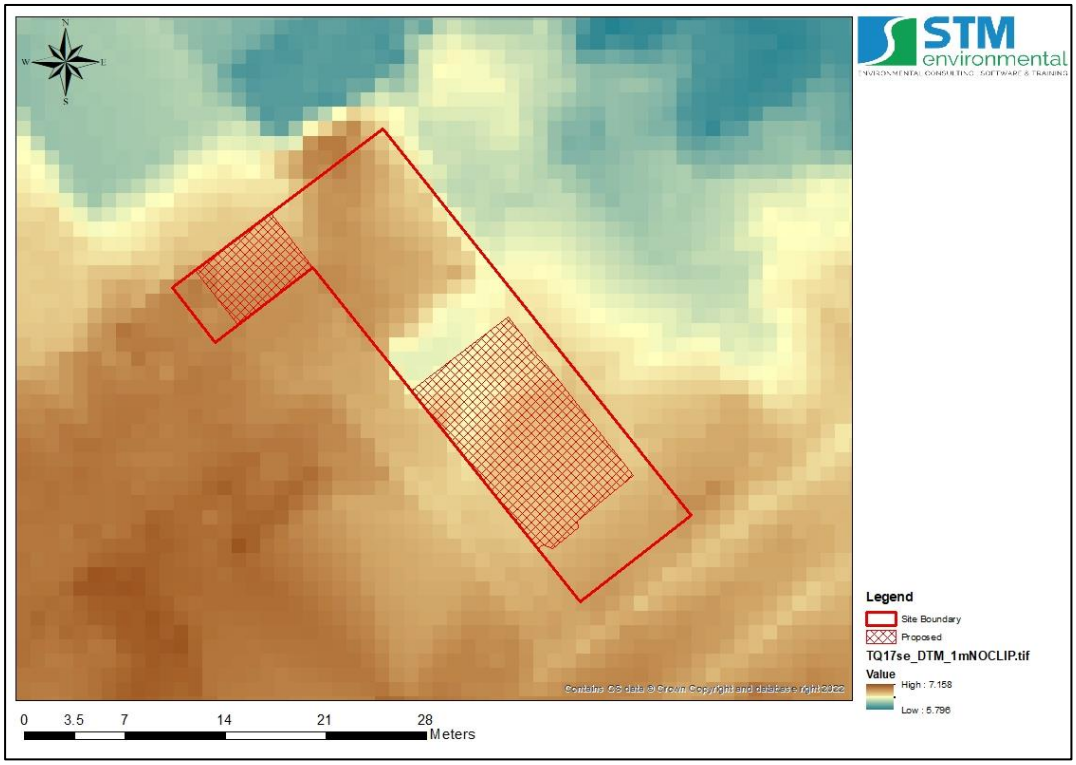
17.3 Appendix 3 – Environmental Characteristics

17.3.1 Superficial Hydrogeology Map

17.3.2 Bedrock Hydrogeology Map

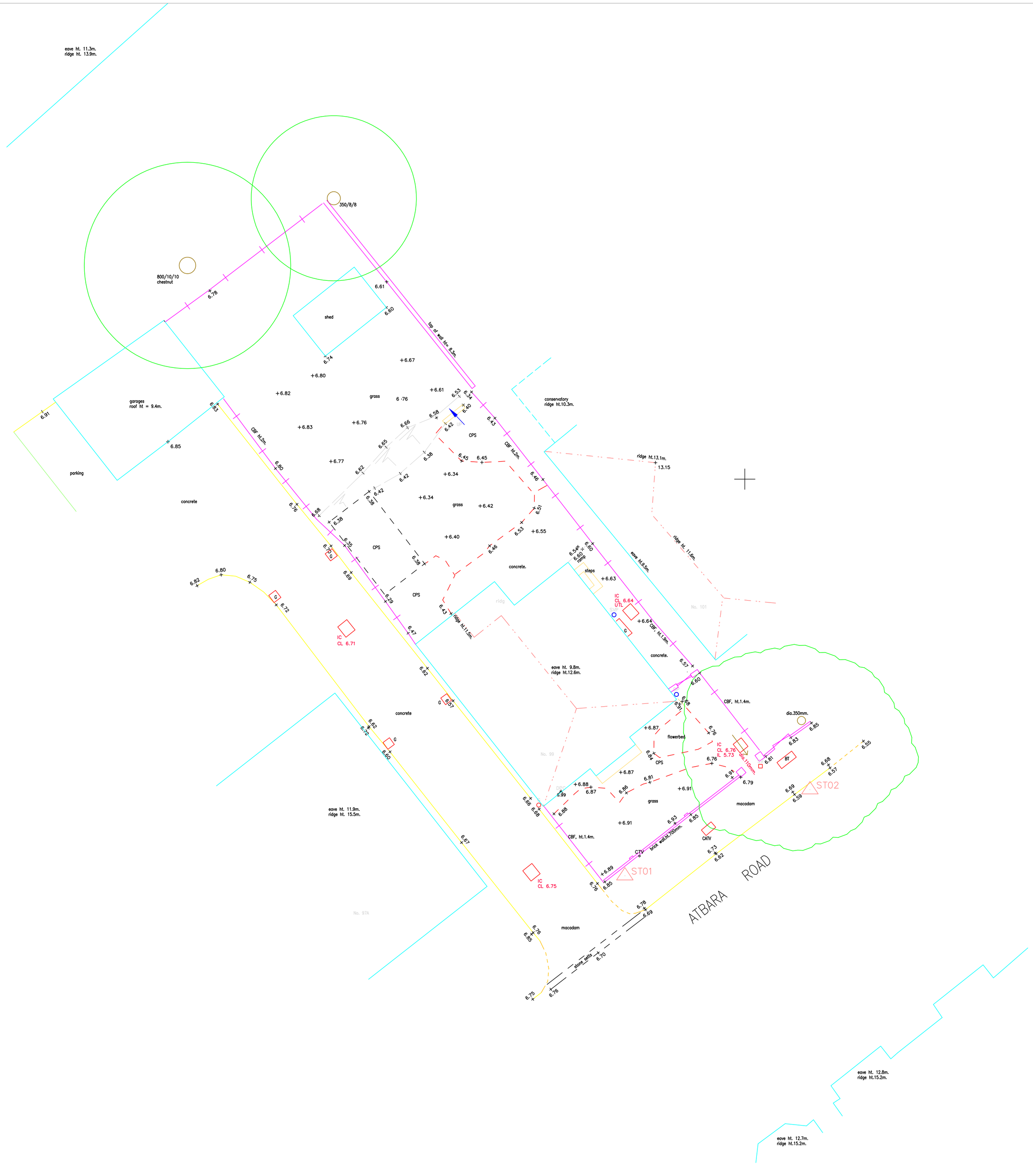


17.3.3 Topography Map



17.3.4 Topographic Survey

See next page.



LEGEND

Kerb Drop kerb	AP	Anchor Point	LP Lamp Post
Overhead /canopy	AV	Air Valve	LPS Lamp Post Short
Building	BH	Borehole	MH Manhole
Surface Change	BL	Bollard	MK Service Marker Post
FENCES	BT	British Telecom cover	OBF Open Board Fence
Chain Link	BWF	Barbed Wire Fence	PM Parking Meter
Board	CATV	Cable Television Cover	PRF Post and Rail Fence
Wooden rail	CTV	Cable Television Point	PWF Post and Wire Fence
Wire	CBF	Close Board Fence	RE Rodding Eye
Security	CLF	Chainlink Fence	RS Road Sign
Iron Railing	CPS	Concrete paving slabs	SC Stop Cock
	CN	Column	SV Sluice Valve
	DP	Downpipe	TCB Telephone Call Box
	DPC	Damp Proof Course	TPAV Tactile Paving
	EC	Electricity Cover	TKT Ticket Machine
	EP	Electricity Pole	TP Telephone Pole
	FFL	Finished Floor Level	TS Traffic Signal
	FH	Fire Hydrant	UL Soffit/upper level
	FP	Fence Post	UTL Unable to lift
	GP	Gate Post	VP Vent Pipe
	G	Gully	WO Wash Out
	KO	Kerb Outlet	WM Water Meter
	LB	Letter Box	WMF Wire Mesh Fence

NOTE. The Survey has been oriented to the O.S. National Grid (OSGB36) via a Global Position System and the O.S. Active Network (OS Net) OSGB36.
True OSGB36 coordinates have been established at a point near the site centre and a further OSBG36 point established to create a true O.S. bearing for angle orientation.All levels are based on O.S.Datum.
No scale factor has been applied to the survey and thus the Coordinate System is Arbitrary and not a true O.S. Coordinate System which would require scale factors to be applied to all distances.
The Survey Station Table should be used to establish any on-site coordinates.

NOTE.
1. This is a topographic survey and as such the physical features shown are not necessarily legal boundaries.
2. Drainage information is by surface inspection only and cannot be guaranteed.
3. This survey has been carried out at an accuracy commensurate with the scale shown on the title block of this drawing. Enlarging the drawing by digital means will not increase the accuracy of the survey.

Tree Information
400/7/8 bole dia.(mm)/spread(m)/height(m)
Tree species should be checked by an expert if identification is critical.
Trees show average spread unless otherwise shown.
Tree heights are by visual estimation and are not measured

SURVEY STATIONS

Station	Easting	Northing	Level	Type
ST01	517094.19	170930.78	6.85	Nail
ST02	517103.16	170934.95	6.61	Nail

Revision	Suff	App	Date
Trees removed	A	ot	May 2024

AT LAND SURVEYS
PRECISION AND RELIABILITY

AT LAND SURVEYS
86,Hightown Gardens,
Ringwood,Hampshire
BH24 3EJ

Office +44 (0) 1425 479480
Mob +44 (0) 7901 686777
Email alan@atlandsurveys.com
Web www.atlandsurveys.com

Project
99, ATBARA ROAD
TEDDINGTON
TW11 9PA

Drawing Title
SITE SURVEY

Drawn	Date	Checked	Date
AT	MAY 2023	AT	MAY 2023

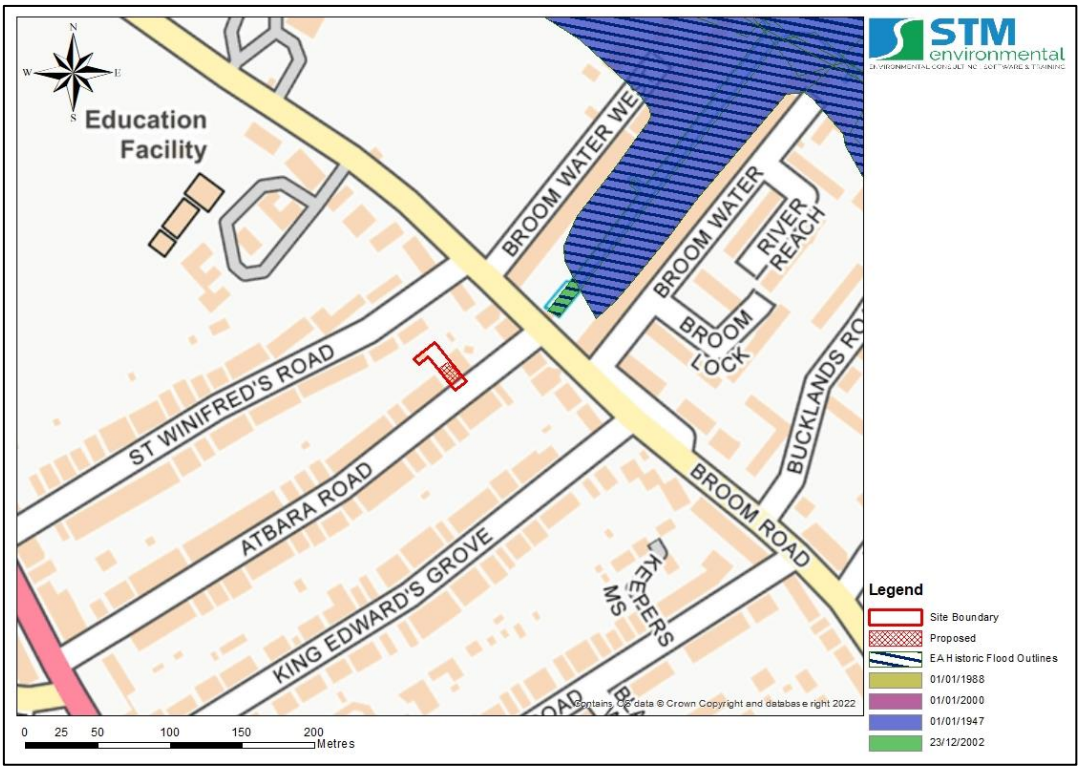
Scale
1:100 (AT A1 SIZE)

Drawing Number
2320-S20

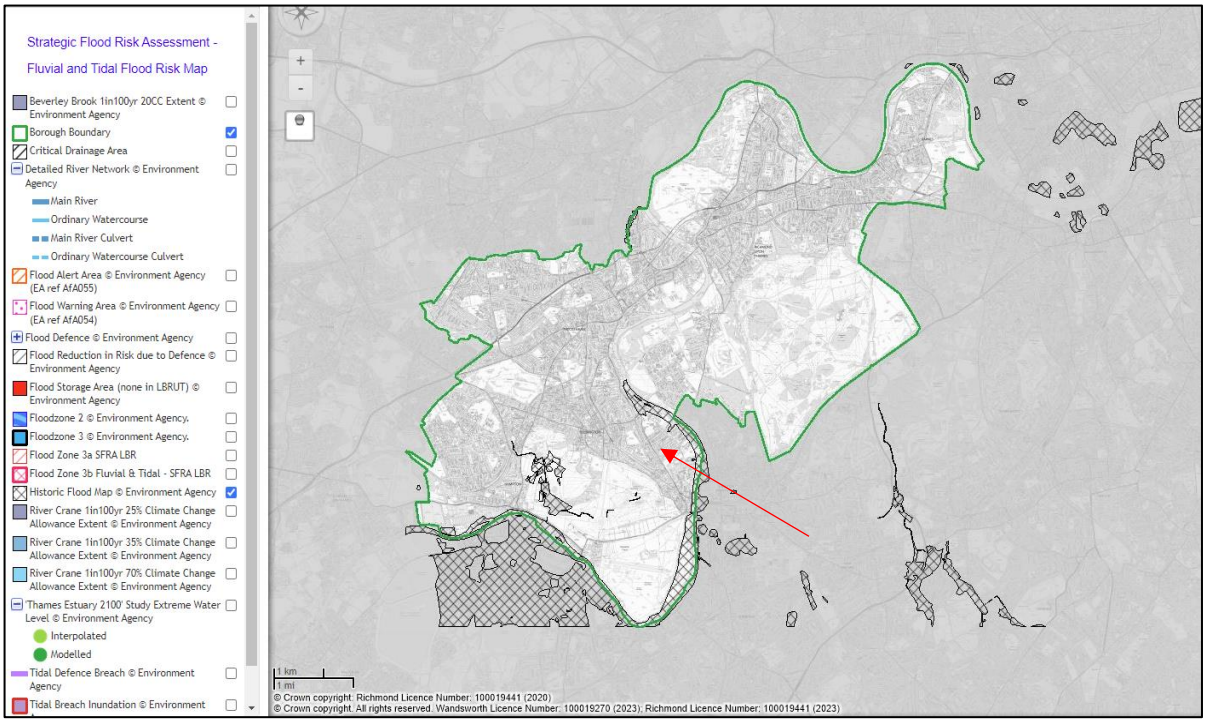
Rev
A

17.4 Appendix 4 – Historical Flood Incident Maps

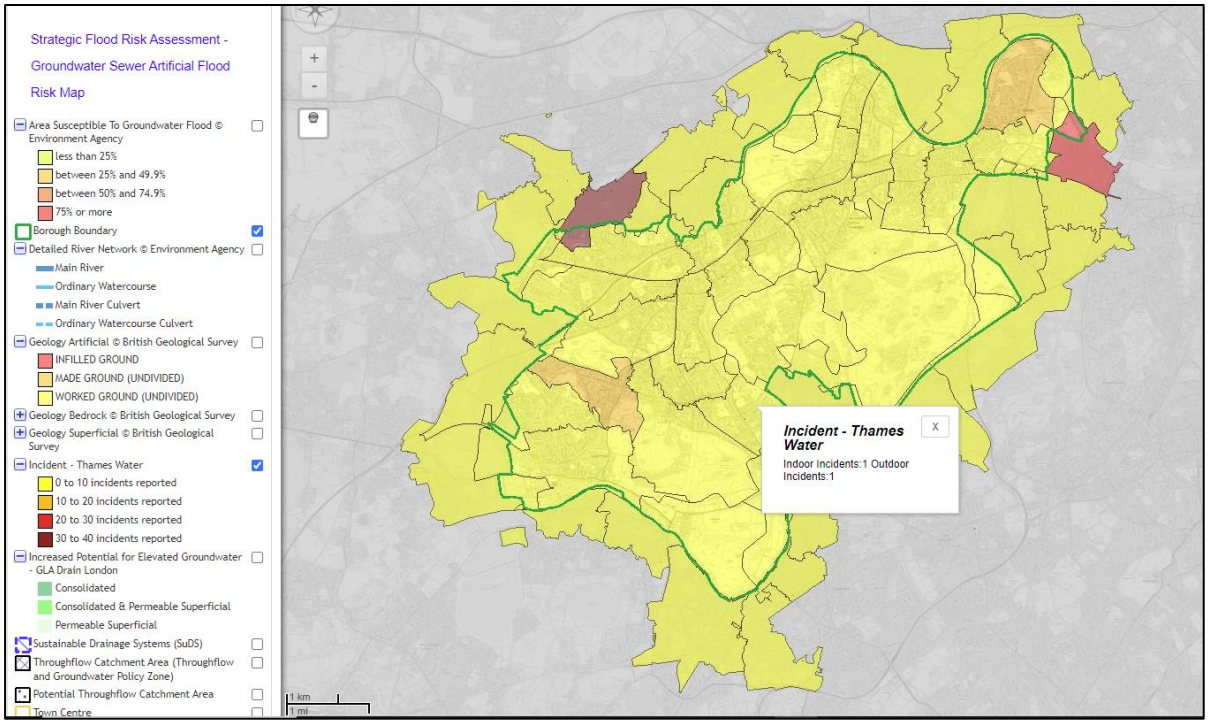
17.4.1 EA Historic and Recorded Flood Outlines



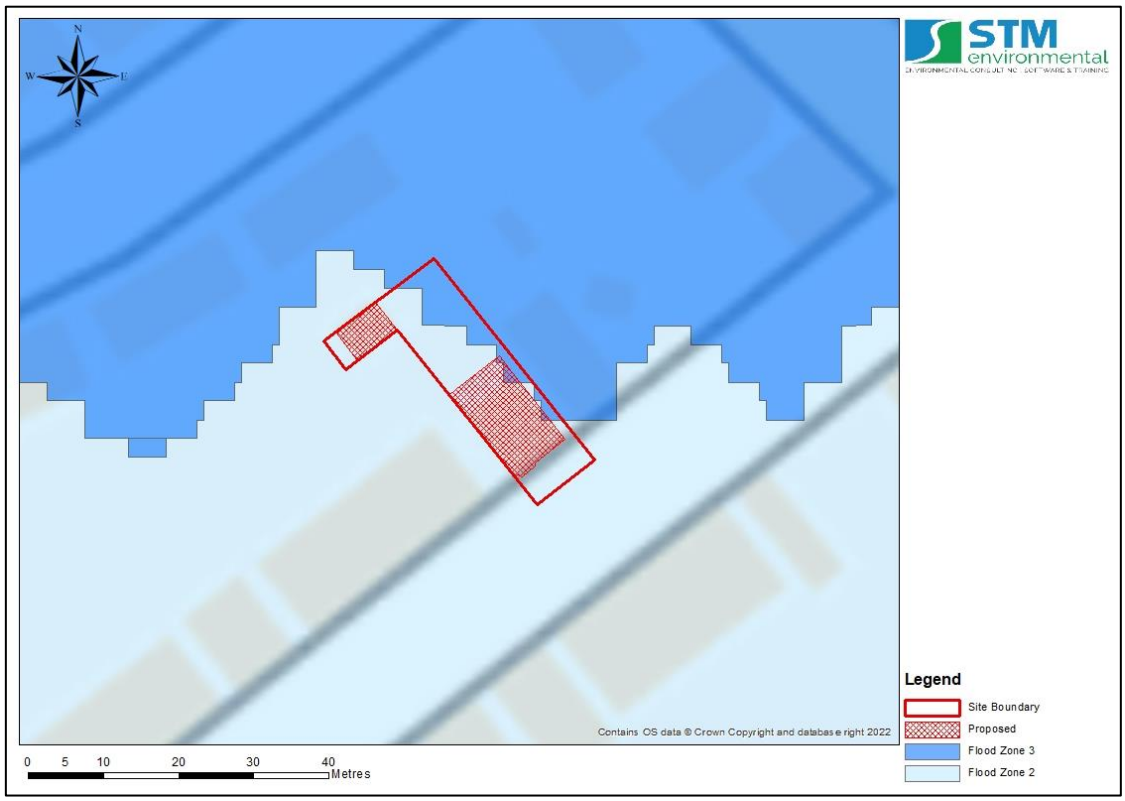
17.4.2 Map Recorded Historic Flooding



17.4.3 Map of Recorded Sewer Flooding

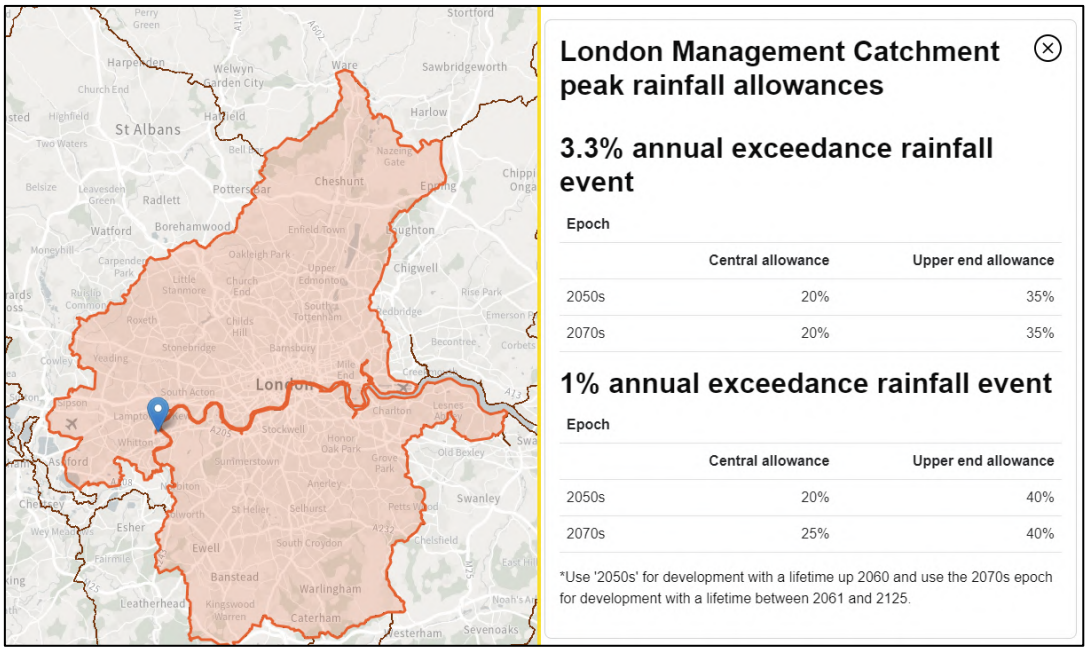


17.5 Appendix 5 - EA Flood Zone Map

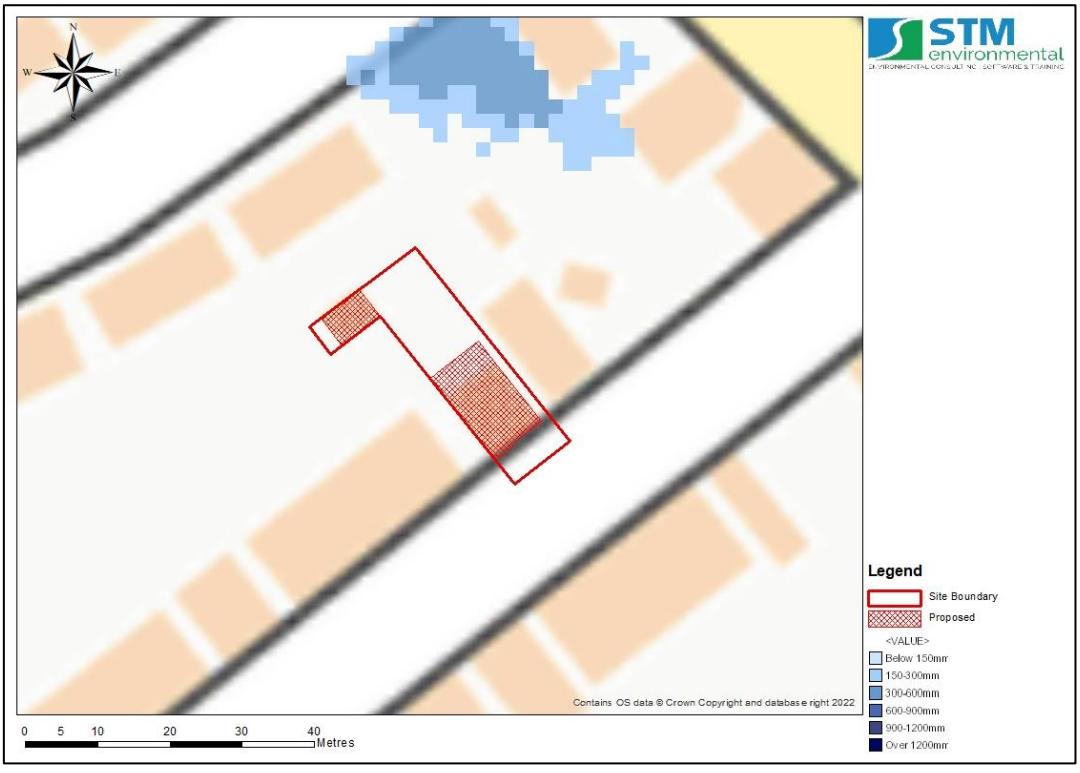


17.6 Appendix 6 – Surface Water Flood Extent and Depth Maps

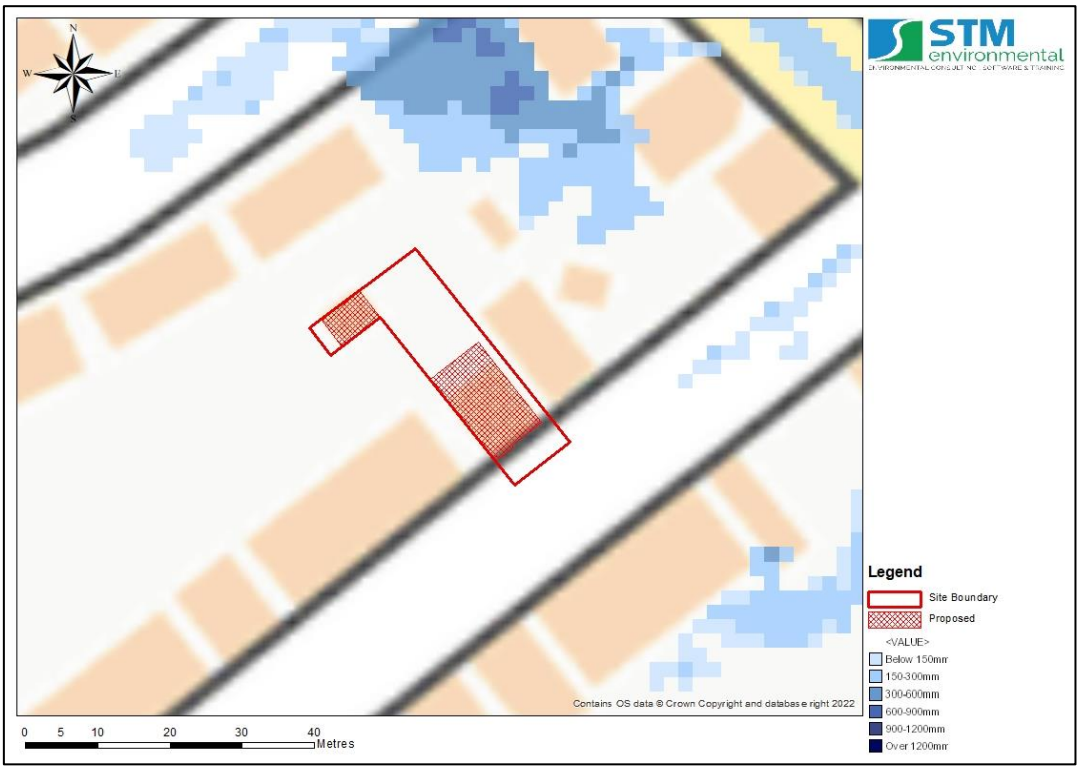
17.6.1 EA Climate Change Allowances for Peak Rainfall



17.6.2 Predicted surface water flood depth for the 1 in 100-year return period (Source: EA, 2016).

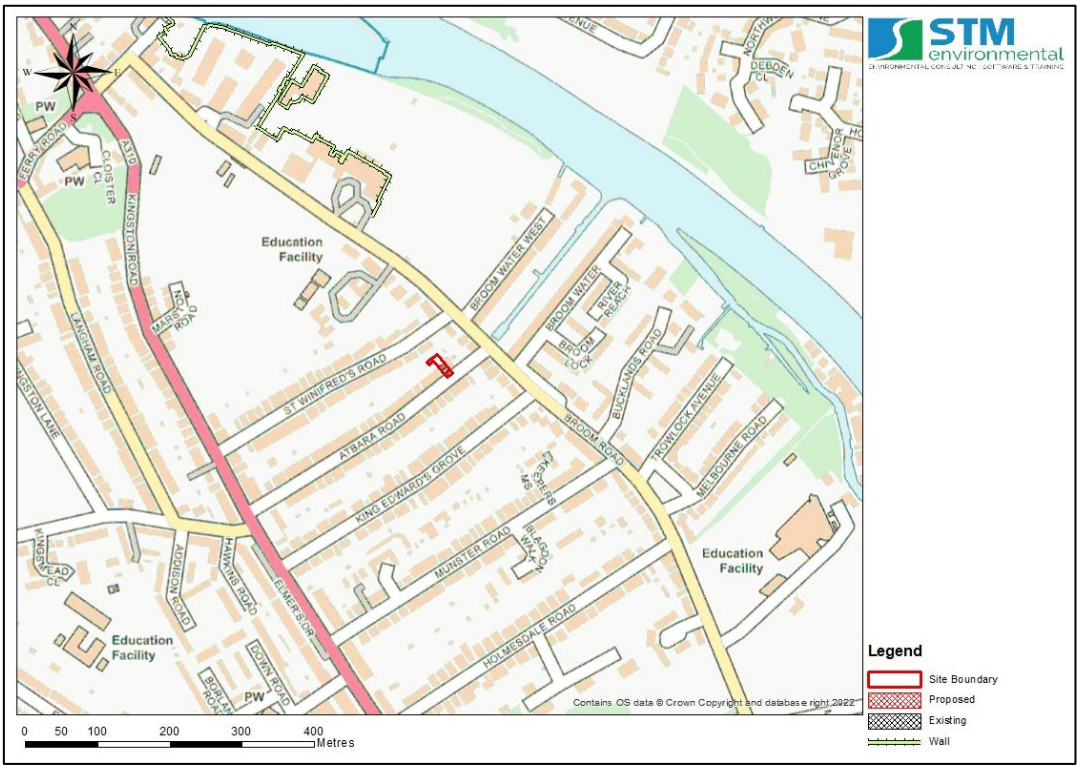


17.6.3 Predicted surface water flood depth for the 1 in 1000-year return period (Source: EA, 2016).

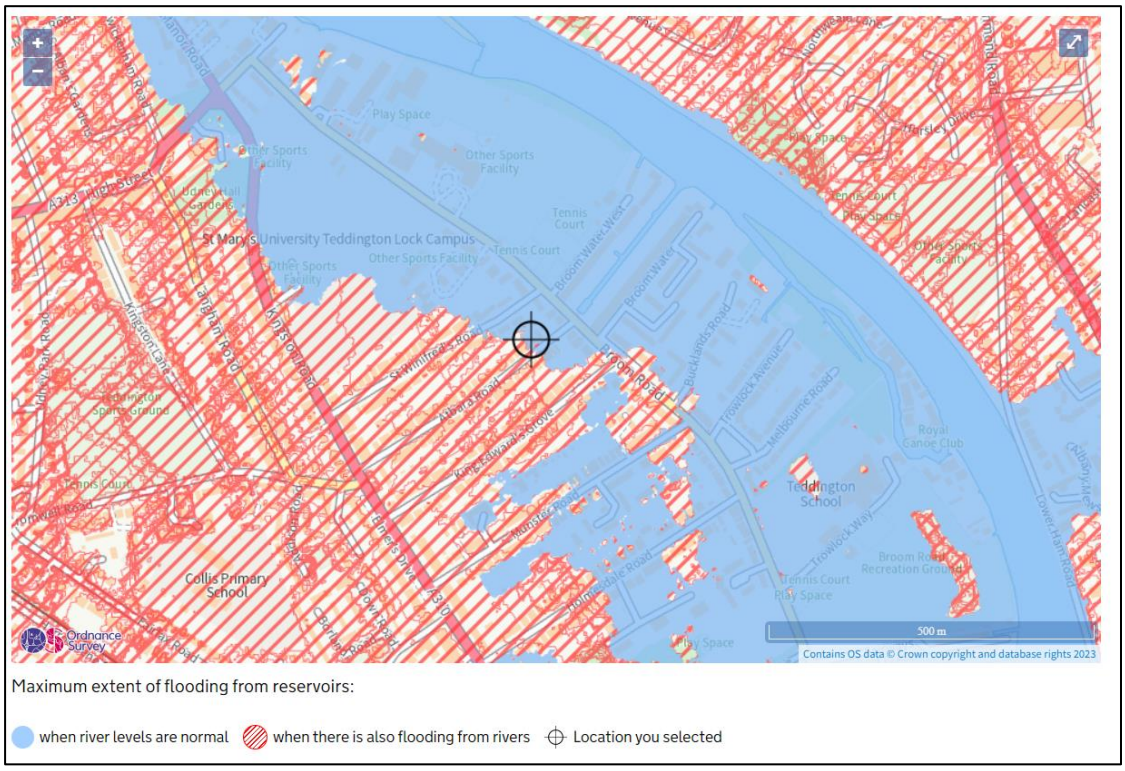


17.7 Appendix 7 –Flood Defence and Reservoir Flood Risk Maps

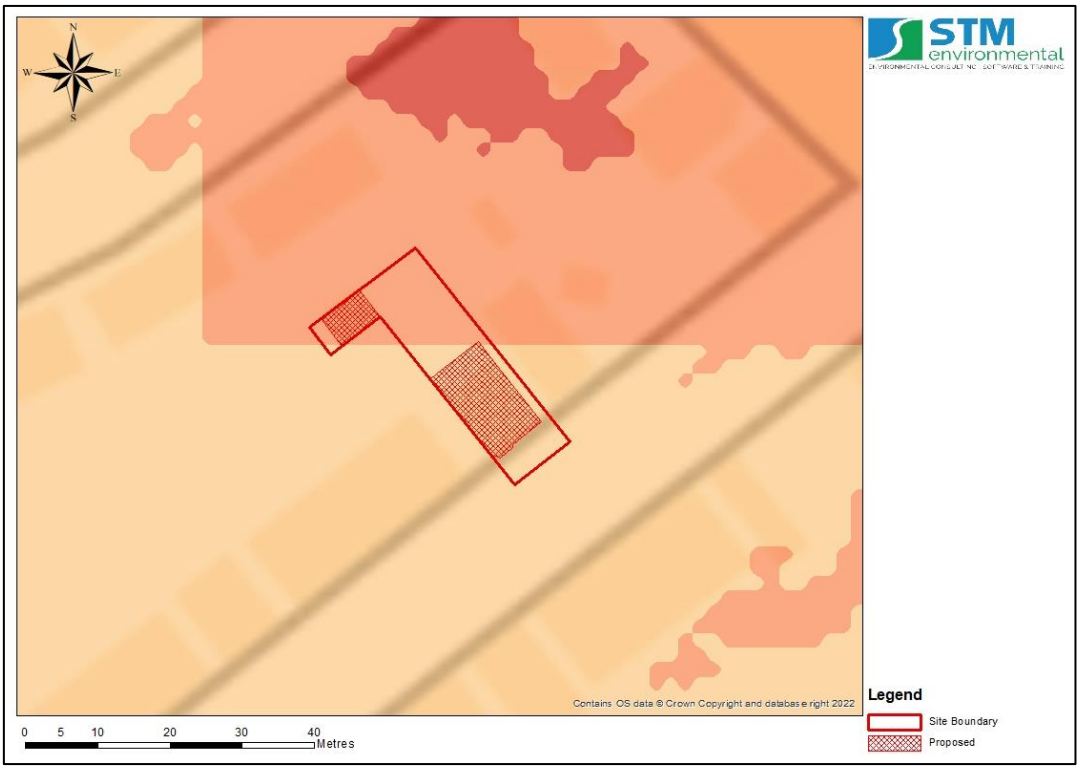
17.7.1 EA flood defence map



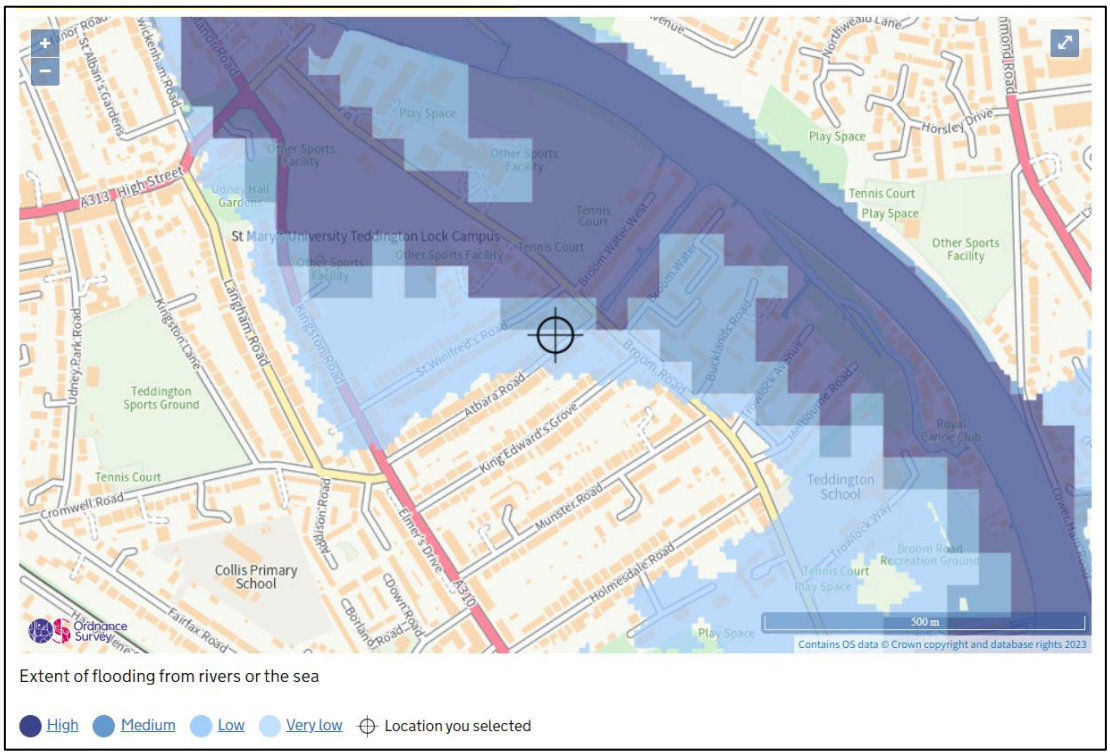
17.7.2 Reservoir Flood Risk Map



17.8 Appendix 8 – Risk of Flooding from Multiple Sources Map

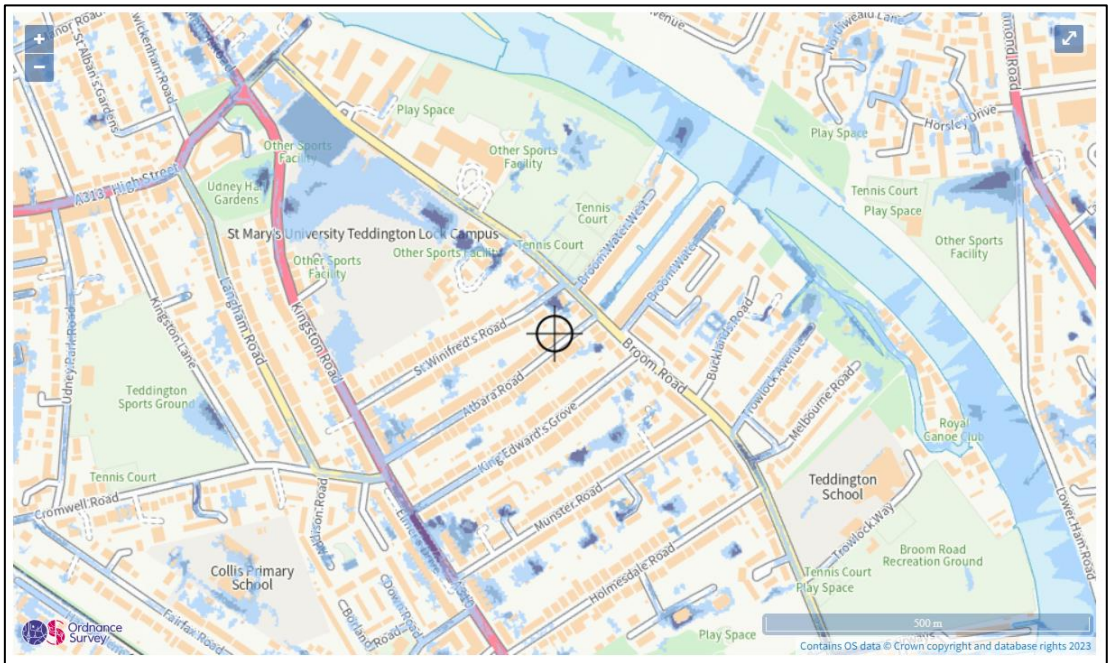


17.9 Appendix 9 – EA's Long Term Flood Risk Maps



Extent of flooding from rivers or the sea

High Medium Low Very low Location you selected

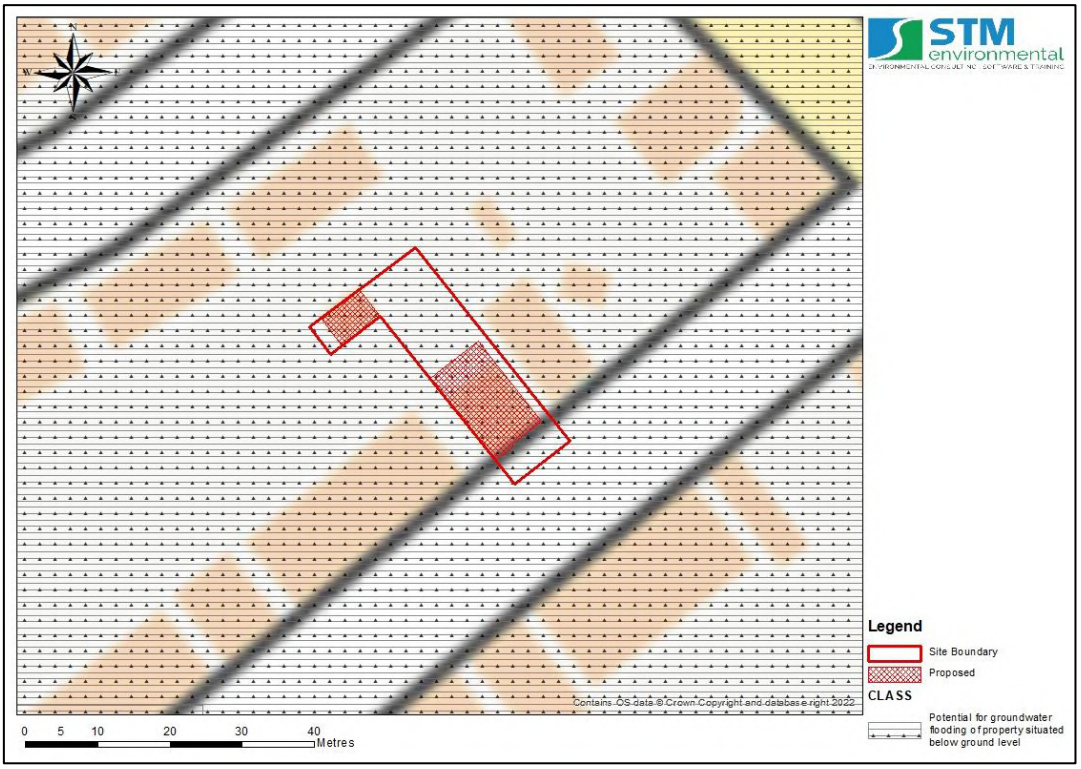


Extent of flooding from surface water

High Medium Low Very low Location you selected

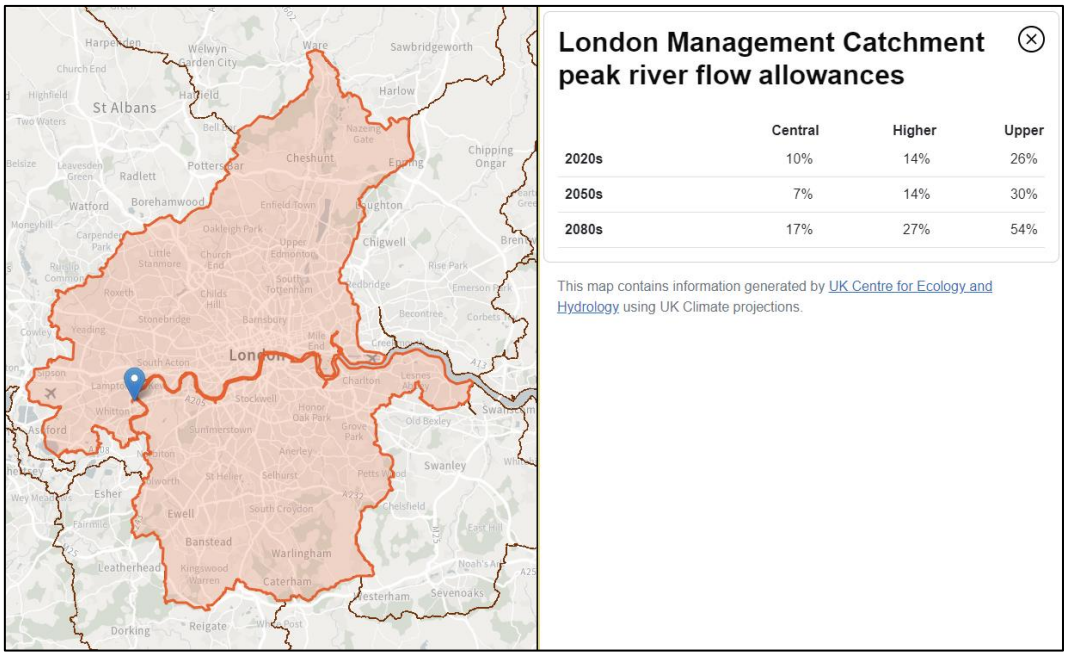
17.10 Appendix 10 – Groundwater Flood Maps

17.10.1 Groundwater Flooding (Susceptibility) Map (BGS) and Potential Depth to the Groundwater Water Map (BGS)

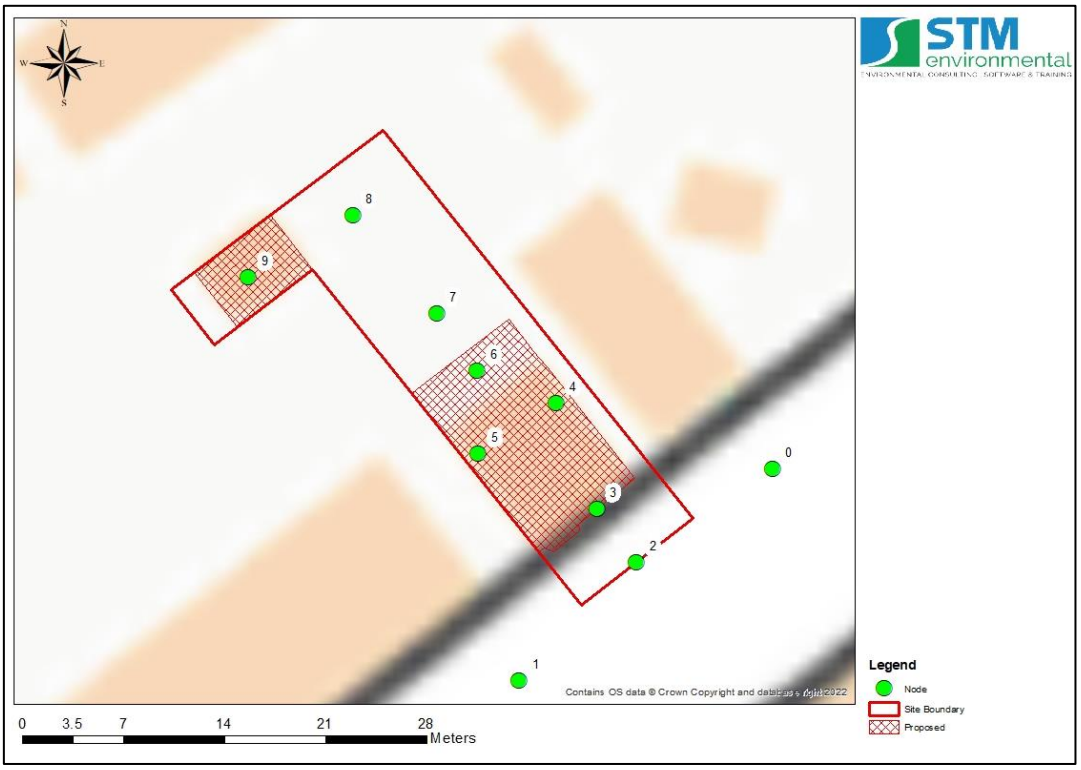


17.11 Appendix 11 - EA Product 4 (Detailed Flood Risk) Data

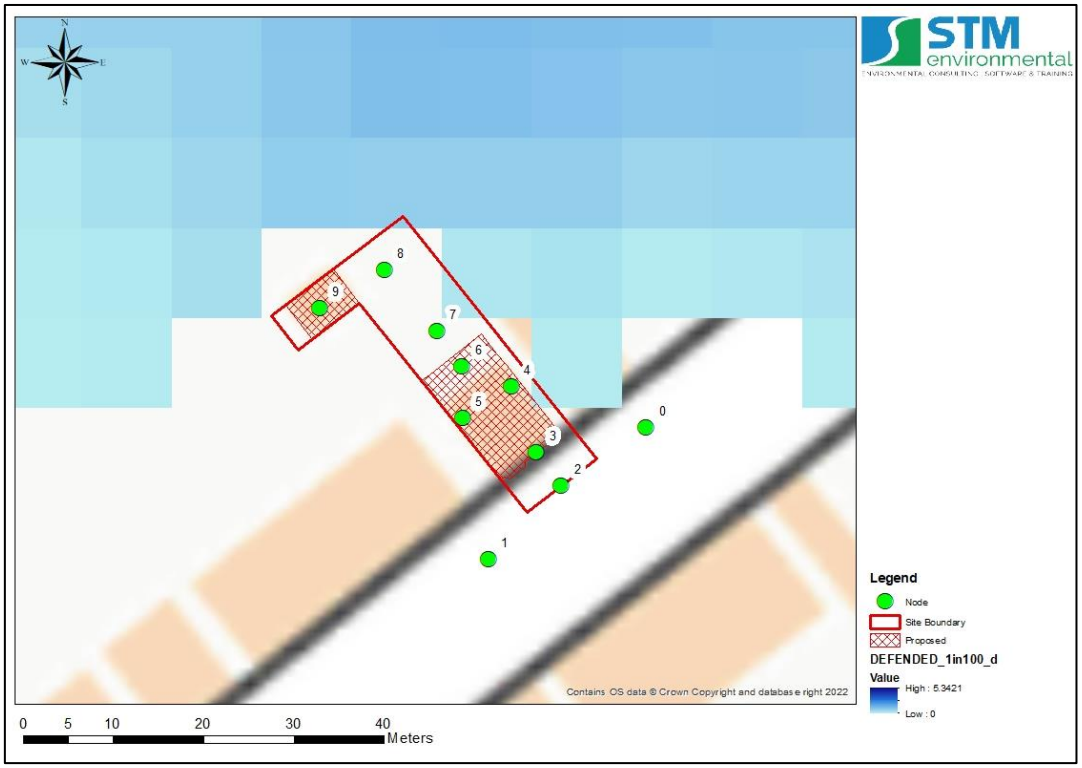
17.11.1 EA Climate Change Allowances for Peak River Flow



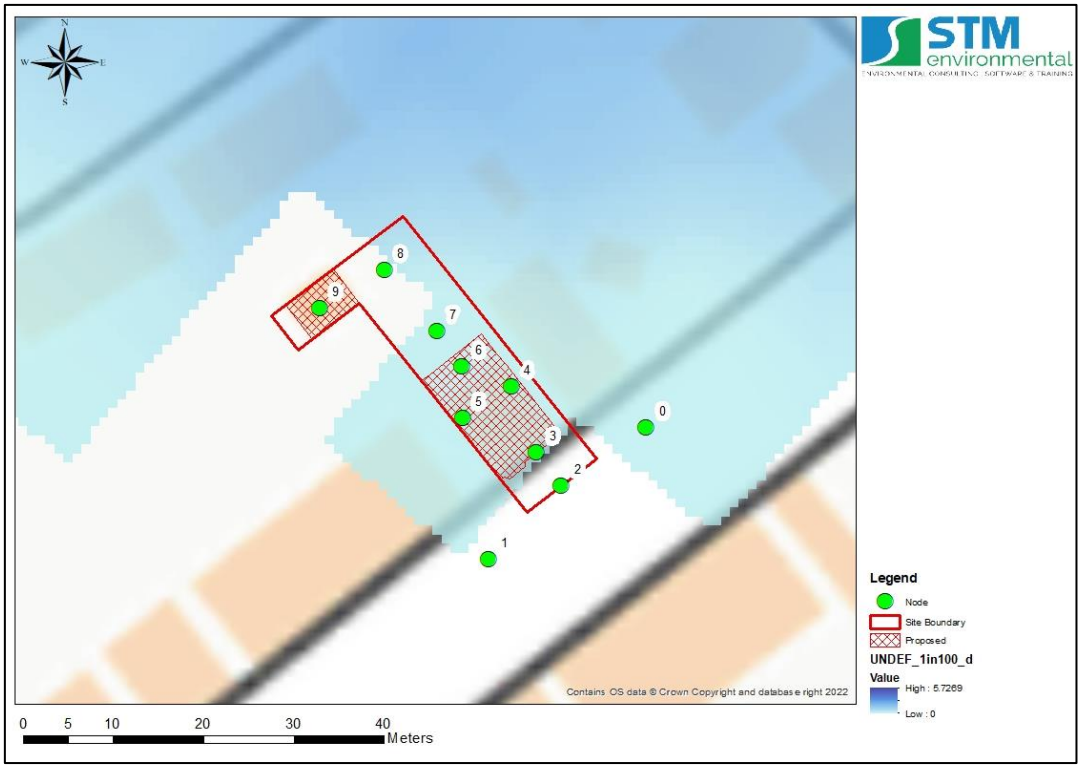
17.11.2 Node Location Map



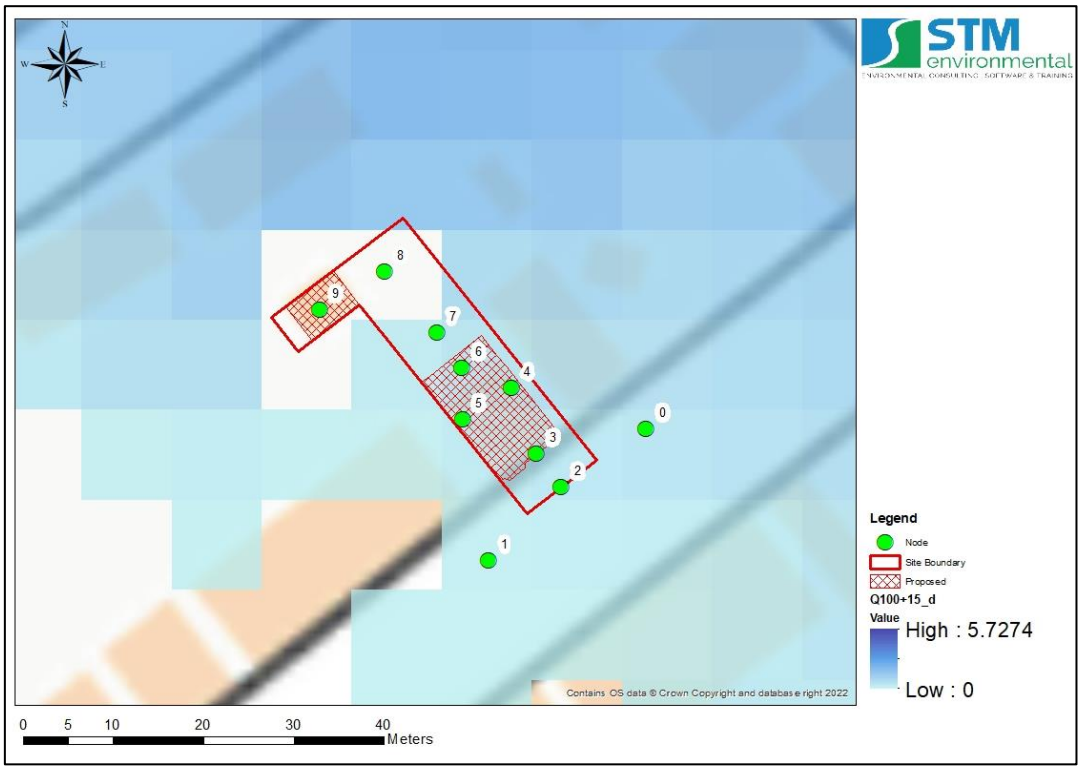
17.11.3 Fluvial Flood Depths during the Defended 1% AEP Scenario Map



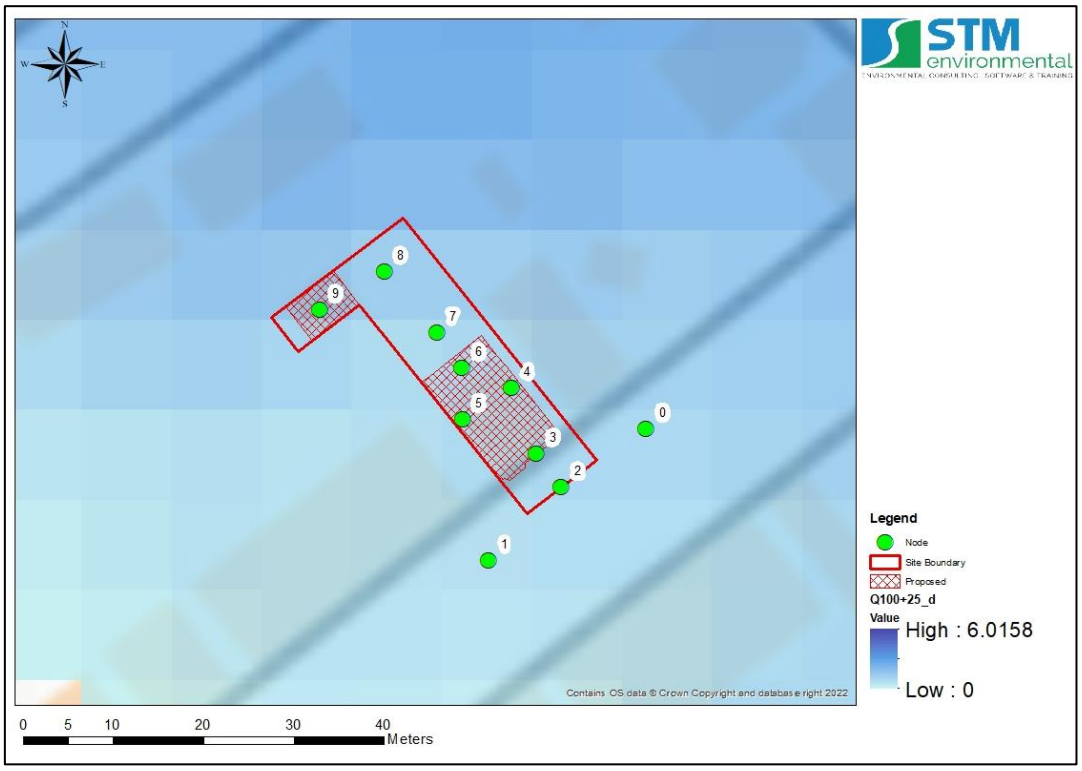
17.11.4 Fluvial Flood Depths during the Undefended 1% AEP Scenario Map



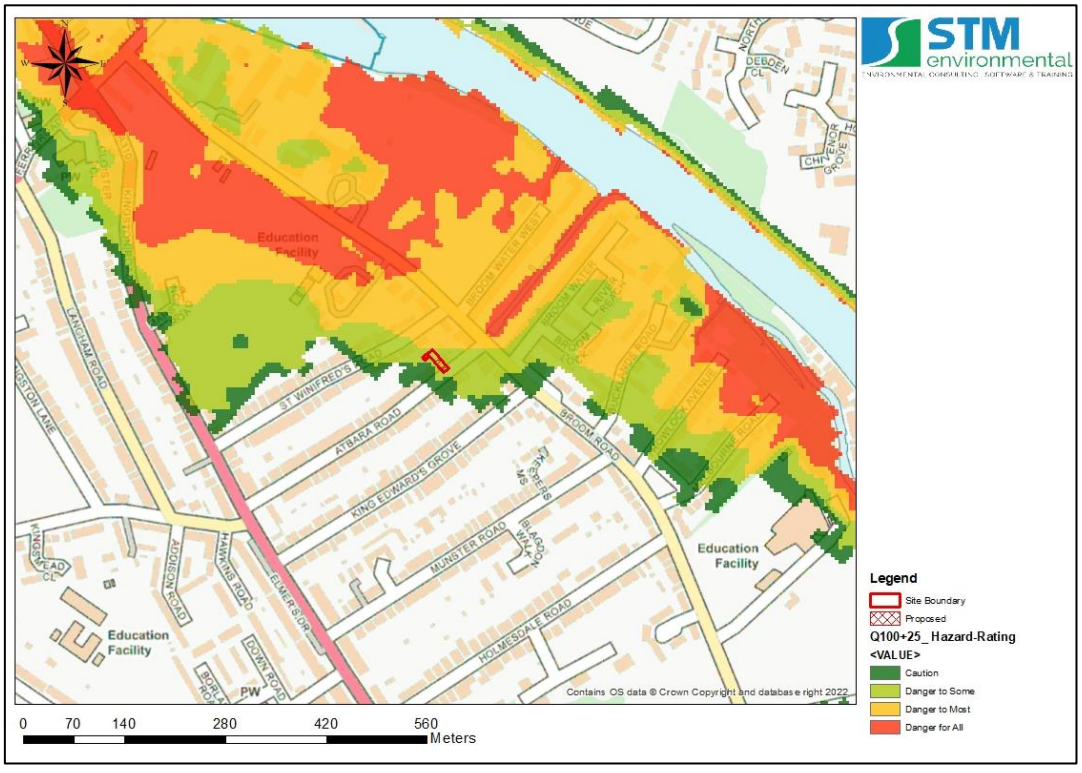
17.11.5 Fluvial Flood Levels during the Defended 1% AEP + 15% CC Scenario Map



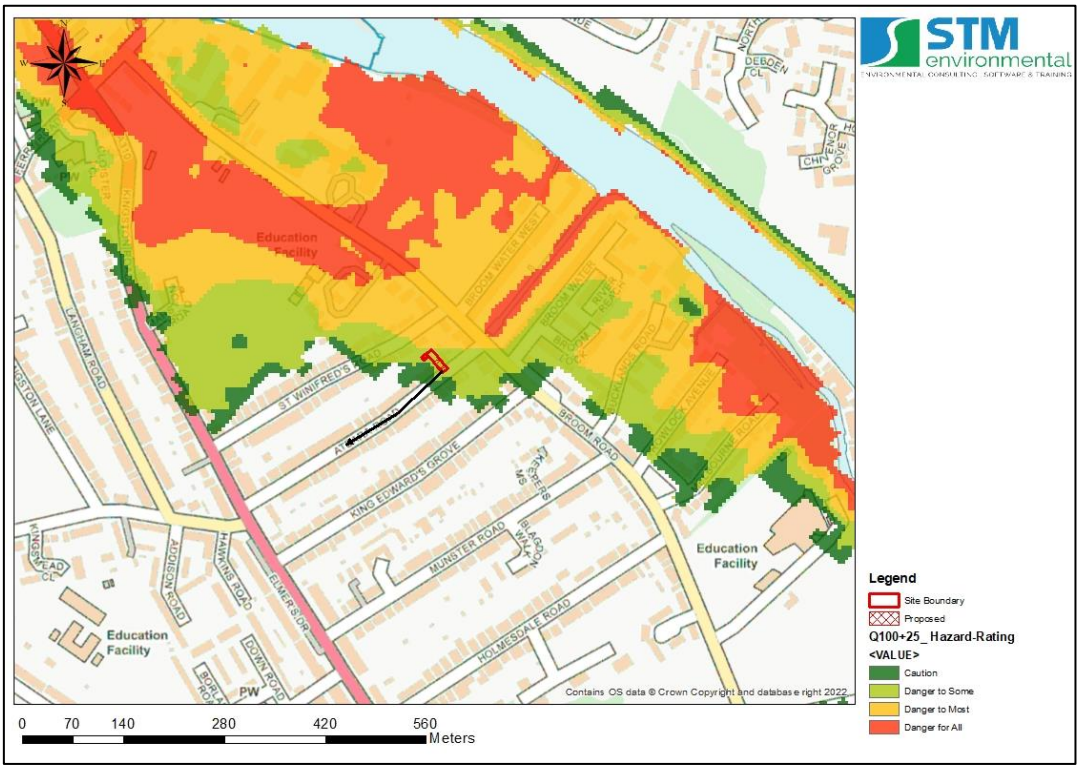
17.11.6 Fluvial Flood Depths during the Defended 1% AEP + 25% CC Scenario Map



17.11.7 Hazard Rating During the Defended 1% AEP + 25% CC Scenario Map



17.12 Appendix 12 – Safe Egress to Flood Zone 1 Map



17.13 Appendix 13 – Calculation of Flood Hazard Rating

Flood Hazard Rating Scores – based on DF score of 0

Velocity	Depth									
	0.25	**0.50**	**0.75**	**1.00**	**1.25**	**1.50**	**1.75**	**2.0**	**2.25**	**2.50**
0.0	0.13	0.25	0.38	0.50	0.63	0.75	0.88	1.00	1.13	1.25
0.5	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50
1.0	0.38	0.75	1.13	1.50	1.88	2.25	2.63	3.00	3.38	3.75
1.5	0.50	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00
2.0	0.63	1.25	1.88	2.50	3.13	3.75	4.38	5.00	5.63	6.25
2.5	0.75	1.50	2.25	3.00	3.75	4.50	5.25	6.00	6.75	7.50
3.0	0.88	1.75	2.63	3.50	4.38	5.25	6.13	7.00	7.88	8.75
3.5	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00
4.0	1.13	2.25	3.38	4.50	5.63	6.75	7.88	9.00	10.13	11.25
4.5	1.25	2.50	3.75	5.00	6.25	7.50	8.75	10.00	11.25	12.50
5.0	1.38	2.75	4.13	5.50	6.88	8.25	9.63	11.00	12.38	13.75

Summary of Scores

	Score From	Score To	Flood Hazard	Description
	<0.75	0.75	Low	Exercise Caution
Class 1	0.75	1.5	Moderate	Danger for some
Class 2	1.5	2.5	Significant	Danger for most
Class 3	2.5	20.0	Extreme	Danger for all

Values for Debris Factor for different flood depths

Depths	Pasture/Arable Land	Woodland	Urban
0 to 0.25	0	0	0
0.25 to 0.75	0.5	1	1
d>0.75 and/or v > 2	0.5	1	1

- The “danger to some” category includes vulnerable groups such as children, the elderly and infirm. “Danger: Flood zone with deep or fast
- flowing water”
- The “danger to most” category includes the general public.

- The danger to all category includes the emergency services.

A flood emergency plan is considered to be an acceptable way of managing flood risk where the flood hazard has been given a “very low hazard” rating. In some instances, flood emergency plans may also be acceptable where the rating is “danger for some”. However, it is unlikely to be an acceptable way of managing residual flood risk where the hazard to people classification is “danger for most” or “danger for all”.

17.14 Appendix 14 - Proposed CFS location