GeoSmart Information

FloodSmart Plus

Flood Risk Assessment

Site Address

The Navigator's House
River Lane
Petersham
TW10 7AG

Grid Reference

517950, 173314

Report Prepared for

Matteo D'Angelo

Date

2024-09-02

Report Status

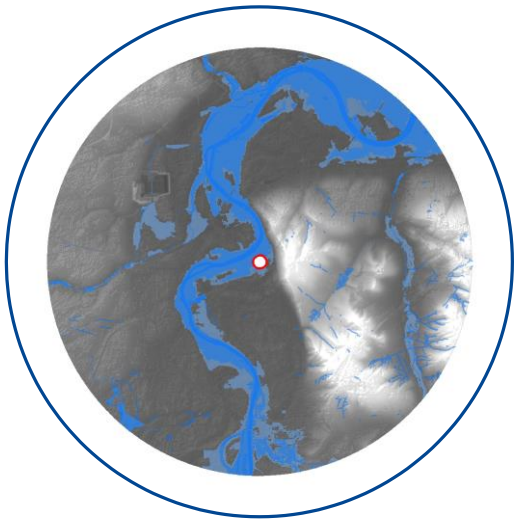
FINAL

Site Area

0.16 ha

Report Reference

82971R1



Risk – Very Low to Low

The Site is mapped within EA's fluvial Flood Zones 3 (High Probability) from the River Thames. According to EA's Risk of Flooding from Rivers and Sea (RoFRS) map, the risk of flooding to the Site is Low. Model flood data indicates that the Site is likely to be free from flooding in both the present day and future overtopping scenarios but is modelled to flood in the unlikely event of a breach in the River Thames defences.

Surface water (pluvial) flood risks are Low. Groundwater flood risks are negligible and flooding risks from artificial sources (i.e. canals, reservoirs and sewers) are Low.

Mitigation measures are recommended in this report to reduce the risks to an acceptable level over the lifetime of the development.

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GeoSmart Information

1. Executive summary

A review has been undertaken of national environmental data sets to assess the flood risk to the Site from all sources of flooding in accordance with the National Planning Policy Framework (NPPF) (2023) and National Planning Practice Guidance (NPPG) (Published in 2014 and updated in August 2022). A site-specific flood risk assessment, to assess the flood risk to and from the development Site, is provided within this concise interpretative report written by an experienced GeoSmart consultant. Baseline flood risk and residual risks that remain after the flood risk management and mitigation measures are implemented are summarised in the table below.

Site analysis

Source of Flood Risk	Baseline[1]	After analysis[2]	After Mitigation[3]
River (fluvial) flooding	Low		Very Low
Sea (coastal/tidal) flooding	Low		Very Low
Surface water (pluvial) flooding	Low		Very Low
Groundwater flooding	Negligible		
Other flood risk factors present	Yes		
Is any other further work recommended?	Yes (see below)		

1 BASELINE risks assigned for the whole Site, using national risk maps, including the benefit of EA flood defences.

2 AFTER ANALYSIS modification of risk assessment based on detailed site specific analysis including some or all of the following: flood model data, high resolution mapping, building location, access routes, topographic and CCTV surveys. Reasons for the change in classification are provided in the text.

3 AFTER MITIGATION risks include risks to proposed development / asset and occupants if mitigation measures recommended in this report are implemented, including the impacts of climate change.

*N/A indicates where mitigation is not required.

Summary of existing and proposed development

The Site is currently used within a residential capacity as a two-storey semi-detached plus basement dwelling including an outbuilding and rear garden.

Development proposals comprise the extension of the conservatory on the ground floor to the rear of the dwelling, the extension of the patio area, and internal modifications.

Summary of flood risks

The flood risks from all sources have been assessed as part of this report and are as follows:

River (fluvial) and Sea (Estuarine/Coastal) flooding

According to the Environment Agency's (EA) Flood Map for Planning Purposes, the Site is located within a fluvial and tidal Flood Zone 3 (High probability).

The Site benefits from the presence of flood defences, adjacent to the Site boundary, in unknown condition, designed to provide a 1 in 1000 year event standard of protection.

According to the EA's Risk of Flooding from Rivers and Sea (RoFRS) map, which considers the type, condition and crest height of flood defences, the Site has a Low risk of flooding.

The Site could potentially be at risk from flooding due to blockage or failure of an ordinary watercourse culvert located on the 50m east from the Site.

Modelled flood data obtained from the EA has been analysed in line with the most up to date guidance on climate change (EA, 2022), to confirm a maximum "design" flood level at the Site.

- During a 1 in 100 year plus 17% climate change allowance event the flood level at the Site would be 6.03 mAOD. While currently 0.01m is expected during a 1 in 100 year plus climate change event, nearby flood defences are proposed to be raised in line with climate change to a minimum of 6.35 mAOD. Therefore, flooding will likely not occur as flood defences will be raised to account for the climate change event.
- The Site is mapped to be affected by a breach in both the 2005 and 2100 breach scenarios. In the 2005 scenario, flood depths on-Site are expected to reach up to 0.30 which increases to 0.99 in the 2100 breach scenario. The likelihood of a breach in the current and future defences is considered to be Low.

Emergency evacuation routes are available to the south east. In the event of a flood, safe refuge can be taken on the 1st floor levels and above.

Surface water (pluvial) flooding

According to the EA's Risk of Flooding from Surface Water (pluvial) flood mapping, the Site has a risk of pluvial flooding ranging from Very Low to Low.

- Flooding would not affect the area proposed for development in the 1 in 100 year present day scenario event.
- Flood depths in the area proposed for development could be up to 0.6 m in the 1 in 100 year plus climate change event. (1 in 1000 year event has been used as a proxy for the 100 year plus CC event).
- A SuDS strategy has been prepared separately (ref: 82971.01) to ensure surface water runoff from the Site is managed over the lifetime of the proposed development.

Groundwater flooding

Groundwater Flood Risk screening data indicates there is a Negligible potential risk of groundwater flooding at the surface in the vicinity of the Site during a 1 in 100 year event.

Artificial sources of flooding

The risk of flooding from artificial (man-made) sources such as reservoirs, sewers and canals has been assessed:

- The EA's Risk of Flooding from Reservoir map confirms the Site is at risk of reservoir flooding. The potential for a breach of a reservoir to occur and flooding affecting the Site is Low.
- Ordnance Survey (OS) data confirms there are no canals near to the Site.
- Thames Water identified no incidents of flooding as a result of surcharging sewers at the property (Thames Water, Appendix C).

The risk of flooding from artificial sources is considered to be Low.

The risk to the development has been assessed over its expected 100 year lifetime, including appropriate allowances for the impacts of climate change which could increase the flood risk to the Site. Risks identified include sea level rise, increases in river flooding and increased potential for surface water and appropriate mitigation measures are proposed.

In accordance with paragraphs 167, 174 and footnote 60 of the NPPF (2023), as the development proposals is classed as a minor development (and householder development_ the sequential and exceptions tests are not considered necessary.

Recommendations

Recommendations for flood mitigation are provided below, based upon the proposed development and the flood risk identified at the Site.

- Where it is not possible to raise FFL's to the recommended elevation and as an extension is proposed to extend the habitable living accommodation of the existing building, it would be appropriate to set FFL's to the same level as existing and incorporate standard flood resistance and resilient design measures (see Section 7).
- A Flood Warning and Evacuation Plan (FWEP) is recommended to ensure persons using the Site can evacuate safely on receipt of a Flood Warning.
  - Occupants of the Site should also be signed up to receive EA Flood Alerts and Flood Warnings.
- The ongoing management and maintenance of existing and any proposed drainage networks, under the riparian ownership of the developer, should be undertaken in perpetuity with the development.

GeoSmart recommend the mitigation measures discussed within this report are considered as part of the proposed development where possible and evidence of this is provided to the Local Planning Authority as part of the planning application.

2. Introduction

Background and purpose

A site-specific flood risk assessment has been undertaken, to assess the flood risk to and from the development Site. This assessment has been undertaken by firstly compiling information concerning the Site and the surrounding area. The information gathered was then used to construct a 'conceptual site model', including an understanding of the appropriateness of the development as defined in the NPPF (2023) and the source(s) of any flood risk present, guided by the NPPG (Published in 2014 and updated in August 2022). Finally, a preliminary assessment of the steps that can be taken to manage flood risk to the development was undertaken.

This report has been prepared with reference to the NPPF (2023) and NPPG (2022).

"*The National Planning Policy Framework set out the Government's planning policies for England and how these are expected to be applied*" (NPPF, 2023).

The NPPF (2023) and NPPG (2022) promote a sequential, risk based approach to the location of development. This also applies to locating a development within a Site which has a variable risk of flooding.

"*The approach is designed to ensure that areas at little or no risk of flooding from any source are developed in preference to areas at higher risk. This means avoiding, so far as possible, development in current and future medium and high flood risk areas considering all sources of flooding including areas at risk of surface water flooding*" (Paragraph: 023. NPPG, 2022).

The purpose of this report is to provide clear and pragmatic advice regarding the nature and potential significance of flood hazards which may be present at the Site.

Report scope

In accordance with the requirements set out within NPPG 2022 (Paragraph: 021 Reference ID: 7-021-20220825), a thorough review of publicly and commercially available flood risk data and EA supplied data indicating potential sources of flood risk to the Site from rivers and coastal sources, surface run-off (pluvial), groundwater and reservoirs, including historical flood information and modelled flood extent. Appropriate measures are recommended to manage and mitigate the flood risk to the property.

Information obtained from the EA and a review of the Richmond upon Thames Strategic Flood Risk Assessment (SFRA) (Metis, 2021) is used to ascertain local flooding issues and, where appropriate, identify information to support a Sequential and/or Exception test required as part of the NPPF (2023).

The existing and future flood risk to and from the Site from all flood sources is assessed in line with current best practice using the best available data. The risk to the development has been assessed over its expected lifetime, including appropriate allowances for the impacts of climate change. Residual risks that remain after the flood risk management and mitigation

measures are implemented, are considered with an explanation of how these risks can be managed to keep the users of the development safe over its lifetime.

An indication of whether the Site will potentially increase flood risk elsewhere is provided, including where the proposed development increases the building footprint at the Site. A drainage strategy to control runoff can be commissioned separately if identified as a requirement within this report.

Report limitations

It is noted that the findings presented in this report are based on a desk study of information supplied by third parties. Whilst we assume that all information is representative of past and present conditions, we can offer no guarantee as to its validity and a proportionate programme of site investigations would be required to fully verify these findings.

The basemap used is the OS Street View 1:10,000 scale, however the Site boundary has been drawn using BlueSky aerial imagery to ensure the correct extent and proportion of the Site is analysed.

This report excludes consideration of potential hazards arising from any activities at the Site other than normal use and occupancy for the intended land uses. Hazards associated with any other activities have not been assessed and must be subject to a specific risk assessment by the parties responsible for those activities.

Datasets

The following table shows the sources of information that have been consulted as part of this report:

Table 1. Datasets consulted to obtain confirmation of sources of flooding and risk

Source of flooding	Datasets consulted				
	Commercial Flood Maps	Local Policy & Guidance Documents*	Environment Agency (Appendix B)	Thames Water (Appendix C)	OS Data
Historical	X	X	X		
River (fluvial) / Sea (tidal/coastal)	X	X	X		

Source of flooding	Datasets consulted				
	Commercial Flood Maps	Local Policy & Guidance Documents*	Environment Agency (Appendix B)	Thames Water (Appendix C)	OS Data
Surface water (pluvial)	X	X	X		
Groundwater	X	X			
Sewer		X		X	
Culvert/bridges		X			X
Reservoir		X	X		

*Local guidance and policy, referenced in Section 6, has been consulted to determine local flood conditions and requirements for flood mitigation measures.

Local policy and guidance

For this report, several documents have been consulted for local policy and guidance and relevant information is outlined below:

Richmond upon Thames Adopted Local Plan (Richmond, 2018)

Policy LP 21 Flood Risk and Sustainable Drainage

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.

Application Of Sequential Test

Future development in Zone 3a and Zone 2 will only be considered if the 'Sequential Test' has been applied in accordance with national policy and guidance. However, there will be some exceptions to this. The Sequential Test will not be required if is not a major development and at least one of the following applies:

- It is a Local Plan proposal site that has already been sequentially tested, unless the use of the site being proposed is not in accordance with the allocations in the Local Plan. ·

- It is within a main centre boundary as identified within this Local Plan (Richmond, Twickenham, Teddington, Whitton and East Sheen).
- It is for residential development or a mixed-use scheme and within the 400 metre buffer area identified within the Plan or surrounding the centres referred to above.
- Redevelopment of an existing single residential property.
- Conversions and change of use.

Richmond upon Thames Strategic Flood Risk Assessment (Metis, 2021):

2.4.4 Surface Water Management Plan

The Surface Water Management Plan (SWMP) was published in June 2011. The document helps LLFAs meet certain requirements as outlined in the FRR 2009, as it can provide the evidence based to inform PFRAs and help fulfil the requirement for FRMPs. The London Borough of Richmond upon Thames SWMP was created as part of the Drain London project to outline the preferred management strategy for surface water runoff for each borough.

The SWMP describes predicted and historic flooding from various sources which may impact upon surface water flood risk, including sewers, drains, groundwater plus runoff from land, small watercourses and ditches. It is broken down into a four-phase approach: Phase 1 – Preparation; Phase 2 – Risk Assessment; Phase 3 – Options; and Phase 4 – Implementation and Review.

As part of the Risk Assessment phase, the SWMP defined Critical Drainage Areas (CDAs) for the London Borough of Richmond upon Thames. CDAs are geographical areas (usually hydrological catchments) where multiple and cumulative sources of flood risk have the potential of causing flooding in one or more Local Flood Risk Zones. The impact of this potential flooding could affect people, property, and local infrastructure. The SWMP identified seven CDAs in the Borough:

- CDA 001: Twickenham
- CDA 002: St Margarets
- CDA 003: Strawberry Hill
- CDA 004: Richmond and Mortlake
- CDA 005: Petersham
- CDA 006: Teddington
- CDA 007: Hampton Wick

As part of the Options phase, the SWMP recommends potential mitigation options that could be incorporated into future CDA flood alleviation schemes. Full details regarding these options can be viewed in Section 4.3 of the SWMP

Guidance

Strategic Flood Risk Assessments are carried out by local authorities, in consultation with the Environment Agency, to assess the flood risk to the area from all sources both now and in the future due to climate change. They are used to inform planning decisions to ensure inappropriate development is avoided (NPPF, 2023).

3. Site analysis

Site information

The Site is located in Petersham in a setting of residential land use at National Grid Reference TQ 17950 73314

Figure 1. Aerial imagery of the Site (Bluesky, 2024)

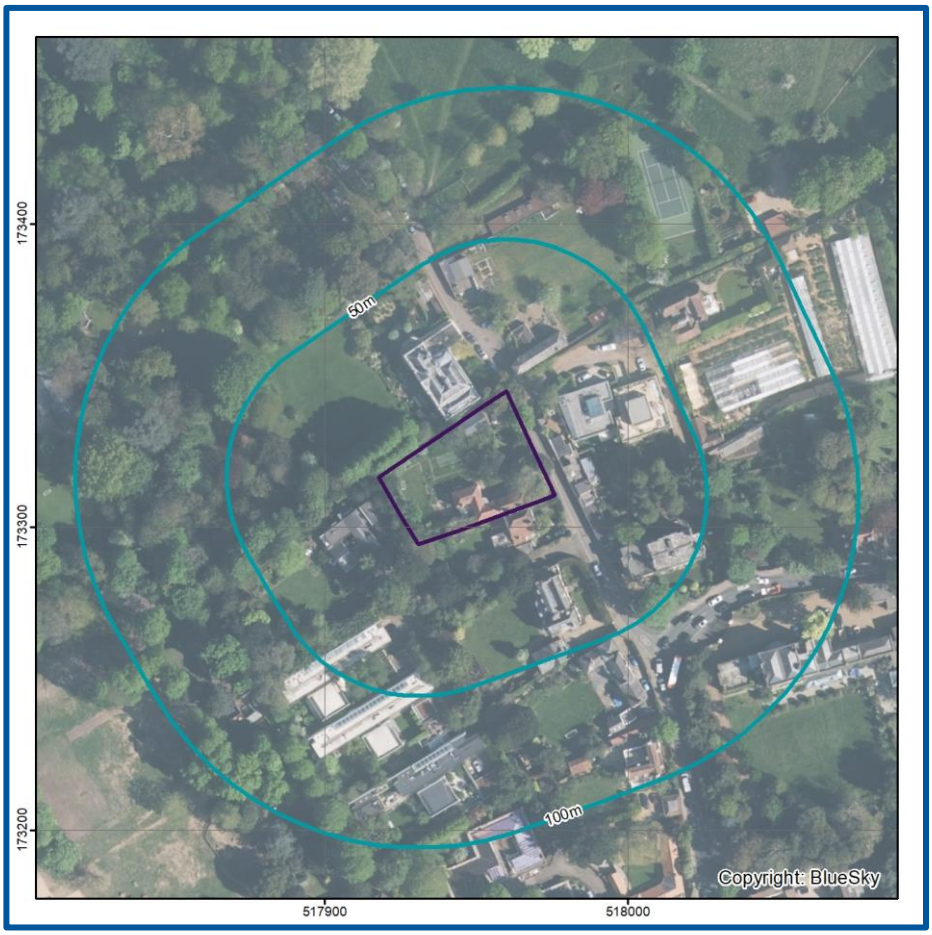
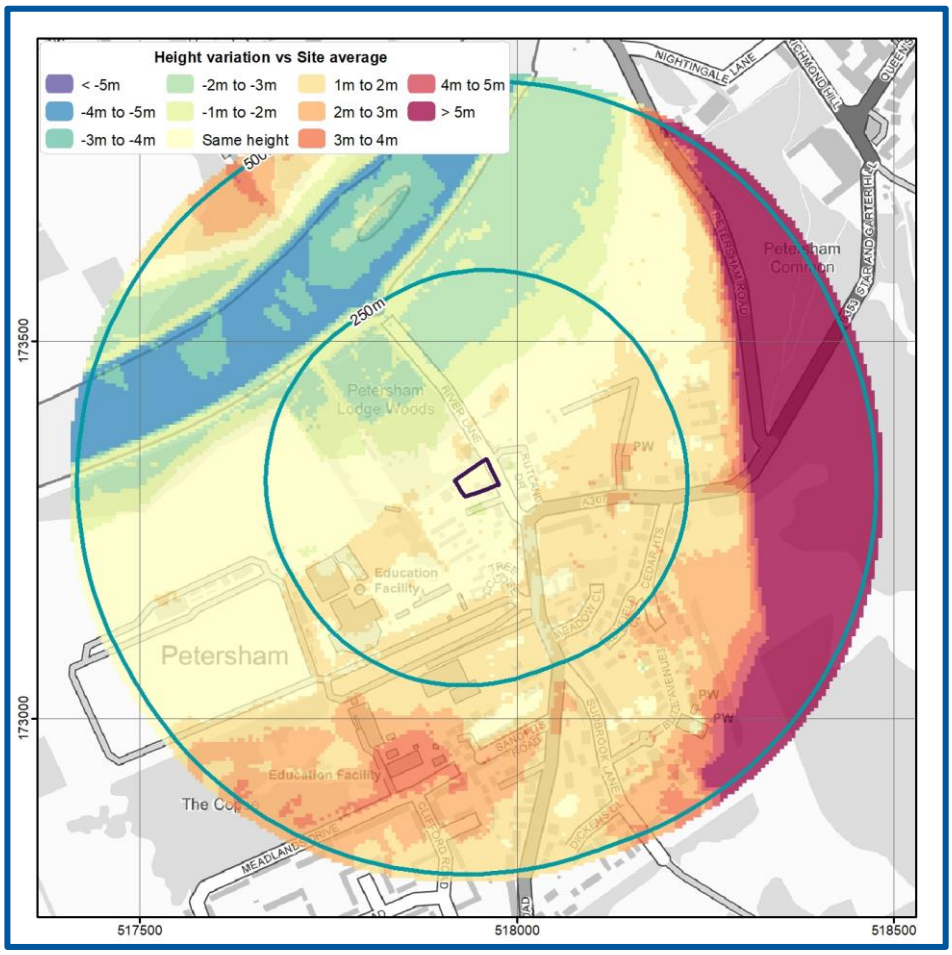


Figure 2 indicates ground levels within 500m of the Site fall in a northerly direction with ground levels rising significantly in an easterly direction and rising gradually in a southerly direction.

The general ground levels on the Site are between 5.36 and 6.39 mAOD with the lowest site levels surrounding the main property. Site levels then gradually increase to the western and northern site boundaries. This is based on EA elevation data obtained for the Site to a 1 m resolution with a vertical accuracy of ±0.15 m (Appendix D).

Figure 2. Site Location and Relative Elevations (GeoSmart, 2024)



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Development

The Site is currently used within a residential capacity as a two-storey semi-detached plus basement dwelling including an outbuilding and rear garden.

Development proposals comprise the extension of the conservatory on the ground floor to the rear of the dwelling, the extension of the patio area, and internal modifications. Site plans are included within Appendix A.

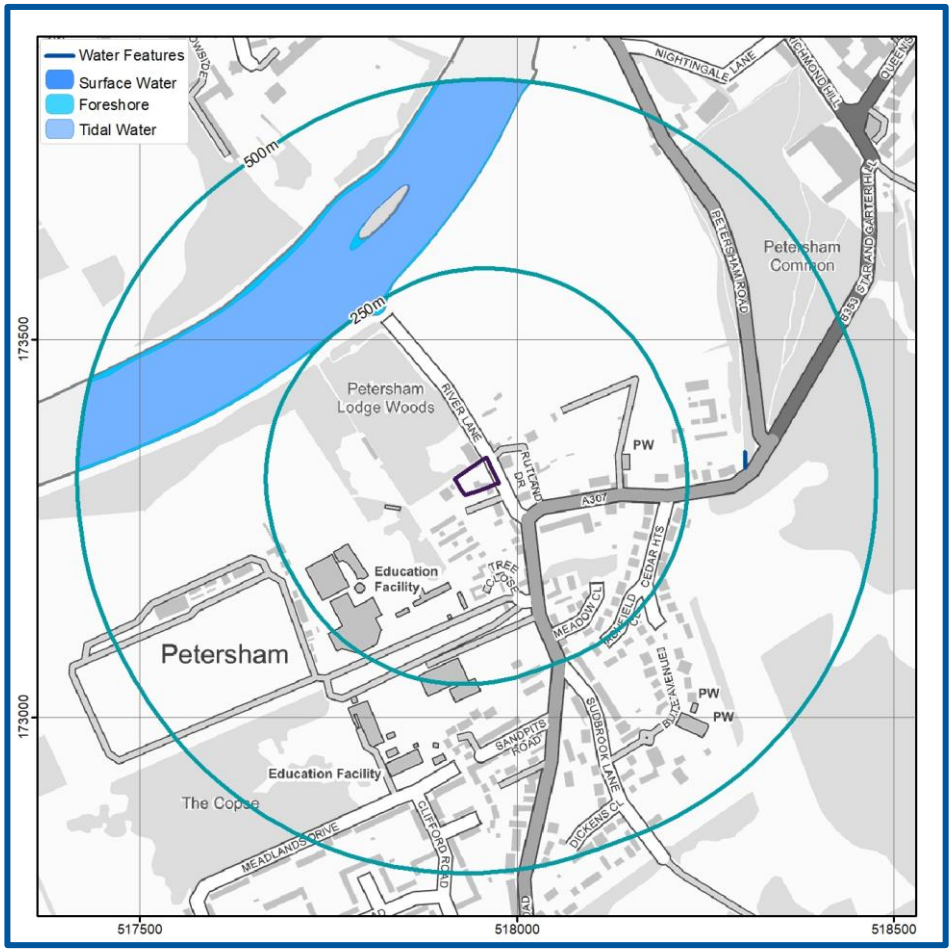
The effect of the overall development will not result in an increase in number of occupants and users of the building and will not result in the change of use, nature or times of occupation. According to Annex 3 of the NPPG (2022), the vulnerability classification of the existing development is More Vulnerable and proposed development is More Vulnerable. The estimated lifespan of the development is 100 years.

Hydrological features

According to Ordnance Survey (OS) mapping (Figure 3) and interactive mapping of the Richmond up Thames SFRA (Metis, 2021) numerous surface water features are located within 500 m of the Site.

- There is an ordinary watercourse culvert located approximately 50m east of the Site.
- The River Thames is located approximately 240m northwest of the Site.
- There is a drainage ditch located approximately 330m east of the Site.

Figure 3. Surface water features (EA, 2024)



Proximity to relevant infrastructure

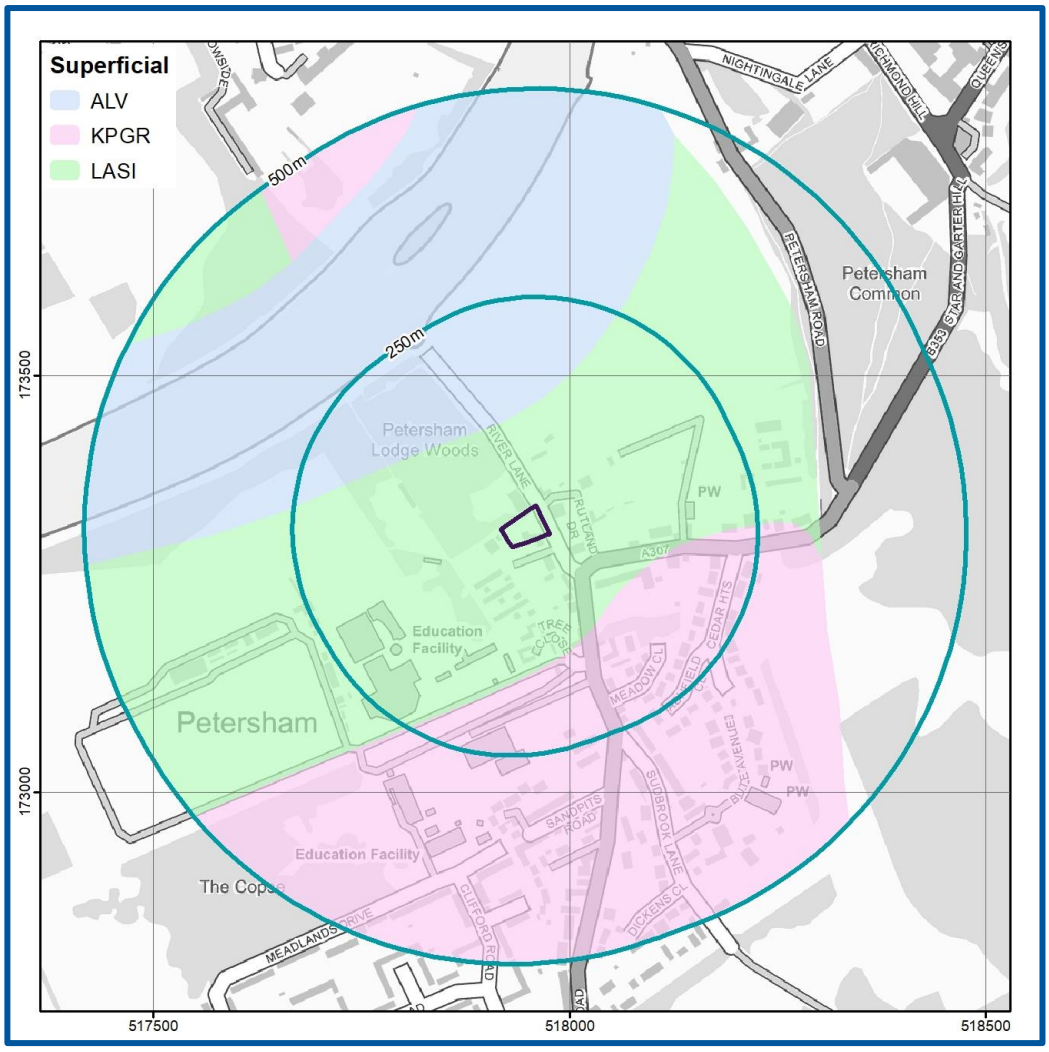
Infrastructure has been identified within 500m of the Site which could influence the risks of flooding to existing or future occupants. These include:

- There is an embankment located adjacent to the northern boundary of the Site.
- Richmond Bridge is located downstream approximately 1.2km north of the Site.

Hydrogeological features

British Geological Survey (BGS) mapping indicates the underlying superficial geology (Figure 4) consists of Langley Silt Member (LASI) (BGS, 2024) and is classified as an Unproductive Strata (EA, 2024).

Figure 4. Superficial Geology (BGS, 2024)



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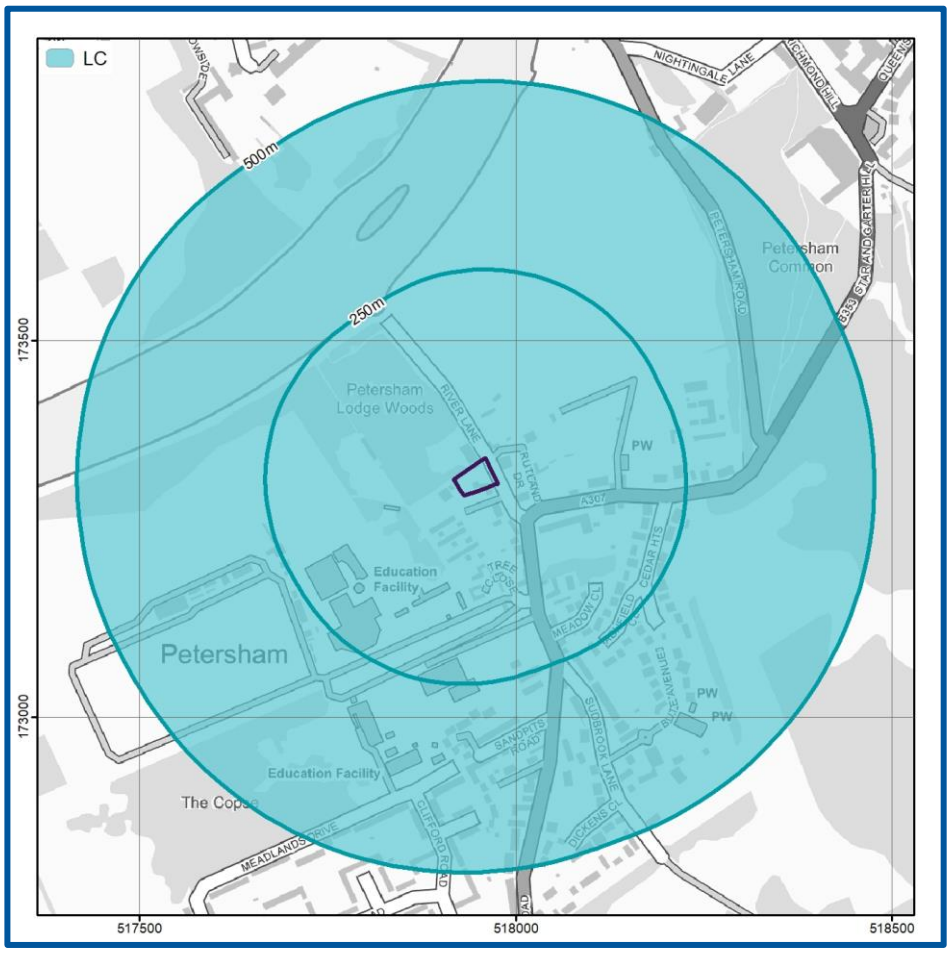
BGS mapping indicates the underlying bedrock geology (Figure 5) consists of the London Clay Formation (LC) (BGS, 2024) and is classified as a Unproductive Strata (EA, 2024).

Figure 5. Bedrock Geology (BGS, 2024)



Geological conditions

A review of the BGS borehole database (BGS, 2024) indicates the nearest and most relevant borehole to the Site (ref: TQ17SE281) is located 275m to the east of the Site boundary at an elevation of 6.5 mAOD. The borehole indicates Ash Brown FILL to a depth of 1.8 below ground level (bgl) underlain by clayey silty SAND to a depth of 3.4m bgl underlain by coarse SAND to a depth of 5.5m bgl underlain by SAND and GRAVEL to depth of 7.4m bgl and then finally underlain by sandy clayey SILT to a depth of 10m bgl where the borehole ends.

Other boreholes located nearby (ref: TQ17SE280 and TQ17SE279) all record similar underlying lithologies with the only salient difference being the thickness of the various strata.

Groundwater

Groundwater levels are recorded at 4.8m below ground level on 25/05/2007, subject to seasonal variations. Within boreholes TQ17SE280 and TQ17SE279, groundwater levels were encountered at 4.5m bgl.

4. Flood risk to the development

Historical flood events

According to the EA's Historical Flood Map (Figure 6) and interactive mapping of the Richmond upon Thames SFRA (Metis, 2021), there has been no flooding events affecting the Site.

The purpose of historical flood data is to provide information on where and why flooding may have occurred in the past. The absence of any recorded events does not mean flooding has never occurred on-Site or that flooding will never occur at the Site.

Figure 6. EA Historic Flood Map (EA, 2024)

Rivers (fluvial) / Sea (coastal) / Estuarine (tidal) flooding

The Site is located in an estuarine location and flooding could occur from a combination of the sea, termed as coastal flooding and from rivers, termed as fluvial flooding. There may be a predominant effect from either the sea or from the river.

River (fluvial) flooding occurs during times of heavy rainfall or snow melt when watercourses' capacity can be exceeded, over topping the banks and flood defences.

Tidal flooding can occur from a combination of the sea, termed as coastal flooding and from rivers, termed as fluvial flooding. There may be a predominant effect from either the sea or from the river, through the following processes:

- High tide levels – variations in tidal levels due to gravitational effects of the sun and moon can result in higher sea levels – there is an approximate twice daily variation between high and low tide, onto which is superimposed a spring-neap tide cycle when extra high and low tides occur.
- Surge – an increase in sea level above tidal level caused by low atmospheric pressure which may be exacerbated by the wind acting on the sea. Tidal flooding is of greatest risk when tidal surges combine with high tides.

The Thames Estuary is one of the United Kingdom's major east-coast estuaries. It extends from the tidal limit of the River Thames at Teddington Lock in the west, through the heart of London, out to the North Sea. The character of the flooding changes from a fluvial dominance in the upstream reaches to the hazards posed by storm surges and waves in the downstream reaches.

According to the EA's Flood Map for Planning Purposes (Figure 7), the Site is located within fluvial and tidal Flood Zone3 and is therefore classified as having a High probability of fluvial and tidal flooding from the River Thames.

Figure 7. EA Flood Map for Planning Purposes (EA, 2024)

Guidance

As defined in the NPPF (2023):

Flood Zone 3

Ignoring the presence of any defences, land located in a Flood Zone 3 is considered to have High probability of flooding with a 1 in 100 year or greater annual probability of fluvial flooding or a 1 in 200 or greater annual probability of coastal flooding in one year.

Development of "Water-Compatible" and "Less Vulnerable" land uses are suitable for this zone with "More Vulnerable" and " Essential Infrastructure" requiring an Exception test to be passed prior to development taking place (see glossary for terminology).

Flood defences

Guidance
Sites that are located close to flood defences are likely to be zones where rapid inundation will occur in the event of the flood defences being overtopped or breached. A Site located close to flood defences (within 250 m) may require a more detailed FRA subject to local topography.

Existing flood defences

- The Site is in an area which benefits from flood defences but is not within the EA's ABD.
- There are formal flood defences in the form of an embankment adjacent to the northern boundary of the Site.

Information from the EA relating to the flood defences is outlined below.

- According to the EA (2024) the flood defences in place for this area are designed to defend up to a 1 in 1000 year flood event.
- The nearest and most applicable formal flood defences are raised, man-made and privately owned with a minimum crest level of 6.02 mAOD.

Model data (Tidal)

As the Site is located within the EA's tidal floodplain, modelled flood elevation data was obtained from the EA. This data is more up to date than that which is included in the London Borough of Richmond upon Thames SFRA (Metis, 2021) and has been used to assess flood risk and to provide recommendations for mitigation for the proposed development. The data is provided in Table 2 below and included with Appendix B.

Thames Estuary 2100 (TE2100)

The Thames Barrier requires regular maintenance and with additional closures the opportunity for maintenance will be reduced. When this happens, river levels - for which the Barrier would normally shut for the 2008 epoch - will have to be allowed through to ensure the barrier is not shut too often. For this reason, levels upriver of the barrier will increase and the tidal walls will need to be heightened to match.

In-channel flood level data has been taken from the nearest and most relevant node point 2.3a and 2.4 (430m northeast and 320m north from the River Thames) to the Site.

There are two node points within close proximity to the proposed Site:

- The flood defences at these nodes have a minimum crest level of 6.02 mAOD in the present day.

- The minimum crest level at Node 2.3a is proposed to be raised to 6.45 mAOD by 2065 and 6.90 mAOD by 2100.
- The minimum crest level at Node 2.4 is proposed to be raised to 6.35 mAOD by 2065 and 6.80 mAOD by 2100.

Residual Tidal Flood Risk

The tidal flood assessment in this section represents the likelihood of flooding from overtopping at the Site, where flood defences are in good condition and are fully maintained. The Site is not at risk of overtopping, however there is a residual risk related to a breach in the Thames flood defences.

Thames Tidal Upriver Breach Inundation Modelling Study (May, 2017)

Modelled breach flood level data has been taken from the Thames Tidal Upriver Breach Assessment (Teddington Weir to Thames Barrier) (Atkins, 2017) to assess flood risk and provide recommendations for mitigation measures.

The breach flood level data has been extracted from the EA's 2D floodplain grid data using QGIS (v3.16.10). (See Table 2)

The mapped data indicates the Site would flood in the 2005 scenario and 2100 scenario.

Table 2. Modelled Breach Flood Levels

Ground levels on-Site (mAOD)	1 in 200 year scenario breach flood level (mAOD)	
	2005	2100
5.36 to 6.39	5.66	6.35
Flood depths (m)	0.30	0.99

As ground levels at the Site are between 5.36 and 6.39 mAOD, the flood depth at the Site would be up to approximately 0.30m in the 2005 breach flood scenario and approximately up to 0.99m in the 2100 breach flood scenario.

Model data (Fluvial)

As the Site is located within the EA's fluvial floodplain, modelled flood elevation data was obtained from the EA and has been used to assess flood risk and to provide recommendations for mitigation for the proposed development.

Defended modelled data from the Hammersmith Modelling Study (JBA Consulting, 2020) has been extracted from the 2D floodplain data provided at the Site.[1]. The data is provided in the table below and is included within Appendix B.

Table 3. EA present day modelled flood data

Ground levels on-Site (mAOD)	Modelled Flood Levels (mAOD)			
	1 in 20 year	1 in 50 year	1 in 100 year	1 in 1000 year
5.36 to 6.39	N/A	N/A	N/A	6.77
Flood depths (m)	No Flooding			1.41

Figure 8 confirms the flood extent associated with overtopping of the flood defences in the present day flooding scenarios. The Site is only impacted in the present day 1 in 1000 year flooding scenario.

[1] The accuracy of the modelled flood levels are not known. These are dependent on the accuracy of input datasets such as LiDAR data, used to model the impacts of flooding within the 2D domain. Confirmation of the accuracy of the modelled flood data can be obtained separately from the Environment Agency.

Figure 8. Modelled Present Day Flooding Scenarios (JBA, 2020)

Climate change factors

The EA's *Flood risk assessments: climate change allowances* guidance (Published 19 February 2016 and updated May, 2022) has been used to inform a suitable increase in peak river flows for the proposed development. The updated guidance confirms 'More Vulnerable' developments are required to undertake a Basic assessment approach.

As the Site is located within the London Management Catchment, within the Thames and the proposed development is classed as More Vulnerable, where the proposed lifespan is approximately 100 years, the Central (17%) allowance has been used to determine a suitable climate change factor to apply to river data.

A stage / discharge (level/flow) relationship graph (Appendix B) has been produced using the EA's modelled in-channel flood flow and level data.

As part of the Hammersmith Modelling Study the 25% allowance has been modelled. From this 25%, a 17% allowance has been calculated and can be found in Appendix B.

Table 4. Flood levels plus climate change allowances

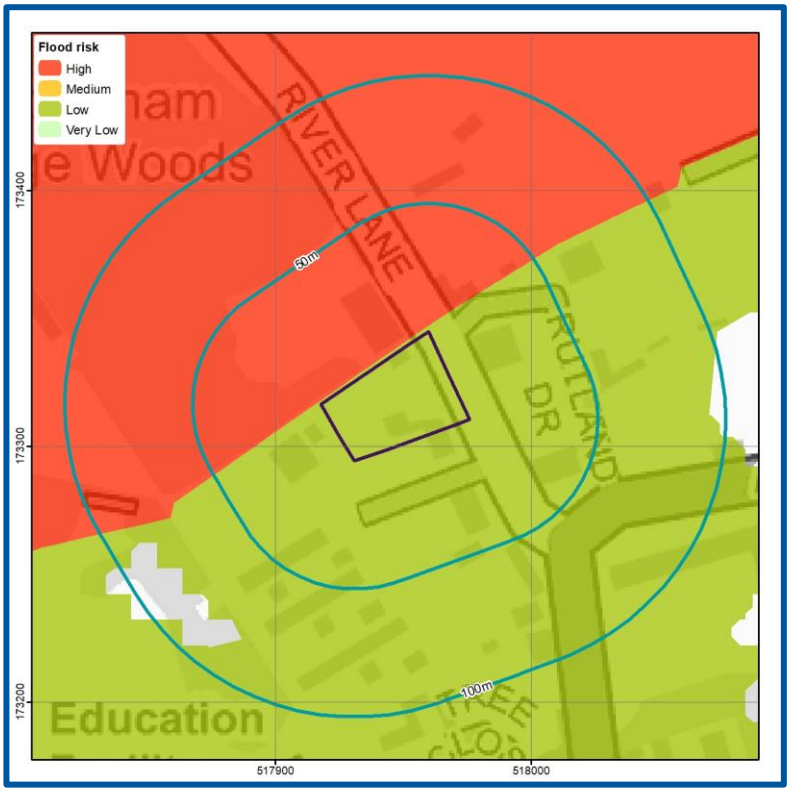
Flood Defence Level (mAOD)	Modelled Flood Levels (mAOD)
	1 in 100 year plus 17% 2080 central allowance for climate change flood level (mAOD)
6.02	6.03
Flood depths (m)	0.01

Flood risk including the benefit of defences

The type and condition of existing flood defences influence the 'actual' risk of fluvial flooding to the Site, albeit the long-term residual risk of flooding (ignoring the defences) should be considered when proposing new development.

According to the EA's Risk of Flooding from Rivers and Sea (RoFRS) map (Figure 9), which considers the type, condition and crest height of flood defences, the Site has a Low risk of flooding from the both the sea and the nearby watercourse, the River Thames.

Figure 9. Risk of Flooding from Rivers and Sea map (EA, 2024)

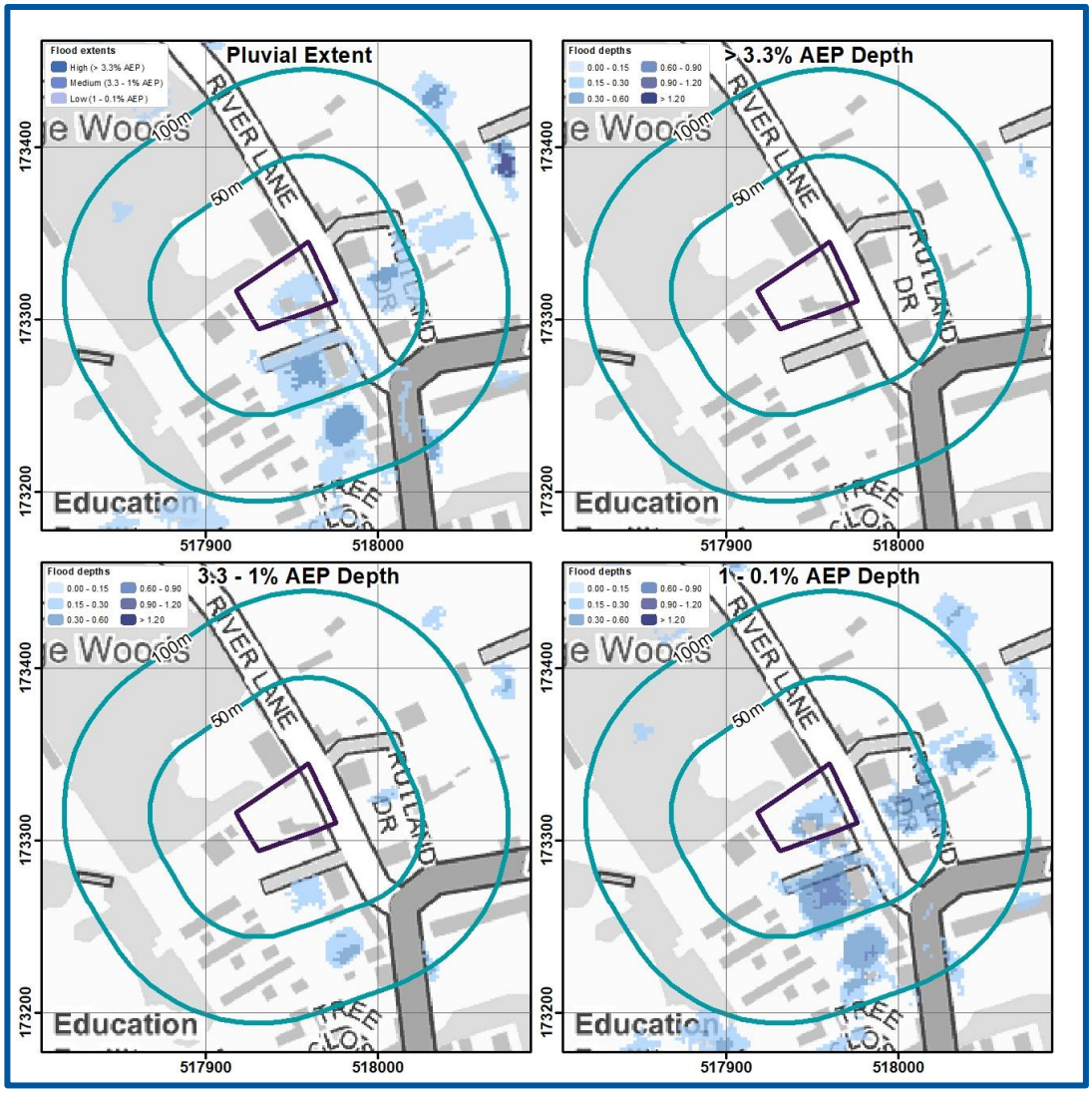


Surface water (pluvial) flooding

Surface water flooding occurs when intense rainfall exceeds the infiltration capacity of the ground and overwhelms the drainage systems. It can occur in most locations even at higher elevations and at significant distances from river and coastal floodplains.

According to the EA's Risk of Flooding from Surface Water (pluvial) flood mapping (Figure 10), the Site has a Very Low to Low risk of pluvial flooding.

Figure 10. EA surface water flood extent and depth map (EA, 2024)



Guidance

According to EA's surface water flood risk map the Site is at:

- Very Low risk - chance of flooding of less than 1 in 1000 (0.1%).
- Low risk - chance of flooding of between a 1 in 1000 & 1 in 100 (0.1% and 1%).

The SFRA does not indicate reported incidents of historical surface water flooding within 100 m of the Site and the SFRA interactive mapping confirms the Site is located within a Critical Drainage Area (CDA) (Petersham CDA) (Metis, 2021).

Figure 10 confirms the extent and depth of flooding in multiple modelled flood scenarios. Flooding depths of up to 0.6 m would impact the Site in the 1 - 0.1% AEP (Low) risk event.

Guidance

According to EA's surface water flood risk map the following advisory guidance applies to the Site:

Flood Depth

- 0.15 to 0.3 m - Flooding would: typically exceed kerb height, likely exceed the level of a damp-proof course, cause property flooding in some areas
- 0.3 to 0.9 m - Flooding is likely to exceed average property threshold levels and cause internal flooding. Resilience measures are typically effective up to a water depth of 0.6 m above floor level.

Climate change factors

Paragraph 002 of the National Planning Practice Guidance (August, 2022) requires consideration of the 1% AP (1 in 100 year) event, including an appropriate allowance for climate change.

As the Site is located within the London Management Catchment and the proposed development is classed as More Vulnerable, where the proposed lifespan is approximately 100 years, the Upper End (40%) allowance is required to determine a suitable climate change factor to apply to rainfall data.

The 0.1% AP (1 in 1000 year) surface water flooding event has been used as a proxy in this instance for the 1% AP (1 in 100 year) plus climate change event.

Surface water flooding flow routes

Analysis of OS mapping, ground elevation data and the EA's pluvial flow route mapping in the 1 in 1000 year (Low probability) event confirms the Site is located on a potential overland flow route.

The 1 in 1000 year (Low probability) event indicates the extent of flooding in a worst-case future 100 year with climate change scenario, where a flood flow route does develop within the Site.

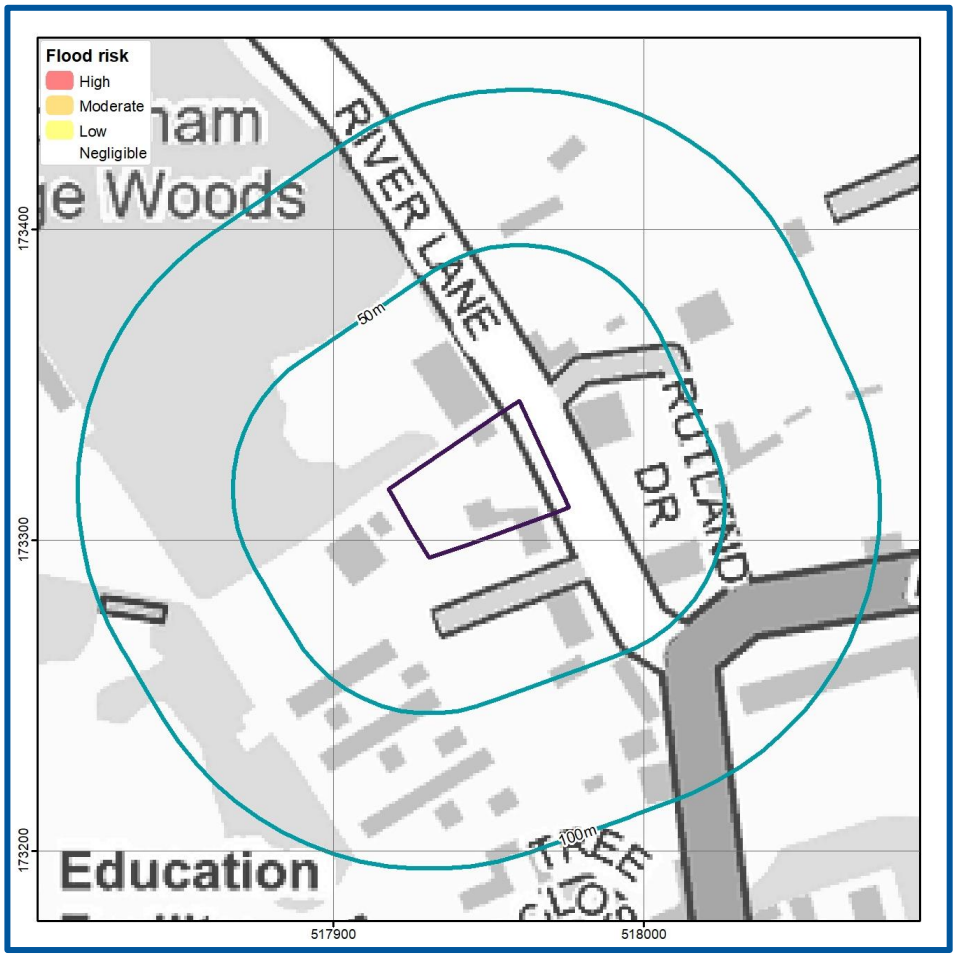
During a 1 in 100 year event the majority of flow velocities are less than 0.25 m/s. The flows could potentially affect the buildings and/or access routes to the Site.

Groundwater flooding

Groundwater flooding occurs when sub-surface water emerges from the ground at the surface or into Made Ground and structures. This may be as a result of persistent rainfall that recharges aquifers until they are full; or may be as a result of high river levels, or tides, driving water through near-surface deposits. Flooding may last a long time compared to surface water flooding, from weeks to months. Hence the amount of damage that is caused to property may be substantially higher.

Groundwater Flood Risk screening data (Figure 11) indicates there is a Negligible risk of groundwater flooding at surface in the vicinity from impermeable bedrock and superficial deposits during a 1 in 100 year event.

Figure 11. GeoSmart GW5 Groundwater Flood Risk Map (GeoSmart, 2024)



Mapped classes within the screening map combine likelihood, possible severity and the uncertainty associated with predicting the subsurface system. The map is a national scale screening tool to prompt site-specific assessment where the impact of groundwater flooding would have significant adverse consequences. Mapping limitations and a number of local factors may reduce groundwater flood risk to land and property even where it lies within

mapped groundwater flood risk zones, which do not mean that groundwater floods will occur across the whole of the risk area.

A site-specific assessment has been undertaken to refine the groundwater risk screening information on the basis of site-specific datasets (see Section 3) including BGS borehole data and the EA's fluvial and tidal floodplain data (where available) to develop a conceptual groundwater model. The risk rating is refined further using the vulnerability of receptors including occupants and the existing and proposed Site layout, including the presence of basements and buried infrastructure. The presence of any nearby or on-Site surface water features such as drainage ditches, which could intercept groundwater have also been considered.

- It is understood the Site contains an existing basement. The depth of the existing basement is unknown. The risks are higher for basements, buried infrastructure and soakaway systems which may be affected by high groundwater levels.
- According to a review of the hydrogeology (Section 3), the Site is underlain by low permeability superficial deposits above low permeability bedrock. There is therefore unlikely to be a significant aquifer beneath the Site and there is unlikely to be a mechanism for groundwater flooding at the Site.
- According to a review of the hydrogeology (Section 3), the nearby boreholes (ref: TQ17SE281, TQ17SE280 and TQ17SE279) encountered groundwater at a depth of 4.8m and 4.5m bgl within the impermeable superficial/bedrock.
- Interactive mapping of the Richmond upon Thames SFRA does not indicate reported incidents of historical ground water flooding within 50 m of the Site (Metis, 2021). The area however according to the SFRA, is less than 25% susceptible to groundwater flooding.
- Spring lines have not been identified in close proximity to the Site.
- The hydrogeological characteristics suggest there is unlikely to be a shallow groundwater table beneath the Site.
- The baseline groundwater flood risk rating is Negligible.

Guidance
Negligible Risk - There will be a remote possibility that incidence of groundwater flooding could lead to damage to property or harm to other sensitive receptors at, or near, this location.

Climate change predictions suggest an increase in the frequency and intensity of extremes in groundwater levels. The impact of climate change on groundwater levels beneath the Site is linked to the predicted risk in both peak river levels and sea levels and also the variation in rainfall recharge which is uncertain.

Flooding from artificial sources

Artificial sources of flood risk include waterbodies or watercourses that have been amended by means of human intervention rather than natural processes. Examples include reservoirs (and associated water supply infrastructure), docks, sewers and canals. The flooding mechanism associated with flood risk from artificial sources is primarily related to breach or failure of structures (reservoir, lake, sewer, canal, flood storage areas, etc.).

Sewer flooding

Interactive Mapping of the Richmond upon Thames SFRA has identified 0 incidences or modelled incidences of flooding as a result of surcharging sewers within the Petersham catchment (Metis, 2021).

Records held by Thames Water indicate that there have been no incidences of flooding related to the surcharging of public sewers at the Site (Thames Water, 2024; Appendix C).

Guidance

Properties classified as "at risk" are those that have suffered, or are likely to suffer, internal flooding from public foul, combined or surface water sewers due to overloading of the sewerage system either once or twice in the ten year reference period. Records held by the sewage utility company provide information relating to reported incidents, the absence of any records does not mean that the Site is not at risk of flooding.

Canal failure

According to Ordnance Survey (OS) mapping, there are no canals within 500 m of the Site.

Water supply infrastructure

Water supply infrastructure is comprised of a piped network to distribute water to private houses or industrial, commercial or institution establishments and other usage points. In urban areas, this represents a particular risk of flooding due to the large amount of water supply infrastructure, its condition and the density of buildings. The risks of flooding to properties from burst water mains cannot be readily assessed.

If more information regarding the condition and history of the water supply infrastructure within the vicinity of the Site is required, then it is advisable to contact the local water supplier Thames Water

Culverts and bridges

The blockage of watercourses or structures by debris (that is, any material moved by a flowing stream including vegetation, sediment and man-made materials or refuse) reduces flow capacity and raises water levels, potentially increasing the risk of flooding. High water levels can cause saturation, seepage and percolation leading to failure of earth embankments or other structures. Debris accumulations can change flow patterns, leading to scour, sedimentation or structural failure.

- Culverts have been identified within 50 m of the Site.
- Culverts have been identified within close proximity to the Site. These structures may pose a flood risk to the Site should they become blocked or damaged.
- The SFRA has not identified any historic drainage issues within the Site area (Metis, 2021).

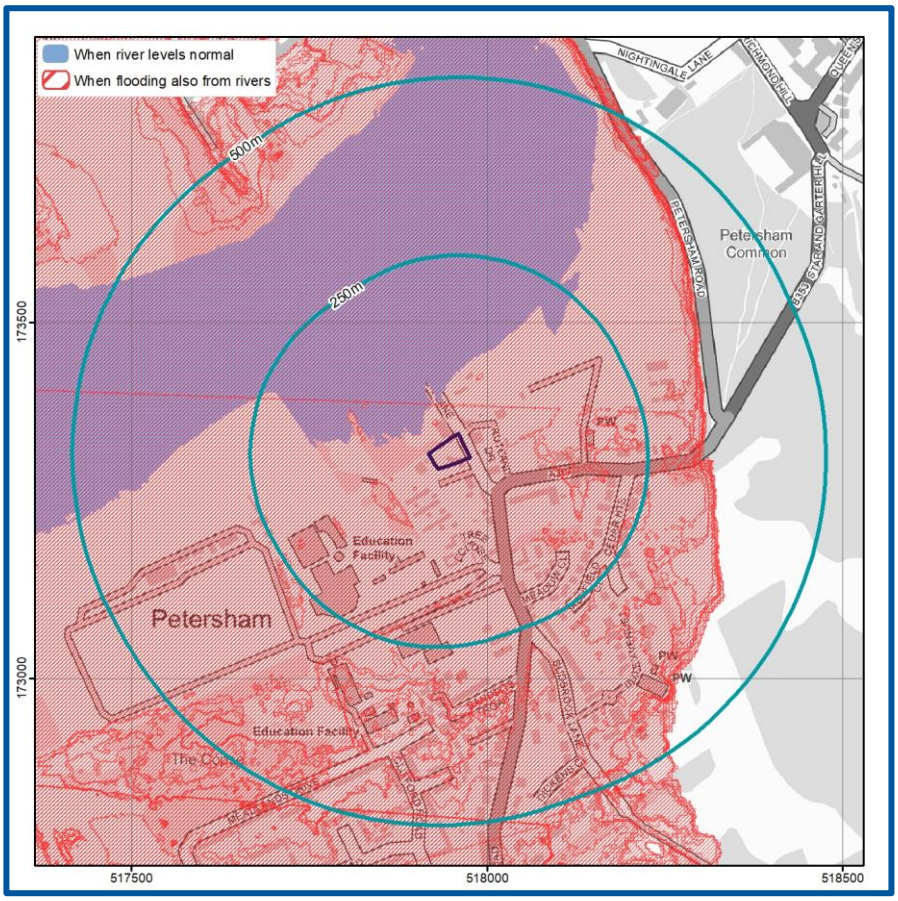
Reservoir flooding

According to the EA's Risk of Flooding from Reservoir mapping the Site is at risk of flooding from reservoirs (Figure 12) (EA, 2024).

The Site is considered to be at risk of flooding from the following reservoirs:

- Barwell Court Lake (GR: TQ1664162657), Brent (GR: TQ2150087000), Island Barn (GR: TQ1390067000), King George VI (GR: TQ0410073200), Queen Elizabeth II (GR: TQ1180067100), Queen Mary (GR: TQ0740069700), Queen Mother (GR: TQ0090076800), Staines North (GR: TQ0500073600), Staines South (GR: TQ0500072500), Walton – Bessborough (GR: TQ1220068000)

Figure 12. EA Risk of Reservoir Flooding (EA, 2024)



Guidance

The risk of reservoir flooding is related to the failure of a large reservoir (holding over 25,000 m^3 of water) and is based on the worst-case scenario. Reservoir flooding is extremely unlikely to occur (EA, 2024).

5. Flood risk from the development

Floodplain storage

Where flood storage from any source of flooding is to be lost as a result of development, on-site level-for-level compensatory storage, accounting for the predicted impacts of climate change over the lifetime of the development, should be provided. Where it is not possible to provide compensatory storage on site, it may be acceptable to provide it off-site if it is hydraulically and hydrologically linked.

The loss of floodplain storage is less likely to be a concern in areas benefitting from appropriate flood risk management infrastructure or where the source of flood risk is solely tidal.

The development is located within a tidal Flood Zone 3 and involves an increase in the proposed building footprint. However, in tidal areas, raising ground levels is unlikely to impact on maximum tidal levels so the provision of compensatory storage is not considered to be necessary (CIRIA C624 (2004)). In addition, the site is located behind a significant flood defence infrastructure and therefore floodplain storage compensation is not required.

Drainage and run-off

Based on the topography and surface water flood risk in the vicinity, interference or interaction with overland flow paths and inflows from off-Site is considered possible. It is recommended that steps are taken to manage these potential inflows within the Site drainage system.

The proposed development involves an increase of impermeable surfaces at the Site. An estimation of run-off is therefore required to permit effective Site water management and prevent any increase in flood risk to off-Site receptors from the Site.

A Sustainable Drainage Strategy has been prepared separately by GeoSmart (ref: 82971.01) to manage the increase in runoff from the Site.

6. Suitability of the proposed development

The information below outlines the suitability of proposed development in relation to national and local planning policy.

National policy and guidance

The aims of the national planning policies are achieved through application of the Sequential Test and in some cases the Exception Test.

Guidance

Sequential test: The aim of this test is to steer new development towards areas with the lowest risk of flooding (NPPF, 2023). Reasonably available sites located in Flood Zone 1 should be considered before those in Flood Zone 2 and only when there are no reasonably available sites in Flood Zones 1 and 2 should development in Flood Zone 3 be considered.

Exception test: In some cases, this may need to be applied once the Sequential Test has been considered. For the exception test to be passed it must be demonstrated that the development would provide wider sustainability benefits to the community that outweigh flood risk and a site-specific FRA must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

Suitability of the proposed development, and whether the Sequential and Exception Tests are required, is based on the Flood Zone the Site is located within and the flood risk vulnerability classification of the existing and proposed development. Some developments may contain different elements of vulnerability and the highest vulnerability category should be used, unless the development is considered in its component parts.

This report has been produced to assess all development types, prior to any development. The vulnerability classification and Flood Zones are compared within the table overleaf (Table 2 of the NPPG (2022)).

As the Site is located within Flood Zone 3a and the proposed development is defined as More Vulnerable; the proposals are acceptable, but may be subject to the Sequential and Exceptions Test.

The proposed development is a small extension to the existing property which would comprise of the extension of the conservatory on the ground floor to the rear of the dwelling, the extension of the patio area, and internal modifications. (the extension would not result in any additional bedrooms) and is therefore defined as minor development.

Paragraph 174 of the NPPF states: *"Applications for some minor development and changes of use [60] 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 59"* (NPPF, 2023).

The NPPG (2022) defines a 'minor development' as *"householder development and small non-residential extensions (with a footprint of less than 250 m^2)."*

As a result, as the proposals are defined as "minor development – householder development" they are not subject to the Sequential Test or an Exception Test.

Table 5. Flood risk vulnerability and flood zone 'incompatibility (taken from NPPG, 2022)

Flood risk vulnerability classification		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood Zone	Zone 1 – low probability	✓	✓	✓	✓	✓
	Zone 2 – medium probability	✓	✓	Exception test required	✓	✓
	Zone 3a - high probability	Exception test required	✓	X	Exception test required*	✓
	Zone 3b – functional flood plain	Exception test required	✓	X	X	X

*As the development proposals are for a minor development the Sequential and Exception Tests are not required.

EA Flood Risk Standing Advice for vulnerable developments located in Flood Zones 2 or 3 (February, 2022)

The proposed development is considered to be a minor extension, this is defined as a household or non-domestic extension with a floor space of no more than 250 m^2.

In line with the 'Minor extensions standing advice'

- A plan is required showing the finished floor levels and the estimated flood levels.
- Floor levels are either no lower than existing floor levels or 0.3 m above the estimated flood level. If your floor levels aren't going to be 0.3 m above existing flood levels, you need to check with your local planning authority if you also need to take flood resistance and resilience measures.

For all relevant vulnerable developments (i.e. more vulnerable, less vulnerable and water compatible), advice on the points should be followed:

- Surface water management;
- Access and evacuation; and
- Floor levels.

Surface water management

Plans for the management of surface water need to meet the requirements set out in either the local authority's:

- Surface water management plan where available; OR
- Strategic flood risk assessment.

They also need to meet the requirements of the approved building regulations Part H: drainage and water disposal. Read section H3 rainwater drainage.

Planning permission is required to use a material that can't absorb water (e.g. impermeable concrete) in a front garden larger than $5m^2$.

Access and evacuation

Details of emergency escape plans should be provided for any parts of a building that are below the estimated flood level:

Plans should show:

- Single storey buildings or ground floors that don't have access to higher floors can access a space above the estimated flood level, e.g. higher ground nearby;
- Basement rooms have clear internal access to an upper level, e.g. a staircase;
- Occupants can leave the building if there's a flood and there's enough time for them to leave after flood warnings.

Floor levels

The following should be provided:

- average ground level of your site
- ground level of the access road(s) next to your building
- finished floor level of the lowest room in your building

Finished floor levels should be a minimum of whichever is higher of 300mm above the:

- average ground level of the site
- adjacent road level to the building
- estimated river or sea flood level

You should also use construction materials that have low permeability up to at least the same height as finished floor levels.

If you cannot raise floor levels to meet the minimum requirement, you will need to:

- raise them as much as possible
- consider moving vulnerable uses to upper floors
- include extra flood resistance and resilience measures

When considering the height of floor levels, you should also consider any additional requirements set out in the SFRA. Flood water can put pressure on buildings causing structural issues. If your design aims to keep out a depth of more than 600mm of water, you should get advice from a structural engineer. They will need to check the design is safe.

Extra flood resistance and resilience measures

Follow the guidance in this section for developments in flood risk areas where you cannot raise the finished floor levels to the required height. You should design buildings to exclude flood water where possible and to speed recovery in case water gets in.

Make sure your flood resilience plans for the development follow the guidance in the CIRIA Property Flood Resilience Code of Practice. Please note that the code of practice uses the term 'recovery measures'. In this guide we use 'resilience measures'.

Flooding can affect the structural stability of buildings. If your building design would exclude more than 600mm of flood water, you should get advice from a structural engineer. They will need to check the design is safe. Only use resistance measures that will not cause structural stability issues during flooding. If it is not possible to safely exclude the estimated flood level, exclude it to the structural limit then allow additional water to flow through the property.

The design should be appropriately flood resistant and resilient by:

- using flood resistant materials that have low permeability to at least 600mm above the estimated flood level
- making sure any doors, windows or other openings are flood resistant to at least 600mm above the estimated flood level
- using flood resilient materials (for example lime plaster) to at least 600mm above the estimated flood level
- by raising all sensitive electrical equipment, wiring and sockets to at least 600mm above the estimated flood level
- making it easy for water to drain away after flooding such as installing a sump and a pump
- making sure there is access to all spaces to enable drying and cleaning

- ensuring that soil pipes are protected from back-flow such as by using non-return valves

Temporary or demountable flood barriers are not appropriate for new buildings. Only consider them for existing buildings when:

- there is clear evidence that it would be inappropriate to raise floor levels and include passive resistance measures
- an appropriate flood warning or other appropriate trigger is available

If proposals involve the development of buildings constructed before 1919, refer to Flooding and Historic Buildings guidance produced by Historic England.

7. Resilience and mitigation

Based on the flood risk identified at the Site, the national and local policies and guidance and proposed development, the mitigation measures outlined within this section of the report are likely to help protect the development from flooding.

Sea (coastal/tidal) flood mitigation measures

The Site is located within an area which is affected by flooding from tidal sources (i.e, during a breach of current and proposed flood defences), the following table confirms the flood depths associated with the area proposed for development.

Table 6. Flood levels compared to ground levels on-site

Ground levels on-Site	1 in 200-year scenario breach flood level (mAOD)	
	2005	2100
5.36 to 6.39	5.66	6.35
Flood depths (m)	0.30	0.99

Rivers (fluvial) flood mitigation measures

The Site is located within an area which is affected by flooding from rivers, the following table confirms the flood depths associated with the area proposed for development.

Table 7. Flood levels compared to ground levels on-site

Flood Defence Level (mAOD)	Modelled Flood Levels (mAOD)
	1 in 100 year plus 17% CC (mAOD)
6.02	6.03
Flood depths (m)	0.01

While currently 0.01m is expected during a 1 in 100 year plus climate change event, nearby flood defences are proposed to be raised in line with climate change to a minimum of 6.35 mAOD. Therefore, flooding will likely not occur as flood defences will be raised to account for the climate change event.

Raising minimum floor levels

As the development proposals are comprised of extensions to existing buildings, the raising of Finished Floor Levels (FFL) is unlikely to be a feasible method of flood mitigation. Finished floor levels should be raised as high as feasibly possible and set no lower than existing.

Flood resilience measures should be considered in lieu of raising the FFL. Ground levels should be designed to channel any overland flows from off-Site away from the development and Site drainage systems.

Alternative Mitigation

In lieu of raising the FFL's, it may be appropriate to adopt a water exclusion strategy for flood depths up to 0.3 m in line with the EA's Standing Advice. A water exclusion strategy, using avoidance and resistance measures, is appropriate where floods are expected to last for short durations. Potential water exclusion strategies include:

- Passive flood door systems;
- Temporary flood barriers;
- Air brick covers (manual or automatic closing);
- Boundary walls/fencing;

Avoidance and resistance measures are unlikely to completely prevent floodwater entering a property, particularly during longer duration flood events. Therefore, it is recommended that the following flood resilience measures are also considered.

- Flood resilient materials and designs:
    - Use of low permeability building materials up to 0.3 m such as engineering bricks (Classes A and B) or facing bricks;
    - Hard flooring and flood resilient metal staircases;
    - The use of internal lime plaster/render or where plasterboards are used these should be fitted horizontally instead of vertically and/or using moisture resistant plasterboard at lower levels;
    - Water, electricity and gas meters and electrical sockets should be located above the predicted flood level;
    - Communications wiring: wiring for telephone, TV, Internet and other services should be protected by suitable insulation in the distribution ducts to prevent damage.

Where flood depths are expected to exceed 0.6 m at the Site, a water entry strategy should be adopted to preserve building integrity and to promote flood resilience rather than resistance (which is more difficult to achieve for significant flood depths). A structural

engineer should be consulted to confirm this would be a suitable strategy for the proposed development, to ensure flood flows would not impact the structural integrity of the building. Potential strategies include:

- Ground floors designed to permit water passage at high flood depths;
- Hard flooring and flood resilient metal staircases;
- Heating systems, electrical sockets and utility meters should be raised above the predicted flood level where possible; and
- Sump and pump.

Where flood depths are expected to be between 0.3-0.6 m both water exclusion and water entry strategies should be adopted depending on a structural assessment of the building.

If these mitigation measures are implemented this could reduce the flood risk to the development from Low to Very Low.

Surface water (pluvial) flood mitigation measures

The mitigation measures detailed above for river and sea flood risk are likely to be suitable for the 0.6m flood depths which could be experienced in a 1 in 1000 (Low risk) year pluvial flood event.

In addition, the regular maintenance of any drains and culverts surrounding/on the Site should be undertaken to reduce the flood risk.

A surface water drainage (SuDS) strategy has been prepared separately (ref: 82971.01) to ensure surface water runoff can be managed effectively over the lifetime of the proposed development.

Groundwater flood mitigation measures

As the Site is not identified as being at risk of groundwater flooding, mitigation measures are not required.

Reservoir flood mitigation measures

There would be a relatively high rate and onset of flooding associated with a reservoir breach, it is therefore unlikely that safe access could be achieved unless a long warning period was provided. Therefore, occupants should get to the highest level of the building as possible and contact the emergency services.

Other flood risk mitigation measures

As the Site is not identified as at risk from other sources, mitigation measures are not required.

Residual flood risk mitigation measures

The risk to the Site has been assessed from all sources of flooding and appropriate mitigation and management measures proposed to keep the users of the development safe over its lifetime. There is however a residual risk of flooding associated with the potential for failure of mitigation measures if regular maintenance and upkeep isn't undertaken. If mitigation measures are not implemented or maintained, the risk to the development will remain as the baseline risk.

Further flood mitigation information

More information on flood resistance, resilience and water entry can be found here: http://www.planningportal.gov.uk/uploads/br/flood_performance.pdf

www.knowyourfloodrisk.co.uk

Emergency evacuation - safe access / egress and safe refuge

Emergency evacuation to land outside of the floodplain should be provided if feasible. Where this is not possible, 'more vulnerable' developments and, where possible, development in general (including basements), should have internal stair access to an area of safe refuge within the building to a level higher than the maximum likely water level. An area of safe refuge should be sufficient in size for all potential users and be reasonably accessible to the emergency services.

Emergency evacuation from the development and the Site should only be undertaken in strict accordance with any evacuation plans produced for the Site, with an understanding of the flood risks at the Site including available mitigation, the vulnerability of occupants and preferred evacuation routes.

Flood warnings

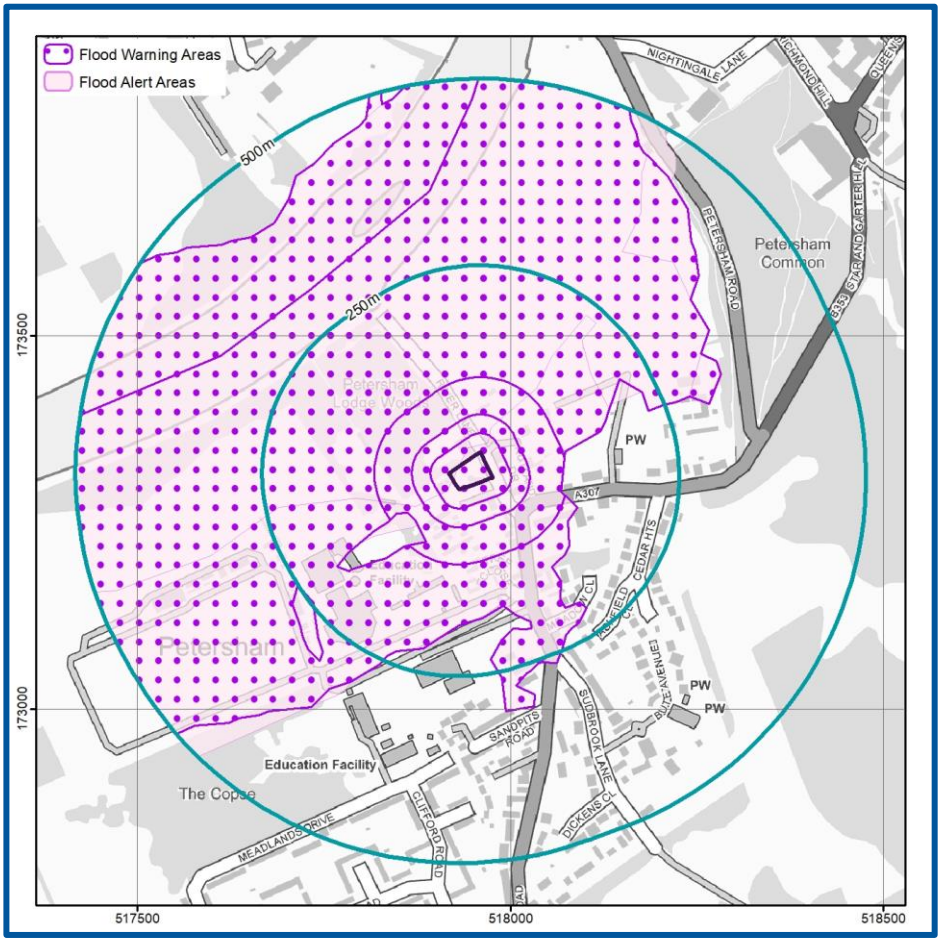
The EA operates a flood warning service in all areas at risk of flooding; this is available on their website: https://www.gov.uk/check-flood-risk. The Site is located within an EA Flood Alerts/Warning coverage area (Figure 13) so is able to receive alerts. All warnings are also available through the EA's 24 hour Floodline Service 0345 988 1188.

Flood Alert: (ref: 063WAT23West) Quick Dial Code: 174115

Flood Warning: (ref: 063FWT23Richmond) Quick Dial Code: 174103

The EA aims to issue Flood Warnings 2 hours in advance of a flood event. Flood Warnings can provide adequate time to enable protection of property and evacuation from a Site, reducing risk to life and property.

Figure 13. EA Flood Warning Coverage for the local area (EA, 2024).



Emergency evacuation

Where possible, a safe access and egress route with a 'very low' hazard rating from areas within the floodplain to an area wholly outside the 1 in 100 year flood event including an allowance for climate change should be demonstrated.

Based on the EA's Flood Zone Map the closest dry evacuation area within Flood Zone 1 is along Petersham Road (c.110 m southeast – direct measurement). It is advised that evacuation from the premises would be the preferred option in a flood event if safe to do so. It is recommended that residents prepare to evacuate as soon as an EA Flood Warning is issued in order to completely avoid flood waters.

On-Site refuge

Evacuation should be the primary action in preference, however safe refuge could be sought at first floor level in a worst-case scenario.

Other relevant information

A Flood Warning and Evacuation Plan (FWEP) is recommended, and occupants should be signed up to receive EAs Flood Alerts and Warnings.

Registration to the Environment Agency's flood warning scheme can be done by following this link: https://www.gov.uk/sign-up-for-flood-warnings.

It is recommended that main communication lines required for contacting the emergency services, electricity sockets/meters, water supply and first aid stations and supplies are not compromised by flood waters. Where possible these should all be raised above the extreme flood level.

8. Conclusions and recommendations

Table 8. Risk ratings following Site analysis

Source of Flood Risk	Baseline[1]	After analysis[2]	After Mitigation[3]
River (fluvial) flooding	Low		Very Low
Sea (coastal/tidal) flooding	Low		Very Low
Surface water (pluvial) flooding	Low		Very Low
Groundwater flooding	Negligible		
Other flood risk factors present	Yes		
Is any other further work recommended?	Yes (see below)		

1 BASELINE risks assigned for the whole Site, using national risk maps, including the benefit of EA flood defences.

2 AFTER ANALYSIS modification of risk assessment based on detailed site specific analysis including some or all of the following: flood model data, high resolution mapping, building location, access routes, topographic and CCTV surveys. Reasons for the change in classification are provided in the text.

3 AFTER MITIGATION risks include risks to proposed development / asset and occupants if mitigation measures recommended in this report are implemented, including the impacts of climate change.

*N/A indicates where mitigation is not required.

The table below provides a summary of where the responses to key questions are discussed in this report. Providing the recommended mitigation measures are put in place it is likely that flood risk to this Site will be reduced to an acceptable level.

The Site is located in Flood Zone 3 and the development is classed as More vulnerable which will require review and discussion of mitigation measures with the Local Authority.

Table 9. Summary of responses to key questions in the report

Key sources of flood risks identified	Fluvial, Tidal, Pluvial (see Section 4).
Are standard mitigation measures likely to provide protection from flooding to/from the Site?	Yes (see Section 7).
Is any further work recommended?	Yes (See exec summary and section 7).

9. Further information

The following table includes a list of additional products by GeoSmart:

Additional GeoSmart Products			
✓	Additional assessment: EnviroSmart Report		Provides a robust desk-based assessment of potential contaminated land issues, taking into account the regulatory perspective. Our EnviroSmart reports are designed to be the most cost effective solution for planning conditions. Each report is individually prepared by a highly experienced consultant conversant with Local Authority requirements. Ideal for pre-planning or for addressing planning conditions for small developments. Can also be used for land transactions. Please contact info@geosmartinfo.co.uk for further information.

10. References and glossary

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GeoSmart Information

Glossary

General terms

BGS	British Geological Survey
EA	Environment Agency
GeoSmart groundwater flood risk model	GeoSmart's national groundwater flood risk model takes advantage of all the available data and provides a preliminary indication of groundwater flood risk on a 50m grid covering England and Wales. The model indicates the risk of the water table coming within 1 m of the ground surface for an indicative 1 in 100 year return period scenario.
Dry-Island	An area considered at low risk of flooding (e.g. In a Flood Zone 1) that is entirely surrounded by areas at higher risk of flooding (e.g. Flood Zone 2 and 3)
Flood resilience	Flood resilience or wet-proofing accepts that water will enter the building, but through careful design will minimise damage and allow the re-occupancy of the building quickly. Mitigation measures that reduce the damage to a property caused by flooding can include water entry strategies, raising electrical sockets off the floor, hard flooring.
Flood resistance	Flood resistance, or dry-proofing, stops water entering a building. Mitigation measures that prevent or reduce the likelihood of water entering a property can include raising flood levels or installation of sandbags.
Flood Zone 1	This zone has less than a 0.1% annual probability of river flooding
Flood Zone 2	This zone has between 0.1 and 1% annual probability of river flooding and between 0.1% and 0.5 % annual probability sea flooding
Flood Zone 3	This zone has more than a 1% annual probability of river flooding and 0.5% annual probability of sea flooding
Functional Flood Plain	An area of land where water has to flow or be stored in times of flood.
Hydrologic model	A computer model that simulates surface run-off or fluvial flow. The typical accuracy of hydrologic models such as this is ±0.25m for estimating flood levels at particular locations.
OS	Ordnance Survey
Residual Flood Risk	The flood risk remaining after taking mitigating actions.

SFRA	Strategic Flood Risk Assessment. This is a brief flood risk assessment provided by the local council
SuDS	A Sustainable drainage system (SuDS) is designed to replicate, as closely as possible, the natural drainage from the Site (before development) to ensure that the flood risk downstream of the Site does not increase as a result of the land being developed. SuDS also significantly improve the quality of water leaving the Site and can also improve the amenity and biodiversity that a Site has to offer. There are a range of SuDS options available to provide effective surface water management that intercept and store excess run-off. Sites over 1 Ha will usually require a sustainable drainage assessment if planning permission is required. The current proposal is that from April 2014 for more than a single dwelling the drainage system will require approval from the SuDS Approval Board (SABs).

Aquifer Types

Principal aquifer	These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.
Secondary A aquifer	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.
Secondary B aquifer	Predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering.
Secondary undifferentiated	Has been assigned in cases where it has not been possible to attribute either category A or B to a rock type due to the variable characteristics of the rock type.
Unproductive Strata	These are rock layers or drift deposits with low permeability that has negligible significance for water supply or river base flow.

NPPF (2023) terms

Exception test	Applied once the sequential test has been passed. For the exception test to be passed it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk and a site-specific FRA must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.
Sequential test	Aims to steer new development to areas with the lowest probability of flooding.

Essential infrastructure	Essential infrastructure includes essential transport infrastructure, essential utility infrastructure and wind turbines.
Water compatible	Water compatible land uses include flood control infrastructure, water-based recreation and lifeguard/coastal stations.
Less vulnerable	Less vulnerable land uses include police/ambulance/fire stations which are not required to be operational during flooding and buildings used for shops/financial/professional/other services.
More vulnerable	More vulnerable land uses include hospitals, residential institutions, buildings used for dwelling houses/student halls/drinking establishments/hotels and sites used for holiday or short-let caravans and camping.
Highly vulnerable	Highly vulnerable land uses include police/ambulance/fire stations which are required to be operational during flooding, basement dwellings and caravans/mobile homes/park homes intended for permanent residential use.

Data Sources

Aerial Photography	Contains Ordnance Survey data © Crown copyright and database right 2024 BlueSky copyright and database rights 2024
Bedrock & Superficial Geology	Contains British Geological Survey materials © NERC 2024 Ordnance Survey data © Crown copyright and database right 2024
Flood Risk (Flood Zone/RoFRS/Historic Flooding/Pluvial/Surface Water Features/Reservoir/ Flood Alert & Warning)	Environment Agency copyright and database rights 2024 Ordnance Survey data © Crown copyright and database right 2024
Flood Risk (Groundwater)	GeoSmart, BGS & OS GW5 (v2.4) Map (GeoSmart, 2024) Contains British Geological Survey materials © NERC 2024 Ordnance Survey data © Crown copyright and database right 2024
Location Plan	Contains Ordnance Survey data © Crown copyright and database right 2024
Topographic Data	OS LiDAR/EA

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11. Appendices

GeoSmart Information

Appendix A

Site plans

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job title

Navigators House

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Gareth and Victoria Bradley

drawing title

Existing Site Plan

drawing number

2038.01.03.Exg.002

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drawn by	VG
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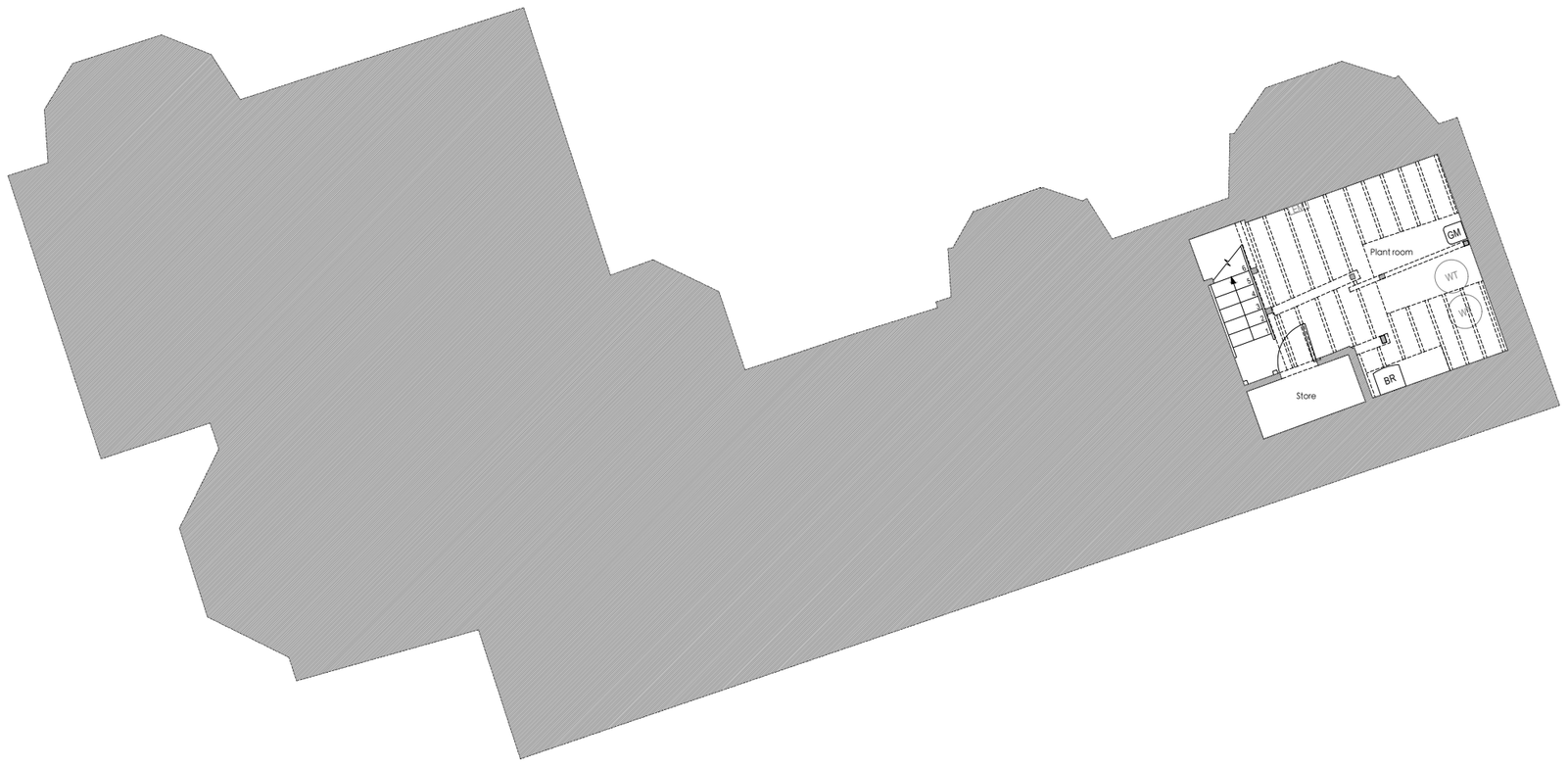

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drawing title
MH - Existing Basement Floor Plan

drawing number
2038.01.03.Exg.021

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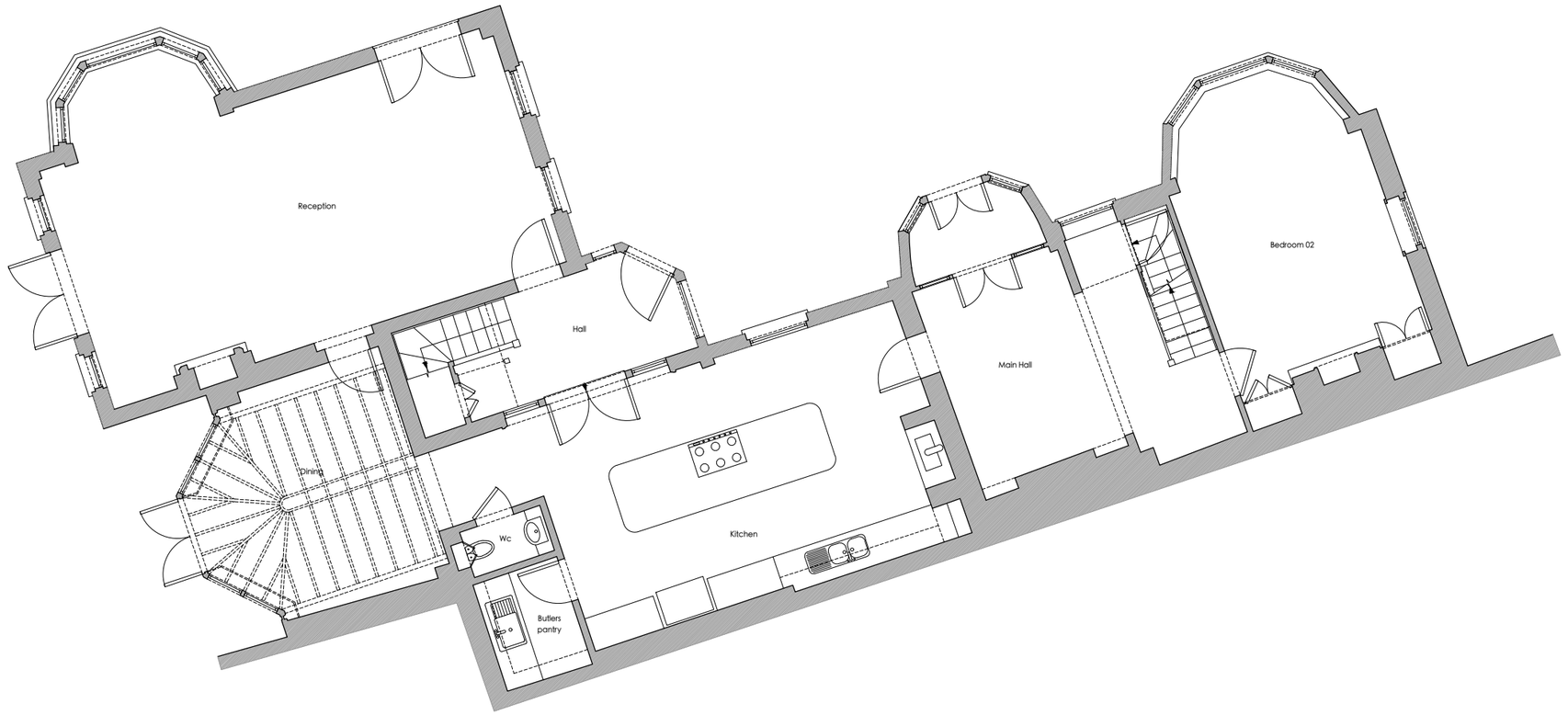

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MH - Existing Ground Floor Plan

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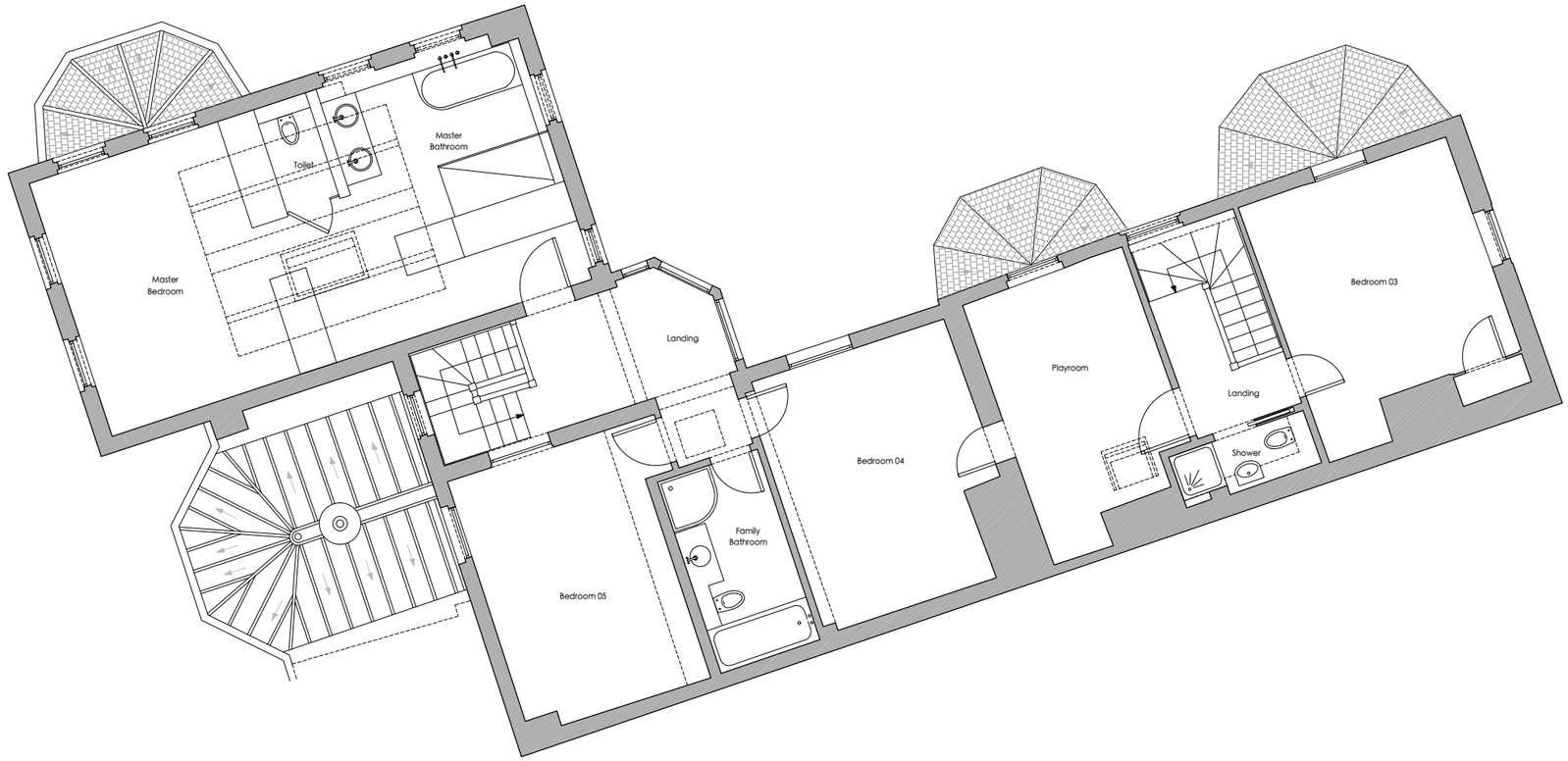

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MH - Existing First Floor Plan

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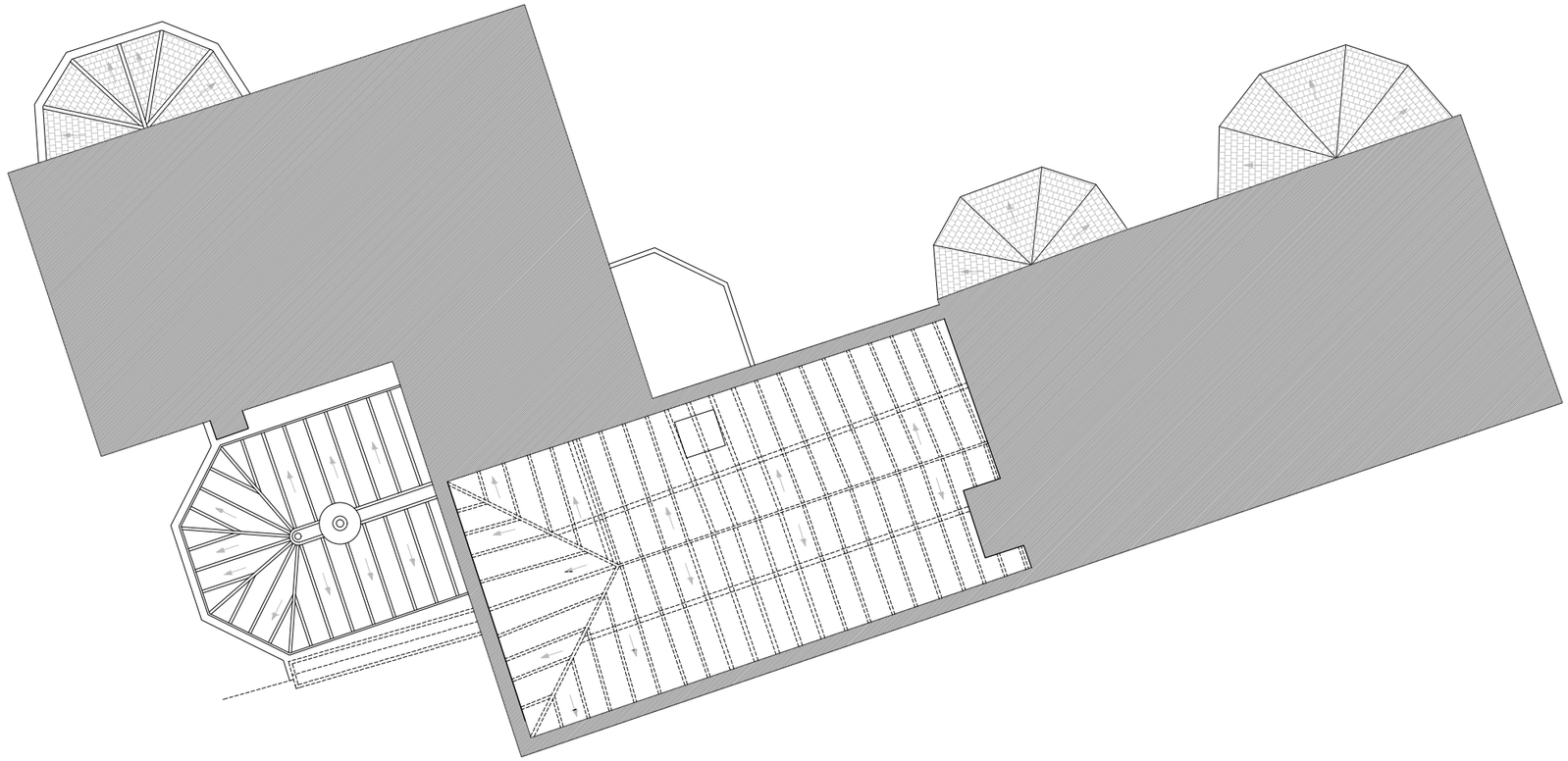

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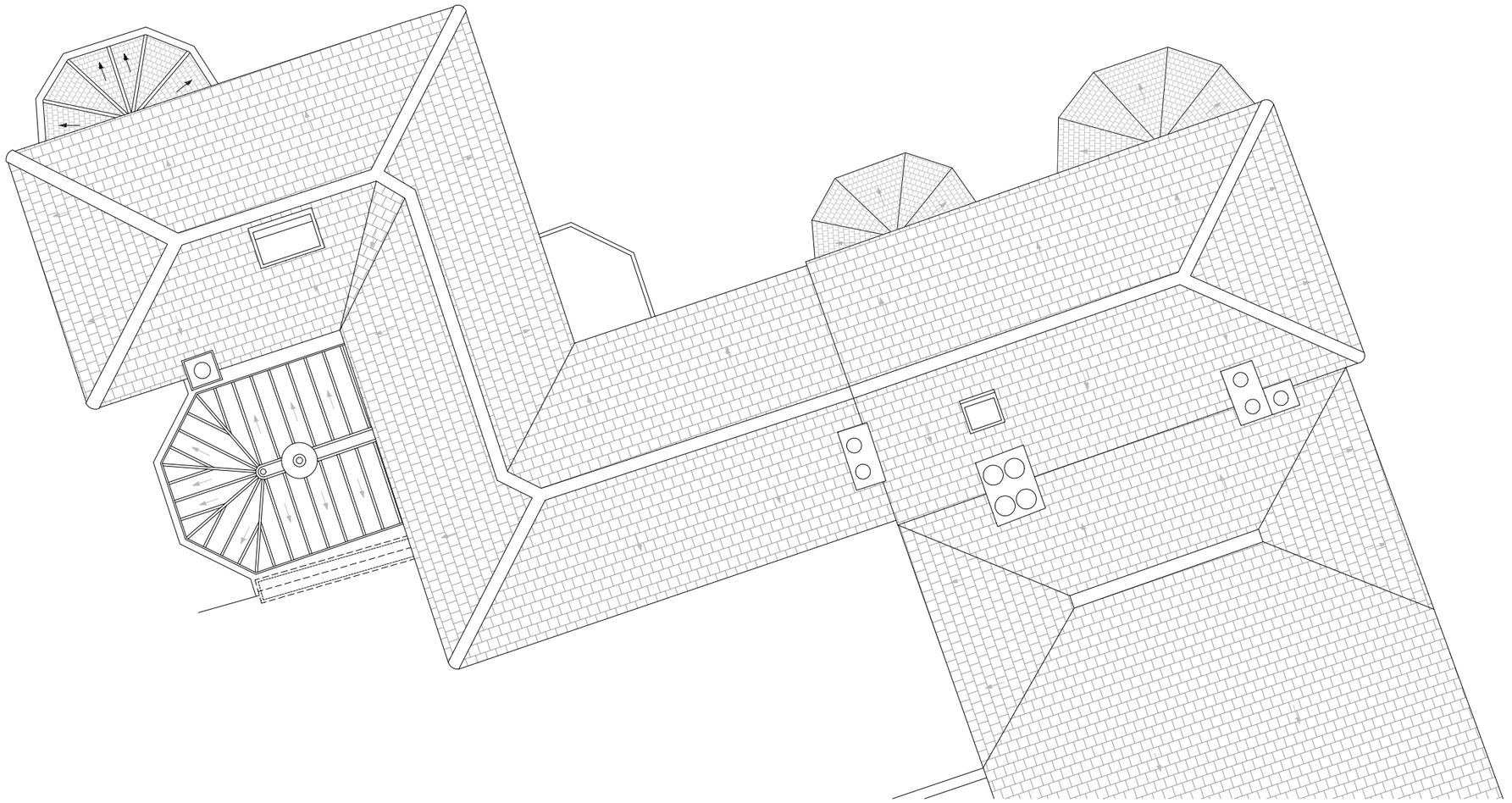

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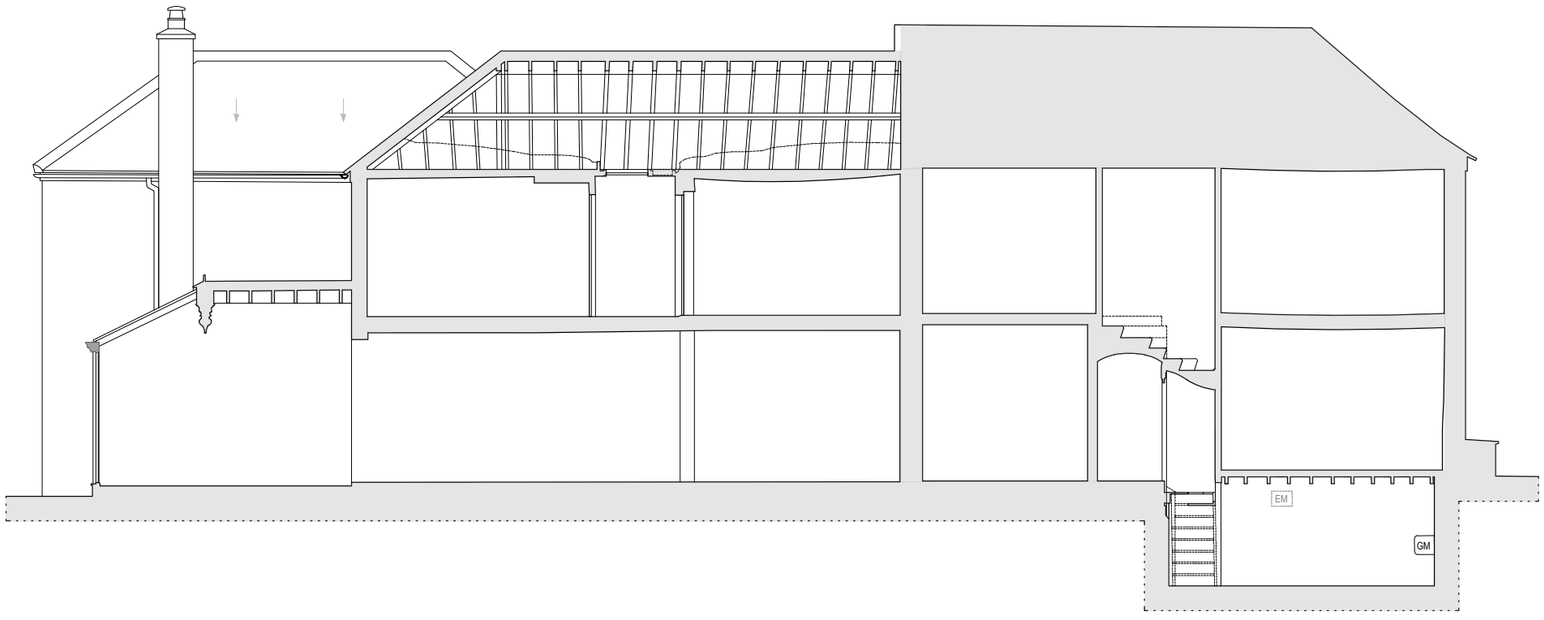

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2038.01.03.Exg.MH.040

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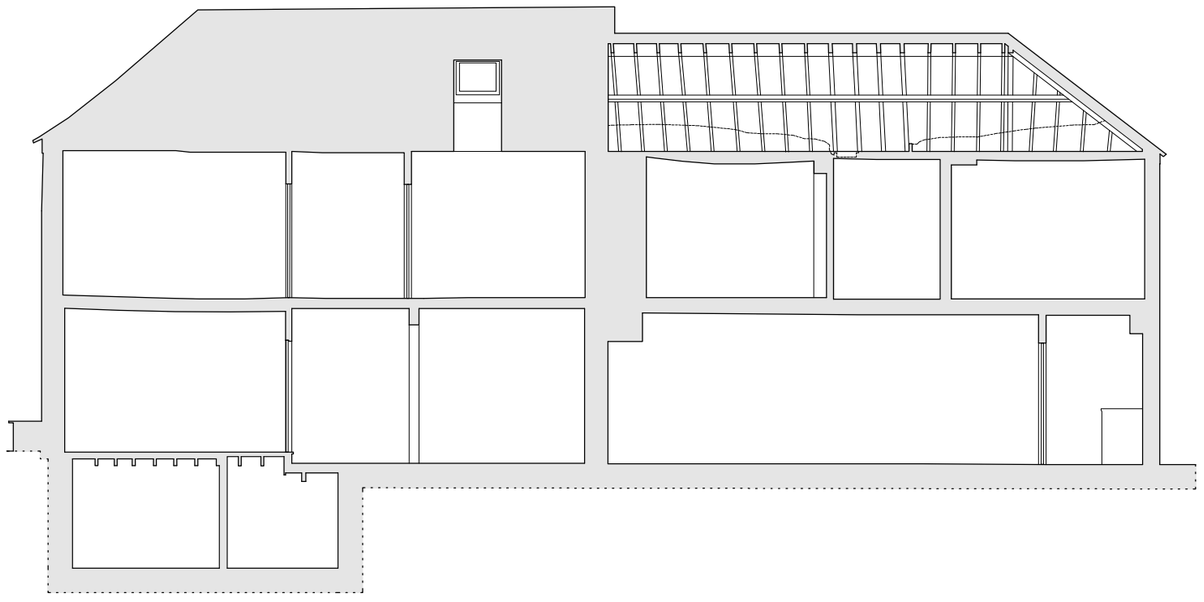

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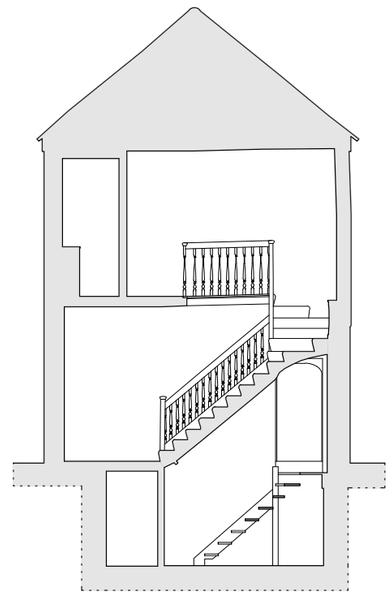

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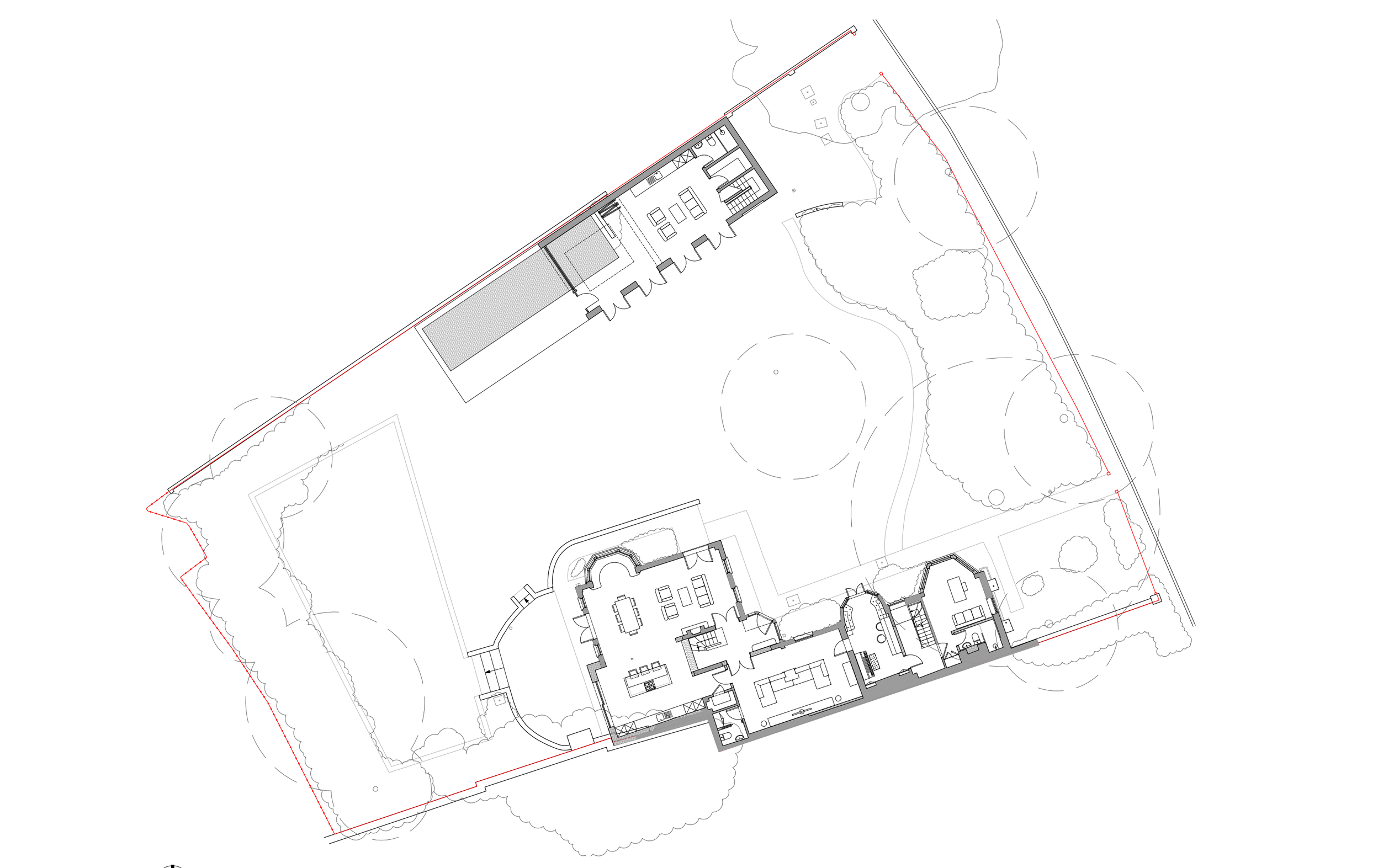

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job title
Navigators House

client
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drawing title
Proposed Site Plan

drawing number
2038.03.03.Pln.002

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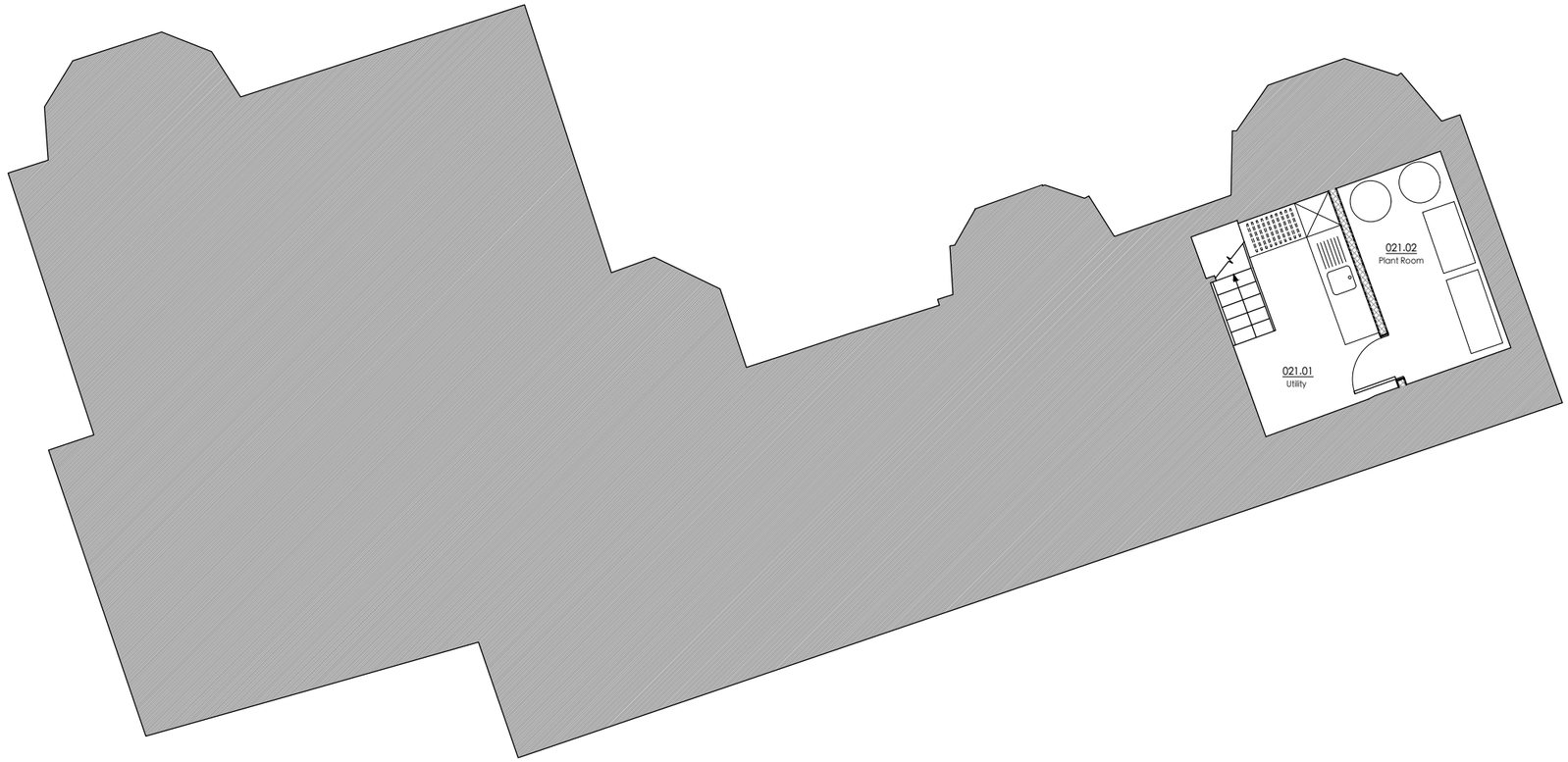

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drawing title
MH - Proposed Basement Floor Plan

drawing number
2038.03.03.Pln.021

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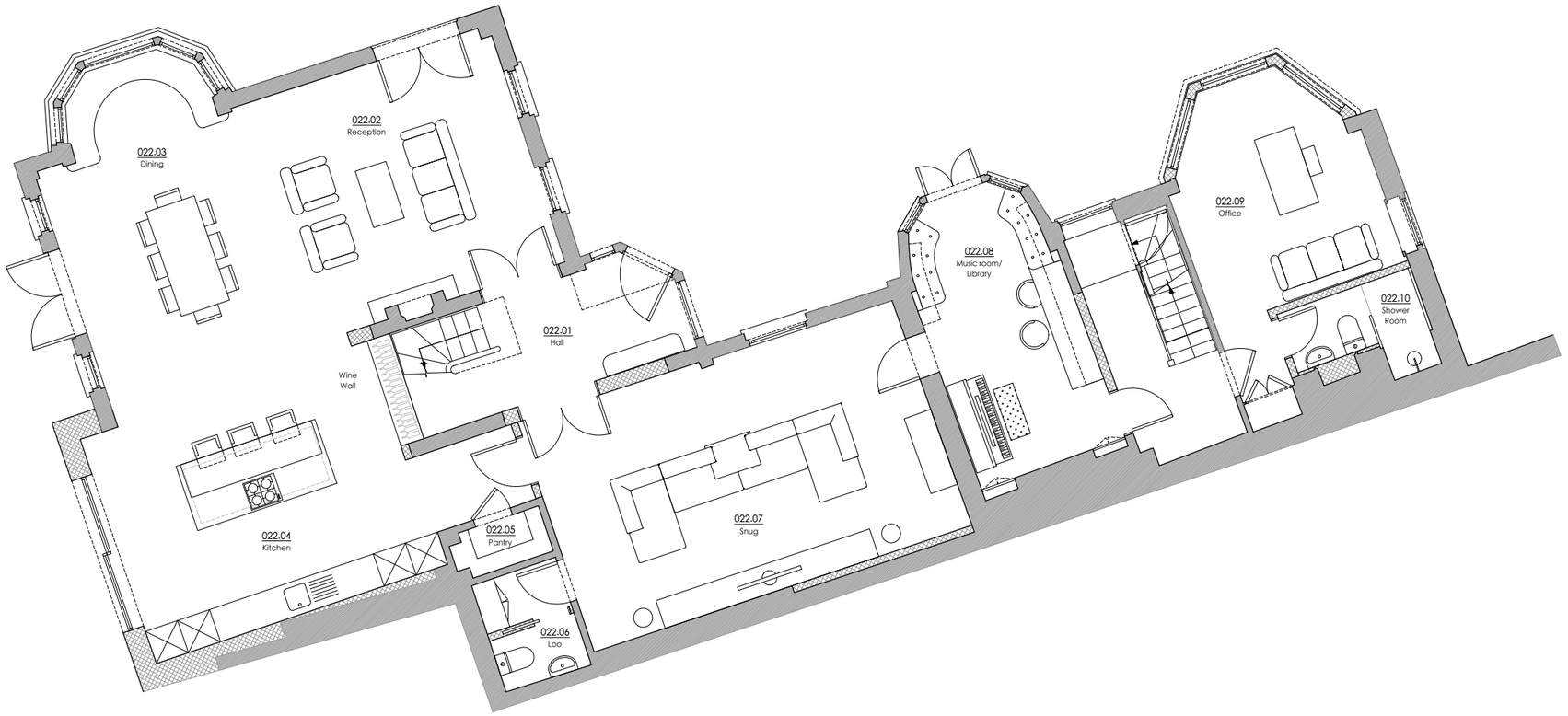

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job title
Navigators House

client
Gareth and Victoria Bradley

drawing title
MH - Proposed Ground Floor Plan

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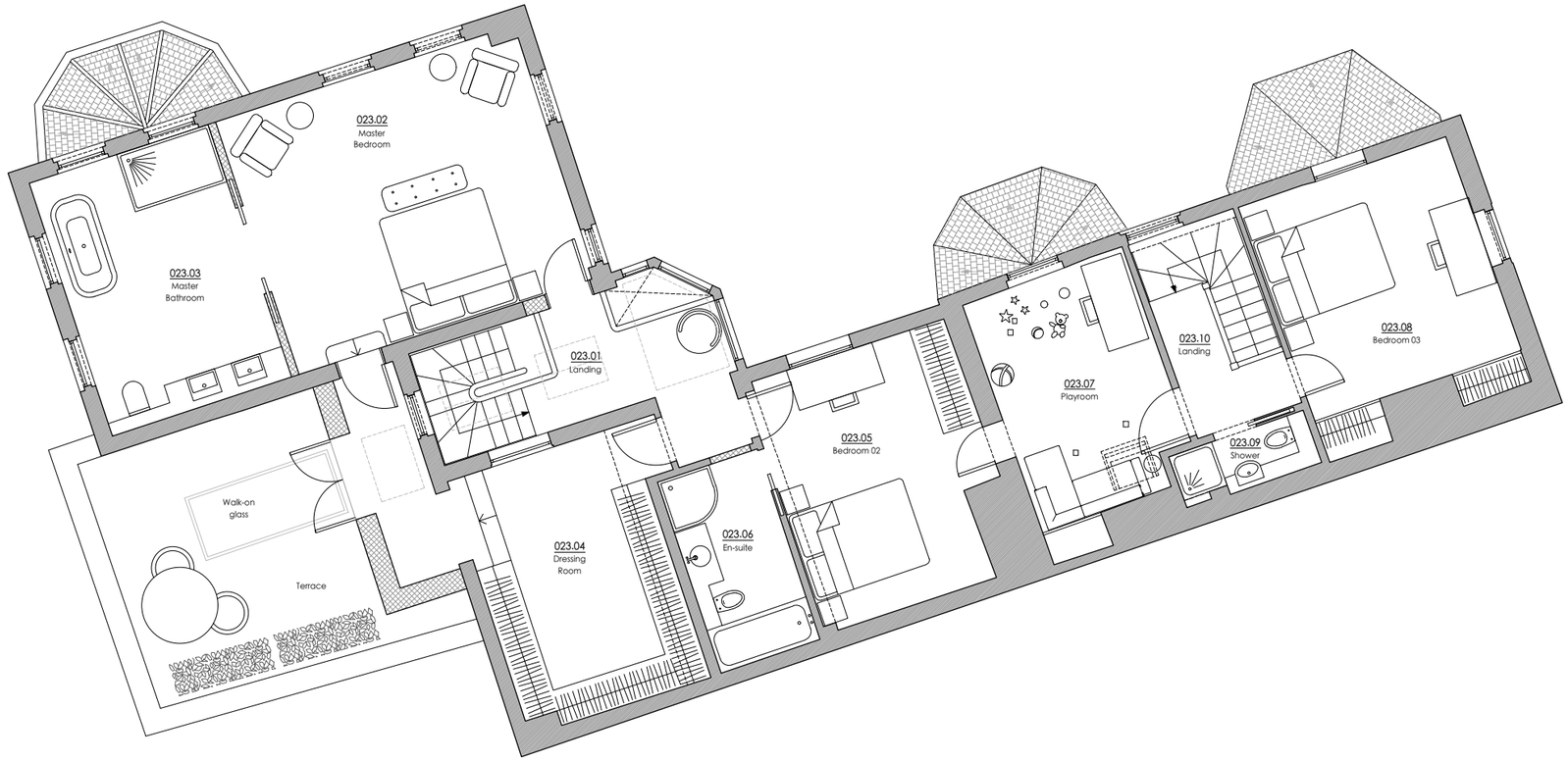

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job title
Navigators House

client
Gareth and Victoria Bradley

drawing title
MH - Proposed First Floor Plan

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2038.03.03.Pln.023

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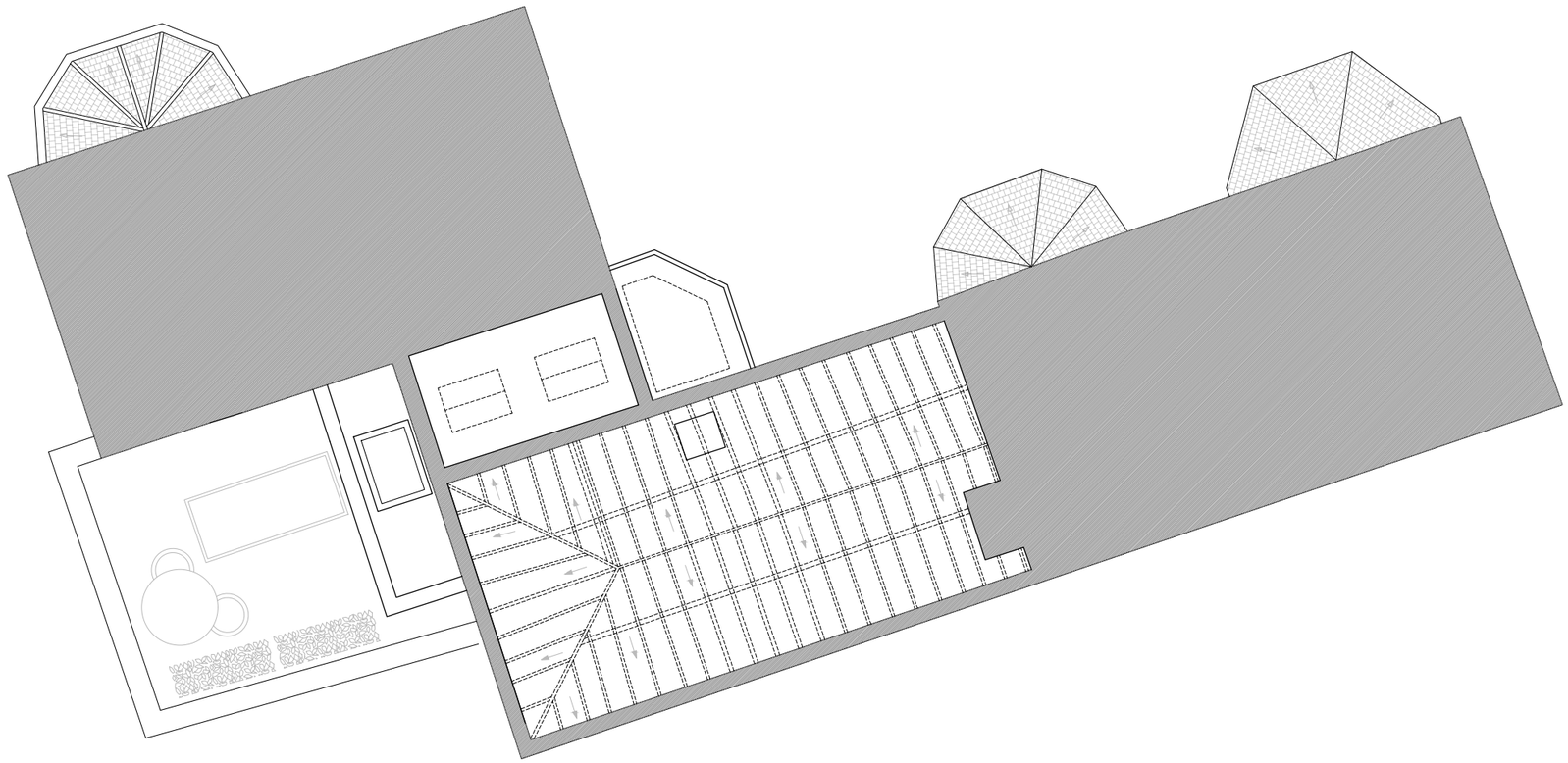

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revisions

job title
Navigators House

client
Gareth and Victoria Bradley

drawing title
MH - Proposed Loft Floor Plan

drawing number
2038.03.03.Pln.024

rev
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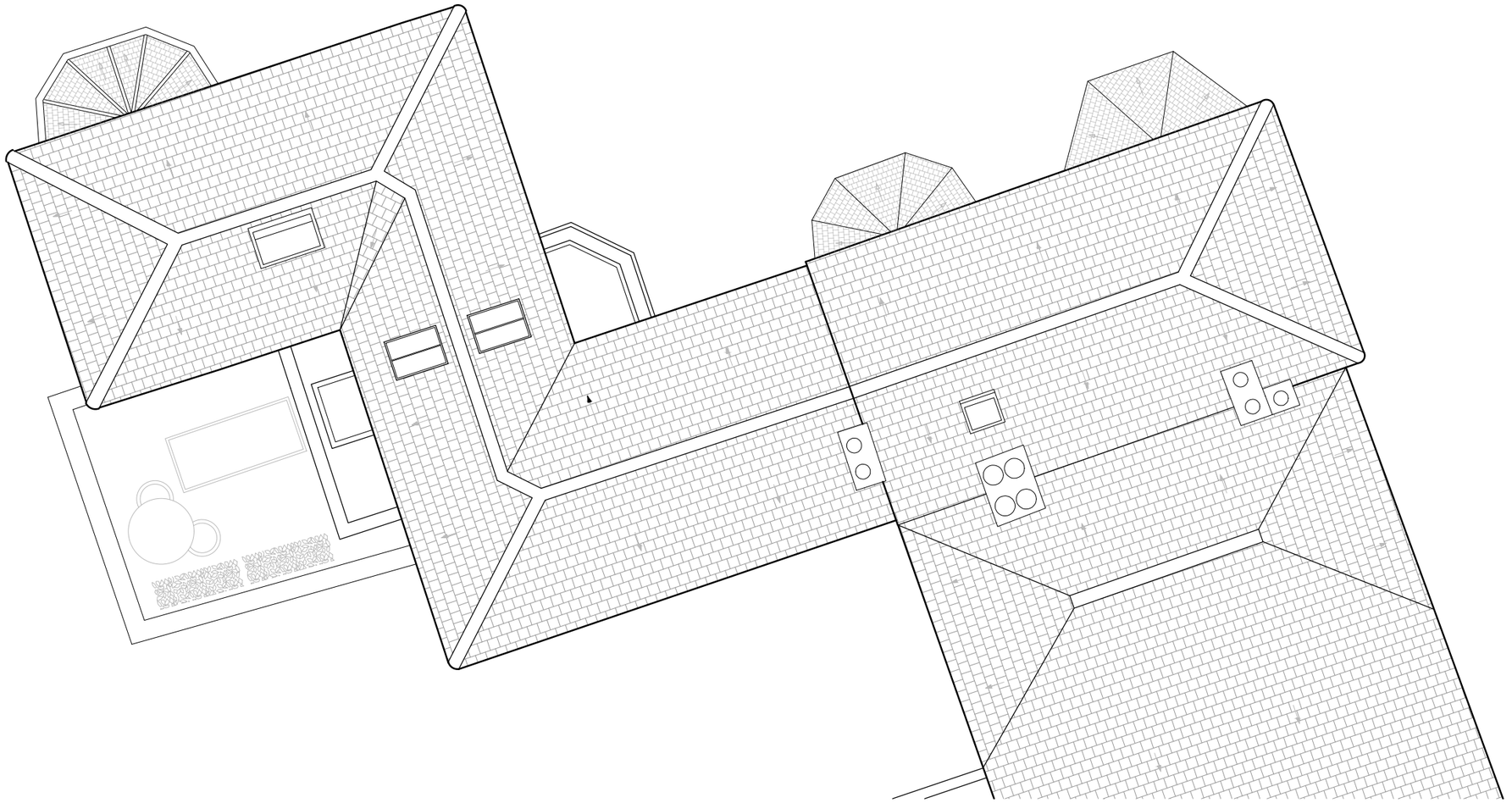

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job title
Navigators House

client
Gareth and Victoria Bradley

drawing title
MH - Proposed Roof Plan

drawing number
2038.03.03.Pln.025

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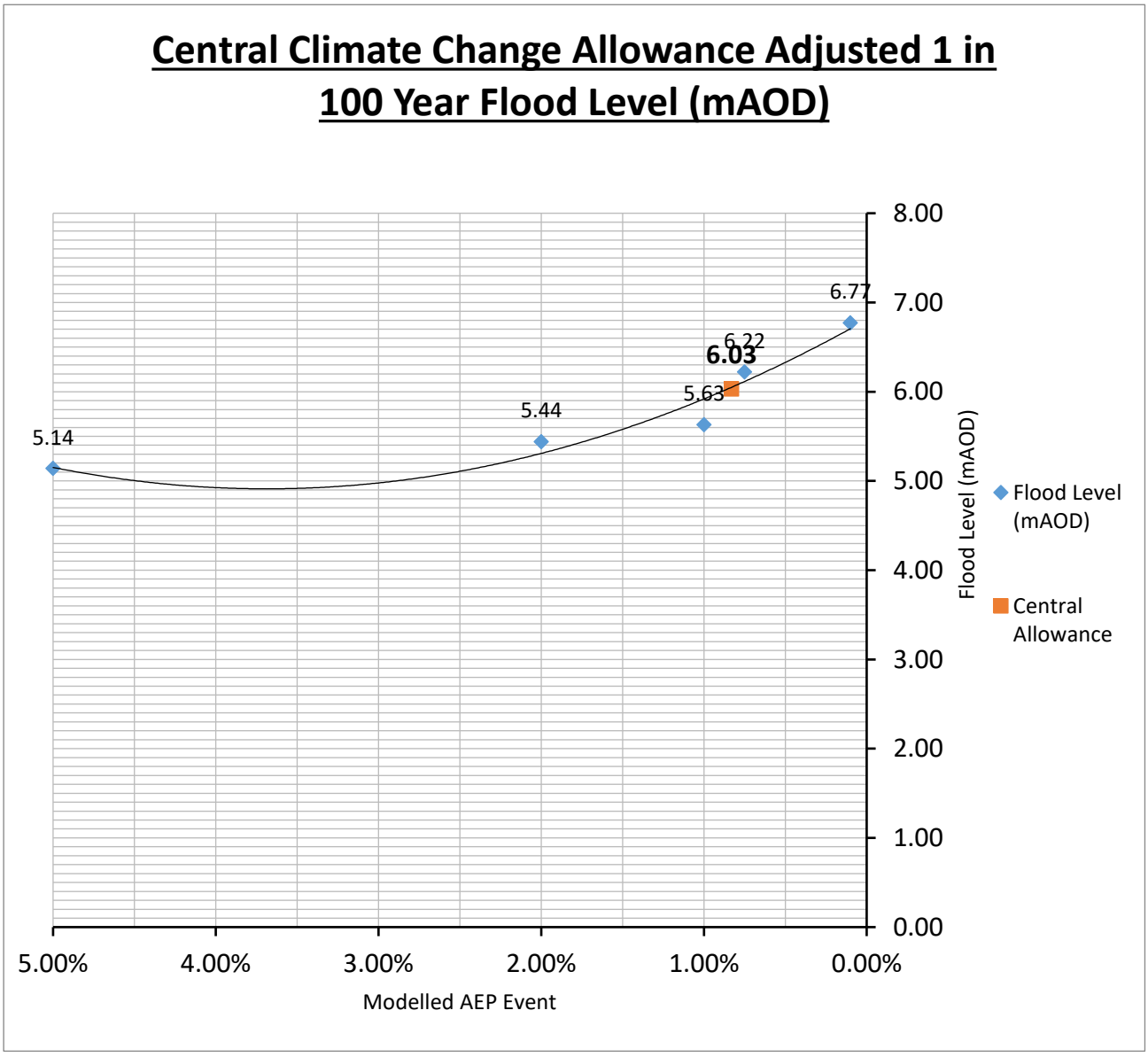
date	Aug 2024
drawn by	VG
checked by	IP

GeoSmart Information

Appendix B

Environment Agency data



GeoSmart Information

Appendix C

Thames Water sewer flooding history

Sewer Flooding
History Enquiry

Property Searches

GeoSmart Information Ltd

Bellstone

Search address supplied	The Navigators House River Lane Richmond TW10 7AG
Your reference	82971
Our reference	SFH/SFH Standard/2024_5033668
Received date	**9 August 2024**
Search date	**9 August 2024**

Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW

searches@thameswater.co.uk
www.thameswater-propertysearches.co.uk

0800 009 4540

Sewer Flooding
History Enquiry

Property Searches

Search address supplied: The Navigators House,River Lane,Richmond,TW10 7AG

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

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

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

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

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

(iv) compensation payments

Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW

searches@thameswater.co.uk
www.thameswater-propertysearches.co.uk

0800 009 4540

Sewer Flooding
History Enquiry

Thames Water Property Searches

History of Sewer Flooding

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

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

For your guidance:

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

Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW

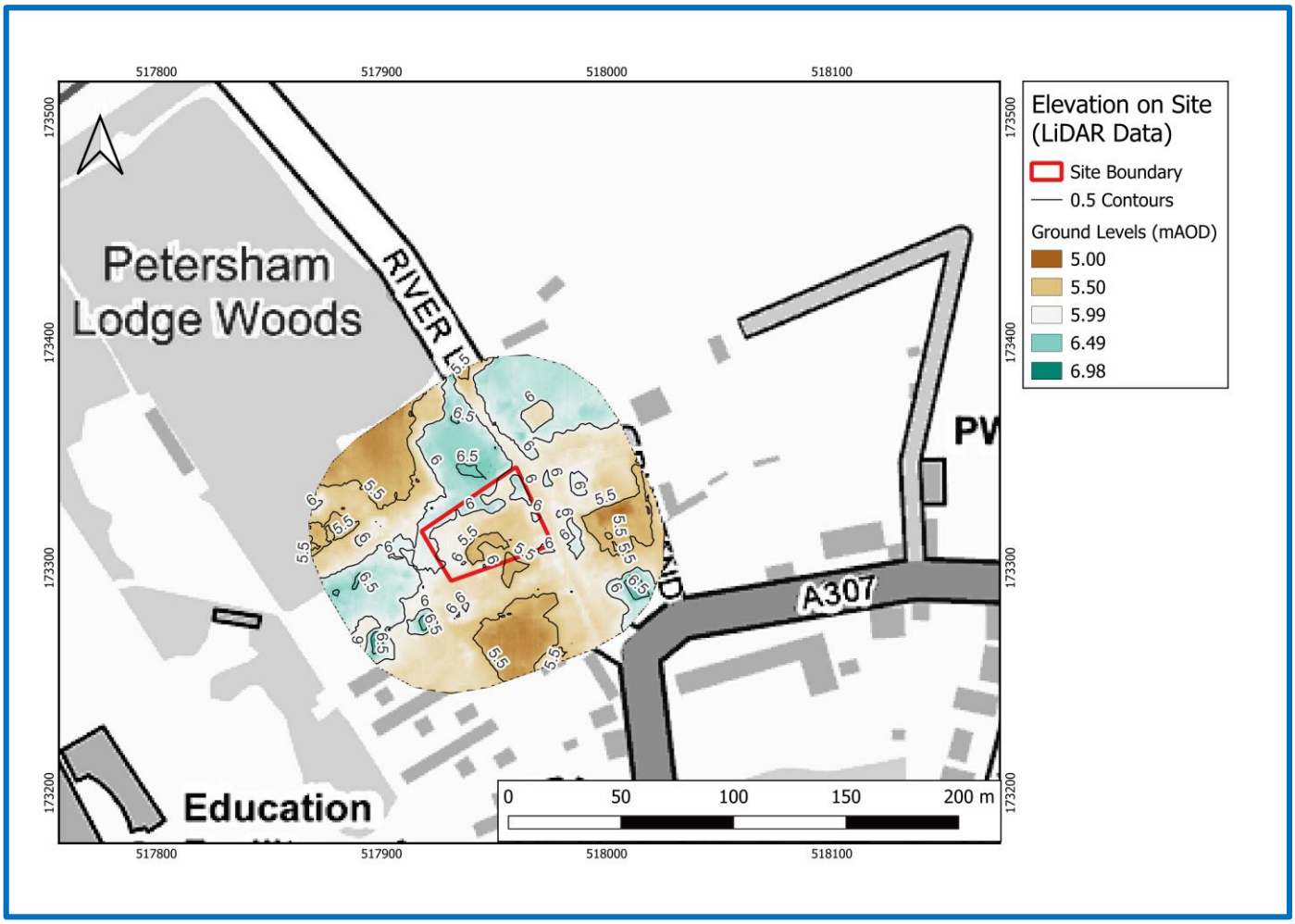
searches@thameswater.co.uk
www.thameswater-propertysearches.co.uk

0800 009 4540

GeoSmart Information

Appendix D

Environment Agency LiDAR ground elevation data



Disclaimer

This report has been prepared by GeoSmart in its professional capacity as soil, groundwater, flood risk and drainage specialists, with reasonable skill, care and diligence within the agreed scope and terms of contract and taking account of the manpower and resources devoted to it by agreement with its client and is provided by GeoSmart solely for the internal use of its client.

The advice and opinions in this report should be read and relied on only in the context of the report as a whole, taking account of the terms of reference agreed with the client. The findings are based on the information made available to GeoSmart at the date of the report (and will have been assumed to be correct) and on current UK standards, codes, technology and practices as at that time. They do not purport to include any manner of legal advice or opinion. New information or changes in conditions and regulatory requirements may occur in future, which will change the conclusions presented here.

This report is confidential to the client. The client may submit the report to regulatory bodies, where appropriate. Should the client wish to release this report to any other third party for that party's reliance, GeoSmart may, by prior written agreement, agree to such release, provided that it is acknowledged that GeoSmart accepts no responsibility of any nature to any third party to whom this report or any part thereof is made known. GeoSmart accepts no responsibility for any loss or damage incurred as a result, and the third party does not acquire any rights whatsoever, contractual or otherwise, against GeoSmart except as expressly agreed with GeoSmart in writing.

For full T&Cs see http://geosmartinfo.co.uk/terms-conditions

Important consumer protection information

This search has been produced by GeoSmart Information Limited, Suite 9-11, 1st Floor, Old Bank Buildings, Bellstone, Shrewsbury, SY1 1HU.

Tel: 01743 298 100

Email: info@geosmartinfo.co.uk

GeoSmart Information Limited is registered with the Property Codes Compliance Board (PCCB) as a subscriber to the Search Code. The PCCB independently monitors how registered search firms maintain compliance with the Code.

The Search Code:

- provides protection for homebuyers, sellers, estate agents, conveyancers and mortgage lenders who rely on the information included in property search reports undertaken by subscribers on residential and commercial property within the United Kingdom.
- sets out minimum standards which firms compiling and selling search reports have to meet.
- promotes the best practice and quality standards within the industry for the benefit of consumers and property professionals.
- enables consumers and property professionals to have confidence in firms which subscribe to the code, their products and services.
- By giving you this information, the search firm is confirming that they keep to the principles of the Code. This provides important protection for you.

The Code's core principles

Firms which subscribe to the Search Code will:

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

GeoSmart Information

Complaints

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

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

TPOs contact details:

The Property Ombudsman scheme

Milford House

43-55 Milford Street

Salisbury

Wiltshire SP1 2BP

Tel: 01722 333306

Fax: 01722 332296

Email: admin@tpos.co.uk

You can get more information about the PCCB from www.propertycodes.org.uk. Please ask your search provider if you would like a copy of the search code

Complaints procedure

GeoSmart Information Limited is registered with the Property Codes Compliance Board as a subscriber to the Search Code. A key commitment under the Code is that firms will handle any complaints both speedily and fairly. If you want to make a complaint, we will:

- Acknowledge it within 5 working days of receipt.
- Normally deal with it fully and provide a final response, in writing, within 20 working days of receipt.
- Keep you informed by letter, telephone or e-mail, as you prefer, if we need more time.
- Provide a final response, in writing, at the latest within 40 working days of receipt.
- Liaise, at your request, with anyone acting formally on your behalf.

If you are not satisfied with our final response, or if we exceed the response timescales, you may refer the complaint to The Property Ombudsman scheme (TPOs): Tel: 01722 333306, E-mail: admin@tpos.co.uk.

We will co-operate fully with the Ombudsman during an investigation and comply with his final decision. Complaints should be sent to:

Martin Lucass

Commercial Director

GeoSmart Information Limited

Suite 9-11, 1st Floor,

Old Bank Buildings,

Bellstone, Shrewsbury, SY1 1HU

Tel: 01743 298 100

martinlucass@geosmartinfo.co.uk

12. Terms and conditions, CDM regulations and data limitations

Terms and conditions can be found on our website:

http://geosmartinfo.co.uk/terms-conditions/

CDM regulations can be found on our website:

http://geosmartinfo.co.uk/knowledge-hub/cdm-2015/

Data use and limitations can be found on our website:

http://geosmartinfo.co.uk/data-limitations/