



Flood Risk Assessment

Former Garage Site, Sullivan Crescent, Harefield

London

19.05.22

The Environmental Protection Group

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CONTENTS

1.	<i>Introduction</i>	4
1.1	Flood Risk Aims	4
1.2	Sources of Information	5
1.3	Sources of Flooding	5
1.3.1	Flooding From Rivers (Fluvial Flooding)	5
1.3.2	Flooding From the Sea (Tidal Flooding)	5
1.3.3	Flooding from Land (Pluvial Flooding)	5
1.3.4	Flooding from Groundwater	6
1.3.5	Flooding from Sewers and Drains	6
1.3.6	Flooding from Other Artificial Sources	6
1.4	Flood Zones & Classification	6
1.5	The Sequential Test, Exception Test and Sequential Approach	8
1.6	Climate Change	8
2.	<i>The Site and Development</i>	10
2.1	Existing Site	10
2.2	Geology	10
2.3	Drainage Infrastructure	10
2.4	Watercourses	11
2.5	Hydrogeology	11
2.6	Proposals	11
3.	<i>Flood Risk Assessment</i>	12
3.1	Flood Zone Allocation	12
3.2	Sequential and Exception Test	12
3.3	Fluvial & Tidal Flooding	12

3.4	Pluvial Flooding	12
3.5	Flooding from Reservoirs, Canals, and other artificial sources	12
3.6	Groundwater Flooding	13
3.7	Sewer and Drain Flooding	13
3.8	Flooding from the Development	13
4.	<i>Assessment of the Impact of the Development to Flood Risk</i>	14
4.1	Safe Access	14
4.2	Loss of Floodplain Storage	14
4.3	Pluvial Flooding	14
4.4	Sustainable Drainage Strategy	14
4.5	Maintaining Flow Paths	16
5.	<i>Conclusion</i>	17

Appendices

Appendix A – Site Location Plan

Appendix B – Midland Survey Ltd Utilities Plan

Appendix C – Proposed Site Plan

Appendix D – The Environment Agency Flood Maps

Appendix D – Thames Water Asset Search

SUMMARY

Site Location	Sullivan Crescent, Harefield, UB9 6NL. OS: TQ 05877 90419
Proposed Development	Residential Development
Vulnerability Classification	More Vulnerable
Climate Change	Allow 40% increase in rainfall intensity
Flood Zone	Flood Zone 1
Tidal Flooding	Low and acceptable risk
Fluvial Flooding	Low and acceptable risk
Pluvial Flooding	Low and acceptable risk with suitable mitigation measures to maintain existing flow paths
Groundwater Flooding	Low and acceptable risk
Sewer Flooding	Low and acceptable risk
Reservoirs, Canal & Artificial Sources	Low and acceptable risk
Flooding from the Development	Low and acceptable risk with the provision of an appropriate SuDS with a 40% allowance for climate change on the 1in100 year event
Ground Conditions	Made Ground, Clay, Silt, Sand and Gravel
Surface Water Drainage Proposals	Provision of an appropriate SuDS with a 40% allowance for climate change on the 1in100 year event.
Flood Risk Vulnerability and Flood Zone Compatibility	Site is within Flood Zone 1 therefore the development is identified as acceptable.
Sequential & Exception Test	N/A
Additional Mitigation Measures	Mitigation measure in order to maintain existing flow paths.
Conclusions & Recommendations	The conclusion of the report is that the scheme should be approved with appropriate conditions to be addressed as part of a detailed design.

1. INTRODUCTION

The London Borough of Hillingdon has appointed The Environmental Protection Group Ltd (EPG) to provide a Flood Risk Assessment (FRA) for the proposed residential development at Sullivan Crescent, Harefield, London, UB9 6NL, on the site of a former garage. An FRA has been requested by the Planners as the site is prone to surface water flooding. The FRA shall review mitigation measures to prevent surface water flood risk on-site and offsite.

1.1 Flood Risk Aims

The key aims of this flood risk assessment are to:

- Assess the flood risk to the development and to demonstrate the feasibility of designing the development so that the risk of flooding is acceptable.
- Assess the potential impact of the development on flood risk elsewhere and demonstrate that this can be mitigated by using sustainable drainage systems to drain the site.
- Satisfy the requirements of the National Planning Policy Framework.

This assessment has been carried out in accordance with the National Planning Policy Framework (NPPF). The aim of the NPPF is to ensure that flood risk is taken into account at all stages in the planning process and to direct development run-off away from the areas at highest risk. Where new development is necessary in such areas, policy aims to make it safe without increasing flood risk elsewhere and where possible to reduce flood risk overall.

Further regional and local planning policies which apply to this area include:

- West London Strategic Flood Risk Assessment, January 2017
- London Borough of Hillingdon Local Flood Risk Management Strategy, 2015
- London Borough of Hillingdon Surface Water Management Plan
- London Borough of Hillingdon Minor Development Flood Risk Assessment Requirements
- The London Plan, March 2021
- Thames Catchment Flood Management Plan, December 2009
- Thames River Basin District Flood Risk Management Plan, March 2016
- Sustainable Design and Construction - Supplementary Planning Guidance, April 2014.

These documents have been referred to and their guidance incorporated into the development proposals where appropriate.

1.2 Sources of Information

EPG have received and reviewed the following documents from the client:

- 01 Site Location Plan-A4 Portrait
- 02 Existing Site Plan and Topo Survey-A3 Landscape
- 03 – Sullivan Crescent Proposed Site Plan-A3 Landscape
- 04 – Proposed Semi-Detached Plans and Roof Plan-A3 Landscape
- 05 – Proposed Elevations Plot 1 to 4
- 06 – Proposed Plans Plot 5 and 6
- 07 Proposed Elevations Plot 5 and 6
- Design and Access Statement Former Garage Site RO Sullivan Crescent – 050222
- F01 Site and Topo Survey with Building Footprints – A1-Landscape
- FD01 TYPICAL FOUNDATION DETAILS – A1-Landscape-A3 Landscape
- Geology report 2011
- GIS Planning Surface Water Flooding Map
- U03102
- U03254 – utilities survey

1.3 Sources of Flooding

The NPPF requires an assessment of flood risk to consider all forms of flooding and lists six forms of flooding that should be considered as part of a flood risk assessment. These forms of flooding are listed in below, along with an explanation of each form of flooding.

1.3.1 Flooding From Rivers (Fluvial Flooding)

Watercourses flood when the amount of water in them exceeds the flow capacity of the river channel. Flooding can either develop gradually or rapidly, depending on the characteristics of the catchment. Land use, topography and the development can have a strong influence on flooding from rivers.

1.3.2 Flooding From the Sea (Tidal Flooding)

Flooding to low-lying land from the sea and tidal estuaries is caused by storm surges and high tides. Where tidal defences exist, they can be overtopped or breached during a severe storm, which may be more likely with climate change.

1.3.3 Flooding from Land (Pluvial Flooding)

Intense rainfall, often of short duration, that is unable to soak into the ground or enter drainage systems can run quickly off land and result in local flooding. In developed areas, this flood water can be polluted with domestic sewage where foul sewers surcharge and overflow. Local topography and built form can have a strong

influence on the direction and depth of flow. The design of development down to a micro-level can influence or exacerbate this. Overland flow paths should be taken into account in spatial planning for urban developments. Flooding can be exacerbated if development increases the percentage of impervious area.

1.3.4 Flooding from Groundwater

Groundwater flooding can occur from three main sources:

- raised water tables;
- seepage; and
- percolation and groundwater recovery or rebound.

Groundwater flooding occurs when groundwater levels rise above ground levels. Groundwater flooding is most likely to occur in low-lying areas underlain by permeable rocks (aquifers). Chalk is the most extensive source of groundwater flooding.

1.3.5 Flooding from Sewers and Drains

In urban areas, rainwater is frequently drained into sewers. Flooding can occur when sewers are overwhelmed by heavy rainfall or become blocked. Sewer flooding continues until the water drains away.

1.3.6 Flooding from Other Artificial Sources

Non-natural or artificial sources of flooding can include reservoirs, canals and lakes. Reservoir or canal flooding may occur as a result of the facility being overwhelmed and/or as a result of dam or bank failure.

1.4 Flood Zones & Classification

For river and tidal flooding, the NPPF uses four Flood Zones to characterise flood risk. These Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences, and are detailed in Table 1.

Table 1 NPPF Flood Zones

Flood Zone	Definition
1	Low probability (less than 1 in 1,000 annual probability of river or sea flooding in any year (<0.1%))
2	Medium probability (between 1 in 100 and 1 in 1,000 annual probability of river flooding (1%-0.1%) or between 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5%-0.1%) in any year).
3a	High probability (1 in 100 or greater annual probability of river flooding (>1%) in any year or 1 in 200 or greater annual probability of sea flooding (>0.5%) in any given year).
3b	Functional floodplain. This zone comprises land where water has to flow or be stored in times of flood. Land which would flood with an annual probability of 1 in 20 (5%), or is designed to flood in an extreme flood (0.1%) should provide a starting point for discussions to identify functional floodplain.

The NPPF classifies the vulnerability of developments to flooding into five categories. These categories are detailed in Table 2. Based on the vulnerability of a development, the NPPF states within what Flood Zone(s) a development is appropriate. The flood risk vulnerability and Flood Zone ‘compatibility’ of developments is summarised in Table 3.

Table 2 Vulnerability Classification

Flood Risk Vulnerability Classification	Examples of Development Types
Essential Infrastructure	Transport Infrastructure Utility Infrastructure (e.g. water treatment works and wind turbines)
Water Compatible	Flood Control Infrastructure Water and Sewerage Infrastructure Navigation Facilities Water Based Recreation
Highly Vulnerable	Emergency Services Basement Dwellings Mobile home parks
More Vulnerable	Hospitals and other health services Residential Establishments Educational Establishments
Less Vulnerable	Commercial Establishments (e.g. shops, restaurants and offices)

Table 3 Development Compatibility

Flood Risk Vulnerability Classification	Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone 1	✓	✓	✓	✓	✓
Flood Zone 2	✓	✓	Exception test required	✓	✓
Flood Zone 3a	Exception test required	✓	x	Exception test required	✓
Flood Zone 3b	Exception test required	✓	x	x	x

✓ Development is appropriate x Developments should not be permitted

1.5 The Sequential Test, Exception Test and Sequential Approach

The Sequential Test is a risk-based test that should be applied at all stages of development and aims to steer new development to areas with the lowest probability of flooding (Zone 1). This is applied by the Local Planning Authority by means of a Strategic Flood Risk Assessment (SFRA). The SFRA and the NPPF may require the Exception Test to be applied to certain forms of new development. The test considers the vulnerability of the new development to flood risk and, to be passed, must demonstrate that:

- There are sustainability benefits that outweigh the flood risk and;
- The new development is safe and does not increase flood risk elsewhere.

The Sequential Approach is also a risk-based approach to development. In a development site located in several Flood Zones or with other flood risks, the sequential approach directs the most vulnerable types of development towards the areas of least risk within the site.

1.6 Climate Change

The NPPF makes it a planning requirement to account for climate change in the proposed design. The recommended allowances are summarised in Table 4 below (Sourced from the Environment Agency).

Table 4 Peak rainfall intensity allowance in small and urban catchments (use 1961 to 1990 baseline)

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper end	10%	20%	40%
Central	5%	10%	20%

2. THE SITE AND DEVELOPMENT

2.1 Existing Site

The existing site is brownfield land and the location of a former garage, approximately 0.5km east of the centre of Harefield. The former garage buildings have been demolished to their concrete base and is now surrounded by either a chain-link fence or a timber fence. The site is accessed from Sullivan Crescent to the northwest of the site.

The site is surrounded by residential housing to the north, south and west and by public open space to the east. A farmer's track runs parallel to the eastern boundary of the site. The site is flat and level at an elevation of 85m above Ordnance Datum (OD). The total site area has been measured as 0.1525 ha.

The site location plan is located within Appendix A.

2.2 Geology

British Geological Survey (BGS) maps show that the underlying bedrock geology is noted to be of the London Clay Formation described as Clay and Silt. The Sedimentary Bedrock formed approximately 48 to 56 million years ago in the Palaeogene Period. The local environment previously dominated by deep seas.

The superficial deposits are described as the Gerrards Cross Gravel Formation sand and gravel, locally with lenses of silt, clay or peat and organic material. The superficial deposits in this area are on average 4m thick.

During borehole testing undertaken by JNP Group groundwater was encountered at depths of 1.10m and 1.00m bgl.

Percolation rates on site will be low due to the geology being clay and silt, combined with the shallow groundwater depths indicate that infiltration as a means of discharge shall not be feasible.

The Envirocheck Report discussed in detail in JNP Group's Desk Top Study and Geoenvironmental Investigation Report identifies no natural or mining cavities within 1km of the site.

2.3 Drainage Infrastructure

The utilities survey undertaken by Midland Survey Ltd highlighted a number of surface water pipes running through the site. A surface water manhole is located in the southern half of the site into which connects a 300mmØ pipe from the north west and a 450mmØ pipe from the north east. Surface water then leaves this manhole towards the south east via 450mmØ pipework. Two gullies located close to the access road of the site collect surface water and direct it towards three manholes on the boundary of the site. Water is then conveyed into the 450mmØ pipework running south west into the manhole in the southern half of the site.

Midland Survey Ltd's utilities survey can be found in Appendix B.

2.4 Watercourses

There are no water courses located close to the development site. The site is not located with a Critical Drainage Area.

2.5 Hydrogeology

The Environment Agency maps show that the site is not situated over any groundwater source protection zones. DEFRA Magic Maps note that the superficial aquifer designation is Secondary A. The maps show that the bedrock aquifer designation is Unproductive.

2.6 Proposals

The proposal for the site is to construct 6no. two-storey residential properties, each with car parking and front and rear gardens. The development shall have permeable pavers with road, parking bays and paths in contrasting coloured pavers with road markings as required.

An eight-bay car park shall be edged with soft planting and contain electric vehicle chargers.

The architect's proposed site plan can be found in Appendix C.

3. FLOOD RISK ASSESSMENT

3.1 Flood Zone Allocation

The Environment Agency (EA) Flood map for planning (Appendix D - Figure 1.0) indicates that the development site is entirely within in a Zone 1 flood risk area (i.e., there is little or no flood risk).

In accordance with Table 2 of the flood risk vulnerability classification of the technical guidance to the NPPF, the development would be classed as More Vulnerable. The flood risk vulnerability table (Section 1.3 - Table 3) indicates that if the Residential development is located in Flood Zone 1 and is More Vulnerable the development can be considered appropriate for the site.

3.2 Sequential and Exception Test

As the development is considered to be located within Flood Zone 1 the Sequential test is not required. The development compatibility table shows that the development does not require the Exception test applying.

3.3 Fluvial & Tidal Flooding

Appendix D – Figure 2.0 indicates that the site is not susceptible to fluvial and/or tidal flooding. The SFRA does not indicate any historic fluvial or tidal flooding within 0.5km of the development site. As the development site is in Flood Zone 1, the risk is deemed low and acceptable.

3.4 Pluvial Flooding

The Environment Agency Pluvial Flood Risk is shown in Appendix D – Figure 3.0 – 3.6. The maps indicates that part of the development site is at low risk of flooding from overland sources. A flow path comes from Sullivan Crescent, across the site and out onto the public open space to the east. This results in a flood depth of less than 300mm. This flooding is most likely to be due to highway incapacity/maintenance issues.

The SFRA or Surface Water Management Plan do not indicate any historic pluvial flooding within 0.5km of the development site.

The site is not located within any Critical Drainage Areas.

With adequate mitigation measures to reduce flooding and maintain the existing flow path across the site, the flood risk from pluvial sources would be deemed low and acceptable.

3.5 Flooding from Reservoirs, Canals, and other artificial sources

The Environment Agency Reservoir Flood Map in Appendix D – Figure 4.0 shows that the site is outside the zone of influence should a reservoir fail. Desktop study shows that there are no other artificial sources close to the

development which could present a flood risk. Flood risk from reservoirs, canals and other artificial sources is therefore deemed low and acceptable.

3.6 Groundwater Flooding

The Environment Agency Ground Water Vulnerability map shows that the land below the development is unproductive with regards to groundwater, see Appendix D - Figure 5.0 Ground Water map. The EA Aquifer Map extract in Appendix D - Figure 5.1 notes that the superficial aquifer designation is Secondary A (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). Appendix D - Figure 5.2 shows that the bedrock aquifer designation is Unproductive.

Further groundwater monitoring should be undertaken to establish local ground water depths across the site prior to construction.

It should be noted that the SFRA does not specifically highlight any flood risk in relation to groundwater flooding within 0.5km of the site location.

The risk of groundwater flooding therefore deemed low and acceptable.

3.7 Sewer and Drain Flooding

The closest drainage infrastructure is multiple surface water sewer pipes which run across the site, previously described in Section 2.3. No information on sewer or drain flooding has been found at the development location in the SFRA, PFRA or Flood Risk Management Strategy. Flood risk from Sewer and Drain flooding is therefore deemed low and acceptable.

3.8 Flooding from the Development

The new development is proposed to have a smaller impermeable area than the existing site, which is predominately concrete and tarmac surfacing. However, incorporating a Sustainable Urban Drainage System (SUDS) will control all runoff associated with the proposed development. A proposed system would allow interception of overland flow via a series of filter drains. An allowance for 40% additional flow for Climate change should be added to any design calculations. With the production of a suitable drainage strategy for the development the risk of flooding from the development would be deemed low and acceptable.

4. ASSESSMENT OF THE IMPACT OF THE DEVELOPMENT TO FLOOD RISK

Development Considerations

In accordance with the NPPF guidance, the development will need to demonstrate that it will:

- Remain operational and safe for users in times of flood;
- Result in no net loss of floodplain storage; and
- Not impede water flows and not increase flood risk elsewhere.

4.1 Safe Access

The NPPF states that the development must provide safe access and egress during a flood event. During low risk fluvial events, the site access is shown to be flooded by less than 300mm of water. The setting of Finished Floor Levels (FFLs) 150mm above adjacent external levels and providing external falls away from the proposed buildings in accordance with building regulations Part H will further safeguard the properties and residents from pluvial flooding. Where the above is not achievable, threshold drains will be provided where necessary to prevent the ingress of surface water into the building footprint. As outlined in section 3.4 the overall flood risk to the site is considered to be low, with depths of less than 300mm that will not impede safe access and egress during a flood event and will be further mitigated by the development proposals and implementation of a sustainable drainage system.

Should the area in which the development is sited be reclassified by the Environment Agency to be within Flood Zones 2 or 3 it is recommended that the facilities management team sign up to the Environment Agency's Flood Line Warnings Direct Service.

4.2 Loss of Floodplain Storage

As the site is located within Flood Zone 1 no loss of active floodplain will occur as a result of the development.

4.3 Pluvial Flooding

Pluvial flooding is most likely due to highway incapacity/maintenance issues. By reducing the impermeable area on the existing site as a result of the development and introducing a sustainable drainage system, particularly the permeable paving, this will further mitigate against existing pluvial flooding.

4.4 Sustainable Drainage Strategy

The NPPF requires that surface water arising from a developed site should as far as practicable be managed in a sustainable manner to mimic the surface water flows arising from the site prior to re-development. Opportunities to reduce the surface water run-off and the associated flood risk should be identified and climate change should be considered. Building Regulations (Part H), the NPPF and Environment Agency advice notes require the consideration of sustainable drainage techniques for new developments. Surface water drainage

should be considered in accordance with a prescribed hierarchy aimed at minimising the impact of the development.

Surface water flows should be designed to discharge to:

1. Infiltration based systems e.g., soakaways / porous pavements etc.
2. Watercourses
3. Surface water sewers
4. Combined water sewers

Discharge via infiltration

Infiltration rates will be negligible due to the underlying geology. Along with the presence of shallow groundwater discharge via infiltration is not deemed feasible.

Discharge to a watercourse

There are no watercourses surrounding the development. Therefore, discharge to a watercourse is not possible.

Discharge to a surface water sewer

Discharge from the site should be restricted as to provide a betterment to the existing brownfield runoff rate.

Table 6 SUDS Checklist

SUDS Feature	Applicability
Pond/Basin	N
Permeable Paving	Y
Reservoir Paving	Y
Green Roof	N
Blue Roof	N
Infiltration Features	N
Tank Systems (e.g., cellular systems)	Y
Filter Drains and/or Swales	Y

Table 6 lists various SUDS features and their applicability for use within the proposed development. Some of the features are not practical to construct within the site or do not form part of the building design.

Further information is required from the client in order to formalise a SUDS strategy.

4.5 Maintaining Flow Paths

There is currently a flow path that cuts across the site from Sullivan Crescent and onto the public open space to the east. Work shall be required in order to maintain this flow path. Alternatively, the drainage system for the site could be designed to accommodate the surface water that flows from Sullivan Crescent onto the site during the extreme events.

5. CONCLUSION

The site is located within Flood Zone 1 and the proposed use is appropriate for development of the site.

This report has considered all potential sources of flooding to the site, including sea, rivers, groundwater, land, existing sewers, artificial sources and the proposed development.

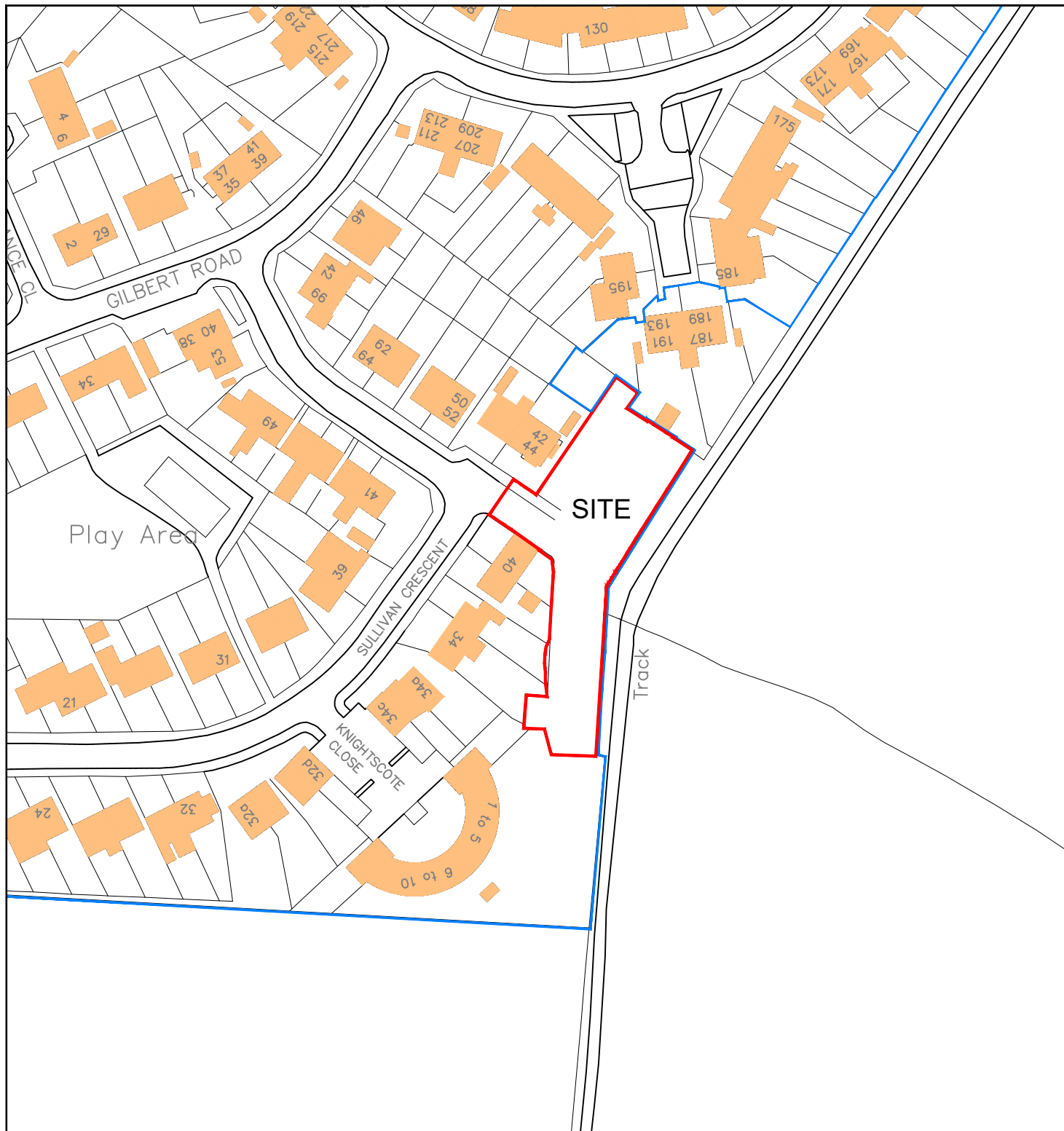
The site is not susceptible to groundwater flooding; however, further monitoring boreholes will need to be carried out to establish the groundwater levels prior to construction.

A drainage strategy needs to be produced in order to demonstrate the development will provide a betterment on the existing brownfield runoff rate.

A mitigation measure needs to be put in place to maintain the surface water flow path that cuts across the site. Alternatively, the drainage system for the site could be designed to accommodate the surface water that flows from Sullivan Crescent onto the site during the extreme events.

Overall, this report demonstrates that with a suitable drainage strategy and a suitable mitigation measure to maintain the existing surface water flow path, the flood risk to the site is low, reasonable and acceptable.

Appendix A – Site Location Plan



SITE AREA = 1525m², 0.1525ha



HILLINGDON
LONDON

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NOTES: - DO NOT SCALE FROM THIS DRAWING. The Contractor must verify all dimensions at the site before setting out, commencing work, or making any shop drawings. Any discrepancies must be reported to the Contract Administrator before proceeding.

Rev	Revision notes	Initials	Date
-	-	-	-
Project FORMER GARAGE SITE, SULLIVAN CRESCENT, HAREFIELD, UB9 6NL		Scale 1:1250 @ A4	
Description SITE LOCATION PLAN		Date NOV 2021	Drawn by MY
		Drawing No. 2021/D320/P/01	Checked by SV
			Rev.

Appendix B - Midland Survey Ltd Utilities Plan

Appendix C – Proposed Site Plan

Appendix D – The Environment Agency Flood Maps

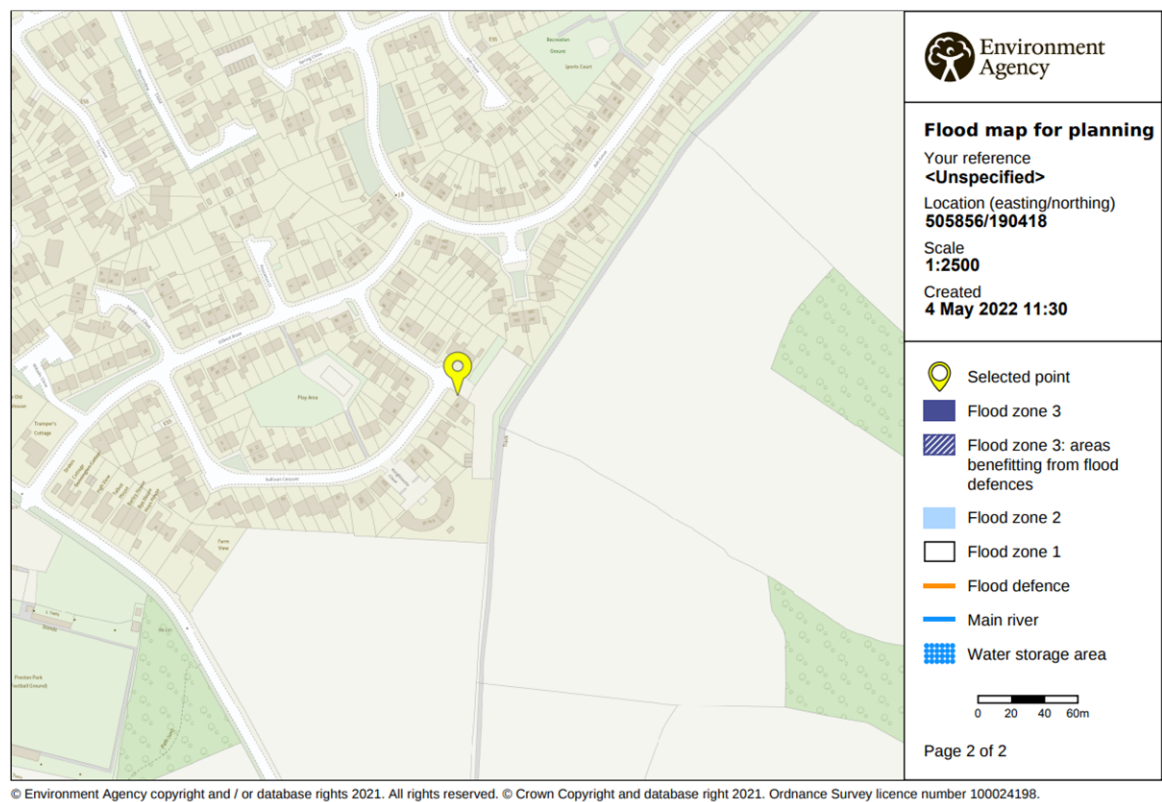


Figure 1.0 – Flood Map for Planning

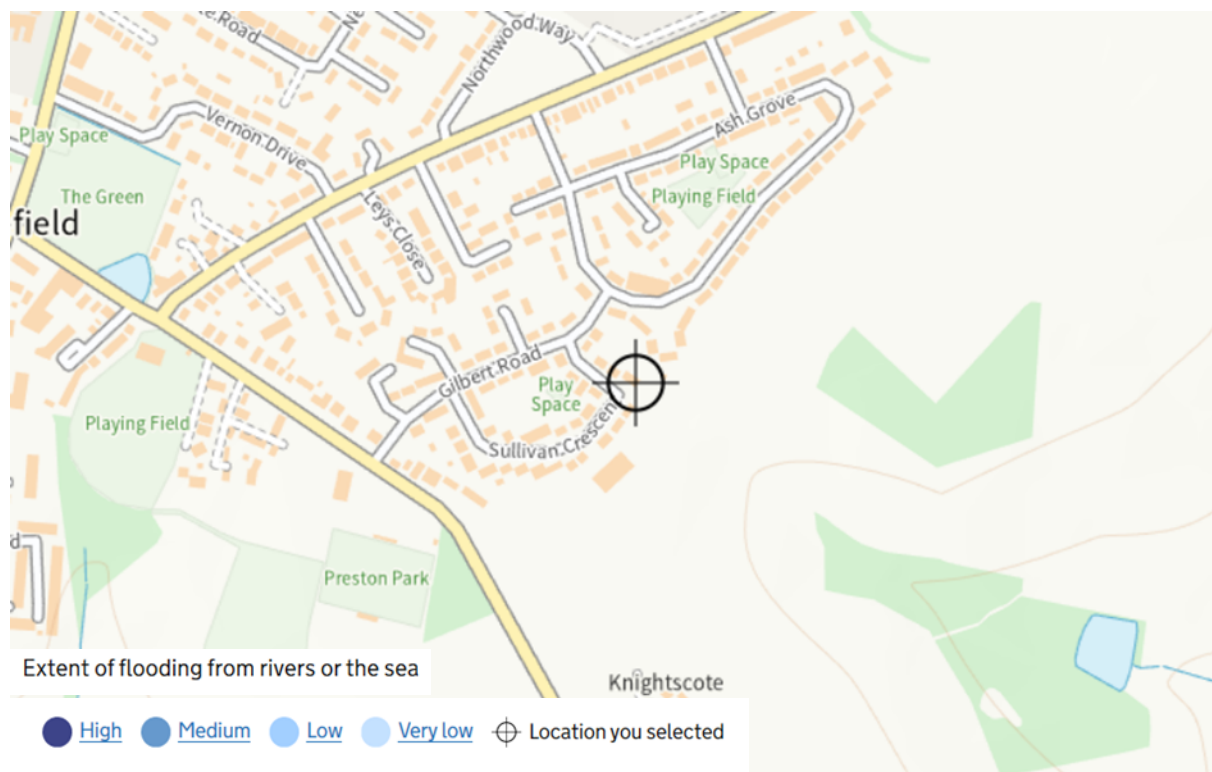


Figure 2.0 – Fluvial Flood Map

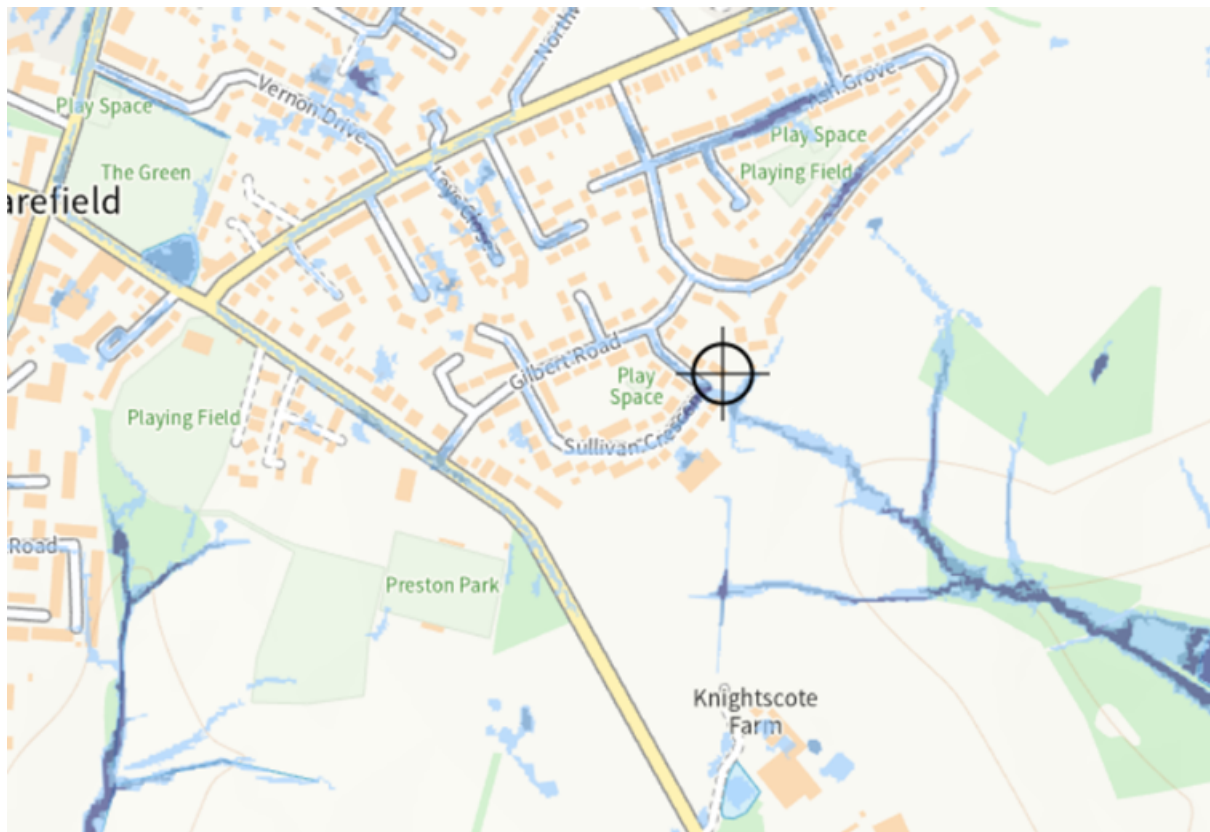


Figure 3.0 – Pluvial Flood Map

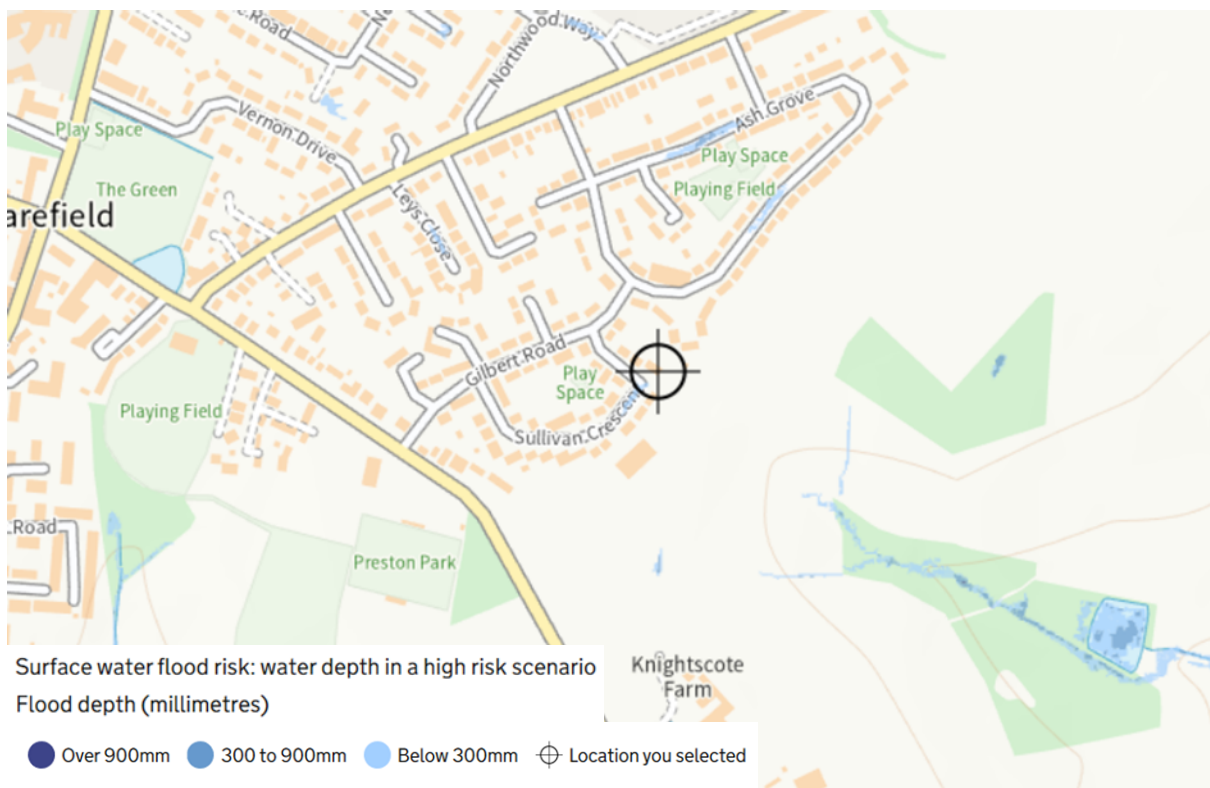


Figure 3.1 – High Risk Pluvial Flood Depth

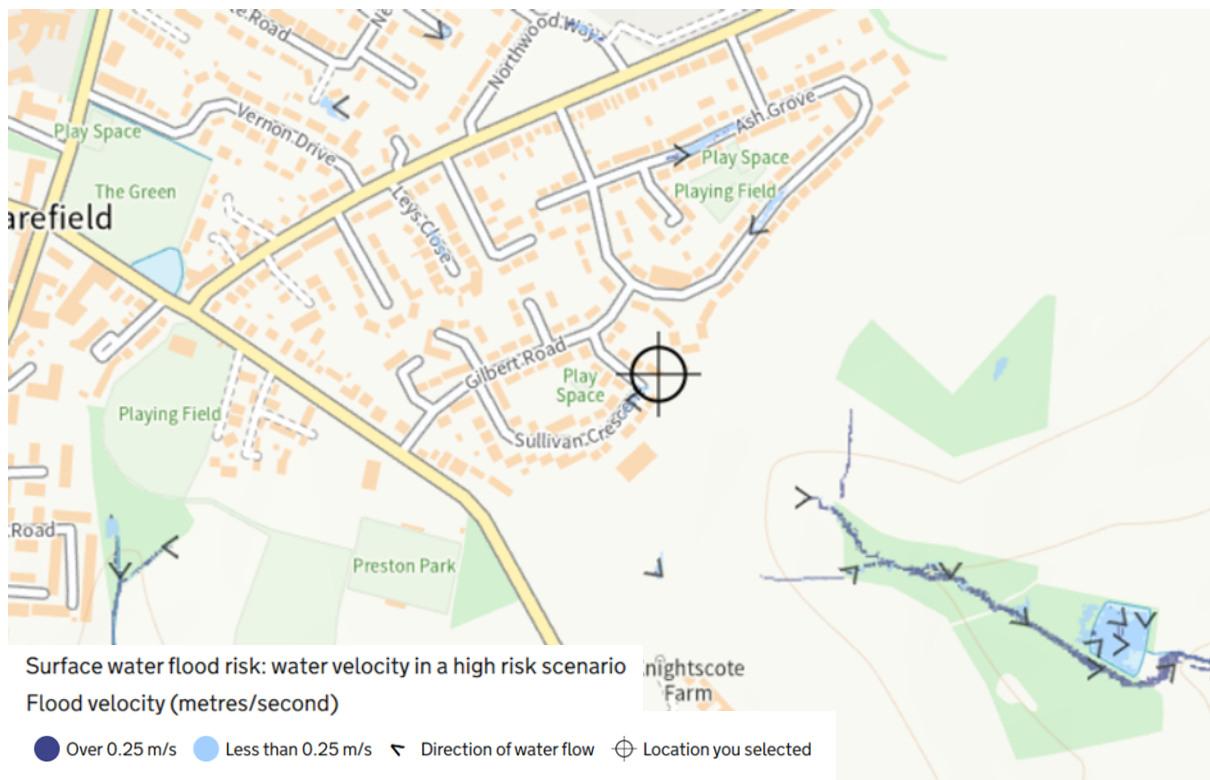


Figure 3.2 – High Risk Pluvial Flood Velocity



Figure 3.3 – Medium Risk Pluvial Flood Depth

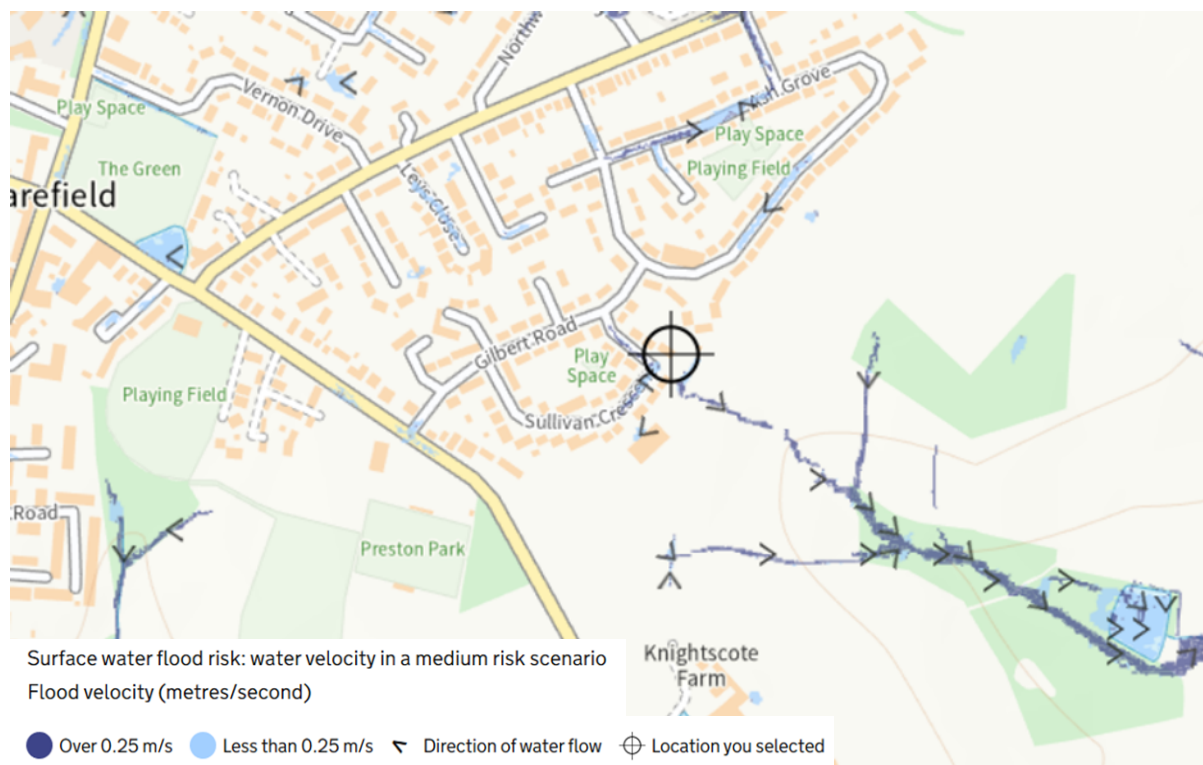


Figure 3.4 – Medium Risk Pluvial Flood Velocity



Figure 3.5 – Low Risk Pluvial Flood Depth



Figure 3.6 – Low Risk Pluvial Flood Velocity



Figure 4.0 – Reservoir Flooding Risk

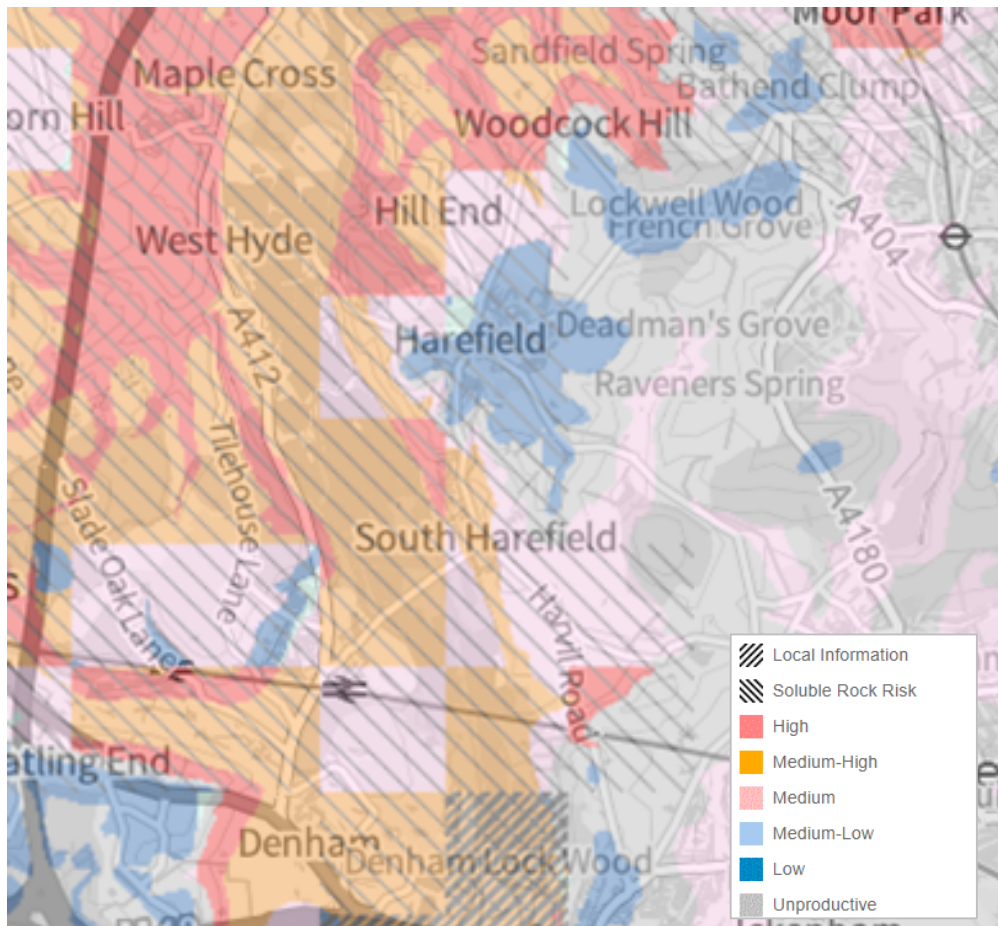


Figure 5.0 - Groundwater Vulnerability Zones

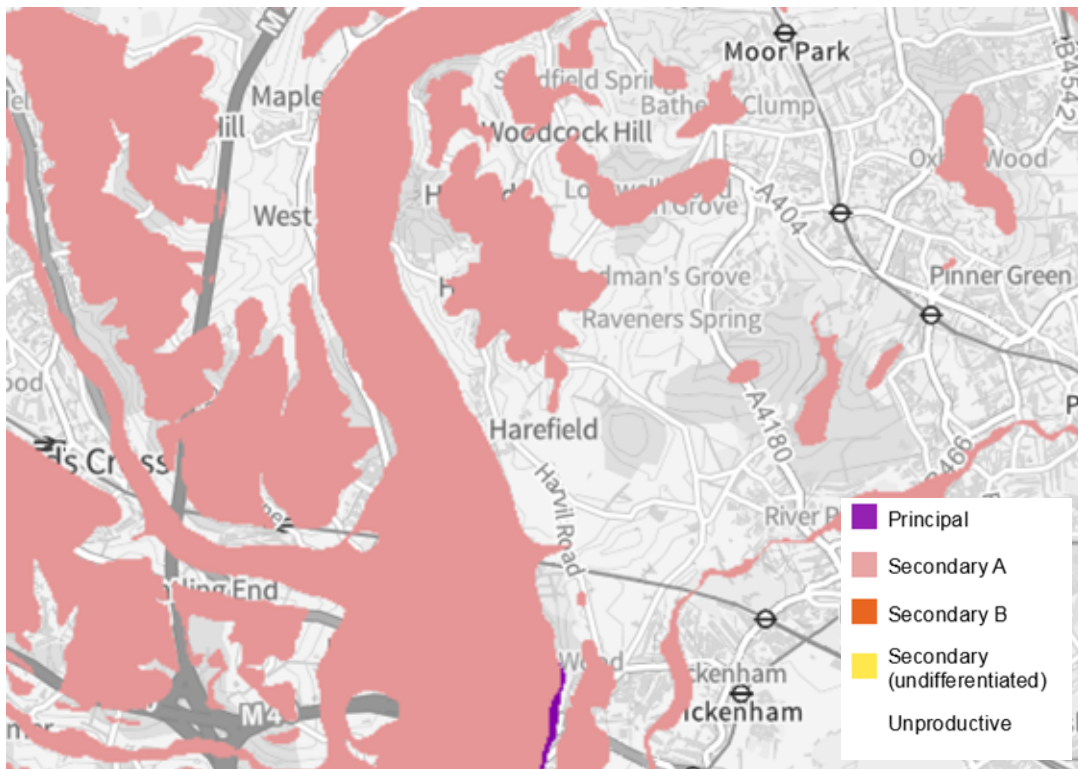


Figure 5.1 – Superficial Aquifer Map

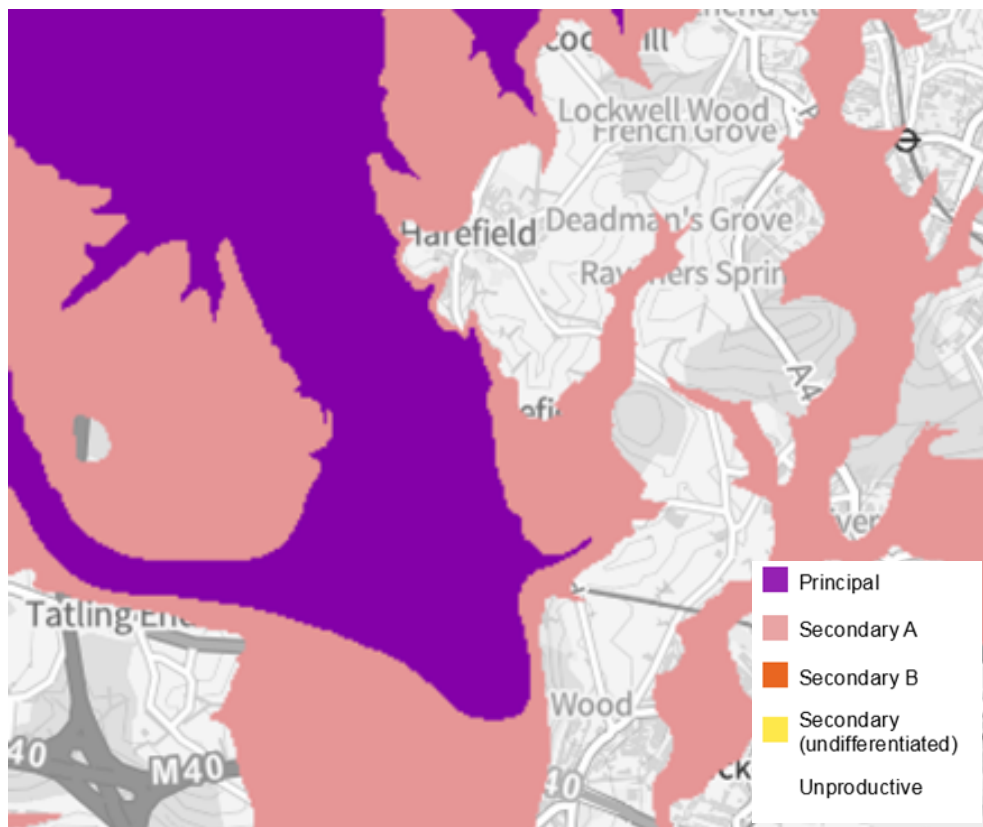


Figure 5.2 – Bedrock Aquifer Map