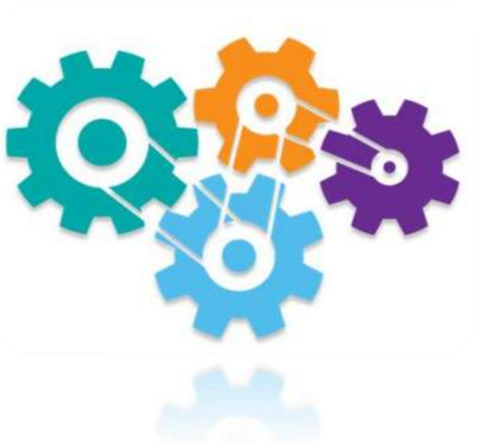
SYNTEGRA CONSULTING

18 Pield Heath Rd, Uxbridge, UB8 3NF

Flood Risk Assessment & Drainage Strategy

April 2022

Ref: 22-8959



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Revision	-
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The conclusions and recommendations contained in this report are based upon information provided by others and upon the assumption that all relevant information has been provided by those parties from whom it has been requested and that such information is accurate. Information obtained by SC has not been independently verified by SC, unless otherwise stated in the report.

The methodology adopted and the sources of information used by SC in providing its services are outlined in this report. The work described in this report was undertaken in **April 2022** and is based on the conditions encountered and the information available during the said period of time. The scope of this report and the services are accordingly factually limited by these circumstances.

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No allowance has been made for changes in prices or exchange rates or changes in any other conditions which may result in price fluctuations in the future. Where assessments of works or costs necessary to achieve compliance have been made, these are based upon measures which, in SC’s experience, could normally be negotiated with the relevant authorities under present legislation and enforcement practice, assuming a pro-active and reasonable approach by site management.

Forecast cost estimates do not include such costs associated with any negotiations, appeals or other non-technical actions associated with the agreement on measures to meet the requirements of the authorities, nor are potential business loss and interruption costs considered that may be incurred as part of any technical measures.

CONTENTS

1. Introduction

Syntegra have been appointed to undertake a Flood Risk Assessment (FRA)and Drainage Strategy for the proposed redevelopment at 18 Pield Heath Rd, Uxbridge, UB8.

The FRA provides information on the nature of flood risk at the site and follows Government guidance with regards to development and flood risk. A site location plan is shown in Appendix A.

The report is based on currently available information, EA flood data and the Strategic Flood Risk Assessment (SFRA) for West London. Proposals contained or forming part of this report represent the design intent and may be subject to alteration or adjustment in completing the detailed design for this project. Where such adjustments are undertaken as part of the detailed design and are deemed a material derivation from the intent contained in this document, prior approval shall be obtained from the relevant authority in advance of commencing such works.

Where the proposed works to which this report refers are undertaken more than twelve months following the issue of this report, we shall reserve the right to re-validate the findings and conclusions by undertaking appropriate further investigations at no cost to Syntegra.

This report has been prepared in accordance with the instructions of our client for their sole and specific use.

2. Scope of Flood Risk Assessment

The assessment has been undertaken in accordance with the standing advice and requirements of the Environment Agency for Flood Risk Assessments as outlined in the Communities and Local Governments Technical Guidance to the National Planning Policy Framework (NPPF).

The assessment has:

- Investigated all potential risks of current or future flooding to the site
- Considered the impact the development may have elsewhere with regards to flood risk
- Considered design proposals to mitigate any potential risk of flooding determined to be present
- Considered outline design proposals for foul and storm water drainage of the site
- Considered the site constraints
- Considered the procedures of the National Planning Policy Guidance and Local Authority

3. Existing Site and Topography

The site is located on the corner of Pield Heath Road and Pield Heath Avenue. It is surrounded by a mix of building types, mostly single and 2 stories in height. The land beyond north, west, south and east of the site is residential, commercial and recreational.

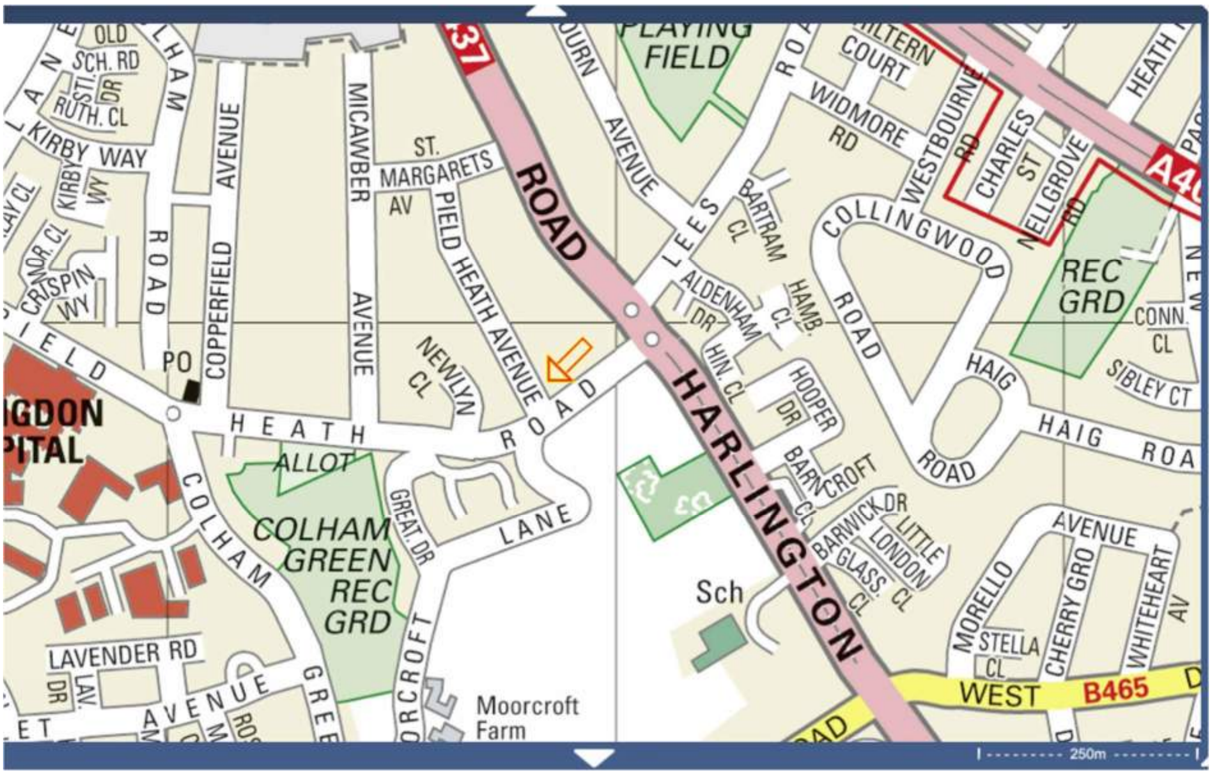


Figure 1: Site Location Plan

4. Existing Drainage and Site Investigations

The site is currently developed and as such there are existing drainage runs serving the property. The nearest watercourse to the site is the River Pinn located approximately 1.27km to the west of the site. The nearest flood zone is the floodplain associated with this watercourse.

The site is underlain by the London Clay formation. These deposits are not considered likely to allow groundwater to rise rapidly.

5. Development Description

The development proposals comprise of the demolition of the existing building, and construction of a 60 bed Care Home5 as seen in Appendix B.

6. National Planning Policy Framework

In March 2012 the Department of Communities and Local Government published the National Planning Policy Framework document (NPPF 2021) which provides guidance on how flood risk should be assessed during the planning and development process. This document was recently revised in 2021. The main Framework is supplemented by a technical guidance document ("Planning Practice Guidance" - PPG) which advises specifically with respect to flooding. The most critical aspects are extracted below.

Section 167 of the NPPF 2021 advises that local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment. A site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.

Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:

a) within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;

b) the development is appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment;

c) it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;

d) any residual risk can be safely managed; and

e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

1.1 Flood Zones (Table 1)

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or Land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding. (Land shown in dark blue on the Flood Map)
Zone 3b The Functional Floodplain	**This zone comprises land where water has to flow or be stored in times of flood.** Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

Flood Risk Vulnerability Classification (Table 2)

As per Annex 3 of the NPPF 2021 the Flood vulnerability classification is set out as follows:

ESSENTIAL INFRASTRUCTURE

- Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk.
- Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including infrastructure for electricity supply including generation, storage and distribution systems; and water treatment works that need to remain operational in times of flood.
- Wind turbines.
- Solar farms

HIGHLY VULNERABLE

- Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operational during flooding.
- Emergency dispersal points.
- Basement dwellings.
- Caravans, mobile homes and park homes intended for permanent residential use.
- Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require

coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as 'Essential Infrastructure'.)

MORE VULNERABLE

- Hospitals
- Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels.
- Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels.
- Non–residential uses for health services, nurseries and educational establishments.
- Landfill* and sites used for waste management facilities for hazardous waste.
- Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.

LESS VULNERABLE

- Police, ambulance and fire stations which are not required to be operational during flooding.
- Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution;
- non-residential institutions not included in the 'more vulnerable' class; and assembly and leisure.
- Land and buildings used for agriculture and forestry.
- Waste treatment (except landfill* and hazardous waste facilities).
- Minerals working and processing (except for sand and gravel working).
- Water treatment works which do not need to remain operational during times of flood.
- Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.
- Car parks.

WATER-COMPATIBLE DEVELOPMENT

- Flood control infrastructure.
- Water transmission infrastructure and pumping stations.
- Sewage transmission infrastructure and pumping stations.
- Sand and gravel working.
- Docks, marinas and wharves.
- Navigation facilities.
- Ministry of Defence installations.
- Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location.
- Water-based recreation (excluding sleeping accommodation).
- Lifeguard and coastguard stations.
- Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.
- Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

Flood Zone and Flood Risk Vulnerability Compatibility (Table 3)

Flood Zones	**Flood Risk Vulnerability Classification**

	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	✗	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	✗	✗	✗	✓*

Key:

✓ Development is appropriate

✗ Development should not be permitted.

Notes to table 3:

- This table does not show the application of the Sequential Test which should be applied first to guide development to Flood Zone 1, then Zone 2, and then Zone 3; nor does it reflect the need to avoid flood risk from sources other than rivers and the sea;
- The Sequential and Exception Tests do not need to be applied to minor developments and changes of use, except for a change of use to a caravan, camping or chalet site, or to a mobile home or park home site;
- 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.

- † In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood.
- * In Flood Zone 3b (functional floodplain) essential infrastructure that has to be there and has passed the Exception Test, and water-compatible uses, should be designed and constructed to:
  - remain operational and safe for users in times of flood;
  - result in no net loss of floodplain storage;
  - not impede water flows and not increase flood risk elsewhere.

7. Development And Flood Risk

7.1. Environment Agency Flood Data

To assess the NPPF flood risk classification for the site, the first step was to inspect the Environment Agency web based flood mapping data for flooding from rivers and seas, surface water and reservoirs. The rivers and sea flood map is used to inform planning of a sites Flood Zone(s), however the surface water and reservoir flood maps available from the Flood Warning Information Service should also be used to identify other flood risks.

From the Environment Agency flooding from rivers and seas map and the SFRA it can be seen that the entire site and the surrounding area are located within an area classified as Flood Zone 1.

7.2. Site Specific Flood Zone Compatibility

As the site is proposed for residential use, the proposals are as follows:

Residential establishments are classified as 'More Vulnerable' development.

The site is located within Flood Zone 1 and therefore considered appropriate under the NPPF classification.

7.3. Flood Risk from Rivers and Seas

Both the Environment Agency Data and the SFRA Flood Risk mapping highlights the site to lie within Flood Zone 1 whereby the annual probability of flooding from fluvial / tidal sources is classified as less than 1 in 1000.

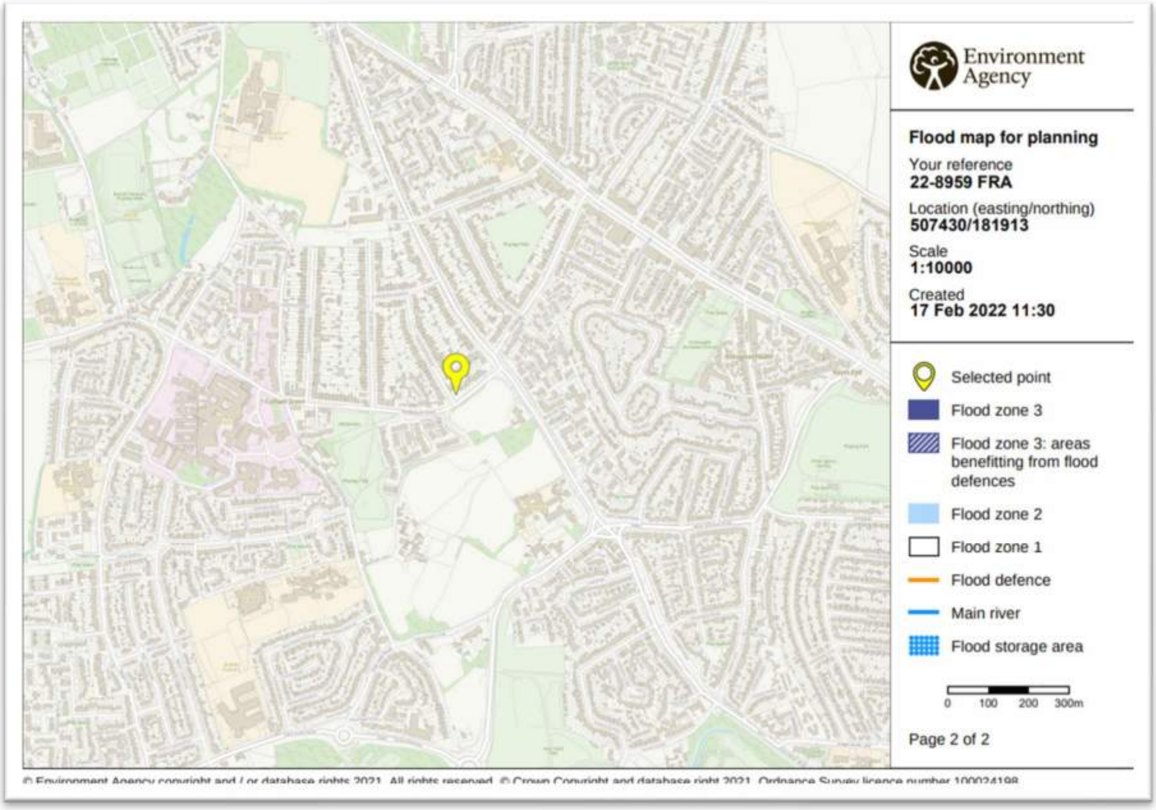


Figure 1- Environment Agency flood Risk Map

According to the EA maps the existing site is at very low risk of flooding from rivers and sea, meaning that each year this area has a chance of flooding less than 0.1%.

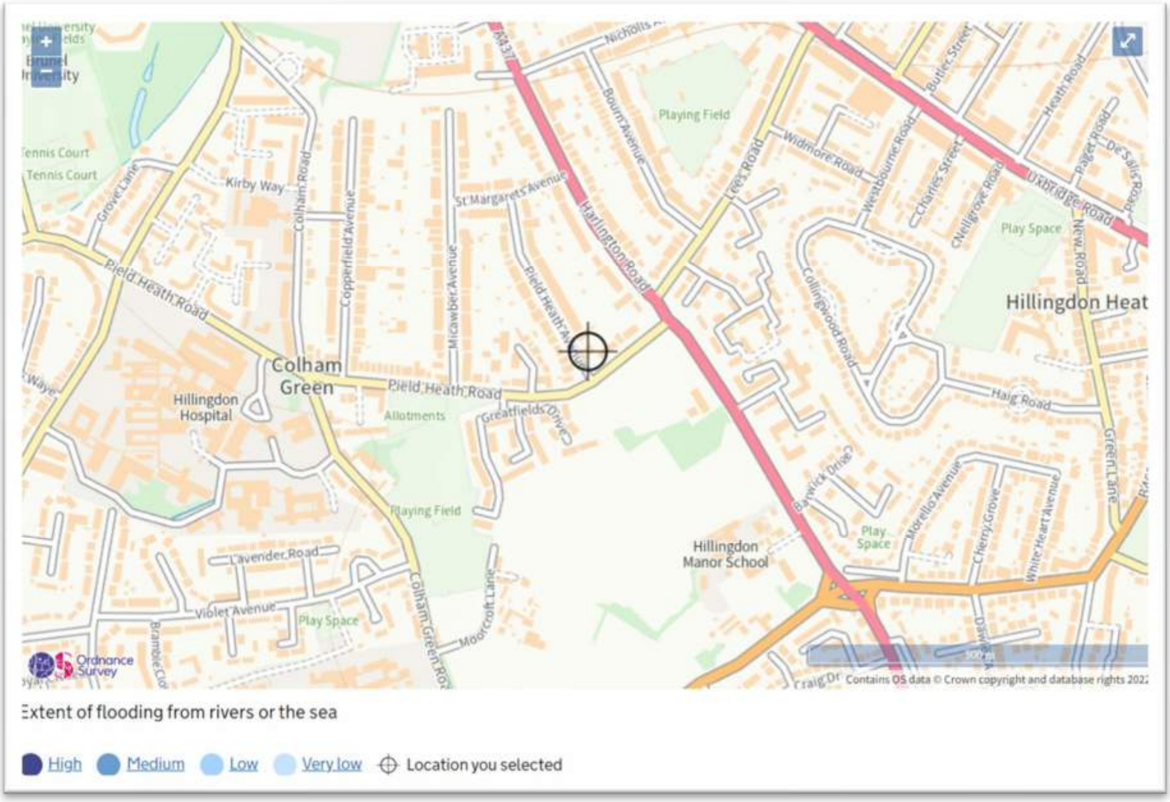


Figure 2: EA Map Extent of flooding from rivers and seas

Although, the proposed development is within the 'More Vulnerable' NPPF classification, the risk from flooding via this source can be considered to be very low. As the site is already developed, the development is considered appropriate for the flood zone given the correct mitigation measures are in order.

Excepting the River Pinn, there are no other watercourses within close proximity to the site known to present a risk of fluvial flooding.

7.4. Risk of Surface Water Flooding to the Site

Surface water sewers are at risk of surcharging during extreme rainfall events with flooding occurring principally from manholes and gullies. Surcharging sewers can result in overland flow which, if originating at a higher elevation than a development the sewers could potentially pose a flood risk.

The UK Government Provides long term flood risk assessment via a flood warning informatics service. Much of this information was previously available from the Environment Agency maps, however this new service offers more detailed site-specific information to the public.

Flooding to the site from surface water is indicated in Figure 3 and it can be seen that are no indications of surface water flood risk at the site. EA mapping indicates a low potential risk of surface water flooding at the site. As the above passages imply, the risk to the site from surface water flooding can be considered to be negligible.

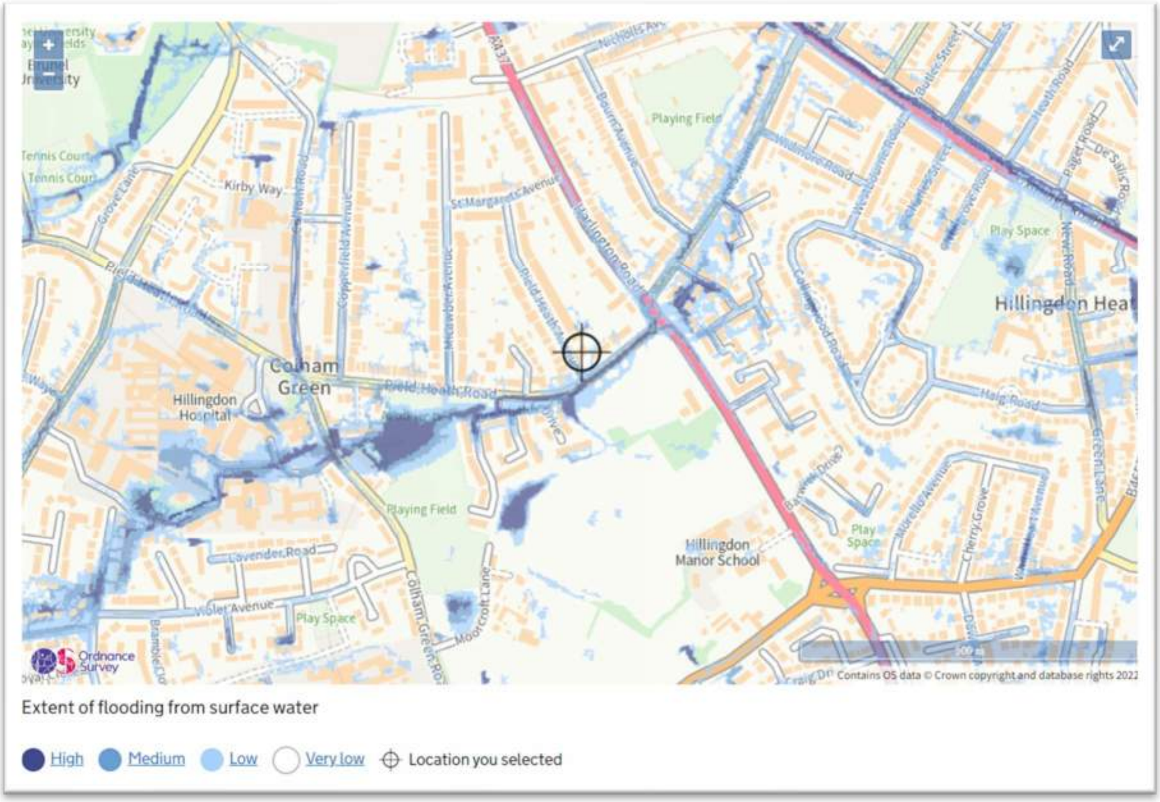


Figure 3: Flooding from Surface Water (Environment Agency).

7.5. Flooding from Reservoirs, Canals and Artificial Sources

The requirement for regular inspections by a Supervising Panel Engineer means that the likelihood of structural failure of reservoirs is considered to be minimal. The risk of failure remains, however, and the Environment Agency has mapped the potential extent of flooding resulting from the failure.

The site is located within an area of potential reservoir flooding should the reservoirs in the area fail. therefore classified as at low risk of flooding from these sources.

Reservoir flooding is extremely unlikely to happen. There has been no loss of life in the UK from reservoir flooding since 1925. All large reservoirs must be inspected and supervised by reservoir panel engineers. As the enforcement authority for the Reservoirs Act 1975 in England, the Environment Agency ensure that reservoirs are inspected regularly, and essential safety work is carried out.

7.6. Groundwater

Groundwater flooding is caused by the natural emergence of water at surface level originating from underlying permeable sediments or rocks (aquifers). The groundwater may emerge as one or more point discharges (springs) over an extended area. Groundwater flooding tends to be more persistent than other sources of flooding, typically lasting for weeks or months rather than hours or days. Groundwater flooding does not generally pose a significant risk to life due to the slow rate at which the water level rises, however it can cause considerable damage to property, especially in urban areas.

The West London Strategic Flood Risk Assessment identifies the area as having a low potential for groundwater flooding. As per the SFRA the majority of the region is underlain by Thames Group (also referred to as London Clay) bedrock, a composition of silty clay/mudstone, sandy silts and sandy clayey silts of marine origin. This geological unit generally has a low hydraulic conductivity which means water does not easily move through it. However, because of this characteristic and poor drainage, ponding can occur if London Clay is downhill of aquifer outcrops.

There have been no recorded incidents of groundwater flooding at the site.

As the above passages imply, the risk to the site from groundwater flooding can be considered to be low.

7.7. Pluvial

The site is bordered by the existing adjacent buildings all of which are positively drained. It is considered that any runoff from adjacent land would be unlikely to enter the site due to topography and positive drainage systems being in place that are maintained, there is therefore a low risk of flooding from properties to the development.

7.8. Public Sewers or Highway Drainage Flooding

Any additional flows to be discharged to the public sewer network will be subject to an impact assessment by the relevant water authority. Under current legislation all developments are required to attempt to implement SUDS systems adopted thus providing a controlled discharge over the current unrestricted runoff.

Providing Thames Water the Local Authority maintain their drainage assets in the vicinity of the site, the risk of flooding to the proposed development site from public sewers or highway drainage is considered as low.

7.9. Risk of Surface Water Flooding from the Site

Developers are responsible for ensuring that any new development does not increase the flood risk elsewhere. Developers are typically required to consider the 100 year storm with an allowance for climate change, ensuring run off can be managed safely on site and to restrict any flows leaving the site to the current discharge rates or lower.

8. Mitigation

8.1. Fluvial / Tidal / Reservoir Flood Mitigation

The development site lies within Flood Zone 1 and at a low risk of fluvial flooding. Environment Agency's website indicates that the site is within an area with the potential for reservoir flooding, however as described above the risk is considered low and sufficient early warning would be available should reservoir safety be a concern.

No mitigation measures are considered necessary.

8.2. Groundwater Flooding Mitigation

Groundwater flooding tends to be more persistent than other sources of flooding and typically lasts for weeks or months rather than hours or days. Generally, groundwater flooding does not pose a significant risk to life due to the slow rate at which the water level rises; however, it can cause considerable damage to property. Finished floor levels for the development should be set above the highest groundwater level.

As per the Environment Agency's online mapping service, there has been no record of groundwater flooding in this area, proposals would will see basement construction employed however the basement is not providing sleeping accommodation and given the risk of groundwater no mitigation measures are deemed necessary over normal construction teqniques.

8.3. Mitigation of Surface Water Flooding to the Site

The Environment Agency Surface Water flood map for the area indicates that there is a low potential for surface water flood risk to the property

Upon implementation of the proposed drainage network, it is proposed that the network will accommodate the necessary flows generated from the site and therefore limit future surface water flood risk from the site.

Providing the above measures are implemented the flooding risk to the development site from surface water is therefore considered low post development.

8.4. Mitigation of Surface Water Flooding from the Site

Any new development site drainage should be designed in accordance with current best practice to provide adequate capacity to convey flows, along with managing a 1 in 100 year plus an allowance for climate change storm effectively on site.

In February 2016, the Environment Agency released updated climate change allowances for peak rainfall intensities which should be applied for new developments. Table 4 demonstrates the climate changes allowances with central and upper end allowances being considered.

Based on the nature of the development, a lifespan in excess of 100years is anticipated. Therefore, the potential climate change allowance for 2070-2115 ranges between 20% for the central allowance and 40% for the upper end allowance. As such, it is proposed to utilise a conservative allowance of 40% for climate change on peak rainfall intensity will be included in calculations.

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%

Table 4: Peak Rainfall Intensity Allowance in small and urban catchments (Extract Environment Agency Guidance).

In following the standard hierarchy of drainage solutions, consideration should firstly be given to the discharge of surface water runoff by sustainable methods such as infiltration.

To minimise localised flooding within the site, the drainage design should ensure that gullies, drainage channels and drains are all suitably sized to accommodate peak storm flows. Also, all inlet features should have suitably sized sumps to catch silts and should be subject to a documented routine maintenance and cleansing regime.

Flood water exceedance routes should be identified, both on and off site.

Assuming that the proposed drainage system is designed to provide adequate capacity, and that the private and adopted sewers will be maintained by their adopted authority, it can be assumed risk of flood from blockage or overloading is minimal.

9. Drainage Strategy

The CIRIA SuDS manual provides the design philosophy:

SuDS design should, as much as possible, be based around the following:

- using surface water run-off as a resource
- managing rainwater close to where it falls
- managing run-off at the surface
- allowing rainwater to soak into the ground
- promoting evapotranspiration
- slowing and storing run-off to mimic natural run-off characteristics
- reducing contamination of run-off through pollution prevention and controlling the run-off at source
- treating run-off to reduce the risk of urban contaminants causing environmental pollution.

9.1. Source control

- Sedum roofing.
- Infiltration devices. Typically, soakaways.
- Rainwater harvesting.
- Bio-retention planting, rain gardens.
- Permeable paving, porous asphalt. These provide both infiltration and short-term storage volumes thus reducing overall un-mitigated run-off volumes.

9.2. End of pipe solutions

To be considered only after implementation of the above options. Retention tanks with outfall controlled by hydraulic means to limiting discharge rates and volumes to discharge to existing SW flow pathways.

Most sites will incorporate multiple solutions and their suitability is assessed based on an ascending scale of sustainability with associated amenity and environmental benefits as below:

Most Sustainable

Suds technique	Flood Reduction	Pollution Reduction	Landscape a & wildlife benefit
Living Roofs	✓	✓	✓
Basins and ponds -constructed wetlands -balancing ponds -detention basins -retention ponds	✓	✓	✓
Filter Strips and Swales	✓	✓	✓
Infiltration devices -soakaways -Infiltration trenches and basins	✓	✓	✓
Permeable surfaces and filter drains -Gravelled area -Solid paving blocks -Porous paving	✓	✓	
Tanked systems -Oversized pipe/tanks -Storm Cells	✓		

Least Sustainable

9.3. Appraisal of Suds Options

9.3.1. Site constraints impacting on SuDS

- No access to adjacent watercourses or features
- Care home therefore above ground features pose a risk
- Impermeable Geology

9.3.2. Infiltration devices

Standard soakaways are considered unlikely to function given the London Clay formation. Such systems are deemed not feasible.

9.3.3. Bio-retention/raingardens

Bio retention areas require open space and to be maintained. There is considered inefficient space to allow this to be feasible and also pose risks due to the nature of use.

9.3.4. Permeable hard standing

The development provides opportunity for permeable paving to be utilised around the proposed building.

Permeable paving promotes the following SuDS design criteria:

- manages rainwater close to where it falls
- manages run-off at the surface
- allows rainwater to soak into the ground
- slows and stores run-off to mimic natural run-off characteristics
- treats run-off to reduce the risk of urban contaminants causing environmental pollution.
- All permeable paving offers sufficient storage volume to accommodate the 5mm event

9.3.5. Rainwater harvesting

Rainwater harvesting is to be considered as part of detailed design proposals.

9.3.6. Sedum/green roofs.

Green roof is not considered a viable option to assist with source control, bioretention and attenuation as can be employed only on flat roofs.

9.3.7. End of pipe components

To be considered only after implementation of the above options. Retention tanks with outfall controlled by hydraulic means (e.g. hydrobrakes, pipe sizing, orifice plate etc.) to limiting rates and volumes to discharge to existing flow pathways.

End of pipe solutions shall be implemented to reduce runoff as appropriate should soakaways be deemed unsuitable as part of site infiltration testing. Sufficient areas are present to provide attenuation to greenfield runoff figures.

9.4. Surface Water Drainage Strategy

The final design of the storm water network needs to be in accordance with requirements set by the Environment Agency and LLFA.

The local Authority expects all developments to take advantage of any suitable opportunities to reduce surface water runoff.

Developers should utilise SuDS on all developments, unless there are practical reasons for not doing so. Therefore, it is expected to see suitable consideration given to using sustainable measures in line with the following drainage hierarchy:

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

The proposed development will not result in any increase in impermeable area. An appraisal of SUDS options above concludes that due to site constraints which limit the available options for discharge of surface water, the most appropriate method of discharge is via attenuation at ground level utilising a cellular tank system via connection to the existing public sewer.

The site is currently considered 85% impermeable.

The greenfield run-off rates are as follows:

Return Period	Runoff Rate l/s
Qbar	0.5
1	0.4
30	1.1
100	1.5

The above indicates a Qbar rate of 0.5 l/s which is considered too small for conventional flow control devices. As the site is brownfield the London plan recommends that sites should aim to achieve a betterment of at least 50% and as close to greenfield runoff figures as possible. For reference the existing site is indicated as discharging at approximately 31l/s (the Qbar brownfield rate is calculated as 2.78x 50x0.22=31l/s).

Calculation are appended to this document which indicate that volume of approximately 95m3 would be required to attenuate flows from the site utilising a 40mm orifice which would reduce runoff rates to a maximum 2.6l/s for the 1 in 100+40% climate change event. This could be accommodated within a permeable paving system of approximately 650mm depth. To provide further benefits it is recommended that the system is unlined regardless of infiltration potential as this would further reduce the discharge volume and rates to the public sewer.

It is expected that during detailed design the volume of attenuation and actual discharge rates would be further reduced as part of detailed calculations and specifications of SUDS systems, however the above demonstrates that a sustainable drainage strategy that reduces runoff to as close to greenfield runoff rates as possible thus providing a significant betterment over the existing and reducing flood risk to the locality.

10. Management and maintenance

All drainage will be required to be maintained by the contractor during construction, following which the post construction phase maintenance would apply as per manufacturer recommendations.

The proposed drainage system for the site adopts a series of SuDS measures to control the rate of storm water discharge and the quality of the water in line with current practice. A site management company will be in place to maintain the drainage to ensure that SuDS elements operate effectively for their lifetime.

This document should be read in conjunction with the drainage system drawings. Responsibility of maintenance will lie with the client and an appropriate management company is to be appointed to oversee future maintenance.

10.1. Overview of Maintenance

All drainage systems, whether piped systems or SuDS systems require regular maintenance. The maintenance of the SuDS system should be included alongside other regular maintenance tasks. The table below gives an overview of typical maintenance tasks and the frequency with which they need to be undertaken.

Activity	Indicative frequency	Typical tasks
Routine/regular maintenance	Monthly to annually (for normal care of SuDS)	Litter picking Inspection of inlets, outlets and control structures
Occasional maintenance	Annually up to 25 years (dependent on the design)	Silt control around components Vegetation management around components Suction sweeping of permeable paving Silt removal from catchpits, soakaways and cellular storage
Remedial maintenance	As required (tasks to repair problems due to damage or vandalism)	Inlet/outlet repair Erosion repairs Reinstatement of edgings Reinstatement following pollution Removal of silt build up

10.2. Typical maintenance tasks and frequency for SUDs drainage

The required maintenance for each of the elements that make up the SuDS systems, is scheduled below. The following guidance is based on CIRIA C753 – The SuDS Manual.

O & M activity	SuDS component																	
	Pond/wetland	Detention basin	Infiltration basin	Silt traps and catchpits	Soakaway	Infiltration trench	Filter trench	Modular storage	Pervious pavement	Swale/bioretention/green roofs	Filter strip	Sand filter	Pre-treatment systems	Perforated ring soakaways	Bio retention areas	Rain gardens	Oil interceptors	Flow control devices
Regular maintenance																		
Inspection	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Litter/debris removal	■	■	■	□	□	■	■	□	■	■	■	■	■	■	■	■	□	□
Grass cutting	■	■	■	□	□	■	■	□	□	■	■	□	□		■		□	□
Weed/invasive plant control	□	□	□			□	□		□	□	□	□	□		□	■		
Shrub management	□	□	□						□	□	□		□		□	■		
Shoreline vegetation management	■	□											□					
Aquatic vegetation management	■	□											□					
Sediment management (*)	■	■	■	■	■	■	■	■	■	■	■	■	■		■	■	■	■
Vegetation/pla nt replacement	□	□	□							□	□		□		□	□		
Vacumn sweeping and brushing										■								

Structure rehabilitation/repair	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Infiltration surface reconditioning			□		□	□	□		□	□	□	□		□	□	□		

■ Will be required

□ May be required

* Sediment should be collected and managed in pre-treatment systems, upstream of the main device.

REGULAR MAINTENANCE ACTIVITIES

Inspections and reporting

Regular SuDS scheme inspections will:

- Help determine optimum future maintenance activities
- Confirm hydraulic, water quality, amenity and ecological performance
- Allow identification of potential system failures, e.g., blockage, poor infiltration, poor water quality etc.

Inspections can generally be required at monthly site visits (e.g., for grass cutting) for little additional cost, and should, therefore, be subsumed into regular maintenance requirements. During the first year of operation, inspections should ideally be carried out after every significant storm event to ensure proper functioning, but in practice this may be difficult or impractical to arrange.

Typical routine inspection questions that will indicate when occasional or remedial maintenance activities are required, and/or when water quality requires investigation include:

- Are inlets or outlets blocked?
- Does any part of the system appear to be leaking?
- Is the vegetation healthy?
- Is there evidence of poor water quality (e.g., Algae, oils, milky froth, odor, unusual colorings)?
- Is there evidence of sediment build-up?
- Is there evidence of ponding above an infiltration surface?
- Is there any evidence of structural damage that requires repair?
- are there areas of erosion or channeling over vegetated surfaces?

Litter/debris removal

This is an integral part of SuDS maintenance and reduces the risks of inlet and outlet blockages, retains amenity value and minimises pollution risks.

IRREGULAR MAINTENANCE ACTIVITIES

Sediment removal

To ensure long-term effectiveness, the sediment that accumulates in SuDS should be removed periodically. The required frequency of sediment removal is dependent on many factors including:

- design of upstream drainage system
- type of system
- design storage volume
- characteristics of upstream catchment area (e.g. land use, level of imperviousness, upstream construction activities, erosion control management and effectiveness of upstream pre- treatment).

Sediment accumulation will typically be rapid for the entire construction period (including time required for the building, turfing and landscaping of all upstream development plots). Once a catchment is completely developed and all vegetation is well-established, sediment mobility and accumulation are likely to drop significantly.

Inspection programmes should identify areas of filtration, or infiltration surfaces where vegetation growth is poor and likely to cause a reduced level of system performance.

Such areas can then be rehabilitated, and plant growth repaired.

10.3. Pipes (Including Oversized) & Manholes

Pipes are intended to be the main conveyance across the development. They are intended to be dry except for during rainfall events. These have been designed to be self-cleansing where possible for smaller diameter pipes, and for larger diameters the risk is reduced due to the overall pipe size. Access for maintenance is provided through access chambers, manholes, rodding plates and rodding eyes.

Regular inspection and maintenance is important to identify areas which may have been obstructed/clogged and may not be drainage correctly thus exposing the development to a greater level of flood risk. Maintenance responsibility for the pipes should be placed with Landowner.

Sediment\material removal should be undertaken in consultation with the environmental regulator to confirm appropriate protocols, as run-off is taken from potentially contaminated areas such as car parks/service yards.

Maintenance Schedule	Required Action	Frequency
Monitoring (to be undertaken more regularly within the first	Initial inspection should be provided as post construction CCTV survey.	N/A

year of operation and adjusted as required)	Inspect for evidence of poor operation via water level in chambers. If required take remedial action.	3-monthly, 48 hours after large storms.
Occasional maintenance	Check and remove large vegetation growth near pipe runs.	6 monthly
Remedial actions	Rod through poorly performing runs as initial remediation.	As required.
	If continued poor performance jet and CCTV survey poorly performing runs.	As required.
	Seek advice as to remediation techniques suitable for the type of performance issue and location.	As required If above does not improve performance.

10.4. Flow Control Devices – Hydro Brake, Orifice Plates

Maintenance to be undertaken according to manufacturer's specification. As a general guide, this should include the following:

Maintenance Schedule	Required Action	Typical Frequency
Routine Maintenance	Inspection	Quarterly
	Litter / debris removal	Monthly or as required
Occasional Maintenance	Sediment removal	6 monthly
Remedial Maintenance	Repair (as a result of damage or vandalism)	As required

11. Conclusion

The report is based on current available information and preliminary discussions.

The assessment has been undertaken in accordance with the standing advice and requirements of the Environment Agency (EA) for Flood Risk Assessments as outlined in the Communities and Local Governments Planning Policy Guidance to the National Planning Policy Framework (NPPF).

The assessment has:

- Investigated all reasonably foreseeable potential risks of flooding to the site,
- Considered the impact the development may have elsewhere with regards to flooding
- Considered outline design proposals to mitigate any potential risk of flooding determined to be present.

The report concludes that:

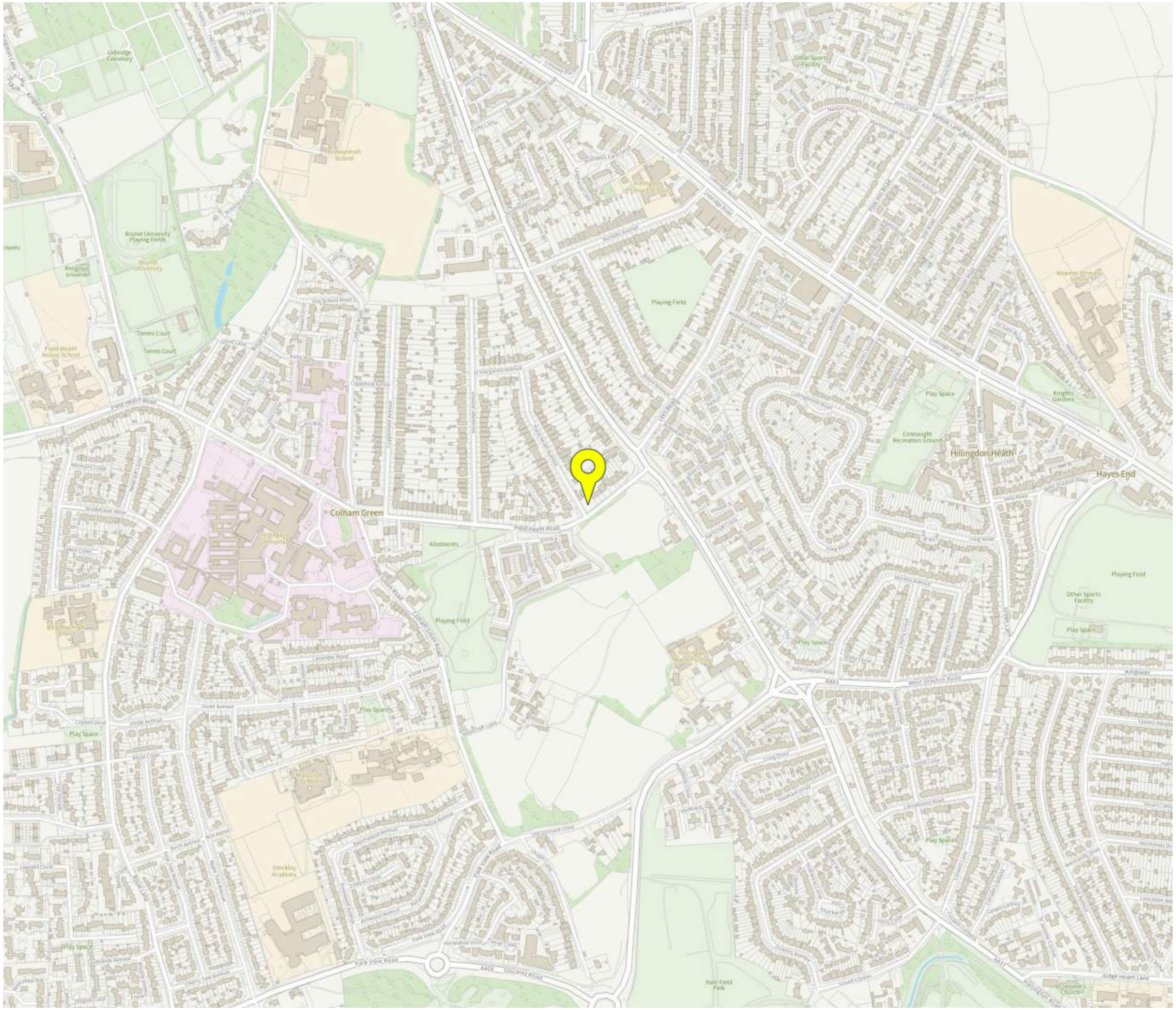
- The site is located within Flood Zone 1 with a negligible risk of flooding, the sequential and exception are not required as the development is considered appropriate.
- The SFRA highlights that the site is potentially within in area of low susceptibility to groundwater flooding and no incidents of groundwater flooding have been reported and the risk to occupants remains low given the nature of the development.
- The Environment Agency Surface Water flood map for the area indicates a low risk of flooding from surface water.
- The proposed development will see sustainable drainage measures adopted reducing runoff rates and as a such a betterment reducing flood risk.
- A permeable paving system will provide attenuation and provide storage of runoff during the 1 in 100 +40% climate change event with no flooding.
- Providing the principles set out within the report are followed and developed at detailed design stage, the site can be considered to have a low probability of suffering from any form of flooding and not increasing the probability of flood risk to other properties within the local catchment area.

Recommendations Include:

- To increase sustainability and reduce excavations, existing drainage should be utilised where possible. Investigations will be undertaken to determine any additional points of connection. Prior to development, these drainage components should be checked for line, blockages and collapse; any defects should be corrected accordingly.
- The use of SuDS techniques are proposed and should be adopted on site to reduce runoff.

APPENDIX A – Site Location & Proposed Layouts

APPENDIX B –Mapping



22-8959 FRA

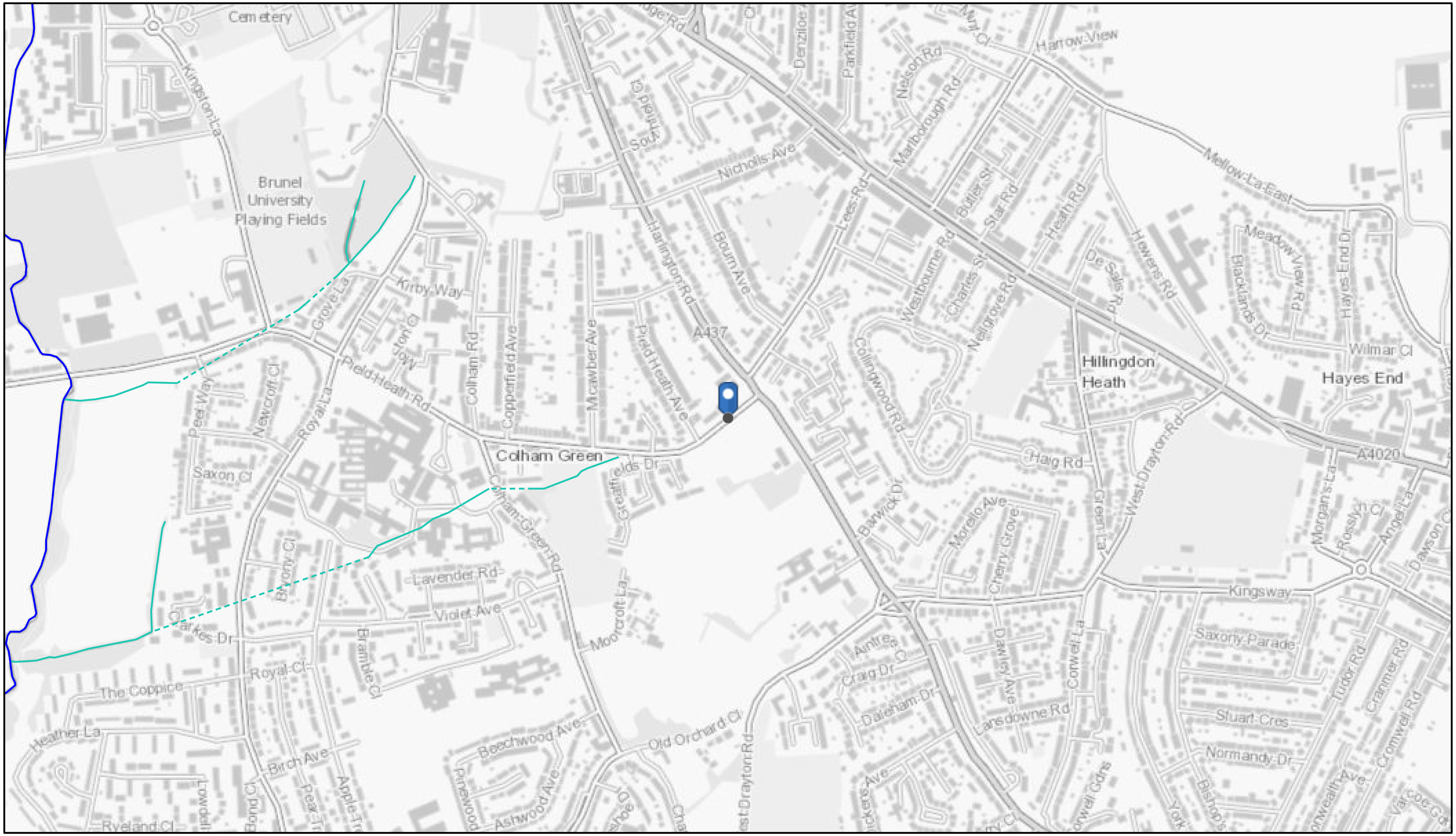
507430/181913

1:10000

17 Feb 2022 11:30

0 100 200 300m

West London SFRA Flood Management Infrastructure



17/02/2022, 16:00:55

Borough Boundary

Study Area Boundary

Main River

Ordinary Watercourse

Ordinary Watercourse - Culverted

Flood_Map_for_Planning_Rivers_and_Sea_Areas_Benefiting_from_Flood_Defences

Flood_Map_for_Planning_Rivers_and_Sea_Spatial_Flood_Defences_without_standardised_attributes

1:10,000

0 0.07 0.15 0.3 mi

0 0.13 0.25 0.5 km

London Boroughs of Brent, Barnet, Harrow, Hillingdon, Hounslow and Ealing

West London SFRA Sewer, Groundwater & Artificial Flood Risk

17/02/2022, 15:56:38

Borough Boundary

Study Area Boundary

Thames Water 2017 - Sewer Flooding Records (No. of Instances)

0

1 - 20

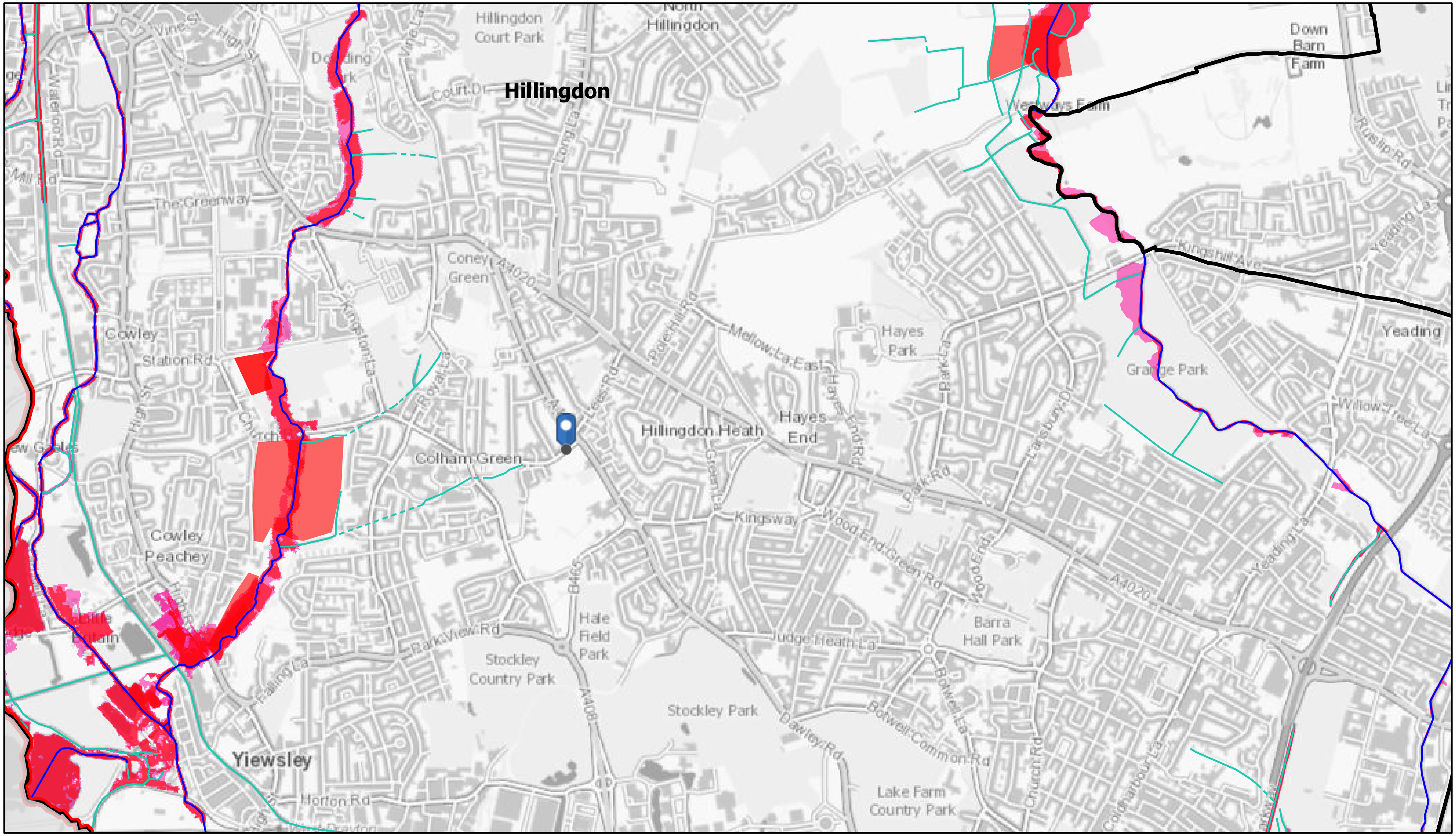
1:25,000

0 0.2 0.4 0.8 mi

0 0.33 0.65 1.3 km

London Boroughs of Brent, Barnet, Harrow, Hillingdon, Hounslow and Ealing

West London SFRA Policy Map



17/02/2022, 15:53:23

Borough Boundary	Main River - Culverted
Study Area Boundary	Ordinary Watercourse
Main River	Ordinary Watercourse - Culverted
Flood Zone 3b Fluvial and Tidal	
Flood Zone 3a Fluvial and Tidal	

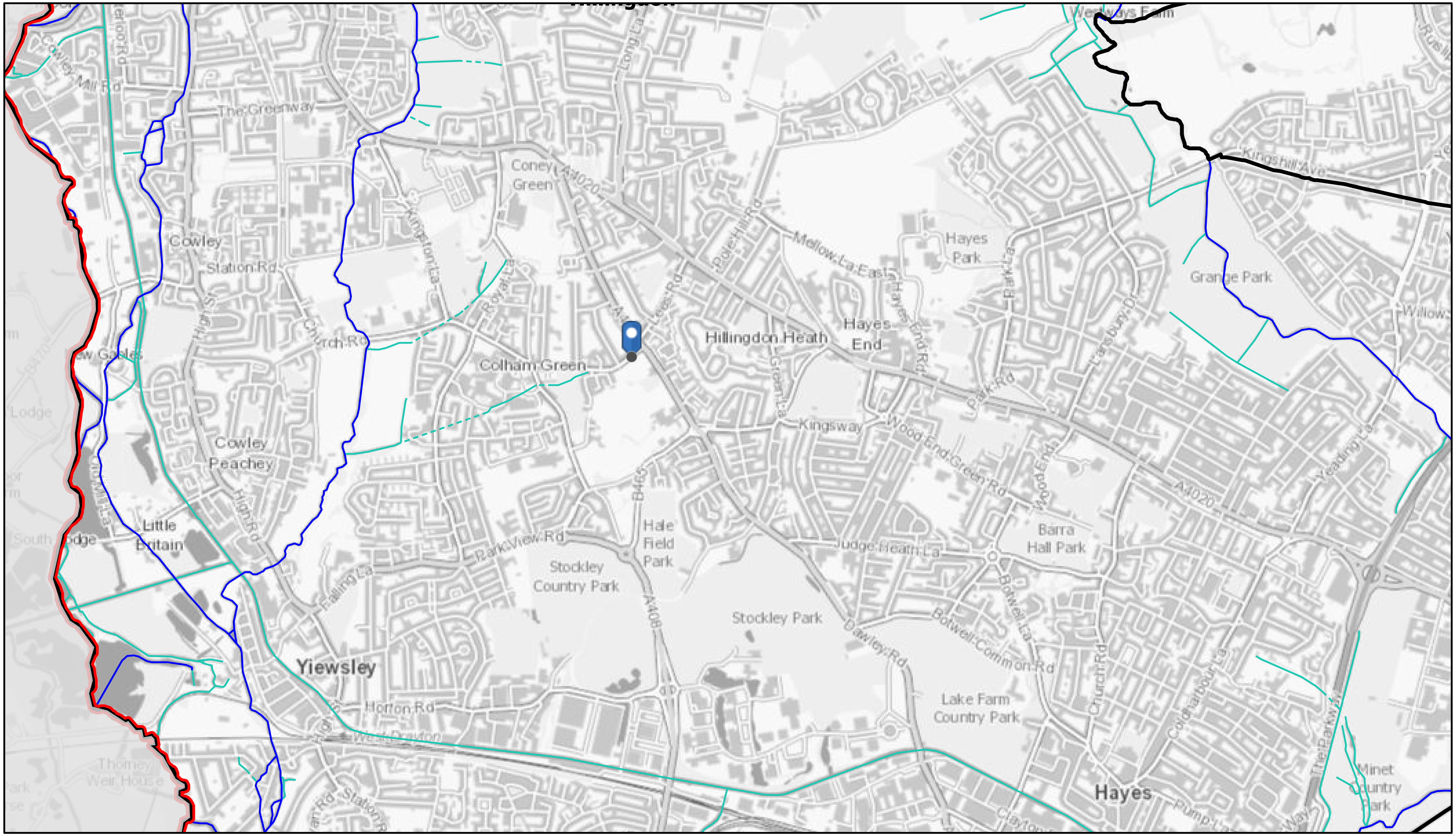
1:25,000

0 0.2 0.4 0.8 mi

0 0.33 0.65 1.3 km

London Boroughs of Brent, Barnet, Harrow, Hillingdon, Hounslow and Ealing

Fluvial & Tidal Flood Risk West London SFRA



17/02/2022, 15:47:55

Legend	
Borough Boundary	Main River - Culverted
Study Area Boundary	Ordinary Watercourse
Main River	Ordinary Watercourse - Culverted

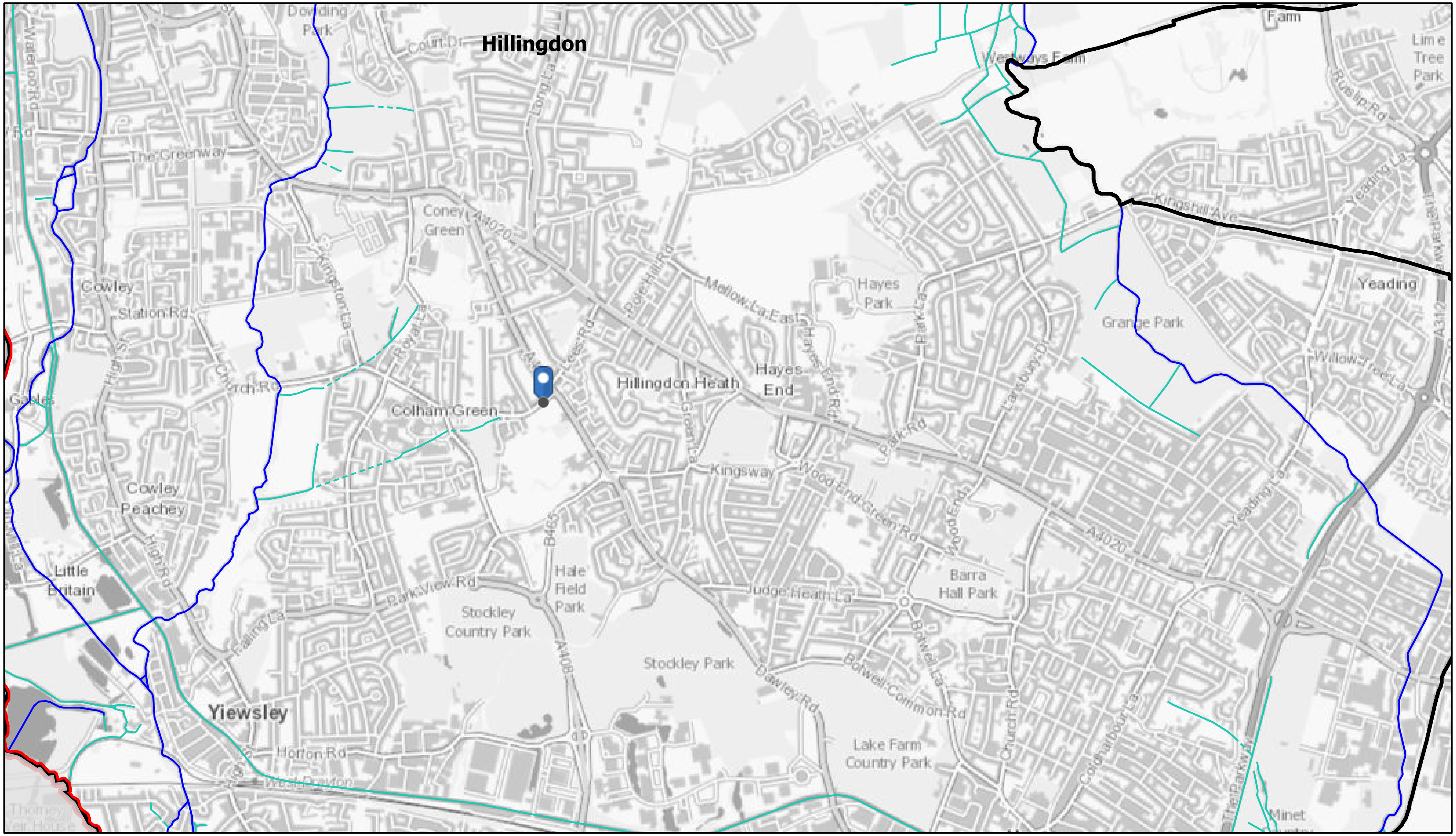
1:25,000

0 0.2 0.4 0.8 mi

0 0.33 0.65 1.3 km

London Boroughs of Brent, Barnet, Harrow, Hillingdon, Hounslow and Ealing

Surface Water Flood Risk West London SFRA



17/02/2022, 15:45:33

- Borough Boundary
- Study Area Boundary
- Main River
- Main River - Culverted
- Ordinary Watercourse
- Ordinary Watercourse - Culverted

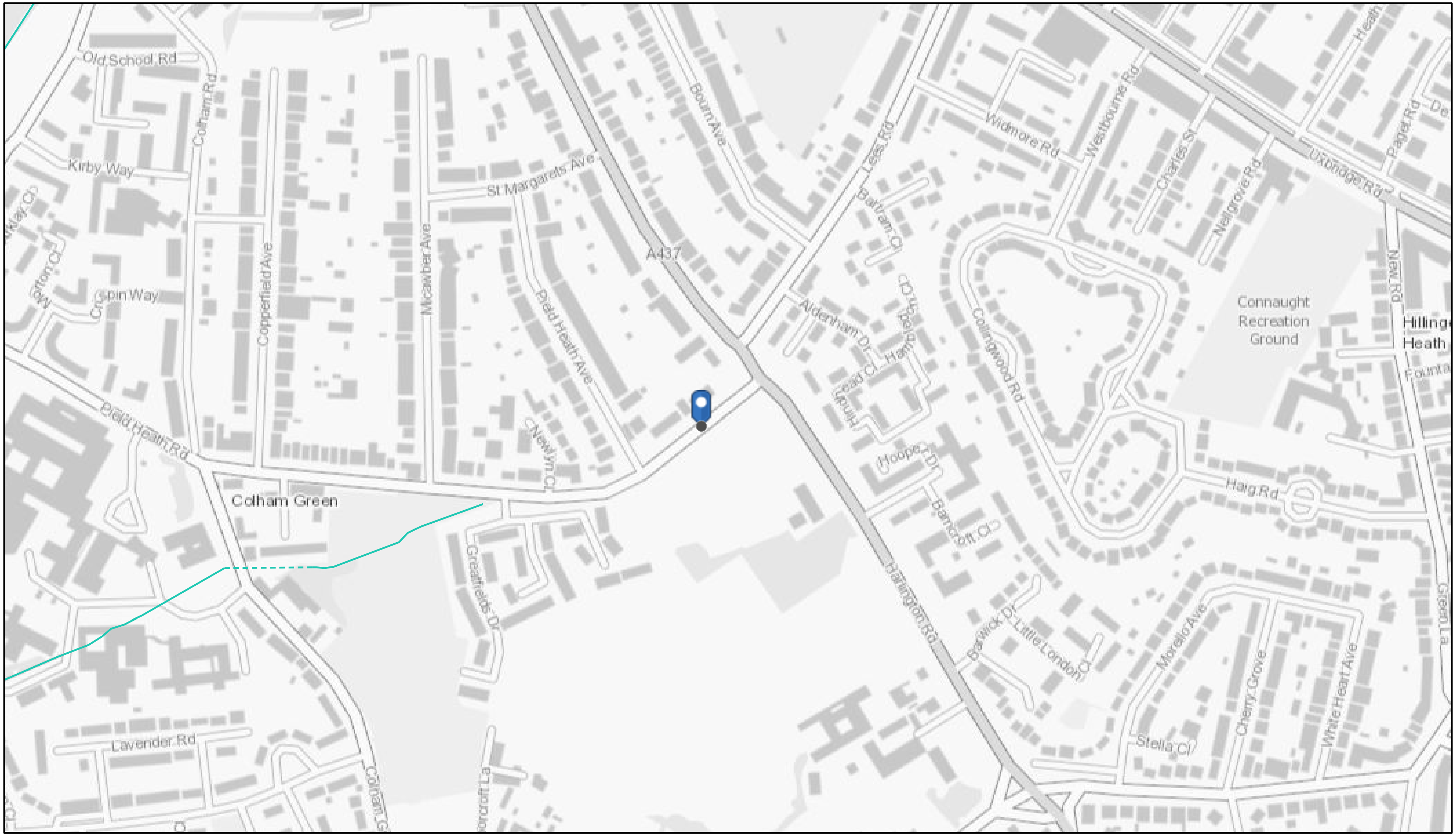
1:25,000

0 0.2 0.4 0.8 mi

0 0.33 0.65 1.3 km

London Boroughs of Brent, Barnet, Harrow, Hillingdon, Hounslow and Ealing

West London SFRA



17/02/2022, 15:39:59

Borough Boundary

Study Area Boundary

Ordinary Watercourse

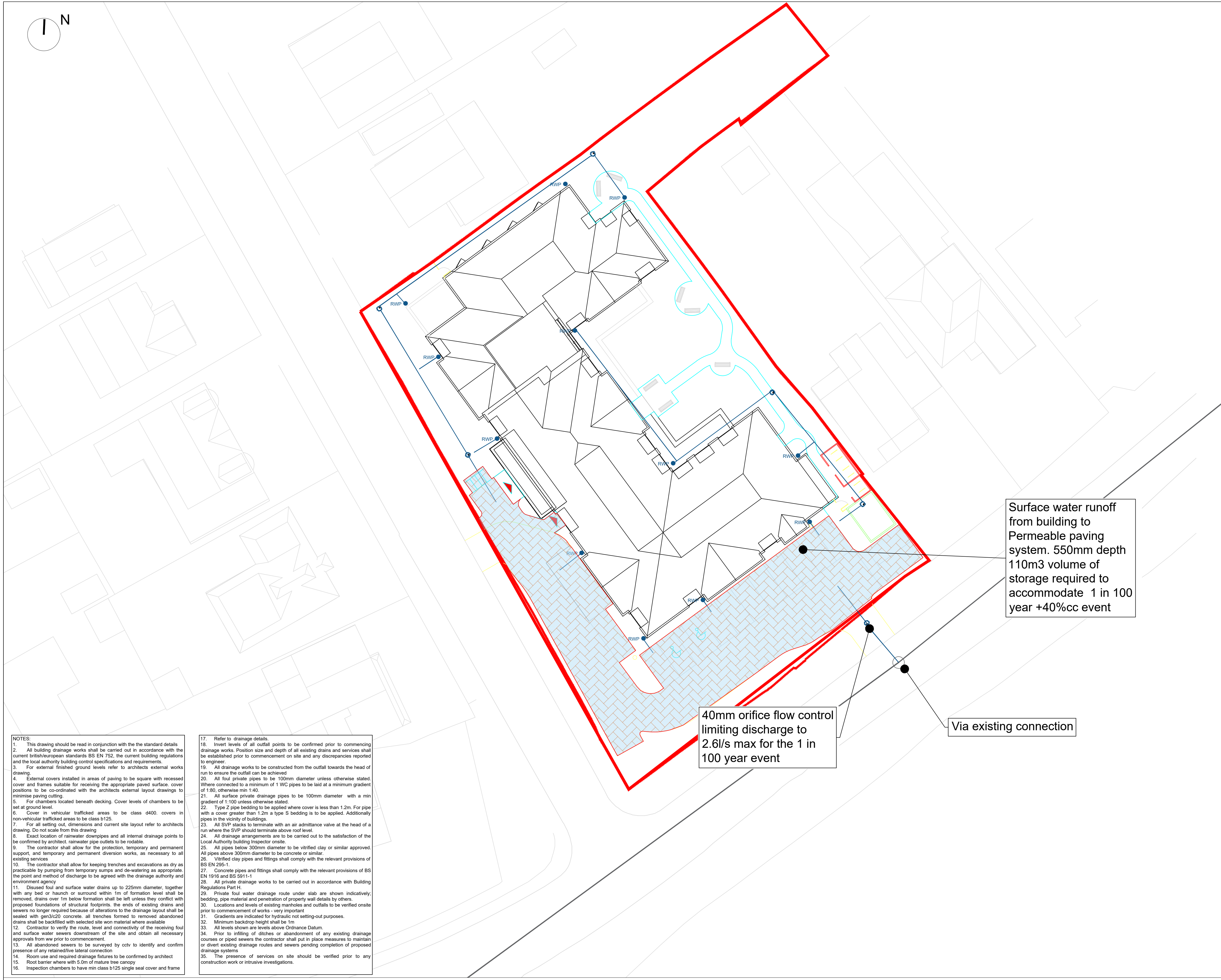
Ordinary Watercourse - Culverted

1:5,000

0 | 0.04 | 0.09 | 0.17 mi

0 | 0.05 | 0.1 | 0.2 km

APPENDIX C – Proposed Drainage Strategy



NOTES:

1. This drawing should be read in conjunction with the the standard details
2. All building drainage works shall be carried out in accordance with the current british/european standards BS EN 752, the current building regulations and the local authority building control specifications and requirements.
3. For external finished ground levels refer to architects external works drawing.
4. External covers installed in areas of paving to be square with recessed cover and frames suitable for receiving the appropriate paved surface. cover positions to be co-ordinated with the architects external layout drawings to minimise paving cutting.
5. For chambers located beneath decking. Cover levels of chambers to be set at ground level.
6. Cover in vehicular trafficked areas to be class d400. covers in non-vehicular trafficked areas to be class b125.
7. For all setting out, dimensions and current site layout refer to architects drawing. Do not scale from this drawing
8. Exact location of rainwater downpipes and all internal drainage points to be confirmed by architect. rainwater pipe outlets to be rodable.
9. The contractor shall allow for the protection, temporary and permanent support, and temporary and permanent diversion works, as necessary to all existing services
10. The contractor shall allow for keeping trenches and excavations as dry as practicable by pumping from temporary sumps and de-watering as appropriate. the point and method of discharge to be agreed with the drainage authority and environment agency
11. Disused foul and surface water drains up to 225mm diameter, together with any bed or haunch or surround within 1m of formation level shall be removed, drains over 1m below formation shall be left unless they conflict with proposed foundations of structural footprints. the ends of existing drains and sewers no longer required because of alterations to the drainage layout shall be sealed with gen3/c20 concrete. all trenches formed to removed abandoned drains shall be backfilled with selected site won material where available
12. Contractor to verify the route, level and connectivity of the receiving foul and surface water sewers downstream of the site and obtain all necessary approvals from ww prior to commencement.
13. All abandoned sewers to be surveyed by cctv to identify and confirm presence of any retained/live lateral connection
14. Room use and required drainage fixtures to be confirmed by architect
15. Root barrier where with 5.0m of mature tree canopy
16. Inspection chambers to have min class b125 single seal cover and frame
17. Refer to drainage details.
18. Invert levels of all outfall points to be confirmed prior to commencing drainage works. Position size and depth of all existing drains and services shall be established prior to commencement on site and any discrepancies reported to engineer.
19. All drainage works to be constructed from the outfall towards the head of run to ensure the outfall can be achieved
20. All foul private pipes to be 100mm diameter unless otherwise stated. Where connected to a minimum of 1 WC pipes to be laid at a minimum gradient of 1:80, otherwise min 1:40.
21. All surface private drainage pipes to be 100mm diameter with a min gradient of 1:100 unless otherwise stated.
22. Type Z pipe bedding to be applied where cover is less than 1.2m. For pipe with a cover greater than 1.2m a type S bedding is to be applied. Additionally pipes in the vicinity of buildings.
23. All SVP stacks to terminate with an air admittance valve at the head of a run where the SVP should terminate above roof level.
24. All drainage arrangements are to be carried out to the satisfaction of the Local Authority building Inspector onsite.
25. All pipes below 300mm diameter to be vitrified clay or similar approved. All pipes above 300mm diameter to be concrete or similar.
26. Vitrified clay pipes and fittings shall comply with the relevant provisions of BS EN 295-1.
27. Concrete pipes and fittings shall comply with the relevant provisions of BS EN 1916 and BS 5911-1
28. All private drainage works to be carried out in accordance with Building Regulations Part H.
29. Private foul water drainage route under slab are shown indicatively; bedding, pipe material and penetration of property wall details by others.
30. Locations and levels of existing manholes and outfalls to be verified onsite prior to commencement of works - very important
31. Gradients are indicated for hydraulic not setting-out purposes.
32. Minimum backdrop height shall be 1m
33. All levels shown are levels above Ordnance Datum.
34. Prior to infilling of ditches or abandonment of any existing drainage courses or piped sewers the contractor shall put in place measures to maintain or divert existing drainage routes and sewers pending completion of proposed drainage systems
35. The presence of services on site should be verified prior to any construction work or intrusive investigations.

DO NOT SCALE DRAWING - IF IN DOUBT, ASK

GENERAL
1. Do not scale from drawing.
2. All dimensions are in metres, unless stated otherwise.
3. This drawing to be read & printed in colour.
4. This drawing to be read in conjunction with other contract drawings.

CONSTRUCTION
1. Works shall comply with the current Department of Transport Specification for Highway Works.
2. Filling of voids formed by site clearance operations shall be measured under Series 600 of the Specification.
3. Contractor is to ensure that all voids are to be filled with granular sub base material Type 1.
4. All hard material broken out under the Contract is to be disposed of to contractor's tip.

CDM (RISKS & HAZARDS)
1. Prior to commencement of construction the contractor is to liaise with all relevant statutory undertakers and protect / divert apparatus and to protect the workforce during the works. Any damage caused to the apparatus to be the responsibility of the contractor.
2. Contractor to undertake their own statutory plant checks on site prior to the commencement of excavation exercise.
3. The contractor is to make sure that any excavation should be adequately covered at night to protect both public and wildlife from becoming trapped.
4. Appropriate health and safety measures should be adhered to while working in close proximity to the existing overhead power lines.

DISCLAIMERS
1. The information contained in this drawing is based on a combination of OS and survey data provided by others and we shall not be liable for any inaccuracies or deficiencies.

KEY:

Existing Drainage

PROPOSED SURFACE WATER DRAINAGE

Surface water drain (all pipes to be 150mmØ UNO)

Inspection chamber (450Ø PPIC)

RWP Rain water pipe (with rodding access) - for exact locations refer to Architects layouts

Proposed cellular tank

Site boundary

Rev	Drawn	App'd	Date	Revision Description

Issue: PRELIMINARY

SYNTEGRA CONSULTING
Syntegra House, 63 Milford Road, Reading, RG1 8LG
Tel: 0118 4028520
mail@syntegragroup.com www.syntegragroup.com

Client: -

Project: 18 Pield Heath Rd, Uxbridge, UB8 3NF

Title: PROPOSED DRAINAGE STRATEGY

Scale: 1:125 @ A1	Drawn By: AS
Date: MARCH 2022	Checked By: AN
Drg. No. 6426/6001	Rev. P1

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

Half Drain Time : 420 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	9.292	0.292	0.0	1.7	1.7	50.4	O K
30 min Summer	9.379	0.379	0.0	2.0	2.0	65.3	O K
60 min Summer	9.462	0.462	0.0	2.2	2.2	79.7	O K
120 min Summer	9.532	0.532	0.0	2.4	2.4	91.8	O K
180 min Summer	9.559	0.559	0.0	2.5	2.5	96.5	O K
240 min Summer	9.569	0.569	0.0	2.5	2.5	98.1	O K
360 min Summer	9.569	0.569	0.0	2.5	2.5	98.2	O K
480 min Summer	9.567	0.567	0.0	2.5	2.5	97.8	O K
600 min Summer	9.562	0.562	0.0	2.5	2.5	96.9	O K
720 min Summer	9.555	0.555	0.0	2.4	2.4	95.7	O K
960 min Summer	9.538	0.538	0.0	2.4	2.4	92.7	O K
1440 min Summer	9.499	0.499	0.0	2.3	2.3	86.0	O K
2160 min Summer	9.442	0.442	0.0	2.2	2.2	76.3	O K
2880 min Summer	9.394	0.394	0.0	2.0	2.0	68.0	O K
4320 min Summer	9.320	0.320	0.0	1.8	1.8	55.1	O K
5760 min Summer	9.265	0.265	0.0	1.7	1.7	45.8	O K
7200 min Summer	9.225	0.225	0.0	1.5	1.5	38.8	O K
8640 min Summer	9.193	0.193	0.0	1.4	1.4	33.4	O K
10080 min Summer	9.169	0.169	0.0	1.3	1.3	29.1	O K
15 min Winter	9.327	0.327	0.0	1.9	1.9	56.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.394	0.0	50.2	26
30 min Summer	90.786	0.0	66.1	40
60 min Summer	56.713	0.0	84.3	68
120 min Summer	34.218	0.0	101.8	126
180 min Summer	25.118	0.0	112.2	184
240 min Summer	20.049	0.0	119.4	242
360 min Summer	14.556	0.0	130.0	310
480 min Summer	11.596	0.0	138.1	372
600 min Summer	9.714	0.0	144.6	436
720 min Summer	8.402	0.0	150.1	504
960 min Summer	6.677	0.0	159.0	642
1440 min Summer	4.823	0.0	171.9	914
2160 min Summer	3.478	0.0	187.4	1320
2880 min Summer	2.755	0.0	197.8	1704
4320 min Summer	1.981	0.0	213.0	2468
5760 min Summer	1.566	0.0	225.3	3184
7200 min Summer	1.304	0.0	234.5	3904
8640 min Summer	1.123	0.0	242.1	4664
10080 min Summer	0.989	0.0	248.5	5352
15 min Winter	138.394	0.0	56.3	26

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	9.425	0.425	0.0	2.1	2.1	73.4	O K
60 min Winter	9.520	0.520	0.0	2.4	2.4	89.7	O K
120 min Winter	9.601	0.601	0.0	2.5	2.5	103.6	O K
180 min Winter	9.634	0.634	0.0	2.6	2.6	109.3	O K
240 min Winter	9.647	0.647	0.0	2.6	2.6	111.6	O K
360 min Winter	9.649	0.649	0.0	2.6	2.6	111.9	O K
480 min Winter	9.642	0.642	0.0	2.6	2.6	110.7	O K
600 min Winter	9.634	0.634	0.0	2.6	2.6	109.4	O K
720 min Winter	9.623	0.623	0.0	2.6	2.6	107.5	O K
960 min Winter	9.597	0.597	0.0	2.5	2.5	103.0	O K
1440 min Winter	9.539	0.539	0.0	2.4	2.4	93.0	O K
2160 min Winter	9.459	0.459	0.0	2.2	2.2	79.1	O K
2880 min Winter	9.392	0.392	0.0	2.0	2.0	67.7	O K
4320 min Winter	9.295	0.295	0.0	1.8	1.8	50.8	O K
5760 min Winter	9.229	0.229	0.0	1.5	1.5	39.5	O K
7200 min Winter	9.183	0.183	0.0	1.3	1.3	31.6	O K
8640 min Winter	9.151	0.151	0.0	1.2	1.2	26.0	O K
10080 min Winter	9.127	0.127	0.0	1.1	1.1	21.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	90.786	0.0	74.1	40
60 min Winter	56.713	0.0	94.5	68
120 min Winter	34.218	0.0	114.1	124
180 min Winter	25.118	0.0	125.7	180
240 min Winter	20.049	0.0	133.8	236
360 min Winter	14.556	0.0	145.7	342
480 min Winter	11.596	0.0	154.8	388
600 min Winter	9.714	0.0	162.0	464
720 min Winter	8.402	0.0	168.1	540
960 min Winter	6.677	0.0	178.1	692
1440 min Winter	4.823	0.0	192.6	986
2160 min Winter	3.478	0.0	209.9	1408
2880 min Winter	2.755	0.0	221.6	1800
4320 min Winter	1.981	0.0	238.7	2560
5760 min Winter	1.566	0.0	252.3	3296
7200 min Winter	1.304	0.0	262.7	4032
8640 min Winter	1.123	0.0	271.3	4752
10080 min Winter	0.989	0.0	278.4	5448

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.402	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.200

Time From:	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**
0	4	0.067	4	8	0.067	8	12	0.067

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 9.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.30
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	**Area (m²)**	**Inf. Area (m²)**	**Depth (m)**	**Area (m²)**	**Inf. Area (m²)**
0.000	575.0	0.0	0.450	575.0	0.0

Orifice Outflow Control

Diameter (m) 0.040 Discharge Coefficient 0.600 Invert Level (m) 9.000

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.300
Area (ha)	0.270	Urban	0.000
SAAR (mm)	669	Region Number	Region 6

Results	**l/s**
QBAR Rural	0.5
QBAR Urban	0.5
Q100 years	1.5
Q1 year	0.4
Q30 years	1.1
Q100 years	1.5