**Final Report**

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# Stevenage Borough Council Level 2 Strategic Flood Risk Assessment

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# List of Acronyms

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|---|---|
| ABD | Areas Benefiting from Defences |
| AEP | Annual Exceedance Probability |
| AIMS | Asset Information Management System |
| AOD | Above Ordnance Datum |
| AWS | Anglian Water Services |
| BGS | British Geological Survey |
| BC | Borough Council |
| CC | County Council |
| CFMP | Catchment Flood Management Plan |
| DC | District Council |
| DCLG | Department for Communities and Local Government |
| Defra | Department for Environment, Flood and Rural Affairs |
| DRN | Detailed River Network |
| EU | European Union |
| FCERM | Flood and Coastal Erosion Risk Management |
| FRA | Flood Risk Assessment |
| FRMP | Flood Risk Management Plan |
| FWMA | Flood and Water Management Act 2010 |
| GCSE | General Certificate of Secondary Education |
| GIS | Geographic Information System |
| GPs | General Practioners |
| HCC | Hertfordshire County Council |
| LFRMS | Local Flood Risk Management Strategy |
| LLFA | Lead Local Flood Authority |
| LoWS | Local Wildlife Sites |
| LPA | Local Planning Authority |
| NNR | National Nature Reserve |
| NPPF | National Planning Policy Framework |
| PDL | Previously Developed Land |
| PFRA | Preliminary Flood Risk Assessment |
| PPG | Planning Policy Guidance |
| PPS25 | Planning Policy Statement 25 |
| RBD | River Basin District |
| RMAs | Risk Management Authorities |
| SBC | Stevenage Borough Council |
| SFRA | Strategic Flood Risk Assessment |
| SSSIs | Site of Special Scientific Interest |
| SuDS | Sustainable Drainage Systems |
| SWMP | Surface Water Management Plan |
| uFMfSW | Updated Flood Map for Surface Water |
| UKCP09 | United Kingdom Climate Projections |
| WCS | Water Cycle Study |
| WFD | Water Framework Directive |
| WwTW | Wastewater Treatment Works |

# Glossary of Terms

| Glossary | Definition |
|---|---|
| Annual exceedance probability (AEP) | Chance of occurrence in any one year, expressed as a percentage. For example, a 1% annual probability event has a 1 in 100 chance of occurring in any given year. |
| Areas Benefitting from Defences (ABD) | Hatched areas on the Environment Agency Flood Map for Planning (Rivers and Sea) behind flood defences, which, if the flood defences were not present, would flood, in the event of a river flood with a 1 % (1 in 100) chance of happening each year, or a flood from the sea with a 0.5 % (1 in 200) chance of happening each year. |
| Asset Information Management System (AIMS) | Environment Agency management system of assets associated with main rivers including defences, structures and channel types. Information regarding location, standard of service, dimensions and condition. |
| Aquifer | A source of groundwater comprising water bearing rock, sand or gravel capable of yielding significant quantities of water. |
| Catchment Flood Management Plan (CFMP) | A high-level planning strategy through which the Environment Agency works with their key decision makers within a river catchment to identify and agree policies to secure the long-term sustainable management of flood risk. |
| Civil Contingencies Act | This Act delivers a single framework for civil protection in the UK. As part of the Act, Local Resilience Forums must put into place emergency plans for a range of circumstances, including flooding. |
| Climate Change | Long term variations in global temperature and weather patterns caused by natural and human actions. For fluvial events a 20% increase in river flow is applied and for rainfall events, a 30% increase. These climate change values are based upon information within the NPPF and Planning Practice Guidance (PPG). |
| Culvert | A channel or pipe that carries water below the level of the ground. |
| DG5 Register | A water-company held register of properties which have experienced sewer flooding due to hydraulic overload, or properties which are 'at risk' of sewer flooding more frequently than once in 20 years. |
| Exception Test | A method set out in the NPPF to help ensure that flood risk to people and property will be managed satisfactorily, while allowing necessary development to go ahead in situations where suitable sites at lower risk of flooding are not available. The two parts to the Test require proposed development to show that it will provide wider sustainability benefits to the community that outweigh flood risk, and that it will be safe for its lifetime, without increasing flood risk elsewhere and where possible reduce flood risk overall. |
| Flood and Water Management Act (FWMA) | Part of the UK Government's response to Sir Michael Pitt's Report on the Summer 2007 Floods; the aim of which is to clarify the legislative framework for managing local flood risk (flooding from surface water, groundwater and ordinary watercourses) in England. |
| Flood Defence | Infrastructure used to protect an area against flooding such as floodwalls and embankments. |
| Resilience measures | Measures designed to reduce the impact of water that enters property and businesses and to promote fast drying and easy cleaning; for example raising electrical appliances, installing tiled flooring. |
| Resistance measures | Measures to prevent flood water entering a building or damaging its fabric, for example the use of flood guards. This has the same meaning as flood proofing. |
| Flood Risk | The level of flood risk is the product of the frequency or likelihood of the flood events and their consequences (such as loss, damage, harm, distress and disruption). |
| Flood Risk Regulations | Transposition of the EU Floods Directive into UK law. The EU Floods Directive is a piece of European Community (EC) legislation to specifically address flood risk by prescribing a common framework for its measurement and management. |
| Flood Zone | Areas defined by the probability of river and sea flooding, ignoring the presence of defences. Flood Zones are shown on the Environment Agency's Flood Map for Planning (Rivers and Sea), available on the Environment Agency's web site. |
| Fluvial | Relating to the actions, processes and behaviour of a watercourse (river or stream). |
| Freeboard | The height of a flood defence crest level (or building level) above a particular design flood level. |
| Functional Floodplain | Land where water has to flow or be stored in times of flood. It is defined by LPAs within SFRAs. Functional floodplain (also referred to as Flood Zone 3b) is not separately distinguished from Zone 3a on the Environment Agency Flood Map for Planning. |
| Groundwater | Water that is in the ground, this is usually referring to water in the saturated zone below the water table. |

| Glossary | Definition |
|---|---|
| Lead Local Flood Authority (LLFA) | As defined by the Flood and Water Management Act, in relation to an area in England, this means the unitary authority or where there is no unitary authority, the county council for the area. In this case, Hertfordshire County Council. |
| Local Planning Authority (LPA) | Body that is responsible for controlling planning and development through the planning system. |
| Main river | Watercourse defined on a 'main river map' designated by Defra. The Environment Agency has permissive powers to carry out flood defence works, maintenance and operational activities for main rivers. However overall responsibility for maintenance lies with the riparian owner. |
| Mitigation measure | An element of development design which may be used to manage flood risk or avoid an increase in flood risk elsewhere. |
| National Planning Policy Framework (NPPF) | The National Planning Policy Framework was published on 27 March 2012. It is a framework which sets out the Government's planning policies for England and how these are expected to be applied. |
| Ordinary watercourse | A watercourse that does not form part of a main river. This includes "all rivers and streams and all ditches, drains, cuts, culverts, dikes, sluices (other than public sewers within the meaning of the Water Industry Act 1991) and passages, through which water flows" according to the Land Drainage Act 1991. |
| Residual Flood Risk | The remaining flood risk after risk reduction measures have been taken into account. |
| Return Period | The average time period between rainfall or flood events with the same intensity and effect. |
| Risk | Risk is a factor of the probability or likelihood of an event occurring multiplied by consequence: Risk = Probability x Consequence. It is also referred to in this report in a more general sense. |
| Sequential Test | An approach to future site planning whereby new development is directed towards areas with the lowest probability of flooding before consideration of higher risk areas. The Sequential Test helps ensure that development can be safely and sustainably delivered and developers do not waste their time promoting proposals which are inappropriate on flood risk grounds. |
| Sewer Flooding | Flooding caused by a blockage or overflowing of a sewer or urban drainage system. |
| Surface Water | Rainwater (including snow and other precipitation) which is on the surface of the ground (whether or not it is moving), and has not entered a watercourse, drainage system or public sewer. |
| Surface Water Management Plan (SWMP) | A plan which outlines the preferred surface water management strategy in a given location. In this context surface water flooding describes flooding from sewers, drains, groundwater and runoff from land, small watercourses and ditches that occurs as a result of heavy rainfall. |
| Sustainable drainage systems (SuDS) | Methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques. |
| Topographic survey | A survey of ground levels. |

# Executive Summary

Stevenage Borough Council (SBC) updated the Level 1 Strategic Flood Risk Assessment (SFRA) for Stevenage in 2016. This study provided a strategic understanding of flood risk within the Borough with particular attention to future development sites proposed in SBC's emerging Local Plan. All development sites were assessed in terms of risk from all sources of flooding and six of them were identified to be at medium or high risk -

- South Stevenage
    - Bragbury End Sports Ground Car Park (Local Plan reference HO1/2)
    - South East of Stevenage (HO4)
- North West Stevenage
    - Major Opportunity Area -New Convenience Retail Provision (TC11)
    - Land West of North Road (EC1/4)
    - The Health Campus (HC3)
    - Land West of Junction 8 (EC1/7)

This Level 2 SFRA has been prepared in order to provide a greater understanding of flood risk at the above sites in accordance with national guidance, the National Planning Policy Framework (NPPF) and the NPPF Planning Practice Guidance (PPG).

The Level 2 SFRA report provides an assessment of the Local Plan sites, taking into consideration SBC's future growth and the onset of climate change, and establishes a process for reducing flood risk and ensuring that development is steered towards appropriate areas taking into account flood risk and the vulnerability classifications of the proposed land use. All sources of flood risk have been included in this Level 2 SFRA report using the most recent datasets made available from the Environment Agency, Hertfordshire County Council (HCC) and SBC.

To provide a long term holistic review of flood risks within the Borough, the latest climate change guidance from Environment Agency's Thames and Anglian River Basin Districts have been considered in the study. It is recommended that values form Thames River Basin District are adopted in the Local Plan so that the planning decisions are robust in the face of climate change and consistent across the Borough. The fluvial flood risk with an allowance for climate change was modelled by AECOM using the existing Environment Agency River Beane hydraulic model. The revised modelling only covers the southern sites. Results from a recent flood risk assessment model have been used to assess climate change vulnerability of the sites in the North West.

A series of Site Assessment tables provide a summary of the flood risk for each site identified as requiring additional assessment as part of this Level 2 SFRA. These tables provide an assessment of current and future flood risk (Climate Change), an assessment of residual risks, and recommendations for development – based on the proposed land use types. These assessments estimate that 95% (Table 7-1) of the combined site area of all six sites is compatible with the types of developments proposed in the Local Plan. It is recommended that SBC adopts a Sequential Test based planning policy to steer development to the parts of sites compatible with respective vulnerability classification and appropriate mitigation measure is included in development plan to manage residual flood risk.

Wider guidance and policy recommendations are provided to assist with the development of site specific Flood Risk Assessments (FRAs), when development proposals are produced for these sites as part of a planning application. The guidance provides a summary of key requirements of the SBC and those of the Environment Agency and HCC, and is aimed at ensuring proposed developments are located in an appropriate area, are made safe and that a flood risk reduction is achieved through sustainable development practices.

# 1 Introduction

## 1.1 Purpose of the Assessment

This Level 2 Strategic Flood Risk Assessment (SFRA) has been prepared in order to provide a greater understanding of flood risk at proposed future development sites within Stevenage Borough Council (SBC), in accordance with the guidance established in the National Planning Policy Framework (NPPF)[1] and the NPPF Planning Practice Guidance (PPG)[2] in addition to Environment Agency and local planning policy requirements.

The Level 2 SFRA will form an important part of the required evidence base, and a framework for managing and addressing future flood risk. Drawing together the baseline evidence of flooding from all sources, and improving upon the existing fluvial flooding information, the study refines and builds upon the work undertaken in the Level 1 SFRA[3], to provide robust supporting evidence and deliver a consistent baseline for managing future flood risk.

## 1.2 Scope of the Assessment

The Level 1 SFRA provided a strategic understanding of flood risk within the Borough with particular attention to future development sites proposed in SBC's emerging Local Plan. All development sites were assessed in terms of risk from all sources of flooding. This Level 2 SFRA study has been undertaken to investigate the flood risk associated with those development sites identified in SFRA Level 1 report to be at medium or high risk of flooding (Table 1-1).

**Table 1-1 Sites included in Level 2 SFRA**

| Local Plan Reference | Description | Overall Flood Risk (SFRA Level 1) | Location | Area (ha) |
|---|---|---|---|---|
| ***South Stevenage*** | | | | |
| HO1/2 | Bragbury End Sports Ground Car Park | High | Aston Lane | 0.60 |
| HO4 | South East of Stevenage | High | A602 | 30.22 |
| ***North West Stevenage*** | | | | |
| TC11 | Major Opportunity Area -New Convenience Retail Provision | Medium | Graveley Road | 3.64 |
| EC1/4 | Land West of North Road | Medium | North Road | 6.76 |
| HC3 | The Health Campus | Medium | Stevenage Health Campus Site | 22.05 |
| EC1/7 | Land West of Junction 8 | Medium | Junction 8 of A1 (M) | 5.64 |

The Level 2 SFRA provides a detailed assessment of these development areas, taking into consideration SBC's future growth and the potential impacts of climate change. The assessments in Section 4 of this report determine the flood risk issues relative to the following sources of flooding considering the vulnerability classification of the proposed land use:

- Rivers (Fluvial);
- Surface Water Runoff from Land (Pluvial);
- Groundwater;
- Sewers; and
- Other Artificial Sources (Reservoirs and Canals).

[1] National Planning Policy Framework, Communities and Local Government, March 2012
[2] http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/ March 2014
[3] Strategic Flood Risk Assessment Level 1 Update, June 2016

## 1.3 Planning Context

The NPPF[4] and accompanying PPG for Flood Risk and Coastal Change[5] emphasise the responsibility of Local Planning Authorities (LPAs) to ensure that flood risk is understood and managed effectively in their areas using a risk-based approach throughout all stages of the planning process. The NPPF requires LPAs to undertake SFRAs to support the preparation of their Local Plan. The NPPF was published in March 2012 and replaces the Planning Policy Statement 25 (PPS25) Development and Flood Risk[6]. The accompanying NPPF Technical Guidance[7] also published in March 2012 retained reference to the PPS25 Practice Guidance[8], but this too has now been superseded by the revised PPG published as an on-line resource in 2014. This Level 2 SFRA has been prepared in accordance with the principles set out in the NPPF and latest supporting PPG.

The NPPF and supporting guidance require LPAs to undertake SFRAs and to use their findings, and those of other studies, to inform strategic land use planning. This includes the application of the Sequential Test which seeks to steer development towards areas of lowest flood risk prior to consideration of areas of greater risk.

## 1.4 SFRA Overview

The NPPF guidance aims to ensure that flood risk is considered at all stages of the planning process, and to avoid inappropriate development in areas of greatest flood risk – steering development towards areas of lower risk. Where new development is considered necessary in such areas, (such as to meet urban growth targets and facilitate regeneration schemes) the policy aims to make the development 'safe' without increasing flood risk elsewhere, and where possible, providing a betterment. The NPPF guidance states that in Paragraph 100:

> *"Local Plans should be supported by Strategic Flood Risk Assessment and develop policies to manage flood risk from all sources, taking account of advice from the Environment Agency and other relevant flood risk management bodies"*

Paragraph 10 of the NPPF PPG document states that:

> *"The Strategic Flood Risk Assessment will be used to refine information on river and sea flooding risk shown on the Environment Agency's Flood Map for Planning (Rivers and Seas). Local planning authorities should use the Assessment to:*
>
> - *determine the variations in risk from all sources of flooding across their areas, and also the risks to and from surrounding areas in the same flood catchment;*
> - *inform the sustainability appraisal of the Local Plan, so that flood risk is fully taken into account when considering allocation options and in the preparation of plan policies, including policies for flood risk management to ensure that flood risk is not increased;*
> - *apply the Sequential Test and, where necessary, the Exception Test when determining land use allocations;*
> - *identify the requirements for site-specific flood risk assessments in particular locations, including those at risk from sources other than river and sea flooding;*
> - *determine the acceptability of flood risk in relation to emergency planning capability;*
> - *consider opportunities to reduce flood risk to existing communities and developments through better management of surface water, provision for conveyance and of storage for flood water."*

The NPPF and NPPF PPG (Flood Risk and Coastal Change) have established a process for the assessment of flood risk, with each stage building upon the previous assessment with a refinement of the evidence base (Table 1-2). Utilising a **Source – Pathway – Receptor** approach, the source of flooding, the spatial distribution of flood risk and the vulnerability of development types are assessed to inform decision making, through each of these key stages, based upon the Flood Risk Management Hierarchy outlined in the PPS25 Practice Guide[9].

[4] Department for Communities and Local Government. 2012. *National Planning Policy Framework*. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf

[5] Department for Communities and Local Government. 2014. Planning Practice Guidance for Flood Risk and Coastal Change. Available at http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/

[6] Department for Communities and Local Government. 2010. *'Planning Policy Statement 25: Development and Flood Risk,* TSO: London.

[7] Department for Communities and Local Government. 2012. '*Technical Guidance to the National Planning Policy Framework'*. TSO: London. Available at: http://www.communities.gov.uk/publications/planningandbuilding/nppftechnicalguidance

[8] Department for Communities and Local Government. 2009. *'Planning Policy Statement 25: Development and Flood Risk Practice Guide'*. TSO: London. Available at: http://www.communities.gov.uk/documents/planningandbuilding/pdf/pps25guideupdate.pdf

[9] Department for Communities and Local Government, 2009. *PPS25 Development and Flood Risk Practice Guide.*

**Table 1-2 Flood Risk Management Hierarchy and the SFRA Process**


| Stage | Approach |
|---|---|
| Level 1 SFRA | Assessment (broad scale and comprehensive) |
| Sequential Test Across Planning Area | Avoidance |
| Level 2 SFRA (if required) | Detailed Assessment (Growth Area or Site Specific) |
| Sequential Approach at Site | Avoidance |
| Control and Improvement | Through Design (e.g. Sustainable Drainage Systems(SuDS)) |
| Mitigate Remaining Risks | Flood Resilient Design and Construction |

## 1.5 Level 2 SFRA Aims and Objectives

Where it is not feasible to allocate future development in Flood Zone 1, LPAs are often required to improve the evidence base to make informed decisions regarding the safe allocation of development in areas of higher flood risk, through the development of a Level 2 SFRA.

Where LPAs have been unable to allocate all proposed development and infrastructure in accordance with the Sequential Test, taking account of the flood vulnerability category of the intended use, it will be necessary to increase the scope of the SFRA to provide the information necessary for application of the Exception test. The increased scope of the SFRA should enable the production of mapping showing flood outlines for different probabilities, impact, speed of onset, depth and velocity variance of flooding, taking account of the presence and likely performance of flood risk management infrastructure.

Therefore the Level 2 SFRA key objective is to facilitate the application of the Sequential and Exception Tests as defined in the NPPF guidance, by providing additional flood risk information. Section 102 of NPPF states:

> *"If, following application of the Sequential Test, it is not possible, consistent with wider sustainability objectives, for the development to be located in zones with a lower probability of flooding, the Exception Test can be applied if appropriate. 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, informed by a Strategic Flood Risk Assessment where one has been prepared."*

Stevenage Borough Council Context

In the case of this Level 2 SFRA no site specific 2D flood mapping has been undertaken therefore it does not include the assessment of speed of onset, depth and velocity variance. This Level 2 SFRA is providing site assessments for specific development sites drawing on the datasets collected in the Level 1 assessment and is providing new climate change modelled extents for the sites in the southern area.

SBC has undertaken the Sequential Test process after publication of the Level 1 SFRA study, and has identified strategic site allocations that are shown to be located in Environment Agency Flood Zones 2 and 3. Therefore, further assessment is required in the form of this Level 2 SFRA, to facilitate the Exception Test, by refining and understanding the risk and consequences from all sources of flooding at each site, to undertake a Sequential Approach and steer development to areas of least flood risk, and to zones appropriate for the use vulnerability classification.

This Level 2 SFRA will therefore form a key component of SBC's evidence base in terms of identifying locations suitable for development and in the preparation of the Sustainability Appraisal (SA) and in defining flood risk policies in the Local Plan. Table 1-3 provides an overview of how the spatial planning process can manage flood risk strategically.

**Table 1-3 Spatial planning process for strategic flood risk management[10]**

| Flood Risk Management Stage | What it Means | How the Planning System deals with it | Who is responsible |
|---|---|---|---|
| **Assess** | Undertake studies to collect data at the appropriate scale and level of detail to understand what the flood risk is. | SFRAs, FRAs and application of the sequential approach. | Planning bodies and developers. |

[10] Reproduced from Figure 2.1 in the PPS25 Practice Guide

| Flood Risk Management Stage | What it Means | How the Planning System deals with it | Who is responsible |
|---|---|---|---|
| **Avoidance Prevention** | Allocate developments to areas of least flood risk and apportion development types vulnerable to the impact of flooding to areas of least risk. | Use the Sequential approach (including the Sequential Test and Exception Test where relevant) to locate development in appropriate locations. At the plan level, the SA should show how flood risk has been weighted against other sustainability criteria. | Planning bodies and developers. |
| **Substitution** | Substitute less vulnerable development types for those incompatible with the degree of flood risk. | | Planning bodies and developers. |
| **Control** | Implement flood risk management measures to reduce the impact of new development on flood frequency and use appropriate design. | Use River Basin Management Plans, Catchment Flood Management Plans, Surface Water Management Plans, Flood Risk Management Strategies, appraisal, design and implementation of flood defences. | Planning bodies, Environment Agency and other flood defence operating authorities, developers and sewerage undertakers. Developers are responsible for design of new developments. |
| **Mitigation** | Implement measures to mitigate residual risks. | Flood risk assessments. Incorporating flood resistance and resilience measures. Emergency Planning Documents. Implementation of flood warning and evacuation procedures. | Planning bodies, emergency planners, developers, the Environment Agency, other flood and coastal defence operating authorities and sewerage undertakers. |

# 2 Sequential Approach to Site Allocation

## 2.1 Flood Zone Definition

The risk of flooding is a function of the probability that a flood will occur and the consequence to the community or receptor as a direct result of flooding. The NPPF seeks to assess the probability of flooding from rivers by categorising areas within the fluvial floodplain into zones of low, medium and high probability, as defined in Table 2-1.

**Table 2-1 Fluvial Flood Zones (PPG, 2014)**

| Flood Zone | Fluvial Flood Zone Definition | Probability of Flooding |
|---|---|---|
| Flood Zone 1 | Land having a less than 1 in 1,000 (0.1%) annual probability of river flooding. | Low |
| Flood Zone 2 | Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (between 1% and 0.1% annual probabilities of flooding each year). | Medium |
| Flood Zone 3a | Land having a 1 in 100 or greater annual probability of river flooding (greater than 1% annual probability of flooding each year). | High |
| Flood Zone 3b | Land where water has to flow or be stored in times of flood, or land purposely designed to be flooded in an extreme flood event (0.1% annual probability).<br>The identification of the functional floodplain takes into account local circumstances but for the purposes of this SFRA, land modelled to flood during a 5% AEP event or greater in any year has been mapped. | Functional Floodplain |

## 2.2 Development Vulnerability

In order to determine the suitability of land for development in flood risk areas, the vulnerability of the proposed development must first be established. Flood Risk Vulnerability Classifications, as defined in the NPPF PPG are summarised in Table 2-2.

**Table 2-2 Flood Risk Vulnerability Classification (PPG, 2014)**

| | |
|---|---|
| **Essential Infrastructure** | • Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk.<br>• Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood.<br>Wind turbines. |
| **Highly Vulnerable** | • Police stations, ambulance stations and fire stations and command centres and telecommunications installations required to be operational during flooding.<br>• Emergency dispersal points.<br>• Basement dwellings.<br>• Caravans, mobile homes and park homes intended for permanent residential use.<br>• 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.<br>• Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels.<br>• Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels.<br>• Non–residential uses for health services, nurseries and educational establishments.<br>• Landfill and sites used for waste management facilities for hazardous waste.<br>• 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.<br>• Buildings used for shops, financial, professional and other services, restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non–residential institutions not included in "more vulnerable", and assembly and leisure.<br>• Land and buildings used for agriculture and forestry.<br>• Waste treatment (except landfill and hazardous waste facilities).<br>• Minerals working and processing (except for sand and gravel working).<br>• Water treatment works which do not need to remain operational during times of flood.<br>• Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place). |
| **Water Compatible Development** | • Flood control infrastructure.<br>• Water transmission infrastructure and pumping stations.<br>• Sewage transmission infrastructure and pumping stations.<br>• Sand and gravel working.<br>• Docks, marinas and wharves.<br>• Navigation facilities.<br>• MOD defence installations.<br>• Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location.<br>• Water-based recreation (excluding sleeping accommodation).<br>• Lifeguard and coastguard stations.<br>• Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.<br>• Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan. |

## 2.3 Sequential Test

The aim of the Sequential Test is to steer development towards areas of lowest probability of flooding first, before allocating development within areas of higher flood risk. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower probability of flooding. A sequential approach should be used in areas known to be at risk from any form of flooding informed by an SFRA. Only where there are no reasonable available alternative sites suitable for the development in areas of lower flood risk, should areas of greater flood risk be considered for development.

When determining planning applications, SBC should ensure flood risk is not increased elsewhere and only consider development appropriate in areas at risk of flooding where, as informed by a site-specific FRA following the Sequential Test, and if required the Exception Test, it can be demonstrated that:

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

- Development is appropriately flood resilient and resistant, including safe access and escape routes where required, and that any residual risk can be safely managed, by emergency planning; and it gives priority to the use of sustainable drainage systems.

SBC have utilised the information from within the Level 1 SFRA to apply the Sequential Test to Local Plan sites within the Borough and determined that some areas required further consideration as part of a Level 2 SFRA. The information supplied as part of this Level 2 SFRA should provide sufficient information to apply the Exception Test to the investigated potential development sites.

For the purposes of effective flood risk planning, development types are classified according to vulnerability. The need to apply the Exception Test is determined based on the Flood Zone i.e. Table 2-1 in which the proposed development is located and the development vulnerability i.e. Table 2-2.

## 2.4 Exception Test

If, following application of the Sequential Test, it is not possible, consistent with wider sustainability objectives for the development to be located in zones with a lower probability of flooding; the Exception Test can be applied if appropriate.

The purpose of the Exception Test is to demonstrate and to help ensure that flood risk to people and property will be managed satisfactorily, while allowing necessary development to go ahead in situations where suitable sites at lower risk of flooding are not available.

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, informed by the SFRA where one has been prepared; and
- A site-specific FRA must demonstrate that the development will be safe for its lifetime considering climate change, taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

This Level 2 SFRA aims to provide some information relating to the second part of the Exception Test for the development sites of interest. However, in all cases developers will need to undertake a site-specific FRA for each individual development site, in order to fully address the requirements of the second element of the Exception Test.

The NPPF PPG specifies that there are a number of ways a new development can be made safe:

- Avoiding flood risk by not developing in areas at risk from floods;
- Substituting higher vulnerability land uses for lower vulnerability uses in higher flood risk locations and locating higher vulnerability uses in areas of lower risk on a strategic scale, or on a site basis;
- Leaving space in developments for flood risk management infrastructure to be maintained and enhanced;
- Providing adequate flood risk management infrastructure which will be maintained for the lifetime of the development; and
- Mitigating the potential impacts of flooding through design and resilient construction.

Table 2-3 has been extracted from the NPPF PPG and provides a matrix of the flood risk vulnerability classifications that are permitted within each Flood Zone, this is subject to the Sequential Test being applied and passed and where necessary the Exception Test being applied and passed.

**Table 2-3 Flood Risk Vulnerability and Flood Zone 'Compatibility' (PPG, 2014)**

| Flood Risk Vulnerability Classification | | Essential Infrastructure | Water Compatible | Highly Vulnerable | More Vulnerable | Less Vulnerable |
|---|---|---|---|---|---|---|
| Flood Zone | 1 | ✓ | ✓ | ✓ | ✓ | ✓ |
| | 2 | ✓ | ✓ | Exception Test Required | ✓ | ✓ |
| | 3a† | Exception Test Required† | ✓ | × | Exception Test Required | ✓ |
| | 3b* | Exception Test Required* | ✓ | × | × | × |

✓ - Development is appropriate
× - Development should not be permitted
† - 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.

Table 2-3 identifies situations where the Exception Test would be required in order for development to be acceptable. Both elements of the test will have to be passed for development to be allocated or permitted. It identifies that all development uses are considered appropriate within Flood Zone 1. A site-specific FRA concentrating on surface water runoff will be required for any major development within Flood Zone 1 that exceeds 1 Ha, demonstrating that surface

water runoff will be effectively managed and the risk of flooding from this source will not be increased elsewhere as a result of the development

Table 2-3 identifies that development types classified as Water Compatible, Less Vulnerable, More Vulnerable and Essential Infrastructure are considered appropriate within Flood Zone 2 subject to the Sequential Test being applied and passed. Highly Vulnerable developments are only permitted subject to the Sequential and Exception Tests being applied and passed. All development proposals within this Flood Zone should be accompanied by a detailed site specific FRA.

Policy aims for Flood Zone 2 are such that developers and SBC should seek opportunities to reduce the overall level of risk in the area through the layout and form of the development and the appropriate application of Sustainable Drainage System (SuDS).

Table 2-3 identifies that development types classified as Water Compatible and Less Vulnerable are permitted within Flood Zone 3a subject to the Sequential Test being applied and passed. Highly Vulnerable land uses should not be permitted. More Vulnerable and Essential Infrastructure uses should only be permitted in this zone subject to the Sequential Test, sequential approach and Exception Test being applied and passed. Essential Infrastructure permitted in this zone should be designed and constructed to remain operational and safe for users in times of flood. All development proposals in this zone should be accompanied by a detailed site-specific FRA.

Policy aims within Flood Zone 3a are such that developers and SBC should seek opportunities to:

- Relocate existing development to land in zones with a lower probability of flooding;
- Reduce the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage techniques; and
- Create space for flooding to occur by restoring functional floodplain and flood flow paths and by identifying, allocating and safeguarding open space for flood storage.

Table 2-3 identifies that development types classified as Water Compatible is permitted within Flood Zone 3b subject to the Sequential Test being passed, and that Essential Infrastructure is permitted within this zone subject to the Exception Test also being applied and passed.

Any permitted development within Flood Zone 3b 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.

All development proposals in this zone should be accompanied by a detailed site-specific FRA.

Policy aims in Flood Zone 3b are such that developers and SBC should seek opportunities to;

- Reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of SuDS; and
- Relocate existing development to land with a lower probability of flooding.

# 3 Level 2 SFRA Methodology

## 3.1 Overview

As outlined in Section 1.1, the main purpose of the Level 2 SFRA is to increase the scope undertaken for the Level 1 SFRA and provide sufficient information for the application of the Exception Test. This information is presented in concise, tabular format for each Local Plan site that summarises flood risk information and makes recommendations for the future development of each area.

## 3.2 Stakeholders

The key stakeholders that have been contacted to provide information/data for the SFRA were;

**SBC** is the LPA for the study area, responsible for long term strategic planning of future development through the preparation of Local Plans, as well as for determining planning applications within the Borough. In accordance with the FWMA and subsequent communication from Central Government, from 6th April 2015, SBC is required to ensure that Sustainable Drainage Systems (SuDS) are implemented for all major developments where appropriate, and that through the use of planning conditions or planning obligations that there are clear arrangements in place for ongoing maintenance over the lifetime of the development. SBC should work with LLFA to secure Local Plan policies compatible with the local flood risk management strategy.

**HCC** is designated as the Lead Local Flood Authority (LLFA) under the FWMA, and has a duty to lead and coordinate the management of local flood risk, which includes flood risk from surface water, groundwater and ordinary watercourses. On 24 March 2015, Government laid a statutory instrument making the LLFA a statutory consultee in planning for all major development in relation to the management of surface water drainage from 15 April 2015.

HCC, as highway authority for local road network, is also responsible for providing and managing highway drainage and roadside ditches, and must ensure that road projects do not increase flood risk.

**Environment Agency** has a strategic overview role for flood risk management associated with main rivers in the Borough and is a statutory consultee for any development proposed within Flood Zone 3 associated with these watercourses. The Environment Agency is continually improving and updating their flood map for main rivers and has permissive powers to carry out flood defence works, maintenance and operational activities for these main rivers. However, overall responsibility for maintenance lies with the riparian owner.

**Affinity Water Services** has a duty as a statutory body to provide clean water services to major proportion of the study area.

**Thames Water Utilities** has the duty as a statutory body to provide waste water services to the majority of the study area and is responsible for the management, maintenance and operation of flood control structures. Water Companies are defined as a Risk Management Authority (RMA) within the FWMA and are responsible for flood risk management functions in accordance with the Water Resources Act 1991 and the Land Drainage Act 1991. Thames Water is responsible for surface water drainage from development via adopted sewers and for maintaining trunk sewers into which much of the highway drainage in the study area connects.

**Anglian Water Services** is responsible for a relative small area in the north west of Stevenage. However, wastewater from this area is currently pumped over the operational border into the Thames Water network via the Coreys Mill pumping station[11].

**Highways England** has responsibilities (under the Highways Act 1980) for the effectual drainage of surface water from Motorways and major A roads insofar as ensuring that drains, including kerbs, road gullies, ditches and the pipe network which connect to the sewers (often Thames Water Utilities), are maintained.

[11] Hyder Consulting (UK) (October 2009) http://www.stevenage.gov.uk/content/15953/26379/43876/Water-Cycle-Strategy-Final-Report.pdf

## 3.3 Information/Data Collected

Each stakeholder was approached to provide data for inclusion within the Level 2 SFRA. Key datasets are summarised below:

**Environment Agency Data**

The following data was obtained from the Environment Agency:

- Fluvial models and outputs for available watercourses. Models, Modelling Reports and GIS layers of the flood outlines for 0.1%, 1% plus CC, 1%, 5% AEP events, and 'Areas Benefitting from Defences', Flood Depth and Hazard outputs.
- Groundwater Vulnerability Map
- Historic records of flooding from all sources
- Information on Flood Storage Areas
- Wychdell FSR IA Documents
- Flood Reports
- Communities at risk report
- Groundwater Level Information

**HCC Data**

The following data was obtained from HCC:

- Flood Incident Reports
- Local Flood Risk Management Strategy
- Preliminary Flood Risk Assessment and associated datasets (Report and GIS layers)
- Ordinary Watercourses (GIS layer)

## 3.4 Flooding from Rivers

### 3.4.1 Hydraulic Models

River Beane 1D-2D model developed during the Environment Agency's River Beane Flood Mapping project was used to assess the sites in the south of Stevenage alongside the Stevenage and Aston End Brooks. However, the Stevenage and Aston End Brooks were only modelled in 1D as they form part of the upper reaches of the River Beane where 2D simulations were not required. As such there is no flood depth or hazard mapping presented in this Level 2 SFRA, only the flood extent is shown. The flood extents, adjusted for climate change, were also calculated for the southern sites using the River Beane model.

The Environment Agency Flood Map and a conceptual 2D hydraulic model[12] of the Ash Brook ordinary watercourse have been used to assess the sites in North West Stevenage. This model was developed by a third party as part of a FRA on the North West development sites. While the output from this model is suitable for a strategic assessment, it is suggested that any future development proposal is supported by a detailed 1D –2D hydraulic model. The revised model would allow a better definition of the flooded area and more accurate assessment of flood risk at the site. The detailed modelling needs to be based on topographic survey of the area surrounding the ordinary watercourse and channel cross section survey of Ash Brook.

[12] RAB Consultants (2015) Land at Stevenage, J8 A1 (M) Flood Risk Assessment

### 3.4.2 Consideration of Climate Change

A considerable amount of research is being carried out worldwide in an endeavour to quantify the impacts that climate change is likely to have on flooding in future years. Climate change may increase peak rainfall intensity and river flow, which could result in more frequent and severe flood events. Climate change is perceived to represent an increasing risk to low lying areas of England, and it is anticipated that the frequency and severity of flooding will change measurably within our lifetime.

In February 2016, the Environment Agency published revised guidance on climate change allowances in an update to the document 'Adapting to Climate Change: Advice to Flood and Coastal Erosion Risk Management Authorities[13]. This version of the document reflects an assessment completed by the Environment Agency between 2013 and 2015 using UKCP09 data, to produce more representative climate change allowances for river basin districts across England. While the greater part of Stevenage Borough falls within Thames River Basin District, a smaller part in the North is located within Anglian River Basin District. As set out in Table 3-1, the values for Thames River Basin District are more stringent. It is recommended that Thames River Basin District guidance is adopted in the Local Plan so that planning decisions are more robust in the face of climate change and consistent across the Borough.

**Table 3-1 Revised climate change allowances for the Thames River basin**

| Allowance category | Total potential change anticipated for '2020s' (2015-39) | Total potential change anticipated for '2050s' (2040-2069) | Total potential change anticipated for the '2080s' (2070-2115) |
|---|---|---|---|
| Old NPPF allowance (all England) for comparison | 10% (1990-2025) | 20% (2025-2115) | 20% |
| Upper end | 25% | 35% | 70% (65%*) |
| Higher central | 15% | 25% (20%*) | 35% |
| Central | 10% | 15% | 25% |
| * Values from Anglian River Basin are shown within parentheses where different | | | |

Applying Peak River Flow Climate Change Allowances

To understand if a land use allocation is appropriate in the context of likely future flood risk, the climate change allowance guidance states that Table 3-2 should be used to determine the appropriate allowance according to current flood zone and vulnerability for the type of development it is allocated for.

**Table 3-2 Peak river flow allowances for flood risk assessments**

| Flood Zones | Flood Risk Vulnerability Classification | | | | |
|---|---|---|---|---|---|
| | Essential infrastructure | Highly vulnerable | More vulnerable | Less vulnerable | Water compatible |
| **Zone 2** | Higher central and Upper | Higher central and Upper | Central and Higher central | Central | None |
| **Zone 3a** | Upper | X | Higher central and Upper | Central and Higher central | Central |
| **Zone 3b** | Upper | X | X | X | Central |

X – development should not be permitted

For the allowances identified above, the site should be assessed as to whether it will move from FZ1 to FZ2 or FZ2 to FZ3. If so, it is recommended that the development be treated accordingly, referring to the flood risk vulnerability and flood zone compatibility table in PPG. Following which the site will need to be assessed if the development is still appropriate, or if the exception test is required.

If the development is still appropriate in Flood Zones 2 and 3, assessment of future flood risk will be needed for planning applications for the type of development allocated in site specific policies.

If the Exception Test is required, SBC expect site specific policies to advise the development and include a detailed FRA using the appropriate climate change allowances. However, it may be that once the climate change allowances

[13] Environment Agency, February 2016. *Adapting to Climate Change: Advice to Flood and Coastal Erosion Risk Management Authorities.* https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/516116/LIT_5707.pdf

have been applied, a particular development may now not be suitable in a particular area, and accordingly the land allocations may need to be re-considered.

### 3.4.3 Notes on Climate Change Modelling - South Area

In order to provide an accurate assessment of the future flood risk posed to the potential development sites, the climate change allowances have been applied to the existing Environment Agency hydraulic model of the Beane River in the south east area of Stevenage. The proposed land use for these sites is housing and is thus classified as "More vulnerable". The flood hydrographs which define Flood Zones 3b, 3a and 2 were therefore adjusted by the Upper end (+70%), Higher central (+35%) and Central (+25%) respectively. Output from the climate change allowance modelling is included in Figures 3.1 and 3.2 in Appendix A.

A summary of the critical elements in the model are summarised as follows:

**Table 3-3 Critical elements in the Beane River Hydraulic Model**

| Modelling Parameters | Beane River Hydraulic Model (south east area) – Climate Change |
|---|---|
| **Critical storm duration** | 5.25 hours |
| **Climate Change allowance method of application** | Inflow hydrograph scaled to match the climate change percentage increase in flows |
| **Any issues reported (e.g. convergence)** | Model outputs adjacent to the sites of interest were interrogated. Stage and flow profiles were sensible and significant oscillations in stage and flow were not apparent. |
| **Model (*.DAT*) file name** | *Beane_design_undef_georef.DAT* |
| **Defended/Undefended** | Undefended |
| **Climate Change Peak Flow Rates** | The peak flow rate for each node has been included in Appendix B |

### 3.4.4 Notes on Climate Change Modelling – North West Area

The existing Ash Brook model does not include the latest climate change allowances. However, the less frequent Annual Exceedance Probability (AEP) simulations can be considered as surrogate climate change scenarios for lower order events (Table 3-4).

**Table 3-4 Ash Brook peak flow rates[14]**

| AEP | In Flow ($m^3/s$) | Percentage increase with respect to previous AEP |
|---|---|---|
| 5% (1 in 20 years) | 0.85 | - |
| 1% (1 in 100 years) | 1.36 | 60% |
| 0.1% (1 in 1000 years) | 2.65 | 95% |

The increase in flow does not seem to have a major impact on the flood envelope as shown in Figure 3-1 and Figure 3-2. This indicates the flood extent will not be very sensitive to increase in flow due to climate change in future. However as highlighted in Section 3.4.1, existing model needs to be converted to a detailed 1D – 2D model to assess flood risk to any potential future development. The flood risk as a result of climate change can then be reassessed.

[14] RAB Consultants (2015) Land at Stevenage, J8 A1 (M) Flood Risk Assessment

**Figure 3-1 Flood extent and depth in meters (1% AEP) for North West Stevenage**[15]


The stretch of Ash Brook between A1(M) and A602 has been realigned as a highways drainage channel and no longer follows the natural watershed. This causes the apparent discrepancy between the water course and modelled flood extent or Environment Agency flood zones.

**Figure 3-2 Flood extent and depth in meters (0.1% AEP) for North West Stevenage**[16]


## 3.5 Flooding from the Land

The Pitt Review into the summer 2007 flooding in the UK identified the importance in quantifying the risk of flooding from land, or 'surface water' flooding. In response to the Pitt Review, the Environment Agency released Areas Susceptible to Surface Water Flooding (AStSWF) Maps in 2008/9. The AStSWF Maps were the first iteration (1st generation) maps used to quantify surface water flood risk on a national scale.

Accompanying guidance document published with the AStSWF Maps state that these maps have been produced using a simplified method where a single rainfall event has been used to analyse the surface water flooding. The method also excludes any underground sewerage and drainage systems, smaller over ground drainage systems and buildings.

[15] RAB Consultants (2015) Land at Stevenage, J8 A1 (M) Flood Risk Assessment
[16] RAB Consultants (2015) Land at Stevenage, J8 A1 (M) Flood Risk Assessment

Therefore, the maps only provide a general indication of areas that are more likely to overwhelm from surface water flooding.

In 2010, the Environment Agency released the national Flood Map for Surface Water (FMfSW). The FMfSW gives an indication of the broad areas likely to be at risk of surface water flooding. The maps build upon the 1st generation data as they consider two different storm events (over a shorter duration) and the influence of buildings and include an allowance for losses to the sewer system. The FMfSW picks out natural drainage channels, rivers, low areas in floodplains, and flow paths between buildings. The maps only indicate flooding caused by local rainfall and do not show flooding that occurs from overflowing watercourses, drainage systems or public sewers caused by catchment-wide rainfall events or river flow.

The Environment Agency has more recently undertaken further modelling of surface water flood risk at a national scale (October 2013) producing maps referred to as the updated Flood Map for Surface Water (uFMfSW) identifying areas at risk during three AEP events:

- 1 in 30 year (>=3.33% AEP) – High Risk,
- 1 in 100 year (>=1% AEP) – Medium Risk, and
- 1 in 1000 year (>=0.1% AEP) – Low Risk.

These now provide the Environment Agency and HCC (as the LLFA) and the public access to information on surface water flood risk that is consistent across England and Wales.

The uFMfSW modelling methodology represents a significant improvement on previous mapping, (namely the AStSWF and FMfSW datasets), for example:

- Increased model resolution to 2m grid providing a more detailed representation of ground levels;
- Representation of varying infiltration rates taking into account the land use and soil type;
- Representation of buildings and flow routes along roads and manual editing of the model for structural features such as subways, flyovers etc;
- Use of 3 storm scenarios;
- Incorporation of appropriate local mapping, knowledge and flood incident records; and
- Local validation by LLFAs where flood records were available.

As such, they are considered the most appropriate dataset available to inform the assessment of surface water flood risk at the development sites as part of this Level 2 SFRA to assist SBC in their duties relating to management of surface water flood risk.

However, it should be noted that this national mapping has the following limitations:

- Use of a single drainage rate for all urban areas;
- It does not show the susceptibility of individual properties to surface water flooding;
- The mapping has significant limitations in flat catchments;
- No explicit modelling of the interaction between the surface water network, the sewer systems and watercourses;
- In a number of areas, modelling has not been validated due to a lack of surface water flood records; and
- As with all models, the uFMfSW is affected by a lack of, or inaccuracies, in available data.

The uFMfSW for Stevenage was provided to SBC as GIS layers by the Environment Agency in March 2016 for use in this Level 2 SFRA. The extents of the risk bands above are presented for each site where available in the summary tables in Section 4.

## 3.6 Flooding from Groundwater

Groundwater flooding usually occurs in low lying areas underlain by permeable rock and aquifers that allow groundwater to rise to the surface through the permeable subsoil following long periods of wet weather. Low lying areas may be more susceptible to groundwater flooding because the water table is usually at a much shallower depth and groundwater paths tend to travel from high to low ground.

The Borough is situated on chalk strata and chalk is associated with groundwater flooding. However, Stevenage lies well upstream of the point where groundwater flooding would be expected to appear in a typical chalk bourne or valley, even under extreme conditions. The risk from groundwater flooding is therefore considered to be low.

## 3.7 Flooding from Sewers

As a modern town, Stevenage has almost entirely separate foul and surface water sewerage systems, some surface water runoff will inevitably find its way into foul sewers during heavy rainfall. The volume of this runoff will probably be small but the large Stevenage Trunk Sewer, which conveys the whole of the town's foul drainage flow, should also be regarded as a possible source of flooding along the downstream portion of its route through the southern end of the town.

## 3.8 Flooding from Reservoirs, Canal and Other Artificial Sources

The Large Reservoirs and Flood Storage Reservoirs (FSRs) present in the Stevenage Borough Council are listed in Table 3-5. There is no previous record of reservoir flooding and none of the reservoirs present have been classified in terms of risk severity. All of the Large Reservoirs and FSRs located within the boundary of Stevenage Borough Council are included within the functional floodplain (Flood Zone 3b).

There are no canals or other artificial sources of flooding in Stevenage.

**Table 3-5 Reservoirs in Stevenage Borough Council**

| Name | FSR/Large Reservoir | Catchment | OS Grid | Date established |
|---|---|---|---|---|
| Sainsbury's | FSR | River Hitz | TL 2250 2670 | Pre-1960 |
| Meadway | FSR | Stevenage Bk | TL 2265 2475 | Pre-1960 |
| Burymead | FSR | Stevenage Bk | TL 2350 2600 | 1964 |
| Elder Way | FSR | Stevenage Bk | TL 2395 2340 | Pre-1960 |
| Old Knebworth Lane | FSR | Stevenage Bk | TL 2430 2195 | Pre-1960 |
| Broad Oak | FSR | Stevenage Bk | TL 2445 2260 | 1964 |
| Wychdell | Large Reservoir | Stevenage Bk | TL 2645 2155 | Pre-1960 |
| Camps Hill Park | FSR | Aston End Bk | TL 2595 2465 | Post-1980 |
| Ridlins Wood | Large Reservoir | Aston End Bk | TL 2650 2235 | Pre-1972 |
| Aston Valley | Large Reservoir | Aston End Bk | TL 2655 2175 | 1966 |
| Bragbury End | FSR | Stevenage Bk | TL 2690 2095 | 1975/6 |
| Boxbury | FSR | River Beane | TL 2725 2665 | Pre-1972 |
| Fairlands Valley Lakes | Large Reservoir | Stevenage Bk | TL 2530 2399 | 1973 |

# 4 Level 2 Strategic Flood Risk Assessment

## 4.1 Introduction

Following the completion of the Level 1 SFRA the SBC has identified sites within the Draft Local Plan that require further assessment. Portions of these sites fall into Flood Zone 2 and Flood Zone 3. The sites that fall within Flood Zone 1 have not been considered for further evaluation, as these would not be subjected to the sequential test under the NPPF. Appendix C lists all the sites assessed as part of the Level 1 SFRA. The aim of the Level 2 SFRA is to assist in informing the suitability of the site according to the proposals of the Local Plan.

## 4.2 South Stevenage Area

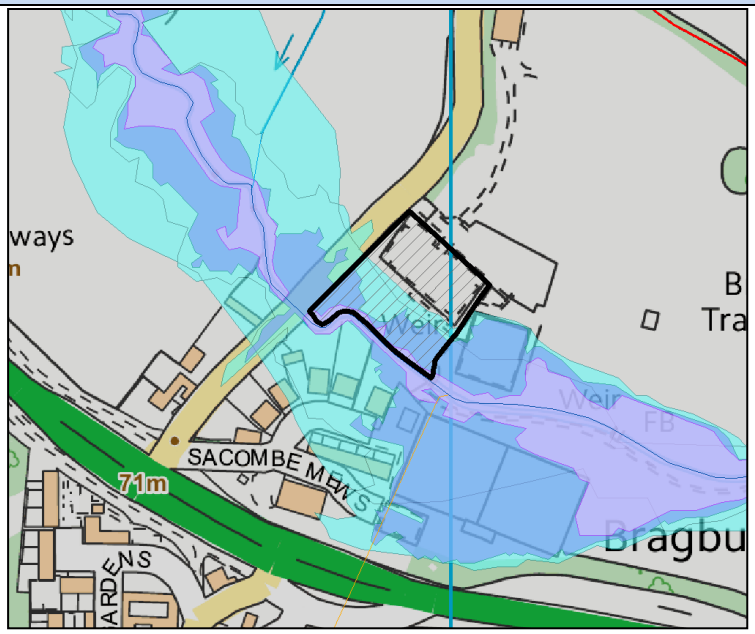
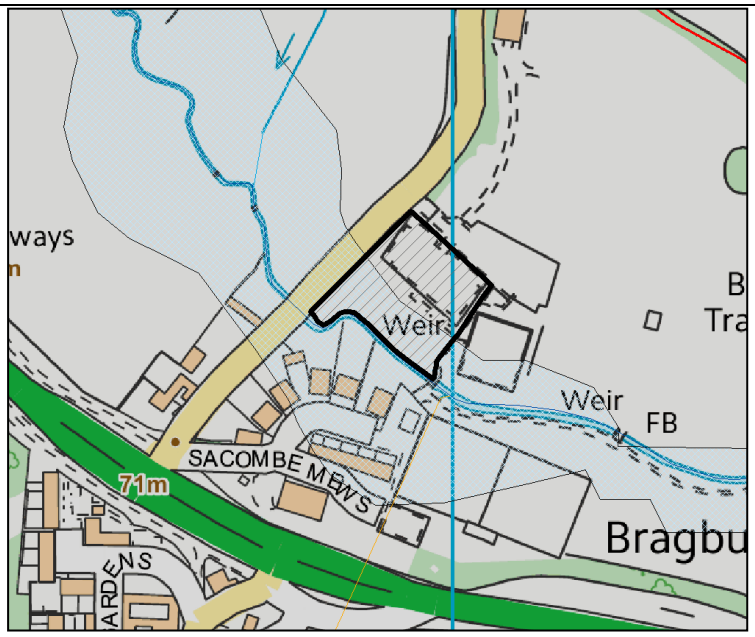
There are two sites being considered in the south east area, namely HO1/2 (Bragbury End Sports Ground Car Park) and HO4 (South East of Stevenage). The proposed land use for both sites is housing.

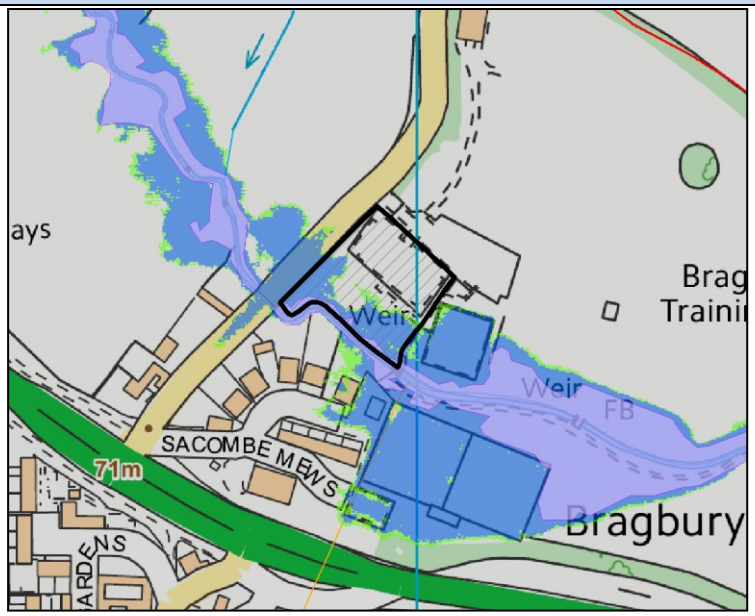
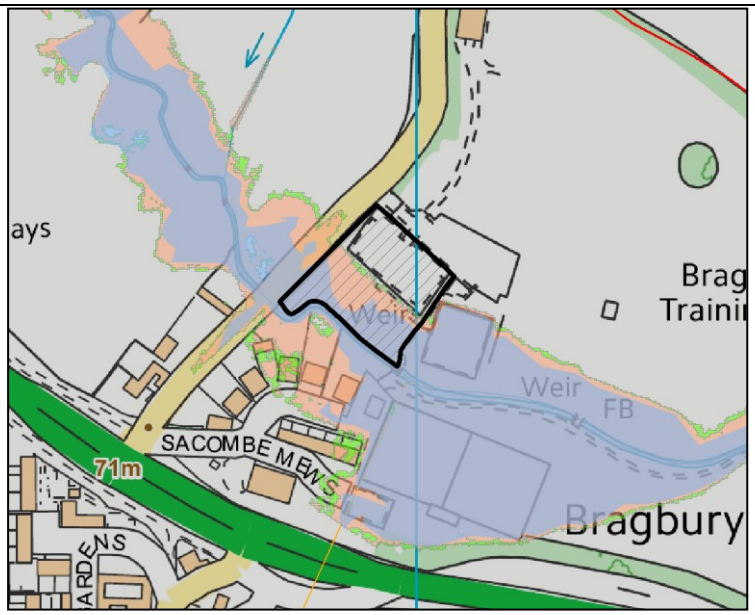
Historically the area has been prone to fluvial flooding from the Stevenage Brook and surface water flooding. The most recent flood event was recorded in July 2015. It was believed that the source of flooding was fluvial, mainly affecting areas in the upper reaches of the Stevenage Brook. However, the brook also overtopped its banks in the Bragbury End area, behind Sacombe Mews.

Previous flooding was also reported in the area of Bragbury End on 7 February 2014 as a result of a succession of storms combined with heavy rainfall over an extended period of time which saturated the surrounding catchment. The increase runoff from the saturated catchment resulted in the surface water flooding. The flood extent was near the sites HO4 and HO1/2, affecting Bragbury Lane. The flood storage reservoir of Bragbury also reached capacity during the event and contributed to the flooding.

### 4.2.1 South Stevenage – Site Assessment HO1/2

| **Site Assessment Summary: HO1/2 – Bragbury End Sports Ground Car Park** | | | | | |
|---|---|---|---|---|---|
| **Location:** | **OS NGR:** | **Area:** | **Current Land use:** | **Proposed Use:** | |
| Aston Lane | TL 26970 21287 | 0.6ha | Car park | Housing (8 dwellings) | |
| **Flood Risk Source Summary**<br>The site is predominately at risk of flooding from fluvial and surface water sources, with several historic records of both. There is also a medium susceptibility to groundwater flooding on this site. | | | | | |
| **Recorded Flood Incidents** | The site is known to flood mainly from river flooding although surface water flooding may also occur. Notable flood events have occurred in 1978, 1993, 2014 and 2015. | | | | |
| **Local Watercourses and Defences** | The site is alongside the left bank of the Stevenage Brook, which runs in an approximate west to east direction. There are no formal Environment Agency flood defences near the site. | | | | |
| **Proposed use and vulnerability classification** | **NPPF Vulnerability classification** | **Flood Zone 1** | **Flood Zone 2** | **Flood Zone 3** | **Flood Zone 3b** |
| | More Vulnerable | ✓ | ✓ | Exception test required | × |
| **Flood Zones for Planning Coverage** | **Notes** | **FZ1** | **FZ2** | **FZ3a** | **FZ3b** |
| | N/A | 0.21ha | 0.23ha | 0.13ha | 0.03ha |

| Site Assessment Summary: HO1/2 – Bragbury End Sports Ground Car Park | |
|---|---|
| **Flood Zones for Planning**<br><br>**Proposed Site**<br><br>**Flood Zone 3b**<br><br>**Flood Zone 3a**<br><br>**Flood Zone 2** |  |
| **Historic Fluvial Flooding**<br><br>**Areas of Historic Flooding Recorded by the EA**<br><br>There are a number of significant fluvial flood events recorded by the Environment Agency at this location as shown in the adjacent figure. |  |

| Site Assessment Summary: HO1/2 – Bragbury End Sports Ground Car Park | |
|---|---|
| **Modelled Flood Extents**<br><br>**Proposed Site**<br><br>**1 in 20 Year**<br><br>**1 in 20 Year +CC (Higher)**<br><br>**1 in 20 Year +CC (Upper)** |  |
| **Modelled Flood Extents**<br><br>**Proposed Site**<br><br>**1 in 100 Year**<br><br>**1 in 100 Year +CC (Central)**<br><br>**1 in 100 Year +CC (Higher)** |  |
| **Fluvial Flood Risk Summary**<br><br>The modelled outputs confirm that a section next to the Stevenage Brook, approximately 25% of the site, is flooded during the 1 in 100 year event. The 1 in 20 year event is shown to marginally affect the site as the Brook does not appear to overtop its bank during this event.<br><br>The site is located within the Flood Warning Area of Stevenage Brook at Stevenage.<br><br><u>Climate Change</u><br><br>Climate change has a very significant effect on the flood extent inside the site. The 1 in 100 year flood event with both higher and upper allowances is shown to affect more than 50% of the site, with the south western half being completely flooded. | |
| **Surface Water Flood Risk** | The Environment Agency uFMfSW indicates that the area in which the site is located is clearly at risk of surface water flooding, due to its location in the valley. The Environment Agency uFMfSW online mapping indicates that the flooding in this site is in the 'Low' and 'Medium' category. It should be noted that the uFMfSW is a nationally developed dataset for strategic use and the limitations of use state that is should not be used for individual properties. Thus a detailed surface water flood risk assessment should be included as part of the site specific FRA. |

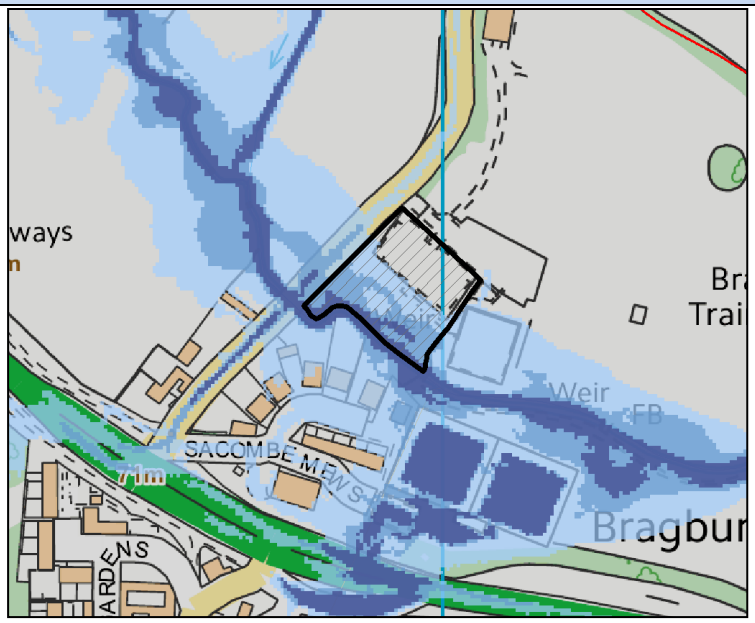
**Site Assessment Summary: HO1/2 – Bragbury End Sports Ground Car Park**

**Risk of Flooding from Surface Water Maps (Environment Agency uFMfSW data)**

**Low**

**Medium**

**High**




| Combined Modelled Fluvial Flood Risk Area of the Site (5% AEP, 5% AEP + CC, 1% AEP and 1% AEP + CC Flood Events) | % of Site at Fluvial Flood Risk | Total Surface Water Flood Risk | Combined Fluvial and Surface Water Flood Risk Area | % of Site at Fluvial Flood and Surface Water Risk |
|---|---|---|---|---|
| 0.24ha | 55% of site | 0.26ha | 0.26ha | 59% of site |

**Groundwater Flood Risk**

**Low**

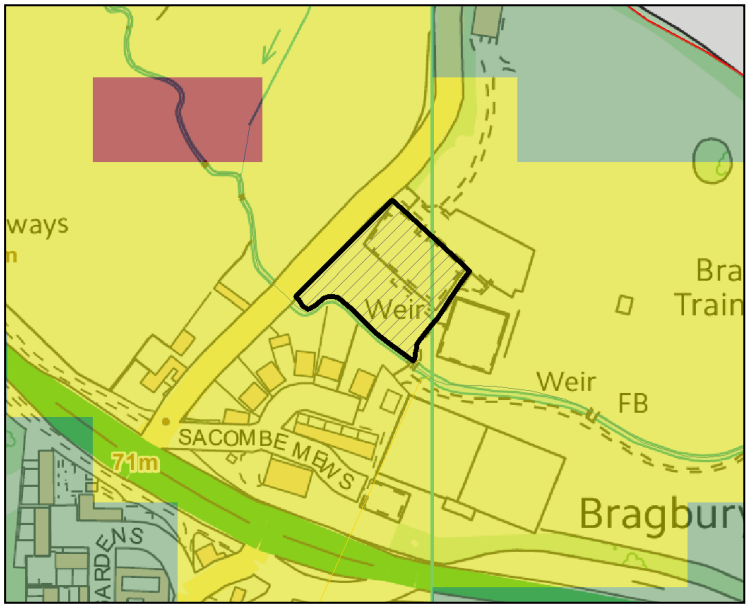
**Medium**

**High**

The site is shown to be located in the following zone:

**Floodtype**: Clearwater

**Class**: B (Potential for groundwater flooding of property situated below ground level).




| Residual Flood Risks | Culvert / Structure Blockage | Impounded Water Body Failure | Defence Breach / Overtopping | Notes |
|---|---|---|---|---|
| | ✓ | ✓ | × | Site is inside of the Environment Agency Risk of Flooding from Reservoirs mapping |

**Site Assessment Summary: HO1/2 – Bragbury End Sports Ground Car Park**

**British Geological Society (BGS) Infiltration SuDS Suitability Map**

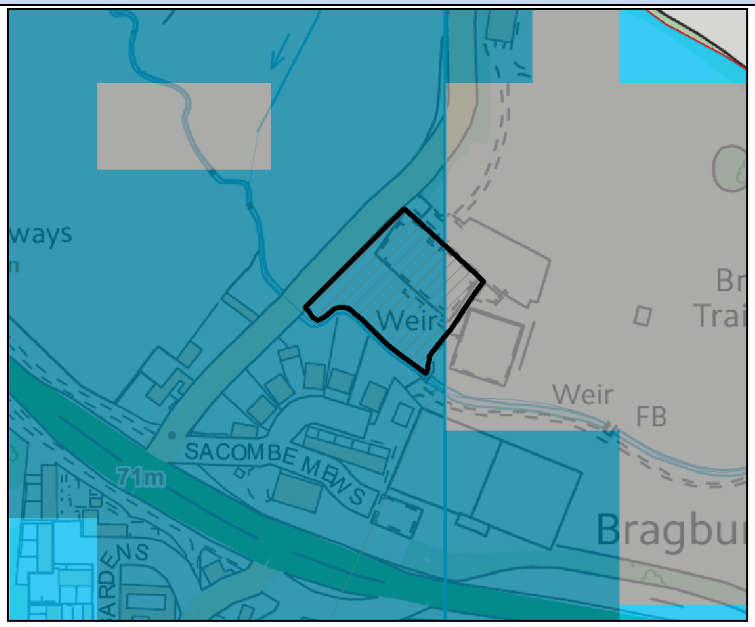
**Highly Compatible for infiltration SuDS**

**Probably Compatible for infiltration SuDS**

**Opportunities for bespoke infiltration SuDS**

**Very significant constraints are indicated**

The site is shown to be located mostly in an area where there are opportunities for bespoke infiltration SuDS.




**Infiltration SuDS Suitability**

Mapping from the BGS suggests that the subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions. The BGS advise quantifying infiltration rate via an infiltration/soakaway test and consider whether infiltration can be used as a SuDS technique alongside water storage and re-use.

There is also an area where very significant constraints are indicated so further geological data is vital before advising or proceeding on the incorporation of any infiltration based SuDS feature. The consequences of infiltration on ground stability should also be considered. Non infiltration SuDS needs to be considered for this area.

Further site investigations are necessary to confirm the local ground conditions and determine the appropriate SuDS technique as part of any future site specific FRA.

Prospective developers should work closely with the Environment Agency, the SBC as the LPA and HCC as the LLFA to manage surface water run-off and implementing the most suitable SuDS system.

**Flood Risk Implications for Development Summary**

Site HO1/2 is located in a known flooding hotspot area. There is a significant proportion of the site at risk of fluvial flooding, and surface water flood risk is also a considerable problem both on the site and on the adjacent off site road of Aston Lane.

The Sequential Testing approach must be followed, steering development to areas of least risk. Ideally, development would be located in the northern half of the site, outside of key flood risk areas; however this could considerably reduce site availability.

The proposed land use for the site is housing, therefore the positioning of residential dwellings would need careful consideration. The houses should be located away from the southern half of the site.

If housing is intended to be sited within areas shown at risk of flooding from the 1 in 100 year event the development should be made safe by ensuring finished flood levels are set above the 1 in 100 year plus the climate change allowance and access and egress to Flood Zone 1 is achievable. Further details on flood resilient and resistant design are provided in Section 6.2 of this report.

If development is proposed that encroaches onto the floodplain for the 1 in 100 year plus climate change, flood plain compensation storage will need to be provided to ensure no loss of floodplain and therefore prevent the increase in flood risk to neighbouring areas.

As of 6th April 2016, the Water Resources Act 1991 and associated land drainage byelaws have been amended and flood defence consents will now fall under the Environmental Permitting (England and Wales) Regulations 2010. Any works within 8m of a Main River will be subject to the Environmental Permitting Regulations (EPR). Further details and guidance are available on the GOV.UK website: https://www.gov.uk/guidance/flood-risk-activities-environmental-permits. The Environment Agency can be consulted regarding permission to do work on or near a river, floor or sea defence by contacting enquiries@environment-agency.gov.uk.

It is recommended that areas which are at a significant risk from fluvial and surface water flooding be kept as open

| Site Assessment Summary: HO1/2 – Bragbury End Sports Ground Car Park |
|---|
| spaces. |
| **Site Specific Policies and Site Recommendations**<br><br>In addition to the wider policy and flood risk recommendations in Chapter 5 of this report, this section contains recommendations specific to this site allocation.<br><br>Flood Warning and Evacuation procedures should be developed for this site as part of a site specific FRA.<br><br>A detailed drainage strategy should be included with the site specific FRA report to fully understand the complex fluvial and surface water interactions at this location. From 6th April 2015, all major development should include provision for SuDS and a Sustainable Drainage Strategy will need to be completed and signed by a competent drainage engineer to verify that the proposals conform to the Government's 'Sustainable Drainage Systems: Non-Statutory Technical Standards[17]. Further information of the Technical Standards and guidance is available on the HCC website: http://www.hertsdirect.org/services/envplan/water/floods/surfacewaterdrainage/sudsguidance/<br><br>As the majority of the site is greenfield, future developments within the area potentially can increase surface water runoff. SuDS should be considered at all stages of the planning and design of new developments to reduce runoff rates and volumes from the developed site, thus reducing the resultant flood risk posed to the site and adjacent/downstream areas. Development should, where reasonably possible, aim to reduce surface water runoff to less than greenfield run off. If this is not possible then greenfield runoff rates should be achieved by the proposed mitigation measures.<br><br>Development should not encroach within 8m of the Stevenage Brook, which is the Environment Agency by-law distance for Main Rivers. |

[17] Sustainable drainage systems: non-statutory technical standards - https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards

### 4.2.2 South Stevenage – Site Assessment HO4

| Site Assessment Summary: HO4 – South East of Stevenage | | | | | |
|---|---|---|---|---|---|
| **Location:** A602 | **OS NGR:** TL 27343 20964 | **Area:** 30.22ha | **Current Landuse:** Site is currently unused. | **Proposed Use:** Housing (550 dwellings) | |
| **Flood Risk Source Summary** The site is predominately at risk of flooding from fluvial and surface water sources, with several historic records of both. There is also a medium susceptibility to groundwater flooding on this site with areas of high susceptibility. | | | | | |
| **Recorded Flood Incidents** | The site is known to flood mainly from river flooding although surface water flooding may also occur. Notable flood events have occurred in 1947, 1978, 1993 and 2014. | | | | |
| **Local Watercourses and Defences** | The site comprises two sections, with the Stevenage Brook running through the north boundary of the northern section, in an approximate west to east direction. There are no formal Environment Agency flood defences alongside this site. | | | | |
| **Proposed use and vulnerability classification** | **NPPF Vulnerability classification** More Vulnerable | **Flood Zone 1** ✓ | **Flood Zone 2** ✓ | **Flood Zone 3** Exception test required | **Flood Zone 3b** × |
| **Flood Zones for Planning Coverage** | **Notes** N/A | **FZ1** 25.66ha | **FZ2** 2.45ha | **FZ3a** 1.50ha | **FZ3b** 0.61ha |

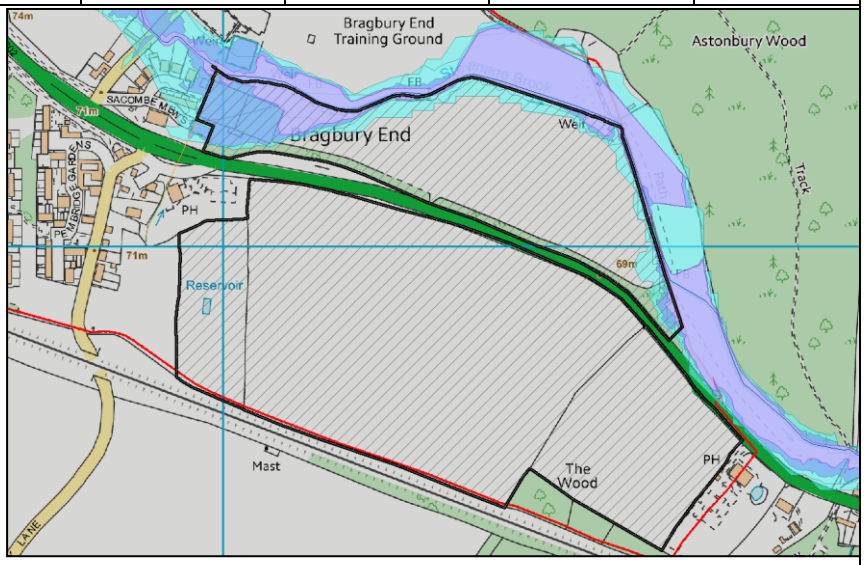
**Flood Zones for Planning**

**Proposed Site**

**Flood Zone 3b**

**Flood Zone 3a**

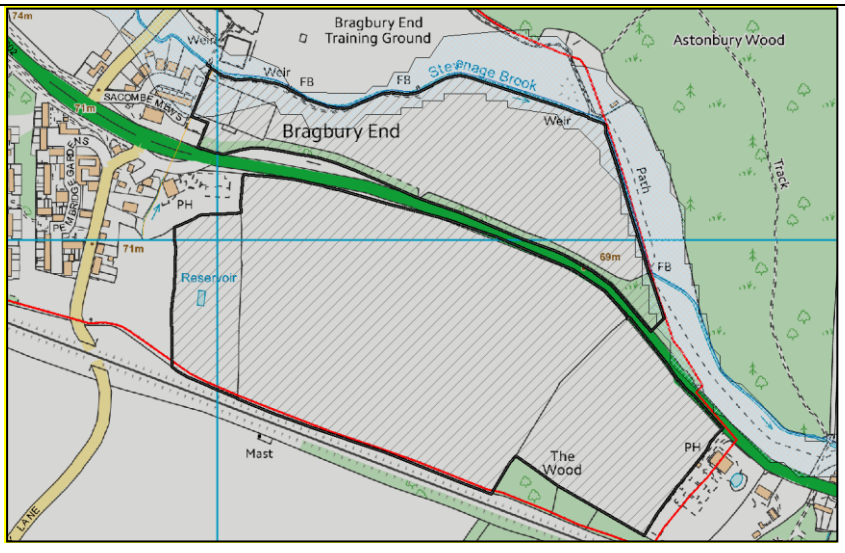
**Flood Zone 2**




**Historic Fluvial Flooding**

**Areas of Historic Flooding Recorded by the Environment Agency**

There are a number of significant fluvial flood events recorded by the Environment Agency at this location as shown in the adjacent figure.



## Site Assessment Summary: HO4 – South East of Stevenage

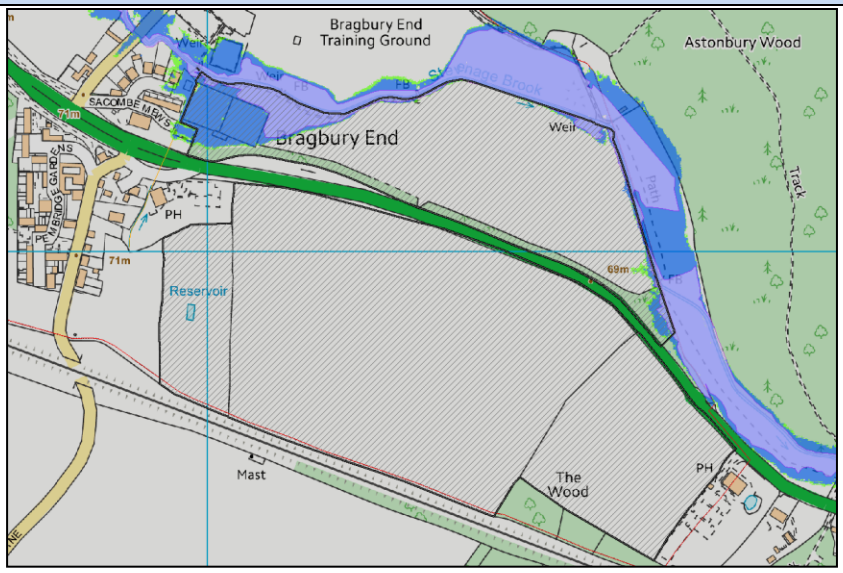
**Modelled Flood Extents**

**Proposed Site**

**1 in 20 Year**

**1 in 20 Year +CC (Higher)**

**1 in 20 Year +CC (Upper)**



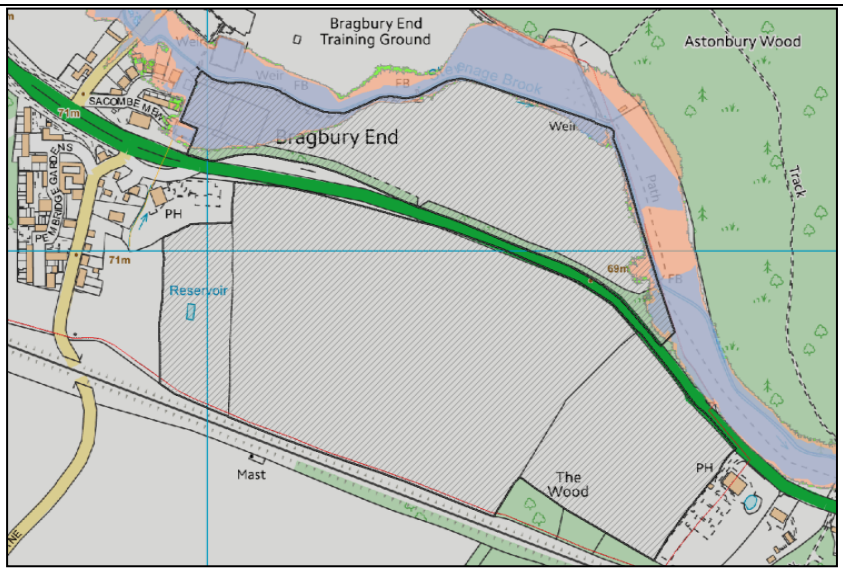

**Modelled Flood Extents**

**Proposed Site**

**1 in 100 Year**

**1 in 100 Year +CC (Central)**

**1 in 100 Year +CC (Higher)**




**Fluvial Flood Risk Summary**

The site is affected by fluvial flood risk north of the A602. The modelled output confirms that the north western corner is at the highest risk to fluvial flooding. The remainder of the northern site has localised sections at risk of flooding. However, these are located in areas where the southern bank of the Stevenage Brook rises steeply from the main channel and therefore changes to the annual exceedance probability has little effect on the inundated area.

Some of the northern areas are included in Flood Zone 2 as they fall within the historic flood outlines.

The area of site HO4 south of the A602 is shown to be unaffected by fluvial flooding.

The site is partly located within the Stevenage Brook at Stevenage Flood Warning Area.

Climate Change

Climate change simulations show a marked change in the inundated area for the 1 in 20 year flood event in the north western corner. This attributed to the relatively flat topography and apparent cresting of a berm alongside the Stevenage Brook.

For the 1 in 100 year fluvial flood event the increase of flood extent is less notable, however a small area in the north eastern section seems to be effected. Further investigation should be conducted in the site specific FRA which should include a topographic survey of critical areas.

The differences between upper and higher allowances for the 1 in 20 year event and between higher and central in the 1 in 100 appear to be minor. Therefore, it is recommended that the greater climate change scenario is selected.

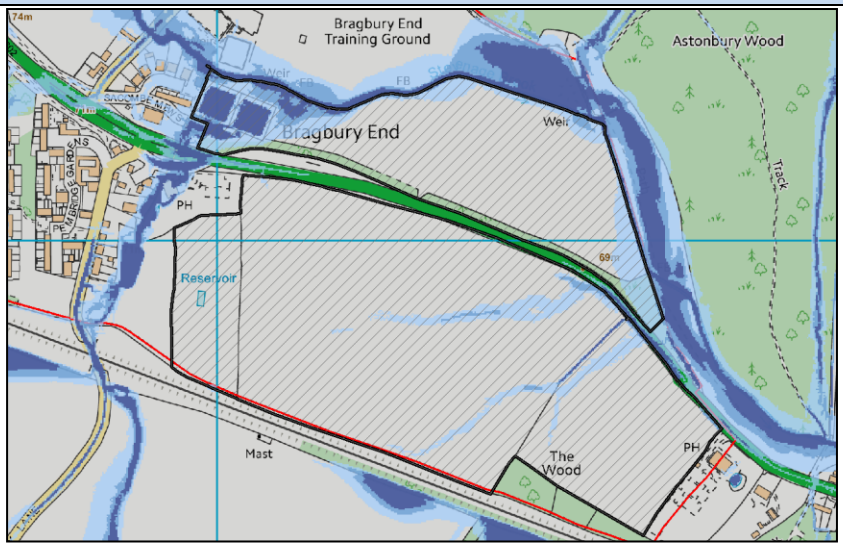
**Site Assessment Summary: HO4 – South East of Stevenage**

**Risk of Flooding from Surface Water Maps (Environment Agency uFMfSW data)**

**Low**

**Medium**

**High**




**Surface Water Flood Risk**

The Environment Agency uFMfSW mapping data indicates that a considerable area to the north west of the site is at risk of surface water flooding (1 in 30 year surface water flood event). Broadhall Way, which serves as access to the site, is also inundated during this event. The assessment of ingress and egress from the site should be considered within the site specific FRA.

Other small areas to the southern section of the site are considered to be at risk of flooding from the 1 in 100 to 1 in 1000 year surface water flood event.

It should be noted that the uFMfSW is a nationally developed dataset for strategic use and the limitations of use state that is should not be used for individual properties. Thus a detailed surface water flood risk assessment should be included as part of the site specific FRA.

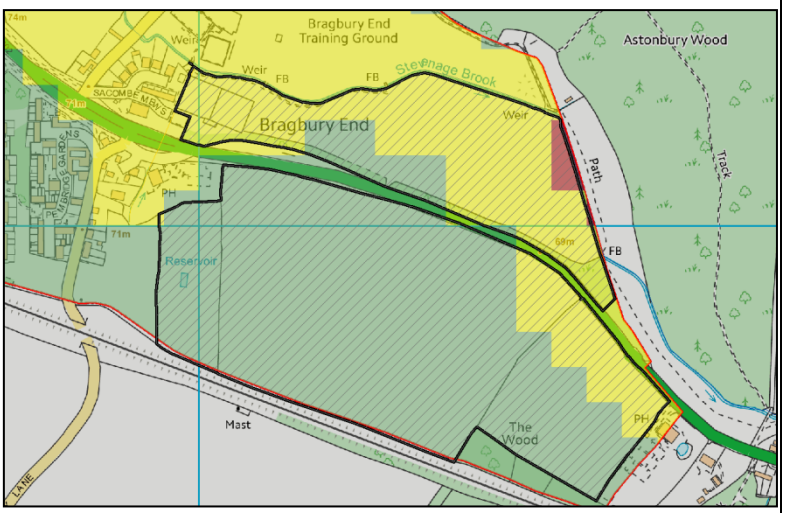
| Combined Modelled Fluvial Flood Risk Area of the Site (5%, 5% + CC, 1% and 1% + CC Flood Events) | % of Site at Fluvial Flood Risk | Total Surface Water Flood Risk | Combined Fluvial and Surface Water Flood Risk Area | % of Site at Fluvial Flood and Surface Water Risk |
|---|---|---|---|---|
| 1.8ha | 6% of site | 3.51ha | 3.51ha | 12% of site |

**Groundwater Flood Risk**

**Low**

**Medium**

**High**




The site is shown to be located in the following zone:

**Floodtype**: Clearwater

**Class**: The majority of the site is A (Low Risk), although there are some parts to the north with class B (Potential for groundwater flooding of property situated below ground level) and C (Potential for

**Site Assessment Summary: HO4 – South East of Stevenage**

groundwater flooding to occur at surface).

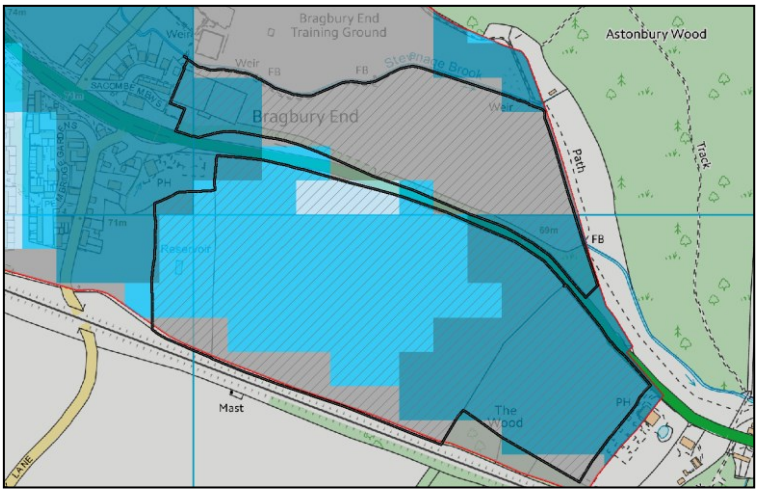
**BGS Infiltration SuDS Suitability Map**

**Highly Compatible for infiltration SuDS**

**Probably Compatible for infiltration SuDS**

**Opportunities for bespoke infiltration SuDS**

**Very significant constraints are indicated**




The northern section of the site is shown to be located mostly in an area where very significant constraints are indicated. The area south of the A602 is shown to contain areas which are probably compatible for infiltration SuDS.

| Residual Flood Risks | Culvert / Structure Blockage | Impounded Water Body Failure | Defence Breach / Overtopping | Notes |
|---|---|---|---|---|
| | ✓ | ✓ | × | Site is inside of the Environment Agency Risk of Flooding from Reservoirs mapping |

**Infiltration SuDS Suitability**

Mapping from the BGS suggests that south of A602 the subsurface is probably suitable for infiltration SuDS although the design will be influenced by the ground conditions. The BGS advise quantifying infiltration rate via an infiltration/soakaway test and consider whether infiltration can be used as a SuDS technique alongside water storage and re-use.

A majority of the area north of A602 has very significant constraints to infiltration SuDS. Further geological data is required before advising or proceeding with SuDS. The consequences of infiltration on ground stability should also be considered. Non infiltration SuDS needs to be considered for this area.

It should be noted that additional ground investigation is necessary to confirm the local ground conditions and determine the appropriate SuDS technique and should form part of a detailed planning application.

Prospective developers should work closely with the Environment Agency, SBC as the LPA and HCC as the LLFA to manage surface water run-off and to implement the most suitable SuDS system.

**Flood Risk Implications for Development Summary**

Site HO4 is located in a known flooding hotspot area. There is a significant proportion of the north part of the site at risk of fluvial flooding, and surface water flood risk is considerable both on the northern part of the site and on the adjacent off site road (A602).

It should be noted that with the higher climate change allowance for the 1 in 20 year fluvial flood event the increase in flood extent is approximately 1ha on the north western corner of the site. This area should be incorporated into the functional floodplain and should be kept free from any development.

The sequential approach must be followed, steering development to areas of least risk. The site has been set aside for housing development; therefore the positioning of residential development (classified as More Vulnerable) would preferably be advised in the southern section or outside of the Flood Zones of the northern section.

If development pressures create the need to develop within areas that are at risk of flooding (i.e., Flood Zone 2 and Flood Zone 3), they should incorporate appropriate mitigation measures which must not increase the risk of flooding to surrounding areas. Examples of flood resistant and resilient mitigation measures can include the raising of finished floor levels and the design buildings such that there is no habitable accommodation at ground level. Further details

| Site Assessment Summary: HO4 – South East of Stevenage |
|---|
| on flood resistant and resilient design are provided in Section 5.4 of this report.<br><br>It is noted that safe ingress and egress may be limited due to fluvial and pluvial flooding. Should this not be achievable it may render areas of the site unsuitable.<br><br>Detailed liaison with the Environment Agency will be necessary during the design and planning process and it cannot be assumed that the Environment Agency will not object to development in these areas.<br><br>It is recommended that the areas of significant hazard and surface water flood risk (i.e. to the north west of the site) are kept as open spaces. |
| **Site Specific Policy Recommendations**<br><br>Flood Warning and Evacuation procedures should be developed for this site as part of a site specific FRA.<br><br>Development allocation across the wider area should follow the principles of the NPPF sequential approach. For example, proposed residential development should be steered to the lower risk areas, with the remaining 'less vulnerable' land uses being located on the (relatively) higher risk areas.<br><br>A detailed drainage strategy should be included with the site specific FRA report to fully understand the complex fluvial and surface water interactions at this location. From 6 April 2015, all major development should include provision for SuDS and a Sustainable Drainage Strategy will need to be completed and signed by a competent drainage engineer to verify that the proposals conform to the Government's 'Sustainable Drainage Systems: Non-Statutory Technical Standards[18]. Further information of the Technical Standards and guidance is available on the HCC website: http://www.hertsdirect.org/services/envplan/water/floods/surfacewaterdrainage/sudsguidance/<br><br>As the majority of the site is greenfield, future developments within the area potentially can increase surface water runoff and affect other areas within the site downstream sites and locations. SuDS should be considered at all stages of the planning and design of new developments to reduce runoff rates and volumes from the developed site, thus reducing the resultant flood risk posed to the site and adjacent/downstream areas. Development should, where reasonably possible, aim to reduce surface water runoff to less than greenfield run off. If this is not possible then greenfield runoff rates should be achieved by the proposed mitigation measures.<br><br>Development should not encroach within 8m of the Stevenage Brook, which is the Environment Agency by-law distance for Main Rivers. |

[18] Sustainable drainage systems: non-statutory technical standards - https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards

## 4.3 North West Area

Four sites are located on the north western outskirts of SBC, near Junction 8 on the A1 (M). The sites are intersected by the Ash Brook, an ordinary watercourse tributary of the River Purwell. Table 4-1 summarises the proposed land use for each site.

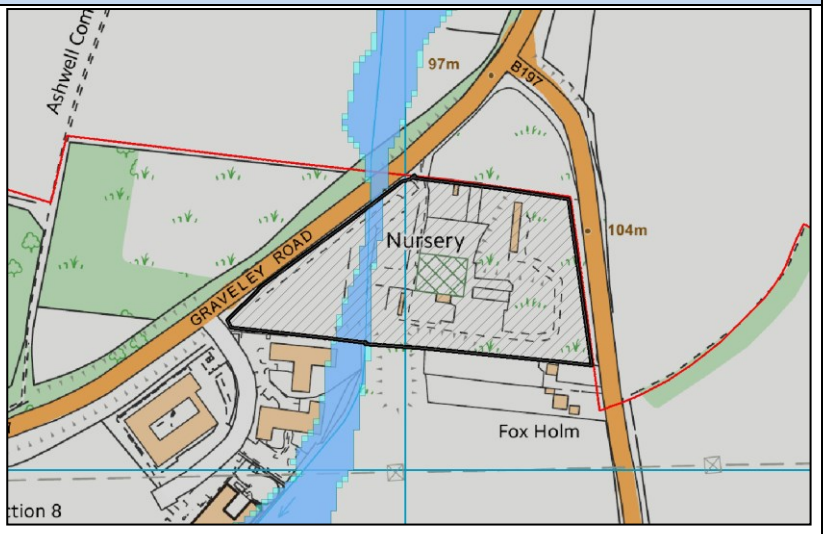
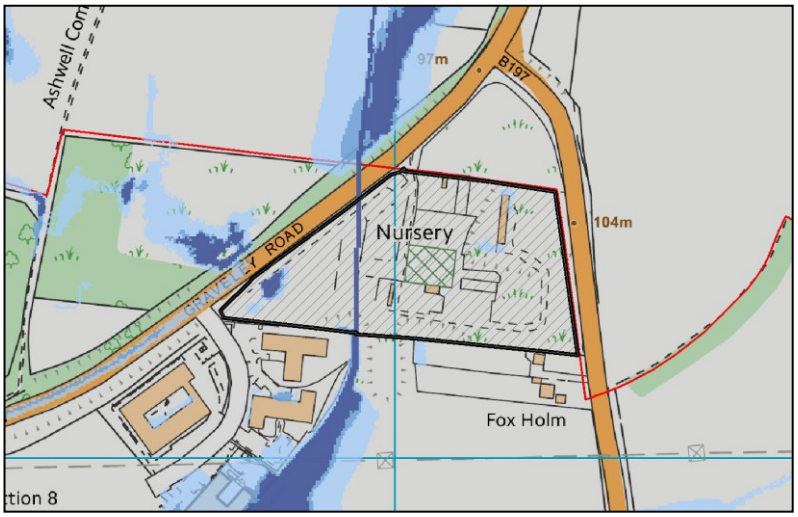
Due to the presence of this ordinary watercourse and surrounding topology this area is considered to be at risk from both fluvial and surface water flooding. However, there are no records of historic flooding in any of the sites. This is most probably due to the fact that the area has remained largely undeveloped and flooding may not have been reported.

**Table 4-1 North West Stevenage Proposed Land-use**

| Site Reference | Proposed Landuse |
|---|---|
| TC11 | Convenience retail provision |
| EC4 | Employment |
| HC3 | Healthcare uses |
| EC1/7 | Storage and distribution |

### 4.3.1 North West Area - Site Assessment TC11

| Site Assessment Summary: TC11 – Major Opportunity Area -New Convenience Retail Provision | | | | | |
|---|---|---|---|---|---|
| **Location:** Graveley Road | **OS NGR:** TQ 23015 27176 | **Area:** 3.42ha | **Current Landuse:** Garden Centre | **Proposed use:** Convenience retail provision (Less Vulnerable) | |
| **Flood Risk Source Summary** Site TC11 is considered to be at risk of fluvial and surface water flooding according to Environment Agency maps. | | | | | |
| **Recorded Flood Incidents** | There are no recorded flood incidents at this site or its surroundings. | | | | |
| **Local Watercourses and Defences** | The Ash Brook flows southwards as an open channel from Graveley Road before entering a culvert, approximately 120m in length, beneath the current car park of the site. | | | | |
| **Proposed use and vulnerability classification** | **NPPF Vulnerability classification** Less Vulnerable | **Flood Zone 1** ✓ | **Flood Zone 2** ✓ | **Flood Zone 3** ✓ | **Flood Zone 3b** × |
| **Flood Zones for Planning Coverage** | **Notes** N/A | **FZ1** 3.19ha | **FZ2** 0.23ha | **FZ3a** 0.22ha | **FZ3b** 0ha |

| Site Assessment Summary: TC11 – Major Opportunity Area -New Convenience Retail Provision | |
|---|---|
| **Flood Zones for Planning**<br><br>**Proposed Site**<br><br>**Flood Zone 3b**<br><br>**Flood Zone 3a**<br><br>**Flood Zone 2** |  |
| **Fluvial Flood Risk Summary**<br><br>According to Environment Agency Flood Map the site is shown to be at risk of flooding from the ordinary watercourse that crosses it from north to south. The area at risk is considered to be in Flood Zone 3..<br><br>The Environment Agency Flood Map is based on the national flood mapping project (J-Flow) rather than channel specific hydraulic model. To quantify the potential flood threat a more detailed 1D – 2D hydraulic model should be developed taking into account the real conditions of the ordinary watercourse (culverted beneath the site).<br><br>The site is not located within any Flood Warning Area.<br><br><u>Climate Change</u><br><br>The effects of climate change should be considered in a site specific flood risk assessment. | |
| **Risk of Flooding from Surface Water Maps (Environment Agency uFMfSW data)**<br><br>**Low**<br><br>**Medium**<br><br>**High** |  |
| **Surface Water Flood Risk** | The Environment Agency uFMfSW mapping data indicates that there is risk of surface water flooding. The surface water flood map shows a risk of surface water flooding alongside the culverted watercourse and in a small area on the western section of the site. |

## Site Assessment Summary: TC11 – Major Opportunity Area -New Convenience Retail Provision

### Groundwater Flood Risk

**Low**

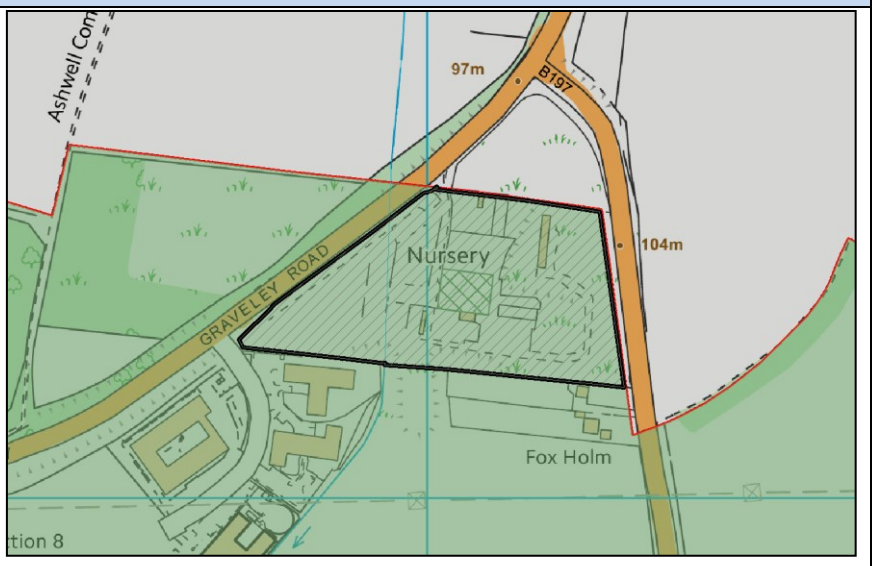
**Medium**

**High**

The site is shown to be located in the following zone:

**Floodtype**: Clearwater

**Class**: A (Low Risk, limited potential for groundwater flooding to occur).




| Residual Flood Risks | Culvert / Structure Blockage | Impounded Water Body Failure | Defence Breach / Overtopping | Notes |
|---|---|---|---|---|
| | ✓ | × | × | Site is outside of the Environment Agency Risk of Flooding from Reservoirs mapping |

### BGS Infiltration SuDS Suitability Map

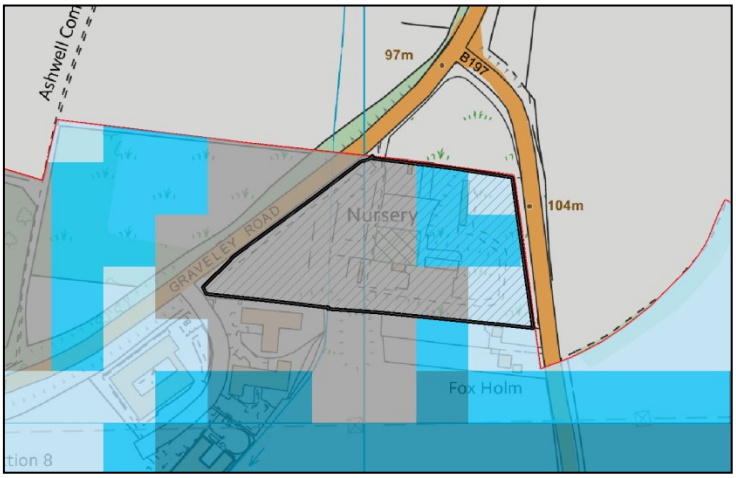
**Highly Compatible for infiltration SuDS**

**Probably Compatible for infiltration SuDS**

**Opportunities for bespoke infiltration SuDS**

**Very significant constraints are indicated**

A large proportion of the site is shown to be located in an area where very significant constraints to SuDS are indicated. However, there are small areas to the east of the site where it is probably and highly compatible for infiltration SuDS.




### Infiltration SuDS Suitability

Mapping from the BGS suggests that on the west half of the site there is a very significant potential for one or more geohazards associated with infiltration. The BGS advise to only install infiltration SuDS if the potential for or the consequences of infiltration are considered not to be significant.

The BGS Map shows some areas in the east half with a subsurface likely to be suitable for free-draining infiltration SuDS and advise to quantify infiltration rate via an infiltration/soakaway test. For the remaining part of the site, non infiltration SuDS needs to be considered for this area.

A detailed drainage assessment based on site specific conditions should be carried out by qualified professionals and submitted with any planning application. These values should not be used for design; further site investigations are necessary to confirm the local ground conditions and determine the appropriate SuDS technique.

| Site Assessment Summary: TC11 – Major Opportunity Area -New Convenience Retail Provision |
|---|
| Prospective developers should work closely with the Environment Agency, SBC as the LPA and HCC as the LLFA to manage surface water run-off and implementing the most suitable SuDS system. |
| **Flood Risk Implications for Development Summary**<br><br>The Environment Agency flood zone mapping has not taken into consideration the presence of the culvert on the Ash Brook. Therefore, it is recommended that a site FRA is conducted which includes a detailed hydraulic model of the site to more accurately define the flood zones.<br><br>It should be noted that any development on this site could affect downstream sites and villages. Due consideration should therefore be taken to ensure that development does not increase the flood risk on the downstream properties.<br><br>The sequential approach must be followed, steering development to areas of least risk. The proposed development on the site is commercial and classified as 'Less Vulnerable'. This is considered appropriate for the site Flood Zones in accordance with the NPPF.<br><br>If development pressures create the need to develop within areas that are at risk of flooding (i.e., Flood Zone 2 and Flood Zone 3), the development should be designed into include flood resistant and resilient design measures to enable rapid clean-up and re-occupancy in the event of flooding. Further details on building design for flood resilience are presented in Section 5.4 of this report. |
| **Site Specific Policy Recommendations**<br><br>According to the Local Plan, development proposals which do not involve deculverting will have an adverse impact on the town's river corridors and water meadows. Opening up river corridors can help to improve the chemical and biological quality of a watercourse. This, in turn, improves habitats for biodiversity and also contributes to open space and health and wellbeing in the town. Where the developer cannot deculvert the water course or improve the health of the water course, they should provide mitigation elsewhere in the Borough as an offset to their development. This may involve the deculverting of an alternative length of watercourse.<br><br>Development allocation across the wider area should follow the principles of the NPPF sequential approach.<br><br>A detailed drainage strategy should be included with the site specific FRA report to fully understand the flooding at this site. SuDS schemes should be developed in consultation with HCC (Hertfordshire SuDS Approval Body when Schedule 3 of the Flood and Water Management Act 2010 has commenced) and reference should be made to the Hertfordshire Interim SuDS Adoption Policy, and SuDS Design Guidance for Hertfordshire[19]. |

[19] http://www.hertsdirect.org/services/envplan/water/floods/surfacewaterdrainage/sudsguidance/

### 4.3.2 North West Area - Site Assessment EC1/4

| Site Assessment Summary: EC1/4 – Land West of North Road | | | | | |
|---|---|---|---|---|---|
| **Location:** North Road | **OS NGR:** TQ 23040 26963 | **Area:** 5.87ha | **Current Landuse:** Undeveloped land | **Proposed use:** Employment (Less Vulnerable) | |
| **Flood Risk Source Summary** Bordered by the Ash Brook, site EC1/4 is considered to be at risk of fluvial and surface water flooding according to Environment Agency maps. | | | | | |
| **Recorded Flood Incidents** | There are no recorded flood incidents at this site. | | | | |
| **Local Watercourses and Defences** | The Ash Brook flows southwards from the culvert beneath site TC11 as an open channel alongside the western boundary of the site EC1/4 and enters another culvert downstream. | | | | |
| **Proposed use and vulnerability classification** | **NPPF Vulnerability classification** Less Vulnerable | **Flood Zone 1** ✓ | **Flood Zone 2** ✓ | **Flood Zone 3** ✓ | **Flood Zone 3b** x |
| **Flood Zones for Planning Coverage** | **Notes** N/A | **FZ1** 4.93ha | **FZ2** 0.94ha | **FZ3a** 0.89ha | **FZ3b** 0ha |

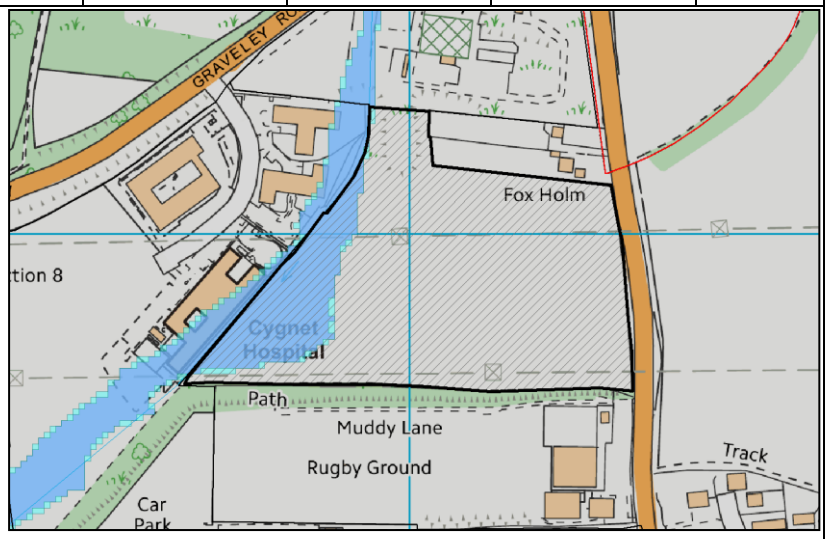
**Flood Zones for Planning**

**Proposed Site**

**Flood Zone 3b**

**Flood Zone 3a**

**Flood Zone 2**



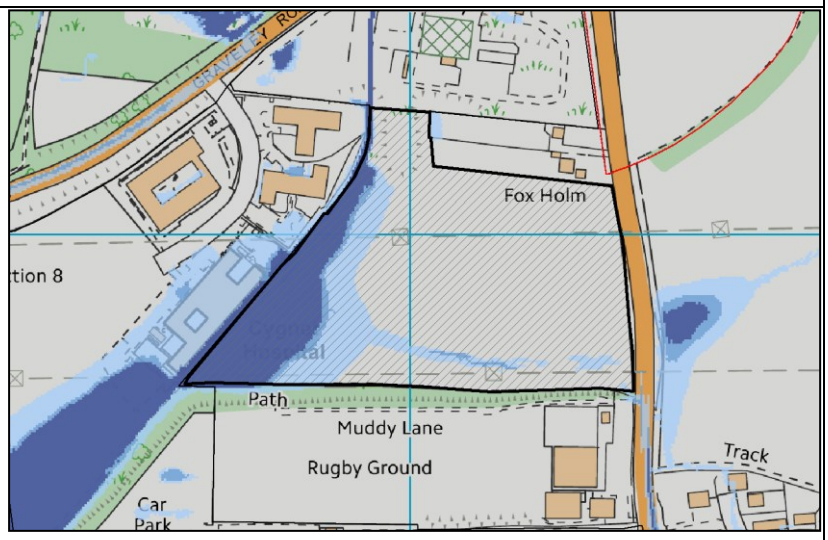
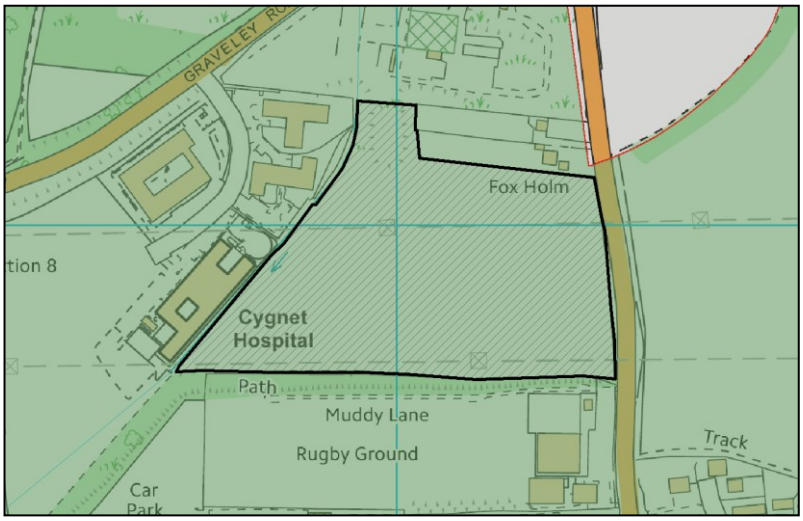

**Fluvial Flood Risk Summary**

According to Environment Agency Flood Map the site is shown to be at risk of flooding from the ordinary watercourse that borders it on the western side. The area at risk is considered to be in Flood Zone 3.

The Environment Agency Flood Map is based on the national flood mapping project (J-Flow) rather than a channel specific hydraulic model. To quantify the potential flood threat a more detailed 1D – 2D hydraulic model should be developed taking into account the real conditions of the ordinary watercourse (with the upstream and downstream culverts).

A conceptual 2D hydraulic model[20] of the Ash Brook ordinary watercourse was carried out as part of a FRA on some of the north west development sites. The intention was to provide an indicative model (without the precision of a 1D – 2D link simulation) that could assess more accurately the flood extent than the Environment Agency Flood Map by using the updated LIDAR DTM Data. This model shows the flood extents for both the 1% AEP and 0.1% AEP which appear to be narrower than the Environment Agency Flood Map, although the flow continues to overtop the channel in the south west of the site. A more detailed model should be undertaken as part of the site specific FRA.

[20] RAB Consultants, 2015. *Land at Stevenage, J8 A1 (M) Flood Risk Assessment*

| Site Assessment Summary: EC1/4 – Land West of North Road | | | | |
|---|---|---|---|---|
| The site is not located within any Flood Warning Areas.<br><br><u>Climate Change</u><br><br>The effects of climate change should be considered in a site specific flood risk assessment. | | | | |
| **Risk of Flooding from Surface Water Maps (Environment Agency uFMfSW data)**<br><br>**Low**<br>**Medium**<br>**High** |  | | | |
| **Surface Water Flood Risk** | The Environment Agency uFMfSW mapping data indicates that the site is at risk of surface water flooding. The main area at risk is located in the western section of the site alongside the open channel.<br><br>There is also an area of risk situated immediately to the east of the site, on the opposite site of North Road which could affect the site if it overtops this road. | | | |
| **Groundwater Flood Risk**<br><br>**Low**<br>**Medium**<br>**High**<br><br>The site is shown to be located in the following zone:<br><br>**Floodtype**: Clearwater<br><br>**Class**: A (Low Risk, limited potential for groundwater flooding to occur). |  | | | |
| **Residual Flood Risks** | **Culvert / Structure Blockage**<br><br>✓ | **Impounded Water Body Failure**<br><br>× | **Defence Breach / Overtopping**<br><br>× | **Notes**<br><br>Site is outside of the Environment Agency Risk of Flooding from Reservoirs mapping |

## Site Assessment Summary: EC1/4 – Land West of North Road

**BGS Infiltration SuDS Suitability Map**

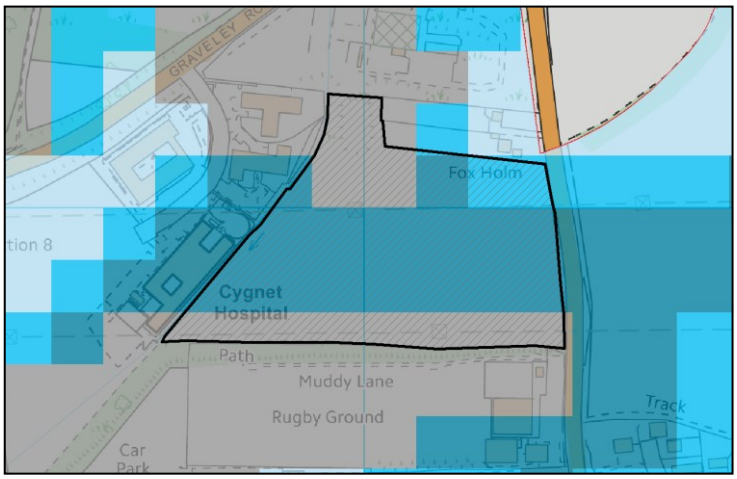
**Highly Compatible for infiltration SuDS**

**Probably Compatible for infiltration SuDS**

**Opportunities for bespoke infiltration SuDS**

**Very significant constraints are indicated**

A majority of the site is shown to be located in an area with opportunities for bespoke infiltration SuDS, however there are some areas where very significant constraints are indicated.




**Infiltration SuDS Suitability**

Mapping from the BGS suggests that on the central section of the site, the subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions. The BGS Map advises to quantify infiltration rate via an infiltration/soakaway test and consider whether infiltration can be used as a SuDS technique alongside water storage (in ponds/chambers) and re-use.

Areas north and south of this central section appear to have very significant constraints; therefore the BGS Map advise to only install infiltration SuDS if the potential for or the consequences of infiltration are considered not to be significant. Non infiltration SuDS needs to be considered for this area.

A detailed drainage assessment based on site specific conditions should be carried out by qualified professionals and submitted with any planning application. These values should not be used for design; further site investigations are necessary to confirm the local ground conditions and determine the appropriate SuDS technique.

Prospective developers should work closely with the Environment Agency, SBC as the LPA and HCC as the LLFA to manage surface water run-off and implementing the most suitable SuDS system.

**Flood Risk Implications for Development Summary**

Site EC1/4 is located in a potential flooding area. There is a significant proportion of the western section of the site at risk of flooding from both fluvial and surface water.

The extent of flooded area may vary if a detailed hydraulic model is carried out as part of a site specific flood risk assessment. This is recommended as it would permit a reassessment of the flood zones and determine the actual capacity of the open channel, downstream culverts and its effect on the site.

It is recommended that the areas at high risk of both fluvial and surface water flood risk (i.e. to the south west of the site) are kept as open spaces.

It should be noted that any development in this site could affect downstream sites and villages; therefore this should be taken into consideration and studied in a site flood risk assessment.

According to the Local Plan, this site is reserved for employment uses, classified as 'Less Vulnerable'. This type of development is considered to be suitable for this site and its flood zones.

**Site Specific Policy Recommendations**

According to the Local Plan, development proposals which propose culverting of watercourses will have an adverse impact on the town's river corridors and water meadows. Opening up river corridors can help to improve the chemical and biological quality of a watercourse. This, in turn, improves habitats for biodiversity and also contributes to open space and health and wellbeing in the town. Where the developer cannot deculvert the water course or improve the health of the water course, they should provide mitigation elsewhere in the Borough as an offset to their development. This may involve the deculverting of an alternative length of watercourse.

| Site Assessment Summary: EC1/4 – Land West of North Road |
|---|
| Development allocation across the wider area should follow the principles of the NPPF sequential approach.<br><br>As the majority of the site is greenfield, future developments within the area can potentially increase surface water runoff and affect other areas within the site and downstream sites and locations. SuDS should be considered at all stages of the planning and design of new developments to reduce runoff rates and volumes from the developed site, thus reducing the resultant flood risk posed to the site and adjacent/downstream areas. Development should, where reasonably possible, aim to reduce surface water runoff to less than greenfield run off. If this is not possible then greenfield runoff rates should be achieved by the proposed mitigation measures. |

### 4.3.3 North West Area - Site Assessment HC3

| Site Assessment Summary: HC3 – The Health Campus | | | | | |
|---|---|---|---|---|---|
| **Location:**<br>Stevenage Health Campus Site | **OS NGR:**<br>TQ 22919 26673 | **Area:**<br>20.89ha | **Current Landuse:**<br>A mixture of undeveloped land, housing sites and existing hospital sites. | **Proposed use:**<br>Healthcare uses (More Vulnerable) | |
| **Flood Risk Source Summary**<br><br>The Ash Brook crosses the site in its northern section, where the site is considered to be at risk of both fluvial and surface water flooding according to Environment Agency Maps. | | | | | |
| **Recorded Flood Incidents** | There are no recorded flood incidents at this site. | | | | |
| **Local Watercourses and Defences** | The Ash Brook flows south westerly as a small open channel and enters a culvert on the boundary of site HC3. This culvert passes beneath the proposed site and Hitchin Road and outfalls to the Corey's Hill Flood Storage Reservoir. | | | | |
| **Proposed use and vulnerability classification** | **NPPF Vulnerability classification**<br>More Vulnerable | **Flood Zone 1**<br>✓ | **Flood Zone 2**<br>✓ | **Flood Zone 3**<br>Exception test required | **Flood Zone 3b**<br>× |
| **Flood Zones for Planning Coverage** | **Notes**<br>N/A | **FZ1**<br>19.59ha | **FZ2**<br>1.30ha | **FZ3a**<br>1.16ha | **FZ3b**<br>0ha |

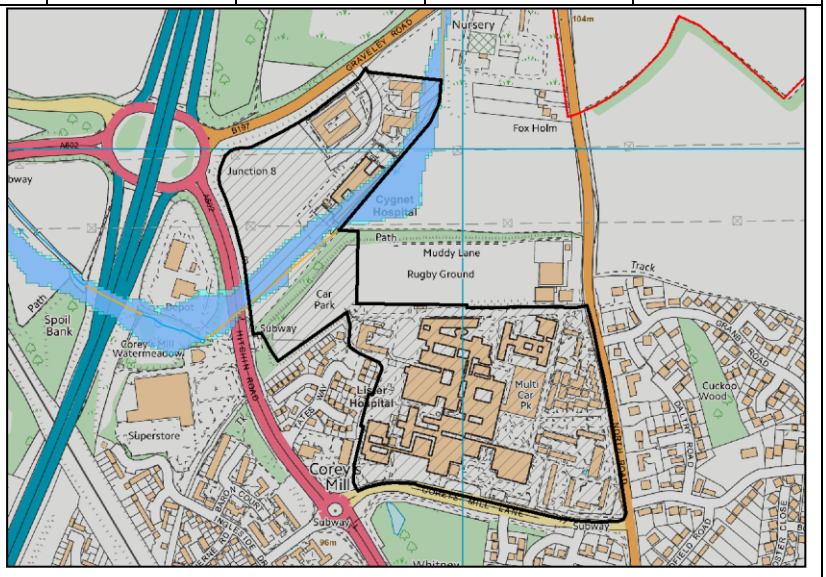
**Flood Zones for Planning**

**Proposed Site**

**Flood Zone 3b**

**Flood Zone 3a**

**Flood Zone 2**




**Fluvial Flood Risk Summary**

According to the Environment Agency Flood Map the site is shown to be at risk of flooding from the ordinary watercourse that crosses it from north to south. The area at risk is considered to be in Flood Zone 3.

The Environment Agency Flood Map is based on the national flood mapping project (J-Flow) rather than a channel

specific hydraulic model. To quantify the potential flood threat a more detailed 1D – 2D hydraulic model should be developed taking into account the real conditions of the ordinary watercourse (culverted beneath the site).

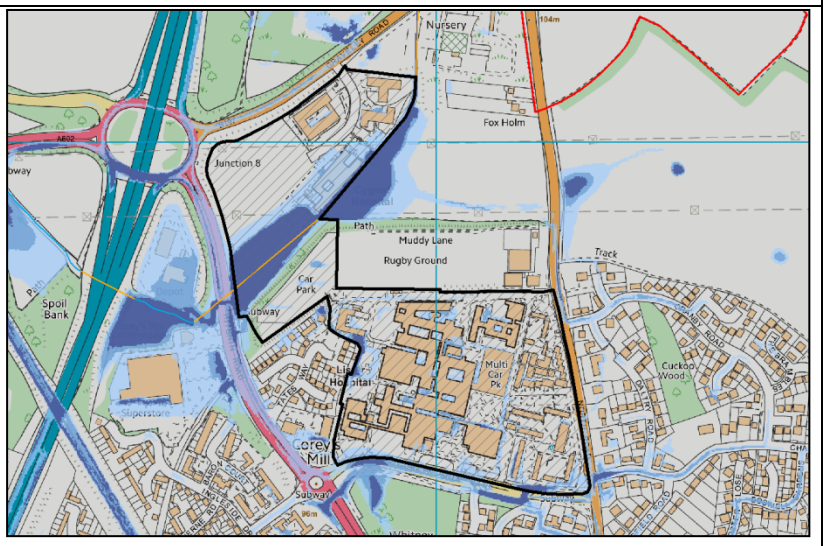
A conceptual 2D hydraulic model[21] of the Ash Brook ordinary watercourse carried out as part of a FRA on some of the north west development sites shows that the Ash Brook flows inside the culvert beneath the site for both 1 in 100 year and 1 in 1000 year flood events without overtopping it.

However, a previous FRA[22] carried out for a proposed development site inside HC3 indicates that the site might flood during the 1 in 100 year flood event. Flood water would inundate a portion of the site by overtopping a small length of the bank between the existing Cygnet Hospital and the entrance to the culvert. Therefore, it is recommended that the site specific FRA reassess the culvert capacity and inlet conditions.

The site is not located within any Flood Warning Area.

Climate Change

The effects of climate change should be considered in a site specific FRA.

| | |
|---|---|
| **Risk of Flooding from Surface Water Maps (Environment Agency uFMfSW data)**<br><br>**Low**<br><br>**Medium**<br><br>**High** |  |
| **Surface Water Flood Risk** | The Environment Agency uFMfSW mapping data indicates that the main risk is located around the culverted watercourse. Overland flow from the northern section of the site will gather over the culvert until it reaches a level where it will overtop into the pedestrian subway beneath Hitchin Road where a surface water pump is located[23].<br><br>There are also some areas at low risk around the Lister Hospital and its car parks and alongside Hitchin Road, which may complicate access to the undeveloped site. |

[21] RAB Consultants, 2015. *Land at Stevenage, J8 A1 (M) Flood Risk Assessment.*
[22] MLM Consulting Engineeers Ltd. 2012. *Cygnet Health Care Flood Risk Assessment*
[23] MLM Consulting Engineeers Ltd. 2012. *Cygnet Health Care Flood Risk Assessment*

**Groundwater Flood Risk**

**Low**

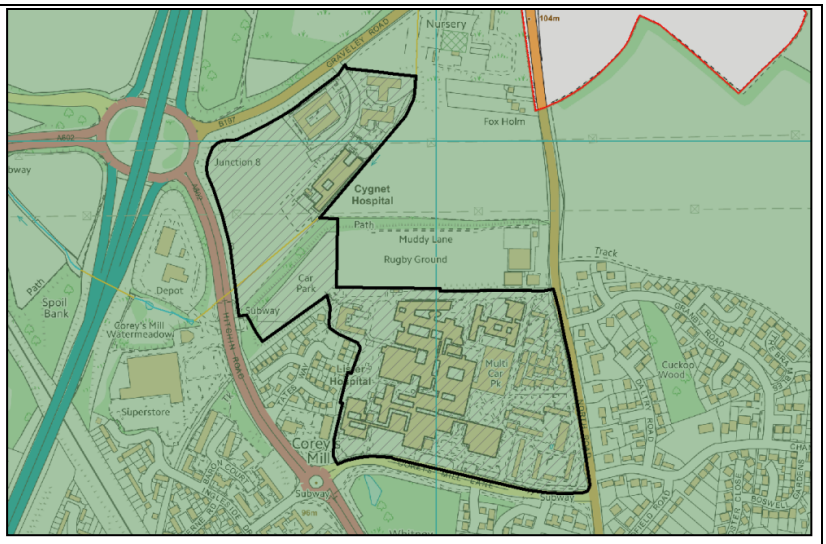
**Medium**

**High**

The site is shown to be located in the following zone:

**Floodtype**: Clearwater

**Class**: A (Low Risk, limited potential for groundwater flooding to occur).




| Residual Flood Risks | Culvert / Structure Blockage | Impounded Water Body Failure | Defence Breach / Overtopping | Notes |
|---|---|---|---|---|
| | ✓ | × | × | Site is outside of the Environment Agency Risk of Flooding from Reservoirs mapping |

**BGS Infiltration SuDS Suitability Map**

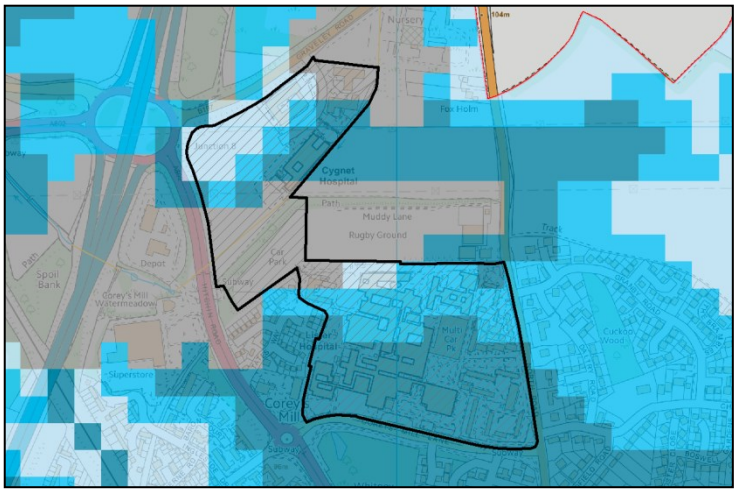
**Highly Compatible for infiltration SuDS**

**Probably Compatible for infiltration SuDS**

**Opportunities for bespoke infiltration SuDS**

**Very significant constraints are indicated**

The site has a varied suitability for SuDS, from very significant constraints in the central section to high compatibility in the northern part of undeveloped land.




**Infiltration SuDS Suitability**

Mapping from the BGS suggests that on the central section of the site, there is a very significant potential for one or more geohazards associated with infiltration, so it is recommended by this map to only install infiltration SuDS if the potential for or the consequences of infiltration are considered not to be significant. Non infiltration SuDS needs to be considered for this area.

The northern section shows a subsurface which is likely to be suitable for free-draining infiltration. Tests and infiltration quantification via a soakaway test is recommended.

According to Cygnet Health Care FRA[24], percolation testing at the undeveloped site shows that crate infiltration systems are suitable to manage surface water runoff.

A detailed drainage assessment based on site specific conditions should be carried out by qualified professionals

[24] MLM Consulting Engineeers Ltd. 2012 *Cygnet Health Care Flood Risk Assessment*

and submitted with any planning application. These values should not be used for design; further site investigations are necessary to confirm the local ground conditions and determine the appropriate SuDS technique.

Prospective developers should work closely with the Environment Agency, SBC as the LPA and HCC as the LLFA to manage surface water run-off and implementing the most suitable SuDS system.

**Flood Risk Implications for Development Summary**

The main areas at risk of this site appear to be in the southern section of the undeveloped land, where it is bisected by the Ash Brook.

Should the developers wish to keep the watercourse culverted beneath the site, then special attention should be given to the maintenance of this culvert. Nevertheless, it is recommended to re-naturalise the culverted watercourse and set back development at least 8m either side as it can improve water quality and health and wellbeing in the town.

It should be noted that any development in this site could affect downstream sites and villages; therefore this should be taken into consideration and studied in a site flood risk assessment.

According to the Local Plan, this site is reserved for healthcare uses, classified as 'More Vulnerable' and it should be steered away from areas affected by the 1 in 100 year flood event.

**Site Specific Policy Recommendations**

According to the Local Plan, development proposals which do not involve deculverting will have an adverse impact on the town's river corridors and water meadows. Opening up river corridors can help to improve the chemical and biological quality of a watercourse. This, in turn, improves habitats for biodiversity and also contributes to open space and health and wellbeing in the town. Where the developer cannot deculvert the water course or improve the health of the water course, they should provide mitigation elsewhere in the Borough as an offset to their development. This may involve the deculverting of an alternative length of watercourse.

Development allocation across the wider area should follow the principles of the NPPF sequential approach. For example, the proposed healthcare development should be steered to the lower risk areas, with the remaining 'less vulnerable' land uses being located on the (relatively) higher risk areas.

A detailed drainage strategy should be included with the site specific FRA report to fully understand the flooding at this site. SuDS schemes should be developed in consultation with HCC (Hertfordshire SuDS Approval Body when Schedule 3 of the Flood and Water Management Act 2010 has commenced) and reference should be made to the Hertfordshire Interim SuDS Adoption Policy, and SuDS Design Guidance for Hertfordshire[25].

[25] http://www.hertsdirect.org/services/envplan/water/floods/surfacewaterdrainage/sudsguidance/

### 4.3.4 North West Area - Site Assessment EC1/7

| Site Assessment Summary: EC1/7 – Land West of Junction 8 | | | | | |
|---|---|---|---|---|---|
| **Location:** Junction 8 of A1 (M) | **OS NGR:** TQ 22315 26862 | **Area:** 4.87ha | **Current Landuse:** Undeveloped land. | **Proposed use:** Storage and distribution (Less Vulnerable) | |
| **Flood Risk Source Summary** The Ash Brook bisects site EC1/7. This area of the site is considered to be at risk of both fluvial and surface water flooding. | | | | | |
| **Recorded Flood Incidents** | There are no recorded flood incidents at this site. | | | | |
| **Local Watercourses and Defences** | The Ash Brook flows in a north westerly direction from Corey's Hill FSR and enters the site after crossing under the motorway. It passes through the site as an open channel and continues on to the village of Little Wymondley. This open channel was built as part of highway drainage and it does not flow the natural drainage topography of the site. | | | | |
| **Proposed use and vulnerability classification** | **NPPF Vulnerability classification** Less Vulnerable | **Flood Zone 1** ✓ | **Flood Zone 2** ✓ | **Flood Zone 3** ✓ | **Flood Zone 3b** × |
| **Flood Zones for Planning Coverage** | **Notes** N/A | **FZ1** 3.99ha | **FZ2** 0.88ha | **FZ3a** 0.77ha | **FZ3b** 0ha |

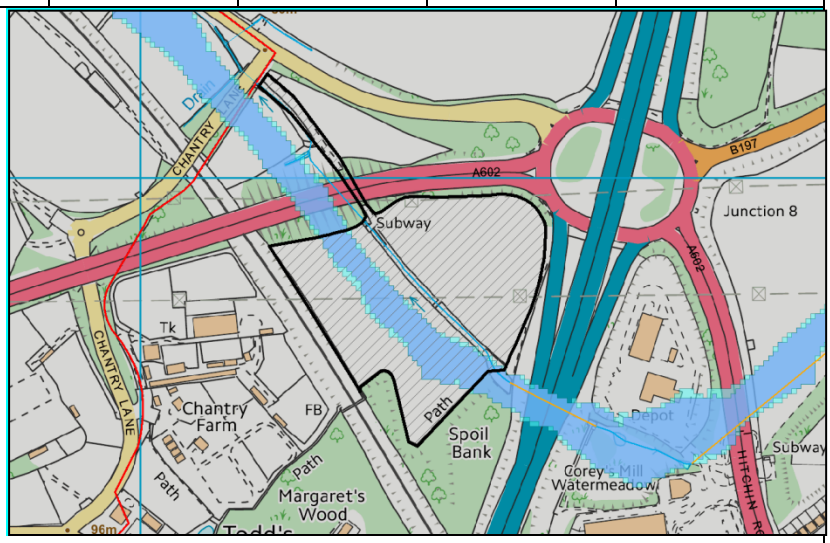
**Flood Zones for Planning**

**Proposed Site**

**Flood Zone 3b**

**Flood Zone 3a**

**Flood Zone 2**




**Fluvial Flood Risk Summary**

According to Environment Agency Flood Map the site is shown to be at risk of flooding from rivers alongside the ordinary watercourse that bisects it in a north westerly direction. The area at risk is considered to be in Flood Zone 3.

The Environment Agency Flood Map is based on the national flood mapping project (J-Flow) rather than a channel specific hydraulic model. As a result there exists a discrepancy between the flood extent and the ordinary watercourse. To quantify the potential flood threat a more detailed 1D – 2D hydraulic model should be developed taking into account the channel of the ordinary watercourse.

The conceptual 2D hydraulic model[26] of the Ash Brook ordinary watercourse carried out as part of a flood risk assessment on some of the north west development sites shows that the Ash Brook floods in this site. The highway drainage channel has a low capacity at this location and once it is overtopped, flood water ponds and is unable to re-enter the drainage channel.

[26] RAB Consultants, 2015. *Land at Stevenage, J8 A1 (M) Flood Risk Assessment*

**Site Assessment Summary: EC1/7 – Land West of Junction 8**

The site is not located within any Flood Warning Area.

Climate Change

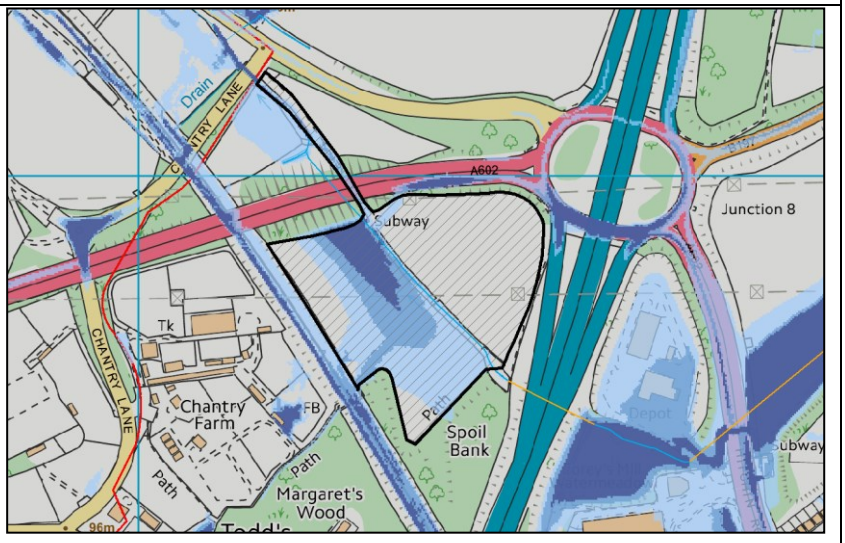
The effects of climate change should be considered in a site specific flood risk assessment.

**Risk of Flooding from Surface Water Maps (Environment Agency uFMfSW data)**

**Low**

**Medium**

**High**




**Surface Water Flood Risk**

The Environment Agency uFMfSW mapping data indicates that the majority of the south western section of the site is at risk from surface water flooding. Overland flow from the site will gather next to the A602 until it reaches a level where it will overtop into the culvert beneath this highway.

The Environment Agency online maps indicate that the flooding on site could reach over 900 mm in critical areas.

Nevertheless, this risk is more likely associated with the Ash Brook than surface water flooding.

**Groundwater Flood Risk**

**Low**

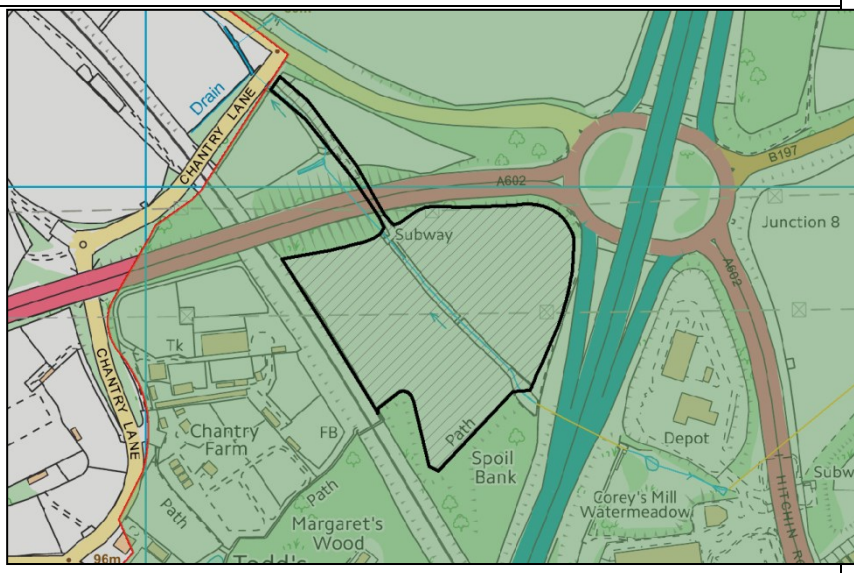
**Medium**

**High**

The site is shown to be located in the following zone:

**Floodtype**: Clearwater

**Class**: A (Low Risk, limited potential for groundwater flooding to occur).




| Residual Flood Risks | Culvert / Structure Blockage | Impounded Water Body Failure | Defence Breach / Overtopping | Notes |
|---|---|---|---|---|
| | ✓ | ✓ | × | Sites at risk of Corey's Hill Watermeadow failure |

## Site Assessment Summary: EC1/7 – Land West of Junction 8

**BGS Infiltration SuDS Suitability Map**

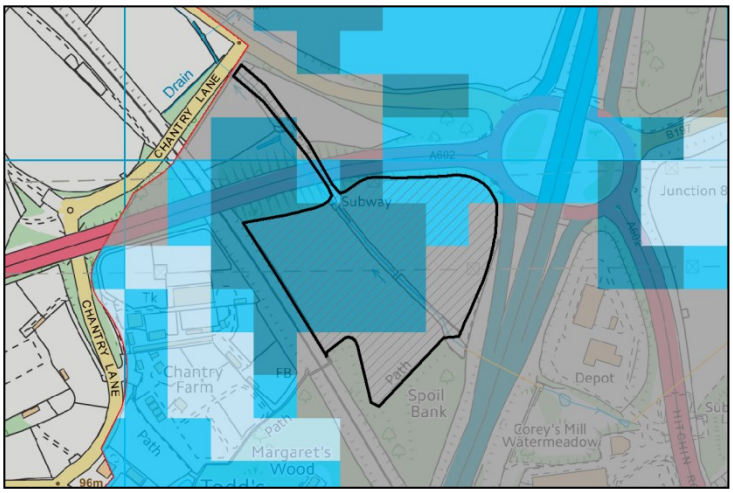
**Highly Compatible for infiltration SuDS**

**Probably Compatible for infiltration SuDS**

**Opportunities for bespoke infiltration SuDS**

**Very significant constraints are indicated**

This map indicates that most of the site subsurface has opportunities for bespoke infiltration SuDS.




**Infiltration SuDS Suitability**

Mapping from the BGS suggests that on most areas of the site the subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions. The BGS Map suggests quantifying infiltration rate via an infiltration/soakaway test to consider whether infiltration can be used as a SuDS technique alongside water storage (in ponds/chambers) and re-use.

Other sections in the site have very significant constraints as there is a potential for one or more geohazards associated with infiltration. Non infiltration SuDS needs to be considered for this area.

A detailed drainage assessment based on site specific conditions should be carried out by qualified professionals and submitted with any planning application. These values should not be used for design; further site investigations are necessary to confirm the local ground conditions and determine the appropriate SuDS technique.

Prospective developers should work closely with the Environment Agency, SBC as the LPA and HCC as the LLFA to manage surface water run-off and implementing the most suitable SuDS system.

**Flood Risk Implications for Development Summary**

The majority of the south western section of the site is shown to be at risk of both fluvial and surface water flooding. However, it is suggested that the future developer undertake cross section surveys of the river to develop a more detailed 1D – 2D hydraulic model that would permit the reassessment of the flooded area and develop potential mitigation measures. Should further refinement be required, the developer could conduct a detailed topographic survey of the area surrounding the ordinary watercourse and rerun the model using this information.

Flood water tends to pond inside the site; therefore, a SuDS technique should be taken into consideration to mitigate this without increasing the risk downstream. Another mitigation measure could be the installation of a new flood storage reservoir upstream of this site or an increase in the capacity of the existing one. This would permit better control of the incoming flow to the site to avoid flooding.

It should be noted that any development in this site could affect downstream sites and villages. This should be taken into consideration and studied in a site flood risk assessment.

According to the Local Plan, this site is reserved for storage and distribution and lower-intensity uses, classified as 'Less Vulnerable'. This type of development is considered to be suitable for this site and its flood zones.

**Site Specific Policy Recommendations**

According to the Local Plan, development proposals which propose culverting of watercourses will have an adverse impact on the town's river corridors and water meadows. Opening up river corridors can help to improve the chemical and biological quality of a watercourse. This, in turn, improves habitats for biodiversity and also contributes to open space and health and wellbeing in the town. Where the developer cannot deculvert the water course or improve the river health, they should provide mitigation elsewhere in the Borough as an offset to their development. This may involve the deculverting of an alternative length of watercourse.

Development allocation across the wider area should follow the principles of the NPPF sequential approach.

| Site Assessment Summary: EC1/7 – Land West of Junction 8 |
| --- |
| As the majority of the site is greenfield, future developments within the area can potentially increase surface water runoff and affect other areas within the site and downstream sites and locations. SuDS should be considered at all stages of the planning and design of new developments to reduce runoff rates and volumes from the developed site, thus reducing the resultant flood risk posed to the site and adjacent/downstream areas. Development should, where reasonably possible, aim to reduce surface water runoff to less than greenfield run off. If this is not possible then greenfield runoff rates should be achieved by the proposed mitigation measures. |

# 5 Site-Specific Flood Risk Assessment

## 5.1 Overview

This SFRA does not remove the responsibility of the developer of each site to consider Flood Risk in a detailed FRA (using this SFRA as a guide). In accordance with the PPG:

*"A site-specific flood risk assessment is carried out by (or on behalf of) a developer to assess the flood risk to and from a development site. Where necessary (see footnote 20 in the National Planning Policy Framework), the assessment should accompany a planning application submitted to the local planning authority. The assessment should demonstrate to the decision-maker how flood risk will be managed now and over the development's lifetime, taking climate change into account, and with regard to the vulnerability of its users (see Table 2* Table 2-2– *Flood Risk Vulnerability).*

The objectives of a site-specific FRA are to establish:

- whether a proposed development is likely to be affected by current or future flooding from any source;
- whether it will increase flood risk elsewhere;
- whether the measures proposed to deal with these effects and risks are appropriate;
- the evidence for the local planning authority to apply (if necessary) the Sequential Test; and
- whether the development will be safe and pass the Exception Test, if applicable".

Regardless of the presence of the Level 2 SFRA for SBC, all developments may need to be subject to a FRA even if it is to use Flood Risk Standing Advice and complete the appropriate checklist, in accordance with footnote 20 in the NPPF. These will be reviewed either by SBC and also the Environment Agency depending upon the scale and nature of the proposed development (see policies and recommendations in Section 4).

On the 18th December 2014 the Department for Communities and Local Government (DCLG) published a further consultation with proposals to make LLFAs statutory consultees for all major planning applications with surface water drainage implications in all flood zones. The same consultation proposes removing the Environment Agency's statutory role for development on sites greater than 1 ha. Government implemented these changes on 6th April 2015.

## 5.2 Detailed/Site-Specific Flood Risk Assessment

Where the quality and/or quantity of information for any of the flood sources affecting a site is insufficient to enable a robust assessment of the flood risks, and/or where the vulnerability of the proposed development is high further investigation will be required. For example, it is generally considered inappropriate to base an FRA for a residential care home at risk of flooding from fluvial sources on Flood Zone maps alone. In such cases, the results of detailed hydraulic modelling are preferable to ensure details of flooding mechanisms and the onset of flooding is fully understood and that the proposed development incorporates appropriate mitigation measures.

Developers should also identify the residual risk as part of a site-specific FRA. Such assessment should be appropriate to the scale and nature of the proposed development and flood risk. Should the potential impact be unacceptable, mitigation should be provided.

At all stages, SBC and where necessary the Environment Agency and HCC should be consulted to ensure the site-specific FRA provides the necessary information to fulfil the requirements for planning applications.

## 5.3 Site Vulnerability and Site Layout

The sequential approach should be applied within development sites to locate the most vulnerable elements of a development in the lowest risk areas e.g. residential developments should be restricted to areas at low hazard and parking, open space or proposed landscaped areas can be placed on lower ground with a higher probability of flooding.

Structures such as (bus, bike) shelters, park benches and refuse bins (and associated storage areas) located in areas with a high flood risk should be flood resilient and be firmly attached to the ground.

## 5.4 Building Design

### 5.4.1 Finished Floor Levels

Where developing in flood risk areas is unavoidable, the most common method of mitigating flood risk to people, particularly with 'more vulnerable' (residential) land uses, is to ensure habitable floor levels are raised above the 1 in 100 annual probability plus climate change and 600mm freeboard level for the site if at risk of fluvial flood risk.

For 'Less Vulnerable' commercial and industrial units, in the first instance the Environment Agency look for the standard 600mm freeboard for finished floor levels (FFLs). However, depending upon the type of proposal and local ground levels, in certain situations the Environment Agency may deviate from the standard requirement. For example, in situations where it is impractical to raise the FFLs to sufficiently meet the standard requirement. However, it is strongly recommended that internal access is provided to upper floors to provide safe refuge in a flood event (it is appreciated that this may not always be possible in heavily urbanised areas where commercial properties are to be located underneath privately owned residential accommodation).

Schools and hotels are classed as 'more vulnerable' land uses, however it may not be viable to raise FFLs. Therefore, internal access to higher floors must be provided to give safe refuge during times of flood.

Further consultation with the Environment Agency will be required during the undertaking of any site-specific FRA. For both 'less and more vulnerable' developments where internal access to higher floors is provided, the associated plans showing this should be included within any site-specific FRA.

In certain situations (e.g. for proposed extensions to buildings with a lower FFL or a conversion of existing historical structures with limited existing ceiling levels), it could prove impractical to raise the internal ground floor FFLs to sufficiently meet the general requirements. In these cases, the Environment Agency should be approached to discuss options for a reduction in the minimum internal ground floor FFLs, providing flood proofing (resilience) measures (Section 7.2) implemented up to the 1 in 100 annual probability plus climate change flood level. There are also circumstances where flood proofing (resilience) measures should be considered first.

It is also advised that local ground levels are profiled to minimise ponding and to channel surface water runoff away from any development.

## 5.5 Surface Water Management

In designing buildings flood risk management policies require that the developments are 'safe', do not increase flood risk elsewhere and where possible reduce flood risk overall. PPG states that a Level 2 SFRA should identify the need (or not) for a Surface Water Management Plan (SWMP).

### 5.5.1 Sustainable Drainage Systems

In accordance with the PPG to the NPPF and Environment Agency guidance, it is strongly recommend that suitable surface water mitigation measures are incorporated into any development plans in order to reduce and manage surface water flood risk to, and posed by the proposed development. This should ideally be achieved by incorporating SuDS.

SuDS designs should aim to reduce runoff by integrating stormwater controls throughout the site in small, discrete units. Through effective control of runoff at source, the need for large flow attenuation and flow control structures should be minimised.

SuDS can be broadly split into two types:

- Source Control - aims to control runoff at or close to the source e.g. green roofs, rainwater harvesting; and

- Site Control - is the management of runoff from several areas e.g. the use of ponds.

In order to identify the most suitable drainage solution, both source and site control measures should be assessed as part of any site-specific FRA. As part of any SuDS scheme, consideration should be given to the long-term maintenance of the SuDS to ensure that it remains functional for the lifetime of the development.

## 5.6 Climate Change

Section 3.4.1 sets out the background for the revised climate change allowances in the Thames River basin. These allowances should be taken into consideration throughout each aspect of the FRA.

The NPPF sets out important objectives in order to tackle climate change, sea level rise and avoid flood risk. The purpose of design policies should be to ensure that developments are sustainable, durable and adaptable to natural hazards such as flooding. Following this guidance, it should be possible to mitigate against increased flood risk through incorporating 'flood proofing' measures such as raised finished floor levels into the development design, and/or development of compensatory storage and flood storage basins.

# 6 Mitigation Meeting the NPPF Exception Test – Residual Risk Mitigation

## 6.1 Residual Risks

Residual risks are those that remain with flood mitigation measures in place. For example, proposed development areas that are located behind defences are at residual risk of flooding if those defences fail.

## 6.2 Flood Resilience and Resistance Measures

Within the design of buildings in areas where the probability of flooding is low or in areas where flood risk management measures have been put in place, guidance has been outlined by the Department of Communities and Local Government (DCLG) in 'Improving the Flood Performance of New Buildings'.

A number of measures can be used to manage residual risk including:

- Use local topography to guide water away from proposed development and into surface water drainage systems (Section 5.3);
- Flood resilience and resistance measures such as raising floor levels above the flood water inundation level (Section 5.4);
- Use SuDS where possible to reduce runoff rates discharging to local drainage systems (Section 5.5); and
- Flood warning and evacuation plans (Section 6.4).

Flood proofing is a technique by which buildings are designed to withstand the effects of flooding. There are two main categories of flood proofing; dry proofing and wet proofing. Dry proofing methods are designed to keep water out of the building, and wet proofing methods are designed to improve the ability of the property to withstand the effects of flooding once the water has entered the building.

Further guidance is also provided in the CIRIA Research Project 624 'Development and Flood Risk: Guidance for the Construction Industry' (2004).

Table 6-1 summarises recommendations made within Table A3.6 of the report for flood proofing measures which can be incorporated within the design of buildings (subject to compliance with Building Regulations).

**Table 6-1 Flood Proofing Options**

| Feature | Considerations to Improve Flood Proofing |
|---|---|
| External Walls | Careful consideration of materials: use low permeability materials to limit water penetration if dry proofing required. Avoid using timber frame and cavity walls. Consider applying a water resistant coating. Provide fittings for flood boards or other temporary barriers across openings in the walls (dry proofing). |
| Internal Walls | Avoid use of gypsum plaster and plasterboard; use more flood resistant linings (e.g. hydraulic lime, ceramic tiles). Avoid use of stud partition walls. |
| Floors | Avoid use of chipboard floors. Use concrete floors with integrated and continuous damp proof membrane and damp proof course. Solid concrete floors are preferable; if a suspended floor is to be used, provide facility for drainage of sub-floor void. Use solid insulation materials. |
| Fitting, Fixtures and Services | If possible, locate all fittings, fixtures and services above design flood level. Avoid chipboard and MDF. Consider use of removable plastic fittings. Use solid doors treated with waterproof coatings. Avoid using double-glazed window units that may fill with flood water. Use solid wood staircases. Avoid fitted carpets. Locate electrical, gas and telephone equipment and systems above design flood level. Fit anti-flooding devices to drainage systems. |

## 6.3 Emergency Access and Egress

Emergency access and egress is required to enable the evacuation of people from developments and also to provide the emergency services with access to the development during times of flood and enable flood defence authorities to carry out any necessary duties during periods of flood.

An emergency access and egress route is a route that is 'safe' for use by occupiers without the intervention of the emergency services or others. A route can only be completely 'safe' in flood risk terms if it is dry at all times.

For developments located in areas at flood risk the Environment Agency consider 'safe' access and egress to be in accordance with 'FRA Guidance for New Developments FD2320, where the requirements for safe access and egress from new developments are as follows in order of preference:

- Safe, dry route for people and vehicles;
- Safe, dry route for people;
- If a dry route for people is not possible, a route for people where the flood hazard (in terms of depth and velocity of flooding) is low and should not cause risk to people; and
- If a dry route for vehicles is not possible, a route for vehicles where the flood hazard (in terms of depth and velocity of flooding) is low to permit access for emergency vehicles.

For commercial development ('less vulnerable') it is considered that dry access and egress from the site will be desirable during times of extreme floods. For all new residential development ('more vulnerable'), it is considered that dry access and egress will be essential during times of extreme floods from each residential unit to an area outside of the floodplain. New properties within a 'dry island' of the fluvial floodplain will also require dry access due to the disruption to essential services (gas, water, etc.) that would be experienced during a flood event.

It is necessary to ensure that proposed road levels are such that emergency access and egress routes are maintained or where possible constructed to the 1 in 100 annual probability plus climate change flood level, as a minimum. This can significantly reduce the risk of the proposed development becoming inundated by flooding.

Details of how this will be achieved should be clearly described in site-specific FRAs. This should include:

- A review of any detailed river models (where available);
- A review of flood extents from broadscale modelling; and
- Comparison of flood extents/levels with local ground levels from topographical survey or digital elevation models.

## 6.4 Flood Warning and Evacuation Plans

Where developing in flood risk areas is unavoidable, it is recommended that the owners/occupiers sign up to the 'Floodline Warnings Direct' service operated by the Environment Agency where the area is designated to receive flood warnings (Environment Agency's website) as a method of mitigating flood risk to people. Where a particular site lies within an area not currently eligible to receive flood warnings, it can be registered with the local Environment Agency office as an 'area of interest' in order to receive such warnings. The flood warnings are able to be provided by the service via mobile, telephone, fax or pager.

More detailed information on the likely extent and time scale of these warnings can be obtained by request from the Environment Agency, by their 'Quickdial' recorded information service, or via their website.

For any proposed commercial or industrial developments within a designated floodplain, or those providing a service to vulnerable groups such as elderly care homes or hospitals, a system for monitoring flood warnings should be developed with designated responsible persons able to monitor and disseminate the warnings. This will provide more time to enable emergency access and egress of staff or residential occupants away from the local area, which may become flooded during a flood event (including routes for egress) prior to inundation.

They should also enable sufficient time to implement protection measures for any commercial goods or personal belongings on site through sealing all external doors to prevent flood inflow into such buildings as a precaution.

The exact nature of these emergency plans and procedures should be determined from the results obtained through the detailed FRAs for the individual sites and may be needed in conjunction with other mitigation measures. The need for, and feasibility of flood warning systems for a development should be discussed with the FRA.

Where there are exceptional circumstances in which development is allowed, which is reliant on evacuation SBC will assess whether the proposals are acceptable to their emergency planners and the local emergency services.

# 7 Summary and Recommendations

## 7.1 Summary

This SFRA has been prepared in order to provide a greater understanding of flood risk at proposed future development sites within the Borough of Stevenage, in accordance with national guidance, the NPPF[27] and the NPPF PPG[28]. In addition, SBC as the LPA needs to be consistent with the HCC and their Local Flood Risk Management Strategy.

The Level 2 SFRA has provided an assessment of critical development areas, taking into consideration SBC's future growth and the onset of climate change, and establishes a process for reducing flood risk and ensuring that development is steered towards appropriate areas taking into account flood risk and the vulnerability classifications of the proposed land use.

All sources of flood risk have been included in this Level 2 SFRA report using the most recent datasets made available from the Environment Agency. The fluvial flood risk with an allowance for climate change was modelled by AECOM using the existing Environment Agency Beane River hydraulic model. The revised modelling is only available for the southern sites. No hydraulic model was available to apply the climate change allowance in the north west of Stevenage.

A series of Site Assessment tables have provided a summary of each site identified as requiring additional assessment as part of this Level 2 SFRA. These tables provide an assessment of current and future flood risk (Climate Change), an assessment of residual risks, and recommendations for development – based on the proposed land use types. Table 7-1 presents a summary of site compatibility with NPPF vulnerability classification of the proposed development for all six sites assessed in the Level 2 SFRA. It is estimated that 95% of the total site area is compatible with the development proposed. A further 4% of the site area could be developed if it passes the Exception test.

Wider guidance and policy recommendations are also provided to assist with the development of site specific FRAs, when development proposals are produced for these sites as part of a planning application. The guidance provides a summary of key requirements in the SBC and those of the Environment Agency and HCC, and is aimed at ensuring proposed developments are located in an appropriate area, are made safe and that a flood risk reduction is achieved through sustainable development practices.

## 7.2 Recommendations

Main recommendations of this study are:

- SBC should adopt a Sequential Test based planning policy to steer development to the parts of sites compatible with respective vulnerability classification and appropriate mitigation measure is included in development plan to manage residual flood risk
- Flood Zone 3b should be protected from future developments not compatible with water
- Development in Flood zone 3 should only be permitted in exceptional circumstances
- Site specific FRAs for the Local Plan sites situated in North West Stevenage should include revised detailed hydraulic modelling. The hydraulic model should be a 1D – 2D hydraulic model taking into account the real conditions of the ordinary watercourse. Climate change projections should also be applied within these models and the flood zones and proposed land use reassessed.
- The SBC Level 2 SFRA has been completed in accordance with the NPPF, Technical Guidance to the NPPF and the current guidance outlined in the PPG. SFRAs have an intended lifespan of 6-10 years. Therefore it should be noted that although up-to-date at the time of production, the SFRA has a finite lifespan and should potentially be updated or revised as required by the LPA. As a result, it is recommended that the SFRA be adopted as a 'Living' document and should be reviewed regularly and, if necessary, updated with new flood risk or planning policy data.

[27] Department for Communities and Local Government. 2012. *National Planning Policy Framework*. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf
[28] http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/ March 2014

**Table 7-1 Site compatibility with NPPF vulnerability classification**

| Site | Site area | NPPF Vulnerability classification | Flood Zone 1 | Flood Zone 2 | Flood Zone 3 | Flood Zone 3b | Portion of site compatible with vulnerability classification | Portion of site needs to pass Exception test | Portion of site incompatible with vulnerability classification |
|---|---|---|---|---|---|---|---|---|---|
| South Stevenage – HO1/2 | 0.6ha | More Vulnerable | ✓ | ✓ | Exception test required | × | 73% | 22% | 5% |
| | | | 0.21ha | 0.23ha | 0.13ha | 0.03ha | | | |
| South Stevenage – HO4 | 30.22ha | More Vulnerable | ✓ | ✓ | Exception test required | × | 93% | 5% | 2% |
| | | | 25.66ha | 2.45ha | 1.5ha | 0.61ha | | | |
| North West Area - TC11 | 3.64ha | Less Vulnerable | ✓ | ✓ | ✓ | - | 100% | 0% | 0% |
| | | | 3.19ha | 0.23ha | 0.22ha | | | | |
| North West Area - EC1/4 | 6.76ha | Less Vulnerable | ✓ | ✓ | ✓ | - | 100% | 0% | 0% |
| | | | 4.93ha | 0.94ha | 0.89ha | | | | |
| North West Area - HC3 | 22.05ha | More Vulnerable | ✓ | ✓ | Exception test required | - | 95% | 5% | 0% |
| | | | 19.59ha | 1.3ha | 1.16ha | | | | |
| North West Area - EC1/7 | 5.64ha | Less Vulnerable | ✓ | ✓ | ✓ | - | 100% | 0% | 0% |
| | | | 3.99ha | 0.88ha | 0.77ha | | | | |
| **Overall** | **68.91ha** | | | | | | **95%** | **4%** | **1%** |

# Appendix A. Level 2 SFRA Flood Risk Figures

# Appendix B. Climate Change Peak Flow Rates

| Inflow | Peak flow ($m^3/s$) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1:100yr | 1:100yr + 25% | 1:100yr + 35% | 1:100yr + 70% | 1:20yr | 1:20yr + 35% | 1:20yr + 70% |
| Ub01 | 2.08 | 2.60 | 2.81 | 3.54 | 1.20 | 1.62 | 2.05 |
| Ub02 | 3.50 | 4.38 | 4.73 | 5.95 | 2.08 | 2.81 | 3.54 |
| Ub03 | 0.41 | 0.51 | 0.55 | 0.70 | 0.23 | 0.31 | 0.39 |
| Ub04 | 1.89 | 2.37 | 2.56 | 3.22 | 1.14 | 1.53 | 1.93 |
| Ub05 | 0.41 | 0.52 | 0.56 | 0.70 | 0.24 | 0.32 | 0.40 |
| Ub06 | 0.31 | 0.39 | 0.42 | 0.53 | 0.16 | 0.21 | 0.26 |
| Ub07 | 0.93 | 1.16 | 1.25 | 1.58 | 0.53 | 0.71 | 0.89 |
| Ub08 | 1.30 | 1.63 | 1.76 | 2.21 | 0.71 | 0.96 | 1.21 |
| Ub09 | 0.82 | 1.03 | 1.11 | 1.39 | 0.48 | 0.64 | 0.81 |
| Ub10 | 0.33 | 0.41 | 0.45 | 0.56 | 0.18 | 0.25 | 0.31 |
| Ub11 | 0.49 | 0.61 | 0.66 | 0.83 | 0.29 | 0.39 | 0.49 |
| Ub12 | 1.53 | 1.91 | 2.06 | 2.60 | 0.88 | 1.19 | 1.49 |
| ST01 | 7.46 | 9.33 | 10.07 | 12.68 | 5.05 | 6.82 | 8.58 |
| ST02 | 2.23 | 2.79 | 3.01 | 3.79 | 1.50 | 2.03 | 2.55 |
| ST03 | 0.81 | 1.01 | 1.09 | 1.38 | 0.49 | 0.66 | 0.83 |
| ST04 | 1.82 | 2.28 | 2.46 | 3.09 | 1.14 | 1.54 | 1.94 |
| ST05 | 1.46 | 1.83 | 1.97 | 2.48 | 0.91 | 1.23 | 1.55 |
| ST06 | 0.56 | 0.70 | 0.75 | 0.95 | 0.36 | 0.49 | 0.61 |
| AS01 | 1.97 | 2.47 | 2.66 | 3.35 | 1.32 | 1.79 | 2.25 |
| AS02 | 0.66 | 0.82 | 0.89 | 1.12 | 0.42 | 0.56 | 0.71 |
| AS03 | 1.11 | 1.39 | 1.50 | 1.89 | 0.76 | 1.03 | 1.30 |
| AS04 | 0.96 | 1.20 | 1.29 | 1.63 | 0.63 | 0.86 | 1.08 |
| DE01 | 8.28 | 10.34 | 11.17 | 14.07 | 4.94 | 6.66 | 8.39 |
| DE02 | 0.56 | 0.70 | 0.75 | 0.95 | 0.32 | 0.43 | 0.54 |
| LB01 | 1.71 | 2.13 | 2.30 | 2.90 | 0.91 | 1.23 | 1.55 |
| LB02 | 1.34 | 1.67 | 1.80 | 2.27 | 0.76 | 1.03 | 1.30 |
| LB03 | 2.60 | 3.25 | 3.51 | 4.42 | 1.49 | 2.01 | 2.53 |

# Appendix C.Site Assessment Database

| Site Ref. | Site Name | Flood Risk from Rivers (Flood Zones) | | | | Updated Flood Map for Surface Water | | | Historic Records | | Susceptibility to Groundwater Flooding | | Flood Response Measures | | Total | Overall Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | FZ 1 | FZ 2 | FZ 3a | FZ 3b | High | Medium | Low | Historic Flood Map | Flooding Database | Medium | High | FWA | FAA | | |
| Weightage | | 0 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.25 | 0.5 | 0.5 | | | | |
| EC1/1 | GSK / Stevenage Bioscience Catalyst | Y | | | | Y | Y | Y | | | | | | | 1.5 | L |
| EC1/2 | South of Bessemer Drive, Gunnels Wood | Y | | | | Y | Y | Y | | | | | | | 1.5 | L |
| EC1/3 | West of Gunnels Wood Road | Y | | | | | | Y | | | | | | | 0.5 | L |
| EC1/4 | Land West of North Rd | Y | Y | Y | | Y | Y | Y | | | | | | Y | 2.5 | M |
| EC1/5 | Stevenage Central | Y | | | | | Y | Y | | | | | | | 1 | L |
| EC1/6 | West of Stevenage | Y | | | | Y | Y | Y | | | | | | | 1.5 | L |
| EC1/7 | Land west of Junction 8 | Y | Y | Y | | Y | Y | Y | | | | | | Y | 2.5 | M |
| EC2 | Gunnels Wood Employment Area | Y | | | | Y | Y | Y | | Y | | | | | 1.75 | L |
| EC2B | Edge-of-Centre Zone | Y | | | | Y | Y | Y | | Y | | | | | 1.75 | L |
| EC3 | Gunnels Wood Industrial Zones | Y | | | | Y | Y | Y | | | | | | | 1.5 | L |
| EC3 | Gunnels Wood Industrial Zones | Y | | | | Y | Y | Y | | | | | | | 1.5 | L |
| EC6 | Pin Green Employment Area | Y | | | | Y | Y | Y | | | | | | | 1.5 | L |
| HO1/1 | Bedwell Crescent neighbourhood centre | Y | | | | Y | Y | Y | | | | | | | 1.5 | L |

| Site Ref. | Site Name | Flood Risk from Rivers (Flood Zones) | | | | Updated Flood Map for Surface Water | | | Historic Records | | Susceptibility to Groundwater Flooding | | Flood Response Measures | | Total | Overall Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | FZ 1 | FZ 2 | FZ 3a | FZ 3b | High | Medium | Low | Historic Flood Map | Flooding Database | Medium | High | FWA | FAA | | |
| Weightage | | 0 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.25 | 0.5 | 0.5 | | | | |
| HO1/2 | Bragbury End sports ground car park | Y | Y | Y | Y | Y | Y | Y | Y | | Y | | Y | Y | 4 | H |
| HO1/3 | Burwell Road neighbourhood centre | Y | | | | Y | Y | Y | | | | | | | 1.5 | L |
| HO1/4 | Dunn Close garage court | Y | | | | Y | Y | Y | | | | | | | 1.5 | L |
| HO1/5 | Ex-play centre, Scarborough Avenue | Y | | | | | | Y | | | | | | | 0.5 | L |
| HO1/6 | Former Pin Green school playing field | Y | | | | | | Y | | | | | | | 0.5 | L |
| HO1/7 | Fry Road day nursery | Y | | | | | | | | | | | | | 0 | NR |
| HO1/8 | Ken Brown car showroom | Y | | | | Y | Y | Y | | | | | | | 1.5 | L |
| HO1/9 | Kenilworth neighbourhood centre | Y | | | | | | Y | | | | | | | 0.5 | L |
| HO1/10 | Land at Eliot Road | Y | | | | | | | | | | | | | 0 | NR |
| HO1/11 | Land West of North Road (Rugby Club) | Y | | | | Y | Y | Y | | | | | | | 1.5 | L |
| HO1/12 | Marymead neighbourhood centre | Y | | | | Y | Y | Y | | | | | | | 1.5 | L |
| HO1/13 | Scout hut, Drakes Drive | Y | | | | | | Y | | | | | | | 0.5 | L |
| HO1/14 | Shephall Centre and adj. amenity land | Y | | | | | | | | | | | | | 0 | NR |

| Site Ref. | Site Name | Flood Risk from Rivers (Flood Zones) | | | | Updated Flood Map for Surface Water | | | Historic Records | | Susceptibility to Groundwater Flooding | | Flood Response Measures | | Total | Overall Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | FZ 1 | FZ 2 | FZ 3a | FZ 3b | High | Medium | Low | Historic Flood Map | Flooding Database | Medium | High | FWA | FAA | | |
| Weightage | | 0 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.25 | 0.5 | 0.5 | | | | |
| HO1/15 | Shephall View | Y | | | | | Y | Y | | | | | | | 1 | L |
| HO1/16 | The Glebe neighbourhood centre | Y | | | | Y | Y | Y | | | | | | | 1.5 | L |
| HO1/17 | The Hyde neighbourhood centre | Y | | | | Y | Y | Y | | Y | | | | | 1.75 | L |
| HO1/18 | The Oval neighbourhood centre | Y | | | | Y | Y | Y | | | | | | | 1.5 | L |
| HO2 | Stevenage West | Y | | | | Y | Y | Y | | | | | | | 1.5 | L |
| HO3 | North of Stevenage | Y | | | | Y | Y | Y | | | | | | | 1.5 | L |
| HO4 | South East of Stevenage | Y | Y | Y | Y | Y | Y | Y | Y | Y | | Y | Y | Y | 4.75 | H |
| HO12 | Gypsy Traveller Site | Y | | | | Y | Y | Y | | | | | | | 1.5 | L |
| TC3 | Centre West Major Opportunity Area | Y | | | | Y | Y | Y | | | | | | | 1.75 | L |
| TC4 | Station Gateway Major Opportunity Area | Y | | | | Y | Y | Y | | | | | | | 1.5 | L |
| TC6 | Northgate Major Opportunity Area | Y | | | | Y | Y | Y | | | | | | | 1.5 | L |
| TC2 | Southgate Park Major Opportunity Area | Y | | | | Y | Y | Y | | Y | | | | | 1.5 | L |
| TC7 | Marshgate Major Opportunity Area | Y | | | | Y | Y | Y | | | | | | | 1.5 | L |

| Site Ref. | Site Name | Flood Risk from Rivers (Flood Zones) | | | | Updated Flood Map for Surface Water | | | Historic Records | | Susceptibility to Groundwater Flooding | | Flood Response Measures | | Total | Overall Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | FZ 1 | FZ 2 | FZ 3a | FZ 3b | High | Medium | Low | Historic Flood Map | Flooding Database | Medium | High | FWA | FAA | | |
| Weightage | | 0 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.25 | 0.5 | 0.5 | | | | |
| TC5 | Central Core Major Opportunity Area | Y | | | | Y | Y | Y | | | | | | | 1.5 | L |
| TC11 | New Convenience Retail Provision | Y | Y | Y | | Y | Y | Y | | | | | | Y | 2.5 | M |
| HC1/1 | Poplars | Y | | | | Y | Y | Y | | | | | | | 1.5 | L |
| HC1/2 | Bedwell | Y | | | | Y | Y | Y | | | | | | | 1.5 | L |
| HC1/3 | The Glebe | Y | | | | Y | Y | Y | | | | | | | 1.5 | L |
| HC1/4 | The Hyde | Y | | | | Y | Y | Y | | Y | | | | | 1.75 | L |
| HC1/5 | Marymead | Y | | | | Y | Y | Y | | | | | | | 1.5 | L |
| HC1/6 | Oaks Cross | Y | | | | Y | Y | Y | | | | | | | 1.5 | L |
| HC1/7 | The Oval | Y | | | | Y | Y | Y | | | | | | | 1.5 | L |
| HC1/8 | Roebuck | Y | | | | Y | Y | Y | | Y | | | | | 1.75 | L |
| HC1/9 | Canterbury Way | Y | | | | Y | Y | Y | | | | | | | 1.5 | L |
| HC1/10 | Chells Manor | Y | | | | Y | Y | Y | | | | | | | 1.5 | L |
| HC1/11 | Filey Close | Y | | | | Y | Y | Y | | | | | | | 1.5 | L |

| Site Ref. | Site Name | Flood Risk from Rivers (Flood Zones) | | | | Updated Flood Map for Surface Water | | | Historic Records | | Susceptibility to Groundwater Flooding | | Flood Response Measures | | Total | Overall Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | FZ 1 | FZ 2 | FZ 3a | FZ 3b | High | Medium | Low | Historic Flood Map | Flooding Database | Medium | High | FWA | FAA | | |
| Weightage | | 0 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.25 | 0.5 | 0.5 | | | | |
| HC1/12 | Hydean Way | Y | | | | | | Y | | | | | | | 0.5 | L |
| HC1/13 | Mobbsbury Way | Y | | | | Y | Y | Y | | | | | | | 1.5 | L |
| HC1/14 | Popple Way | Y | | | | | | Y | | | | | | | 0.5 | L |
| HC1/15 | Rockingham Way | Y | | | | | | Y | | | | | | | 0.5 | L |
| HC3 | The Health Campus | Y | Y | Y | | Y | Y | Y | | | | | | Y | 2.5 | M |
| HC5 | New health, social and community facilities | Y | | | | | Y | Y | | | | Y | | | 1 | L |
| HC9 | Former Barnwell East secondary school | Y | | | | Y | Y | Y | | | | | | | 1.5 | L |

United Kingdom

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