Flood Risk and Drainage Statement
Billing Brook Road, Northampton

April 2019

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### Quality Assurance – Approval Status

This document has been prepared and checked in accordance with Waterman Group’s IMS (BS EN ISO 9001: 2015, BS EN ISO 14001: 2015 and BS OHSAS 18001:2007)

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<th>Checked by</th>
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Comments

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1. Introduction

This statement provides an assessment of flood risk and surface water drainage discharge options for the Site (at land situated to the east of Billing Brook Road in the Boothville suburb of north-east Northampton, together with outline details on infiltration potential and foul water discharge options.

1.1 Site Description

1.1.1 Site Location and Access

The existing Site (hereafter referred to as ‘the Site’) is located on the north-eastern fringe of Northampton city in the residential suburban area of Boothville/Great Billing. The Site is centred on OS grid reference 479363, 264315, is roughly rectangular and covers an approximate area of 0.84ha.

The Site lies in a predominantly residential area with the Thorplands Primary School situated to the west of the development. Local highway infrastructure to the development includes Billing Brook Road, situated along the western boundary of the development. The proposed Site access will be achieved from Billing Brook Road. To the north, east and south of the development residential dwellings, cul-de-sacs and pedestrian footpaths are located.

Currently, the Site comprises undeveloped Greenfield land with several mature trees present locally (within the Site boundary).

Central Northampton is located approximately 5.4km to the south-west of the development.

The Sites existing layout plan is shown in Figure 1 below.

Figure 1: Site Location Plan
1.1.2 Site Topography and Features

The Site topographical survey is provided in Appendix A.

Levels recorded across the development Site area range from 88.26mAOD, recorded to the north-east of the development area, falling to levels approximating 78.40mAOD to the south-west of the Site boundary. Therefore, a level difference of approximately 10.0mAOD is recorded across the development Site from the highest recorded point on Site, situated to the north-east, to the lowest, situated to the south-west.

The Site is located on a considerable slope, with an approximate gradient of 1:11 recorded between the north-east (highest) and south-west (lowest).

1.2 Scope of Report

This report comprises a Flood Risk Assessment in general accordance with requirements of the:

- National Planning Policy Framework (NPPF);¹
- Planning Practice Guidance to the National Planning Policy Framework;²
- Environment Agency Flood Risk Guidance Note 3³.

This report assesses the potential effects upon the development of tidal, fluvial, groundwater, pluvial, reservoir, canal and artificial sources of flooding. The management of surface water is also assessed, and a strategy to effectively manage runoff, whilst working within Site specific constraints is proposed, so as not to increase and, if possible, decrease flood risk elsewhere.

The drainage strategy element of the report includes:

- the drainage requirements for the Site, highlighting potential constraints;
- an estimate the pre- and post-development surface water flows;
- outline surface water treatment and attenuation requirements;
- outline recommendations for SuDS facilities;
- identification and feasibility of both foul and surface water disposal from the Site.

1.3 National Planning Policy Framework

Overview

The National Planning Policy Framework 4 (NPPF) sets out the Government's planning policies for England and how these are expected to be applied. It sets out the Government's requirements for the planning system only to the extent that is relevant, proportionate and necessary to do so.

Where new development is exceptionally necessary in high risk areas, the policy aims to make it safe without increasing flood risk elsewhere, and where possible reduce flood risk overall. The NPPF advocates the use of the risk-based ‘Sequential Test’, in which new development is steered towards the areas at lowest probability of flooding.

EA Flood Zones

Areas of varying flood risk, due to rivers and the sea, are classified using Flood Zones. Full descriptions of

¹ National Planning Policy Framework – Department for Communities and Local Government – 27th March 2012
² National Planning Practice Guidance to the National Planning Policy Framework – Flood Risk and Coastal Change – 5th April 2015
these are included within Appendix F, but are briefly summarised as follows in terms of the annual probability of flooding:

- **Flood Zone 1** – low probability; less than 1 in 1,000 annual probability from rivers/sea.
- **Flood Zone 2** - medium probability; between a 1 in 100 and 1 in 1,000 annual probability of river flooding and between a 1 in 200 and 1 in 1000 annual probability of sea flooding.
- **Flood Zone 3a** – high probability; greater than 1 in 100 annual probability of river flooding or 1 in 200 annual probability of sea flooding.
- **Flood Zone 3b** – the functional floodplain (where water is stored in times of flood, including water conveyance routes); typically greater than 1 in 20 annual probability of river flooding.

**Sequential Test**

The NPPF requires the “Sequential Test” and where applicable the “Exception Test” to be undertaken. The Sequential Test is where the risk of flooding to the development is evaluated against the probability of flooding, based on Flood Zones, and the vulnerability of the type of development. The Technical Guidance to the NPPF provides a matrix which allows development to be permitted, not permitted or requiring the Exception Test. The Exception Test allows consideration of the wider sustainability benefits of a development to be considered to justify development in a high-risk flood zone, as long as the development is not considered vulnerable to flooding.

NPPF gives guidance on the aim of the Sequential Test, which states:

"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. The Strategic Flood Risk Assessment will provide the basis for applying this test. A sequential approach should be used in areas known to be at risk from any form of flooding"

The Environment Agency’s Flood Zone Map, as shown in Figure 2, indicates that the entire development Site lies within Flood Zone 1 and is therefore considered suitable for all types of development. Therefore, the sequential test is considered satisfied and the exception test is deemed as not required.

Extracts from the National Planning Policy Framework are provided in Appendix C.
2. Potential Source of Flooding

2.1 Introduction

Based on the Environment Agency Floodzone maps, included in Figure 2, the Site is located within Flood Zone 1 (less than 1 in 1000 annual probability of river or sea flooding in any year) which is defined as having a low (or lowest possible) probability of flooding in the Planning Practice Guidance to the National Planning Policy Framework (NPPF).

- Flood Zone 1 - land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%)
- Flood Zone 2 - land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year
- Flood Zone 3 - land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year

The local sewerage and water undertaker is Anglian Water (NW), the Local Planning Authority and Lead Local Flood Authority (LLFA) for the Site is Northamptonshire County Council (NCC).

2.2 Fluvial Sources

Based on the Environment Agency Flood Zone maps, as shown in Figure 2 below, the developed Site is located entirely within Flood Zone 1. Flood Zone 1 is classified as an area that has an annual probability of river or sea flooding of less than 1 in 1000 years. Flood Zone 2 and Flood Zone 3 areas are shown to affect eastern areas, although these areas are allocated to remain undeveloped and unchanged.

Figure 2: Environment Agency Flood Risk Map

Source: Environment Agency, Accessed Online: 30/04/19
A series of interconnected lakes and conveyance watercourses/channels are located approximately 0.3km to the east of the Site boundary. Flooding associated with this fluvial system does not affect the development and elevations of between 70m AOD and 75m AOD (compared to elevations of 78m AOD to 80m AOD within the Site) are documented within proximity to this watercourse.

A second ordinary watercourse is located to the north of the development, flowing east into Kingfisher Lake. There is no flooding predicted from this watercourse.

In summary, the Site is located away from all sources of fluvial flooding and the risk of fluvial flooding to the Site is low.

2.3 Pluvial Sources

The Environment Agency surface water flood maps, included in Figure 3, indicate that the entire Site is situated in an area classified to have a ‘very low’ risk of surface water flooding.

Surface water flooding occurs to the west of the Site boundary with a surface water flow pathway documented along Billing Brook Road. The surface water flooding recorded along Billing Brook Road does not affect the Site directly and is not deep enough to affect access and egress from the development. The depth of surface water flooding is below 300mm in all adjacent locations along Billing Brook Road.

It is therefore considered that the Site is at a low risk of flooding from surface water sources.

Pluvial Flood Risk Mitigation Measures

To mitigate any residual risk (however small) that may occur from surface water flooding, the following mitigation measures are advised. Firstly, it is recommended that developed areas are prioritised on elevated land situated away from any local drainage ditches (and any corresponding surface water flood risk areas).

Landuse in these low-lying areas, particularly in south-west areas (where surface water flooding is more likely to occur), would be best suited for areas of public open space (which could also include the provision of sustainable drainage features such as an attenuation basin or geo-cellular tank system), which would be free to flood in the unlikely event of a surface water flooding event of significant magnitude to affect the Site.

As a further mitigation measure, the proposed Development will include a positive surface water drainage system that will intercept the majority of run-off generated within the Site itself, hence minimising the risk to new buildings in addition to reducing the risk to others across the wider area. The Site will therefore offer a significant reduction in surface water flow rates, following development, by the utilisation of Sustainable Drainage Systems (SuDS). In addition to a reduced flood risk, the incorporation of sustainable drainage systems into the development will also contribute to local amenity value and offer pollution prevention measures and water quality benefits.
2.4 Local Geology

2.4.1 Bedrock Geology

Northern Site areas (approximately 50%) are underlain by the Northampton Sand Formation. Southern Site areas (approximately 50%) are underlain by the Whitby Mudstone Formation.

A Site ground investigation has been undertaken with the results presented in Appendix D. The intrusive investigation documents sandy layers at shallow depths, generally occurring at depths of 0-2 meters (or less. The sandy strata overlie a firm/stiff clay recorded to the base of the trial pits in all trial holes across the Site.

Based on the properties of clay strata and the descriptions provided in the ground investigation, infiltration is unlikely to be feasible across the Site.

The ground investigation refers to no groundwater ingress in any of the trial pits. This confirms that there is no groundwater flood risk posed to the development.

2.4.2 Superficial Geology

According to the British Geological Survey online mapping, there are no superficial geology underlying the Site or local area.
2.5 Groundwater

The character of the underlying geology is an important consideration and can indicate the behaviour of hydrological processes. Large grained Sedimentary rocks, or those with significant faults and fractures such as karst landscapes, can indicate good catchment porosity. Other rock types such as metamorphic or small grained sedimentary rocks, like mudstone, are less permeable. Equally, the types of superficial deposits can also indicate differing hydrological behaviours. The presence of deposits such as sands and gravels often indicate good drainage whereas clays and other fine grained Glacial Till deposits might suggest poor permeability and therefore fast runoff and increased flood risk.

The ‘Aquifer Designation Bedrock Geology Map’, as shown in Figure 5, shows the aquifer designations for bedrock aquifers across England. The aquifer classifications are defined as follows:

- **Principle aquifers** – The ‘principal’ classification is assigned to bedrock geologies that exhibit high permeability and/or provide a high level of water storage. These aquifers may support water supply and/or river base flow supply on a strategic scale.
- **Secondary A aquifers** – ‘Secondary A’ aquifers are defined as permeable strata capable of supporting water supplies at a local rather than strategic scale and in some cases form an important source of base flow to rivers.
- **Secondary B aquifers** – ‘Secondary B’ classifications are assigned to predominantly lower permeability strata which may (in part) have the ability to store and yield limited amounts of groundwater by virtue of localised features such as fissures, thin permeable horizons and weathering.
- **Secondary Undifferentiated** – These classifications are assigned where it has not been possible to assign either a category A or category B classification to a rock type.
- **Unproductive Strata** – These strata display low permeability that have negligible significance for water supply or river base flow.

According to the Magic Map (DEFRA) online dataset (accessed online 30/04/2019), the geological deposits underlying the Site are classified as per Table 1:

<table>
<thead>
<tr>
<th>Stratum</th>
<th>EA Classification</th>
<th>Hydrogeological Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bedrock Geology (Northampton Sand Formation)</td>
<td>Secondary A Aquifer</td>
<td>May be important in supporting local abstractions or in providing baseflow to rivers and streams.</td>
</tr>
<tr>
<td>Bedrock Geology (Whitby Mudstone Formation)</td>
<td>Unproductive Strata</td>
<td>Contains insignificant quantities of vertically or laterally extensive groundwater.</td>
</tr>
</tbody>
</table>

2.5.1 Consideration of Infiltration Drainage Potential

Based on the recorded ground conditions beneath the Site it is considered unlikely that infiltration-based SuDS will offer a suitable means of draining the Site.

This is confirmed by the Site ground investigation report, which records a stiff/firm sandy clay in excess of 2.0 meters beneath the Site. Typically, clays are not porous, no groundwater was encountered in any of the trial pits.

Infiltration potential is therefore low and other discharge options for surface water will need to be
considered.

2.6 Reservoir, Canal and Artificial Sources

The Environment Agency flood map of reservoir flooding highlights that there is no risk of reservoir flooding affecting the Site. The closest area of reservoir flooding is situated to the east and does not affect the development.

Therefore, the risk of reservoir water flooding affecting the Site can be considered as low.

There are no canals situated within proximity to the development.

Artificial waterbodies present locally include a series of lakes or standing water bodies located to the east of the development (where the aforementioned reservoir flooding occurs).
3. Drainage Strategy

3.1 Background

3.1.1 Existing Drainage

The existing Site is entirely Greenfield. Existing drainage will therefore follow the Site contours, discharging offsite to the south-west and/or partially infiltrating into the topsoil’s and subsoils.

A local watercourse assessment has concluded that there are no suitable watercourses crossing the development Site or passing within proximity to the boundaries of the development Site. Therefore, it is considered that discharging the Site drainage to a watercourse is not suitable.

In the assumed absence of infiltration drainage and based on there being a lack of surface water sewers present locally to the development, the only remaining option for surface water is discharge to a local public sewer. Local public surface sewers are present along Billing Brook Road to the west of the development Site that should offer a suitable surface (and foul water discharge option) for the prospective Site.

A new drainage system should be designed and constructed in accordance with any development proposals.

Correspondence and confirmation from the local sewerage undertaker, Anglian Water, and the Lead Local Flood Authority (LLFA) is advised before the Site drainage parameters are confirmed as acceptable.

3.2 Consideration of Sustainable Drainage Systems (SuDS)

Surface water arising from a developed site should, as far as practical, be managed in a sustainable manner to mimic the surface water flows arising from an undeveloped site. Part H of the Building Regulations 2010\(^5\) recommends that surface water run-off shall discharge to one of the following, listed in order of priority:

i) Surface Water drainage should discharge to a soakaway or other infiltration system, where practicable;

ii) Discharge to a watercourse may require consent from the Environment Agency/LLFA, who may limit the rate of discharge. Maximum flow rates can be limited by provision of SuDS (i.e. attenuation basins);

iii) Where other forms of outlet are not practicable, discharge should be made to a sewer.

3.2.1 Surface Water Discharge Via Infiltration

Disposal of surface water run-off by the preferred method of infiltration is subject to assessment of ground conditions. Based on the recorded geology present beneath the Site (as outlined in section 2) infiltration is not considered to offer a suitable surface water drainage solution. Intrusive ground investigations (see Appendix D) confirm a firm clay geology present beneath the Site, again suggesting a low potential for infiltration.

3.2.2 Surface Water Discharge to a Watercourse

No watercourse or ditches pass the Site that would offer a suitable surface water discharge location.

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3.2.3 Surface Water Discharge to a Local Public Sewer

Anglian Water sewer asset location plans are provided in Appendix B.

Surface water sewers are present along Billing Brook Road, flowing in a southerly direction adjacent to the western Site boundary.

Therefore, it is proposed to discharge flows from the Site to these public surface water sewers.

3.3 Existing Runoff

Based on the mixed sandstone and clay bedrock geology underlying the Site, which has been allocated a ‘Secondary A’ and ‘unproductive’ groundwater classification by the Environment Agency, a Winter Rain Acceptance Potential (WRAP) of 4 and 1 is considered as the most suitable reflection of the bedrock geology present beneath the Site. The Site lies close to a boundary between these two rock units.

A Winter Rain Acceptance Potential (WRAP) of 1, is described as:

‘Well drained permeable sandy or loamy soils and shallower analogues over highly permeable limestone, chalk sandstone or related drifts’.

‘Less permeable loamy over clayey soils on plateaux adjacent to very permeable soils in valleys.

A Winter Rain Acceptance Potential (WRAP) of 4, is described as:

‘Clayey, or loamy over clayey soils with an impermeable layer at shallow depth’.

3.4 Proposed Surface Water Drainage Strategy

Overview

Surface Water from the current Site will discharge to the south-west in accordance with the local topography.

Greenfield runoff rates from the undeveloped Site are presented in Appendix E.

Using a 150-soil type (WRAP 1) the runoff rate is 0.3l/s.

Using a 450 soil type (WRAP 4) the runoff rate is 3.2l/s.

To reduce the risk of blockage to the flow control device (hydrobrake or similar approved device) a 5.0l/s minimum discharge rate is advised.

Although, it is proposed that surface water runoff is restricted via a hydrobrake or similar flow control device to 3.2l/s (calculated Greenfield Runoff Rate) during all storm events up to and including the 1 in 100 year + 40% Climate Change storm event.

Attenuation Storage

It is proposed that attenuation storage is provided by a geo-cellular tank, positioned in low lying carparking/vehicular areas situated to the south-west of the developable area. The proposed attenuation system will discharge into the adjacent public sewers. An attenuation calculation is provided in Appendix E.

The required volume to attenuate flows from the Site during the critical 1 in 100 year + climate change storm is approximately 242m$^3$ with a 5.0l/s runoff rate applied.

The required volume to attenuate flows from the Site during the critical 1 in 100 year + climate change storm is approximately 270m$^3$ with a 3.2l/s (Greenfield) runoff rate applied.
Connection to the adjacent public surface water sewers in Billing Brook Road is proposed. At manhole 3352, an invert level of 80.3mAOD is recorded. Ideally, a more suitable manhole would be utilised, downstream of manhole reference 3352 (although this is outside of the area covered by the Anglian Water asset location plans provided).

3.5 Proposed Foul Water Disposal Strategy

As per the surface water arrangement, foul flows will pass in a predominantly south-westerly direction in accordance with the natural topographical fall of the Site. A public foul water sewer runs parallel to the aforementioned public surface water sewers and should offer a suitable foul water gravity connection option from the development.

A drainage investigation is recommended to confirm the invert level of the receiving foul sewer as invert levels at the most proximal manhole to the development are not provided by the Anglian Water mapping records.

The sewerage undertaker for the area is Anglian Water and a pre-development enquiry has been undertaken to confirm the discharge location to Billing Brook Road, and the response is currently awaited.
4. Conclusions and Recommendations

This statement provides an initial preliminary assessment of the flood risk and surface water drainage discharge options for the Site (at land situated to the east of Billing Brook Road in the Boothville suburb of north-east Northampton, together with outline details on infiltration potential and foul water discharge options.

4.1 Flood Risk

There is no flood risk posed to the Site from fluvial sources and the Site lies entirely in Flood Zone 1 (the lowest risk flood zone).

The Site remains free from surface water flooding. Surface water (pluvial) flooding is shown to affect Billing Brook Road to the south-west of the development at a maximum depth of 300mm. Safe access and egress is considered to be available for the Site.

Intrusive investigations confirmed that there is no risk of groundwater flooding affecting the development.

Flooding from all other sources such as reservoir, coastal and/or manmade/artificial sources is low.

In summary, the development is at a low risk of flooding from all the aforementioned sources.

4.2 Drainage

The Site will freely drain via gravity to the south-west, approximately 10 meters of topographical variation exists between the north-eastern Site (high point) and south-western Site (low point).

Infiltration potential is limited across the Site, this has been confirmed by an intrusive ground investigation as shown in Appendix D.

No watercourses or ditches pass the development. Therefore, surface water discharge to the local public surface water sewers is proposed.

Attenuation can be provided by a geo-cellular crate system positioned beneath carparking/vehicular areas to the south-west of the development. With a 3.2l/s discharge rate applied, the Site will require approximately 270m$^3$ of storage to cater for flow from all storm events up to and including the 1 in 100 + climate change (critical) storm event.

Foul flows from the Site will route via gravity to the public sewers present in Billing Brook Road.

4.3 Summary

Future maintenance responsibilities for main drainage systems would be taken over by the sewerage undertaker once the drainage is adopted. Residual risk of flooding due to collapse or blockage of drainage systems would be mitigated through this and the layout and finished levels of the Development.

In summary, it is concluded that the Development is at low risk of flooding and a viable means of drainage for the Site is available.
A. Indicative Site Development Masterplan
B. Local Sewerage Asset Location Plans – Sourced from Anglian Water
### C. Extracts from the National Planning Practice Guidance - Flood Risk and Coastal Change

**Table 1: Flood Zones**

In accordance with the sequential test in the National Planning Policy Framework, sites are to be classed as follows:

<table>
<thead>
<tr>
<th>Flood Risk Vulnerability</th>
<th>Definition</th>
<th>Appropriate Uses</th>
<th>FRA Requirements</th>
<th>Policy Aims</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Zone 1 – Low Probability</strong></td>
<td>This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (&lt;0.1%).</td>
<td>All uses of land are appropriate in this zone.</td>
<td>For development proposals on sites comprising one hectare or above the vulnerability to flooding from other sources as well as from river and sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water run-off, should be incorporated in a FRA. This need only be brief unless the factors above or other local considerations require particular attention.</td>
<td>In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage systems.</td>
</tr>
<tr>
<td><strong>Flood Zone 2 – Medium Probability</strong></td>
<td>This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1%) in any year.</td>
<td>Essential infrastructure and the water-compatible, less vulnerable and more vulnerable uses as set out in table 2 are appropriate in this zone. The highly vulnerable uses are only appropriate in this zone if the Exception Test is passed.</td>
<td>All development proposals in this zone should be accompanied by a FRA.</td>
<td>In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage systems.</td>
</tr>
<tr>
<td><strong>Zone 3a - High Probability</strong></td>
<td>This zone comprises land assessed as having a 1 in 100 or greater annual probability of river (&gt;1%) or a 1 in 200-year greater</td>
<td>The water-compatible and less vulnerable uses of land (table 2) are appropriate in this zone. The highly vulnerable uses in the All development in this zone should be accompanied by a FRA.</td>
<td>In this zone, developers and local authorities should seek opportunities to: i. reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage systems.</td>
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### Flood Risk Vulnerability

<table>
<thead>
<tr>
<th>Definition</th>
<th>Appropriate Uses</th>
<th>FRA Requirements</th>
<th>Policy Aims</th>
</tr>
</thead>
<tbody>
<tr>
<td>annual probability of flooding from the sea (&gt;0.5%) in any year.</td>
<td>Table below should not be permitted in this zone.</td>
<td>The more vulnerable uses and essential infrastructure should only be permitted in this zone if the Exception Test is passed. Essential infrastructure permitted in this zone should be designed and constructed to remain operational and safe for users in times of flood.</td>
<td>Form of the development, and the appropriate application of sustainable drainage systems;</td>
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<td>i. relocate existing development to land in zones with a lower probability of flooding; and</td>
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<tr>
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<td>ii. create a space for flooding to occur by restoring functional and flood flow pathways and by identifying, allocating and safeguarding open space for flood storage.</td>
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#### Zone 3b - The Functional Floodplain

This zone comprises land where water has to flow or be stored in times of flood.

Local Planning Authorities should identify in their SFRAs areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. But land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood, should provide a starting point for consideration and discussions to identify the functional floodplain.

Only the water-compatible uses and essential infrastructure listed in table 2 that has to be there should be permitted in this zone. It 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.

Essential infrastructure in this zone should pass the Exception Test.

All development in this zone should be accompanied by a FRA.

In this zone, developers and local authorities should seek opportunities to:
- reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage techniques; and
- relocate existing development to land with a lower probability of flooding.
### Table 2 - Flood Risk Vulnerability Classification

<table>
<thead>
<tr>
<th>Vulnerability</th>
<th>Land Use Types</th>
</tr>
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</table>
| Essential Infrastructure | *Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk;*  
*Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary stations; water treatment works that need to remain operational in times of flood;*  
Wind turbines.                                                                                     |
| Highly Vulnerable     | *Police stations, Ambulance stations and Fire stations and Command Centres and telecommunications installations required to be operational during flooding;*  
*Emergency dispersal points;*  
*Basement dwellings;*  
*Caravans, mobile homes and park homes intended for permanent residential use;*  
*Installations requiring hazardous substances consent.*                                                                                             |
| More Vulnerable       | *Hospitals;*  
*Residential institutions such as residential care homes, children’s homes, social services homes, prisons and hostels;*  
*Buildings used for: dwelling houses; student halls of residence; drinking establishments; nightclubs; and hotels;*  
*Non-residential uses for health services, nurseries and educational establishments;*  
*Landfill and sites used for waste management facilities for hazardous waste;*  
*Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.*                                             |
| Less Vulnerable       | *Police stations, Ambulance stations and Fire stations which are not required to be operational during flooding;*  
*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;*  
*Land and buildings used for agriculture and forestry;*  
*Waste treatment (except landfill and hazardous waste facilities);*  
*Minerals working and processing (except for sand and gravel working);*  
*Water treatment plants which are not required to be operational during flooding;*  
*Sewage treatment plants (if adequate measures to control pollution and manage sewage during flooding events are in place).*                              |
| Water-compatible Development | *Flood control infrastructure;*  
*Water transmission infrastructure and pumping stations;*  
*Sewage transmission infrastructure and pumping stations;*  
*Sand and gravel workings;*  
*Docks, marinas and wharves;*  
*Navigation facilities;*  
*MOD defence installations;*  
*Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location*  
*Water-based recreation (excluding sleeping accommodation);*  
*Lifeguard and coastguard stations;*  
*Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms;* |
- Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

Notes:
1. This classification is based partly on Department for Environment, Food and Rural Affairs and Environment Agency research on “Flood Risks to People (FD2321/TR2) and also on the need of some uses to keep functioning during flooding.
2. Buildings that combine a mixture of uses should be placed into the higher of the relevant classes of flood risk sensitivity. Developments that allow uses to be distributed over the site may fall within several classes of flood risk sensitivity.
3. The impact of a flood on the particular uses identified within the flood risk vulnerability classification will vary within each vulnerability class. Therefore, the flood risk management infrastructure and other risk mitigation measures needed to ensure the development is safe may differ between uses within a particular vulnerability classification.

### Table 3 - Flood Risk Vulnerability and Flood Zone Compatibility

<table>
<thead>
<tr>
<th>Flood Risk Vulnerability</th>
<th>Essential Infrastructure</th>
<th>Water Compatible</th>
<th>Highly Vulnerable</th>
<th>More Vulnerable</th>
<th>Less Vulnerable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 1</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Zone 2</td>
<td>√</td>
<td>√</td>
<td>Exception Test Required</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Zone 3a</td>
<td>Exception Test Required</td>
<td>√</td>
<td>X</td>
<td>Exception Test Required</td>
<td>√</td>
</tr>
<tr>
<td>Zone 3b</td>
<td>Exception Test Required</td>
<td>√</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

- Development is appropriate.

X – Development should not be permitted.

Notes: This table does not show:
1. The application of the Sequential Test which gives development to Flood Zone 1 first, then Zone 2, and then Zone 3;
D. Ground Investigation Report and Exploratory Hole Location Plan
E. Site Runoff and Attenuation Calculations
F. Site Attenuation/Drainage Drawing (Ref: WIE15311-C-SA-92-100-A01)
UK and Ireland Office Locations