



Flood Risk Assessment

LITTLE HAMPTON, Land at Watersmead Business Park

4 February 2019

Prepared for: Amazon

**STRUCTURAL • CIVIL • DUE DILIGENCE • ENGINEERING MASTERPLANNING
FLOOD MANAGEMENT • INFRASTRUCTURE DESIGN
PRE-DEVELOPMENT ENGINEERING • BIM • TRANSPORTATION**

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VERSIONS

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CONTENT

1	INTRODUCTION.....	3
2	EXISTING SITE CONDITIONS.....	4
2.1	Site description.....	4
2.2	Topography.....	4
2.3	Geological ground conditions.....	5
2.4	Existing surface water management.....	5
3	PROPOSED DEVELOPMENT.....	6
4	PROBABILITY OF FLOODING.....	7
4.1	Flooding from rivers (fluvial flooding) & sea (tidal flooding).....	7
4.2	Flooding from land & sewers	8
4.3	Flooding from groundwater.....	9
4.4	Flooding from reservoirs, canals, and other artificial sources	10
5	POLICY STATUS FOR PROPOSED DEVELOPMENT	11
5.1	Vulnerability classification	11
5.2	Sequential Test & Exception Test.....	12
6	FLOOD RISK MANAGEMENT STRATEGY	14
7	CONCLUSION	15
	APPENDIX A – SITE LOCATION PLAN.....	16
	APPENDIX B – TOPOGRAPHIC SURVEY	17
	APPENDIX C – EXISTING & PROPOSED IMPERMEABLE AREAS	18
	APPENDIX D – PROPOSED DEVELOPMENT PLANS	19
	APPENDIX E – DRAINAGE CALCULATIONS	21
	APPENDIX F – PROPOSED DRAINAGE STRATEGY	22

1 INTRODUCTION

Pinnacle Consulting Engineers Ltd have been commissioned by Amazon to carry out a Flood Risk Assessment report (FRA) for a proposed development of a site off Norway Lane, Watersmead Business Park, Toddington, BN17 6GY. A site location plan is enclosed in Appendix A.

With reference to the indicative flood maps published by the Environment Agency, the site appears to lie in Flood Zone 1. This FRA report has been prepared in accordance with the requirements contained within National Planning Policy Framework (NPPF, July 2018) and the associated Planning Practice Guidance. The guidance refers to the Environment Agency's "standing advice" on flood risk. Based on requirements set by the Environment Agency, a Flood Risk assessment is needed to support the planning application.

This report has been prepared in accordance with (i) National Planning Policy Framework (NPPF), (Department for Communities and Local Government, July 2018) and the accompanying (ii) Planning Practice Guidance (Ministry of Housing, Communities and Local Government, March 2014); and (iii) Level 1 and 2 Strategic Flood Risk Assessment (SFRA) undertaken on behalf of Arun District Council by JBA Consulting, Nov 2016 (iv) Other statutory laws and local bylaws and rules.

It is stated in Paragraph 30 of the Flood Risk and Coastal Change chapter within the Planning Practice Guidance that "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 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".

This report has been prepared to address the requirements of the NPPF and has derived the following data/information from various sources including:

- Information published or explicitly provided by the Environment Agency;
- Information published by the Local Planning Authority, including the SFRA;
- A site-specific topographical survey;
- Enquiries made to relevant authorities to understand possible risks of flooding in the area; and
- Specific design works carried out for this report.

Pinnacle Consulting Engineers Ltd are specialists in flood studies with a track record of several hundred successful FRA reports and assessments.

2 EXISTING SITE CONDITIONS

2.1 Site description

The proposed development is located at National Grid Reference (NGR) 503839, 103654 off Norway Lane, Watersmead Business Park, Toddington, BN17 6GY.

The existing site consists of three large warehouse buildings, associated service yards, circulation routes and HGV parking areas. The site is located to the east of Wick, in the north of Toddington and just north of A259. The site is bound to the north by railway tracks between Angmering and Ford, to the south by parking and circulation roads associated with the Bodyshop HQ building and the “kids unlimited” pre-school, to the west by The Co-operative Childcare nursery and residential dwellings along Gratwicke Drive and to the east by a large feature lake running northwards towards Black Ditch. An approximately 0.5ha feature lake can be identified to the east of the site and appears to run into a complex of interconnecting tributaries and reservoirs roughly 140m north of the site.



Figure 2.1 – Aerial View of the existing development site (approximate site boundary edged red)

2.2 Topography

The development site is relatively flat with ground levels across the site varying between approximately 5m and 4m Above Ordnance Datum (AOD). The site falls generally in a south direction.

Topographical survey has been commissioned to confirm the levels across the site.

Details of existing development site levels are enclosed in Appendix B.

2.3 Geological ground conditions

Geological conditions at the site are detailed below and are based on a British Geological Survey (BGS) report. The focus of an FRA study on geology is on the potential movement of water through Made Ground, Drift Geology and Solid Geology

These strata are outlined in Table 2.2.

Formation	Description
Artificial Ground (Made Ground)	No artificial deposits have been delineated on the BGS site maps.
Superficial Deposits (Drift Deposits)	River Terrace Deposits (undifferentiated) - Sand, Silt And Clay. Superficial Deposits formed up to 3 million years ago in the Quaternary Period. Local environment previously dominated by rivers (U). Setting: rivers (U). These sedimentary deposits are fluvial in origin. They are detrital, ranging from coarse- to fine-grained and form beds and lenses of deposits reflecting the channels, floodplains and levees of a river or estuary (if in a coastal setting).
Rockhead	None Recorded
Bedrock	New Pit Chalk Formation - Chalk. Sedimentary Bedrock formed approximately 90 to 94 million years ago in the Cretaceous Period. Local environment previously dominated by warm chalk seas. Setting: warm chalk seas. These sedimentary rocks are shallow-marine in origin. They are biogenic and detrital, generally comprising carbonate material (coccoliths), forming distinctive beds of chalk.

Table 2.2 – Geological Ground Conditions

2.4 Existing surface water management

It is assumed that existing surface water networks is collecting the surface water runoff from the existing impermeable areas and discharging into the existing attenuation ponds within the site boundary at an unrestricted rate.

Topographical survey and drainage survey has been commissioned to confirm the existing surface water management in the site.

3 PROPOSED DEVELOPMENT

The proposed development comprises installation of 5 no. 'vehicle-to-ground' lifts and a canopy cover over the associated service yard area for a temporary period of five years, minor alterations to the internal access road, including widening works, creation of a new spur, provision of a pedestrian footbridge, and associated lighting and drainage infrastructure provision.

The proposed development plans are enclosed in Appendix D.

4 PROBABILITY OF FLOODING

The NPPF identifies six potential sources of flooding:-

- Flooding from rivers (fluvial flooding);
- Flooding from the sea (tidal flooding);
- Flooding from land;
- Flooding from sewers;
- Flooding from groundwater; and
- Flooding from reservoirs, canals, and other artificial sources.

These are considered below.

4.1 Flooding from rivers (fluvial flooding) & sea (tidal flooding)

The assessment of flood risk in this report is based on the definitions in Table 1 of the Flood Risk and Coastal Change, Planning Practice Guidance, which recognises the following Flood Zones:

- Flood Zone 1 - little or no risk, with annual probability of flooding from rivers and the sea of less than 0.1% (1 in 1000-year)
- Flood Zone 2 - low to medium risk, with annual probability of flooding between 0.1% and 1.0% from rivers and between 0.1% and 0.5% from the sea
- Flood Zone 3a - high risk of flooding with an annual probability of flooding of 1.0% or greater from rivers, and 0.5% or greater from the sea.
- Flood Zone 3b – the ‘Functional Floodplain’ with an annual probability of flooding of 5% or greater.

An extract from the Environment Agency’s online flood map published on their website is shown in Figure 4.1 below, with Flood Zone 3a & 3b denoted by dark blue hatch and Flood Zone 2 a light blue. The site is located within a Flood Zone 1 ‘Low Probability’ area and therefore lies outside an area at risk of fluvial/tidal flooding.

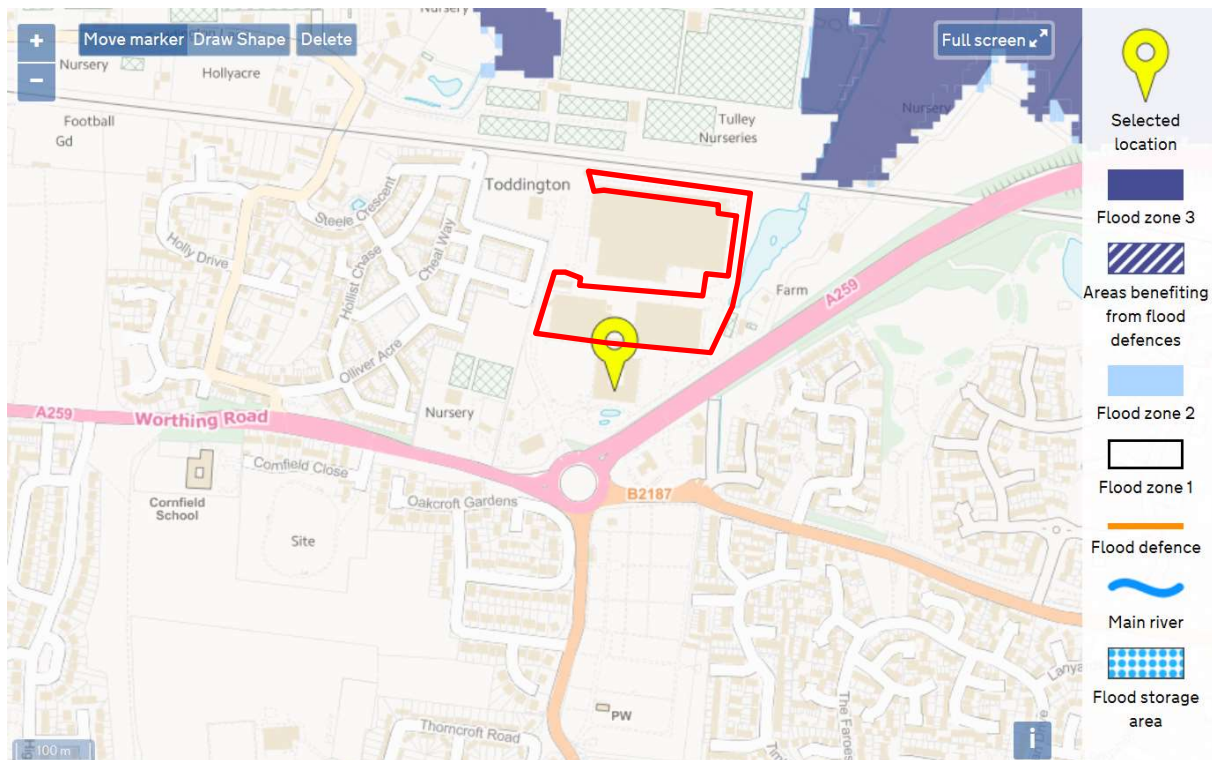


Figure 4.1 – Environment Agency Online Flood Map Extract for Planning (Approximate Site Extents Edged Red)

Based on the Figure 4.1, proposed site lies in Flood Zone 1.

4.2 Flooding from land & sewers

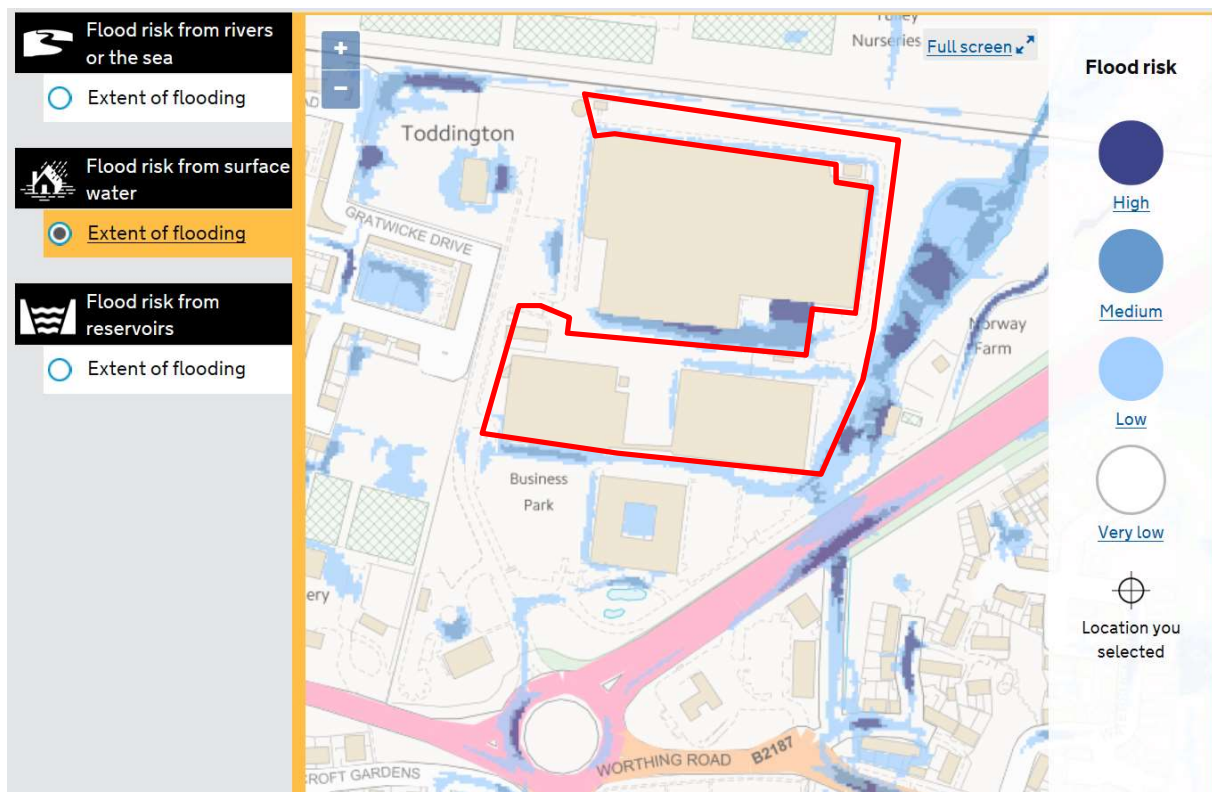


Figure 4.2 – Environment Agency Online Flood Map Extract for surface water flooding (Approximate Site Extents Edged Red)

Based on the Figure 4.2, proposed site lies in low to medium zone for the surface water flooding.

4.3 Flooding from groundwater

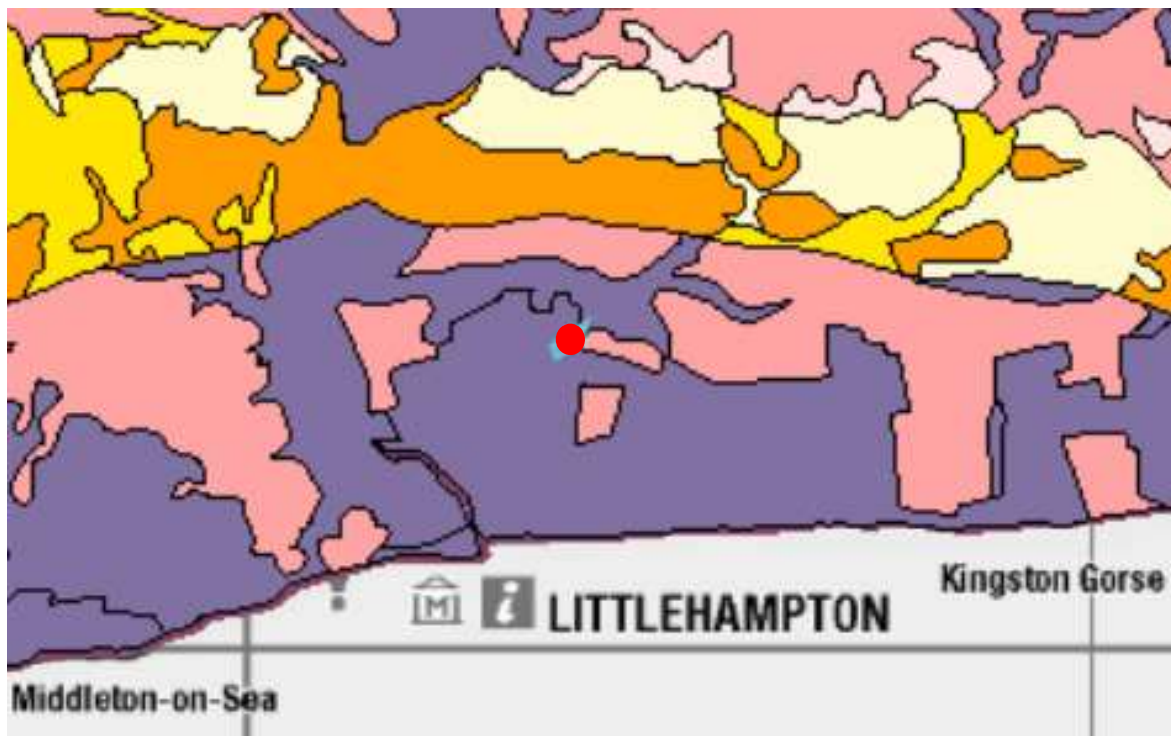


Figure 4.3 – Defra Groundwater Vulnerability Map (Approximate Site location Edged Red)

Based on the Figure 4.3 the proposed site lies in Major Aquifer High vulnerability zone.

4.4 Flooding from reservoirs, canals, and other artificial sources

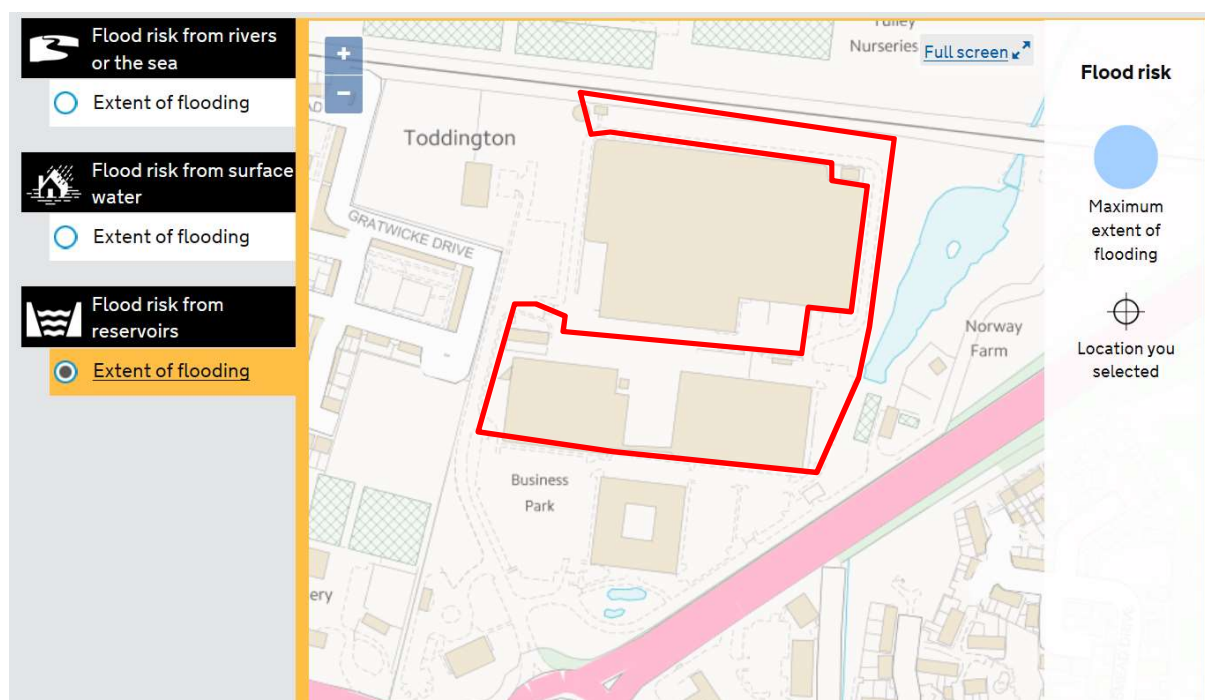


Figure 4.4 – Environment Agency Online Flood Map Extract for Reservoir flooding (Approximate Site Extents Edged Red)

Based on the Figure 4.4 the proposed site lies in a no risk zone of flooding from reservoirs.

5 POLICY STATUS FOR PROPOSED DEVELOPMENT

5.1 Vulnerability classification

The proposed development complies with the following principles:

- The proposed development lies within Flood Zone 1;
- The proposed development is classified as 'less vulnerable' in accordance with Table 2 of the Flood Risk and Coastal Change, Planning Practice Guidance (reproduced as Table 5.1 below).

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 substations; and water treatment works that need to remain operational in times of flood Wind Turbines
Highly Vulnerable	Police stations, Ambulance stations, Fire stations, 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, ambulance 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 and sewage treatment plants (if adequate pollution control measures are in place). Sewage treatment works (if adequate measures to control pollution and manage sewage during flood events are in place).
Water-compatible Development	Flood control infrastructure. Water transmission infrastructure, pumping stations. Sewage transmission infrastructure and pumping stations. Sand and gravel workings. Docks, marinas, 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 Defra/Environment Agency research on Flood Risks to People (FD2321/TR2)21 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 this 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 5.1 – Flood Risk Vulnerability Classification

Vulnerability Classification		Essential Infrastructure	Water-compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test	✓	✓
	Zone 3a	Exception Test	✓	✗	Exception Test	✓
	Zone 3b	Exception Test	✓	✗	✗	✗
Key ✓ Development is appropriate ✗ Development should not be permitted						

Table 5.2 – Flood Risk Vulnerability and Flood Zone ‘Compatibility’

The proposed development is appropriate in accordance with Table 3 of the Flood Risk and Coastal Change, Planning Practice Guidance, reproduced in Table 5.2 above.

5.2 Sequential Test & Exception Test

The NPPF requires that all development is sequential tested to steer new development to areas at the lowest probability of flooding (Flood Zone 1). The Sequential Test would normally be completed by the Local Planning Authority (LPA) to inform the preparation of the Local Development Framework (LDF), where one exists. However, where this process has not yet been completed the onus for the provision of evidence demonstrating successful application of the Sequential Test falls to the developer, or

promoter of the site. The NPPF also requires the layout of a site to be sequentially tested to locate the most vulnerable land uses in the areas at lowest risk of flooding.

The NPPF Planning Practice Guidance acknowledges that in some circumstances it may not be possible to locate development in areas of low or appropriate (considering development vulnerability) flood risk or that there may be other valid reasons for a development to take place within the floodplain. In these circumstances, it is necessary to apply the Exception Test to clearly demonstrate that the benefits for development of a site outweigh the flood risks to the development and its occupants. Table 3 of the Flood Risk and Coastal Change, Planning Practice Guidance (reproduced in Table 5.2 above) indicates when the Exception Test is required.

The proposed development site falls entirely into Flood Zone 1, meaning the Sequential Test is deemed to be passed and the Exception Test is not required.

6 FLOOD RISK MANAGEMENT STRATEGY

The proposed alterations to the internal access road have necessitated the replacement of a small area of landscaping with additional hardstanding. It is anticipated that the associated minor increase in runoff could be accommodated within the existing surface water drainage infrastructure.

A topographical and drainage survey has been commissioned for the site to confirm the existing surface water drainage infrastructure.

It is assumed that the existing surface discharge into the adjacent pond is unrestricted. Therefore, additional impermeable area created by the proposed development runoff can be managed within the existing drainage infrastructure.

7 CONCLUSION

With reference to the indicative flood map published by the Environment Agency, the development site is located within Flood Zone 1 'Low probability'. This has been confirmed by the site-specific flood risk assessment as detailed at Section 4.1.

From Table 5.1 the site is classified as 'Less Vulnerable' (Flood Risk Vulnerability Classification) and therefore, from Table 5.2 the development is classified as 'appropriate'.

Due to vulnerability groundwater zone, the use of infiltration methods is considered a very low viability option for the discharge of surface water runoff. It is assumed that the existing surface water drainage infrastructure has capacity to accommodate the minor increase in runoff associated with the proposed development.

The capacity of the existing surface water drainage infrastructure will be checked in terms of accommodating the extra impermeable area runoff created by the proposed development and additional storage will be provided if necessary.

Additional water quality measures will be provided by the inclusion of appropriate petrol interceptors, deep silt trapped gullies and silt boxes to all channel drains.

Appendix A – Site Location Plan



Appendix B – Topographic Survey

Appendix C – Existing & Proposed Impermeable Areas

Appendix D – Proposed Development Plans



Appendix E – Drainage Calculations

Appendix F – Proposed Drainage Strategy

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