

PRIOR APPROVAL - CLASS PA FLOOD RISK ASSESSMENT



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**Proposed Change of use from B1 (Light Industrial) to C3 (Residential) at Castle Roofing,
Six Score Road, Langtoft, PE6 9QF**

This Flood Risk Assessment accompanies a Prior Approval application made to South Holland District Council as set out in Class PA, introduced by The Town and Country Planning (General Permitted Development) (England) (Amendment) Order 2016. This Order may be cited as the Town and Country Planning (General Permitted Development) (England) (Amendment) Order 2016 and came into force on 6th April 2016.

This amendment to the allows a change of use from B1(c) (light industrial) to C3 (dwellinghouses) subject to limitations and conditions including the prior approval of the local planning authority in respect of certain matters.

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1.0 Introduction :

1.1.1 An FRA is required because the Site is located within Flood Zone 3 and is therefore at a theoretical risk of flooding. This is based upon the EA Flood Zone Maps - the Strategic Flood Risk Assessment (Flood Plain Map - see below) indicates that the site is situated in Flood Zone Three.

1.1.2 This section of the report provides an introduction to the FRA, flood risk and the latest planning guidance on development and flood risk in England.

1.1.3 Local Plan Policy **Policy SG9 - Development and Flood Risk...** In areas of flood risk planning permission will only be granted where a flood risk assessment has been carried out and submitted to the Council. Proposals shall, where necessary, include details of measures designed to reduce the risk and consequences of flooding. For permission to be granted the Strategic Flood Risk Assessment and site specific assessment will need to demonstrate how the proposed development will be defended from flooding for its proposed life, taking into account proposed mitigation measures. Built development that would be at high risk of flooding, or which may be subject to rapid inundation, will not normally be permitted unless exceptionally required for operational reasons.

1.2 Flood Risk

1.2.1 Flood risk takes account of both the probability and the consequences of flooding.

1.2.2 Flood risk = probability of flooding x consequence of flooding

1.2.3 Probability is usually interpreted in terms of the return period, e.g. 1 in 100 and 1 in 200 year event etc. In terms of probability, there is a 1 in 100 (1%) chance of one or more 1 in 100 year floods occurring in a given year. The consequence of flooding depends on how vulnerable a receptor is to flooding.

1.2.4 The components of flood risk can be considered using the source-pathway-receptor model.

1.2.5 Sources constitute flood hazards, which are anything with the potential to cause harm through flooding (e.g. rainfall, extreme sea levels, river flows and canals). Pathways represent the mechanism by which the flood hazard would cause harm to a receptor (e.g. overtopping and failure of embankments and flood defences, inadequate drainage and inundation of floodplains). Receptors comprise of the people, property, infrastructure and ecosystems that could potentially be affected should a flood occur.

1.3 National Planning Policy Framework

1.3.1 NPPF and its associated Technical Guidance replaces Planning Policy Statement 25 and provides guidance on how to evaluate Sites with respect to flood risk.

1.3.2 A summary of the requirements of NPPF is provided below.

Sources of Flooding

1.3.3 NPPF requires an assessment of flood risk to consider all forms of flooding, and lists six forms of flooding that should be considered as part of a flood risk assessment. These forms of flooding are listed in Table 1, along with an explanation of each form of flooding.

Forms of Flooding

Flooding From Rivers (Fluvial Flooding)

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

Flooding From the Sea (Tidal Flooding)

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

Flooding from Land (Pluvial Flooding)

Intense rainfall, often of short duration, that is unable to soak into the ground or enter drainage systems can run quickly off land and result in local flooding. In developed areas, this flood water can be polluted with domestic sewage where foul sewers surcharge and overflow. Local topography and built form can have a strong influence on the direction and depth of flow. The design of development down to a micro-level can influence or exacerbate this. Overland flow paths should be taken into account in spatial planning for urban developments. Flooding can be exacerbated if development increases the percentage of impervious area.

Flooding from Groundwater

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

Flooding from Sewers

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

Flooding from Other Artificial Sources (i.e. reservoirs, canals, lakes and ponds)

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

Flood Zones

1.3.4 For river and sea flooding, NPPF uses four Flood Zones to characterise flood risk. These Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences, and are detailed in Table 2.

Flood Zones

Flood Zone Definition

1 Low probability (less than 1 in 1,000 annual probability of river or sea flooding in any year (<0.1%))

2 Medium probability (between 1 in 100 and 1 in 1,000 annual probability of river flooding (1%-0.1%) or between 1 in 200 and 1 in 1,000 annual probability

of sea flooding(0.5%-0.1%) in any year).

3a High probability (1 in 100 or greater annual probability of river flooding (>1%) in any year or 1 in 200 or greater annual probability of sea flooding (>0.5%) in any given year).

3b This zone comprises land where water has to flow or be stored in times of flood. Land which would flood with an annual probability of 1 in 20 (5%), or is designed to flood in an extreme flood (0.1%) should provide a starting point for discussions to identify functional floodplain.

Vulnerability

1.3.5 NPPF classifies the vulnerability of developments to flooding into five categories. These categories are detailed in Table 3.

Table 3 – Flood Risk Vulnerability Classification

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

1.3.1 Based on the vulnerability of a development, NPPF states what Flood Zone(s) the proposed development is appropriate within. The flood risk vulnerability and Flood Zone 'compatibility' of developments is summarised in Table 4.

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Table 4 - Flood Risk Vulnerability and Flood Zone Compatibility

Parameter Horizon	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Peak rainfall intensity	+5%	+10%	+20%	+30%

2 Table 5 - Climate Change Allowances

Flood Zone	1	✓	✓	✓	✓	✓
	2	✓	✓	Exception Test	✓	✓
	3a	Exception Test	✓	x	Exception Test	✓
	3b	Exception Test	✓	x	x	x

Climate Change

1.3.5 NPPF makes it a planning requirement to account for climate change in the proposed design. The recommended allowances are summarised in Table 5 below.

2.1 Site Description

The application site area is 2307 sq m (inc. yard area). The GIA of the B1 building is 75 sq m. Situated alongside an existing two storey dwelling, the site is essentially a 'builders yard' with an office and storage/workshop facility. Some 89% of the site is impervious - mostly concreted yard area - see plan based upon the Topographic Survey. The Western and Southern boundaries are flanked by a tall mature tree belt. The property is served by a fully functioning package sewage treatment plant.

Environment Agency Flood Zone Mapping shown below ;



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Geology

Based on the SFRA, this part of the South Holland District is underlain by Oxford Ampthill clay/Kimmeridge clay. This solid geology is at a considerable depth below the surface. Above it the geology is classified as alluvium. The surface soils are fenland in character, predominantly deep silty clay or clay

Hydrogeology

2.1.1 Based on the Environment Agency's online mapping¹, the Site is not located within a Ground Water Source Protection Zone (GWSPZ), above an aquifer, nor in an area designated as a Groundwater Vulnerability Zone (GVZ).

2.2 Watercourses and Water bodies

Main Rivers

2.2.1 Based on the Environment Agency online Flood Map there are no Main Rivers located within the boundary of the Site. It is noted that the Site is located within Flood Zone 3 and is at risk of flooding. Furthermore, the Site is located within an area which benefits from flood defences which offer a 1% (1 in 100yr) standard of protection of flooding from rivers or a 0.5% (1 in 200yr) standard of protection of flooding from the sea.

Ordinary Watercourses

2.2.2 There are a number of Ordinary Watercourses (drainage ditches) operating in the general vicinity of the proposed Site. These are controlled by the Welland and Deepings Internal Drainage Board.

Flood Warning Areas

2.2.3 Based on the Environment Agency online Flood Warning Areas Map the Site is located within an area which the Environment Agency issues flood warning.

Artificial Water bodies

2.2.4 There are no artificial water bodies located within the boundary of the Site.

Historic Flooding

2.2.5 The Environment Agency Historic Flood Extent Map shows that the Site is not located within an area which has historically been reported to have flooding.

Strategic Flood Risk Assessment

2.2.6 A Strategic Flood Risk Assessment (SFRA) was produced by Royal Haskoning on behalf of

South Holland District Council during 2010. A summary of the of SFRA mapping is included below along with relevant extracts

FINDINGS FROM THE STRATEGIC FLOOD RISK ASSESSMENT

The findings from the SFRA are appropriate to the nature of the District. They recognise the importance of flood risk across the agricultural areas forming the majority of the District, as these have high value and underpin the social and economic well-being of South Holland. In addition, particular attention is paid to the anticipated areas of development growth around both Spalding, the District Centre, and Sutton Bridge. The SFRA gives greater detail for these two localities.

Four key findings are:

101. From a strategic point of view, the flooding threats to the District are from the sea, from the rivers and from any shortfalls in capacity in the internal drainage network.

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102. All the District is reliant on flood protection given by the various defence systems and related flood risk management measures.

103. At present these systems largely sustain a satisfactory level of flood risk within the District.

104. If the currently projected effects of climate change materialise (with higher sea levels and increased river flows), yet the defence systems are not upgraded from their present form, there will be significant flood risk within the District by the Year 2115, with impact in the main urban areas as well as in agricultural areas. The flood risk to people would become unacceptable. A lesser, but notable, increase in flood risk would also be apparent by the Year 2055. As regards specific outputs, the mapping accompanying this report shows, in summary: For the District as a whole:

The extent of land within Flood Zone 3a (high probability of flooding).

The potential maximum flood depth and maximum flood flow velocity within the Flood Zone 3a areas.

The extent of land within Flood Zone 3b (functional floodplain, including washlands).

The location of raised flood defences

A potential rapid inundation zone behind raised defences, where flooding could rapidly occur to a significant depth in the event of failure in the local defence.

The location of key infrastructure and of key access routes.

Overview of Results

The SFRA gives the following information. For all eras (2007, 2055, 2115):

105. Maximum flood extent.

106. Extent of the rapid inundation zone. Additionally, for eras 2007 and 2115:

- Maximum flood depth, in bands 0 to > 1m.
- Maximum flood flow velocity, in bands 0 to > 1 m/s. plus, for the Spalding and Sutton Bridge areas only:
- Maximum flood hazard, in four bands, Low to Extreme.
- Contours showing the potential flood extent at various timesteps from the onset of flooding at the defence line. A full schedule summarising the results available is given as Table 6. Table 6 – Results Summary

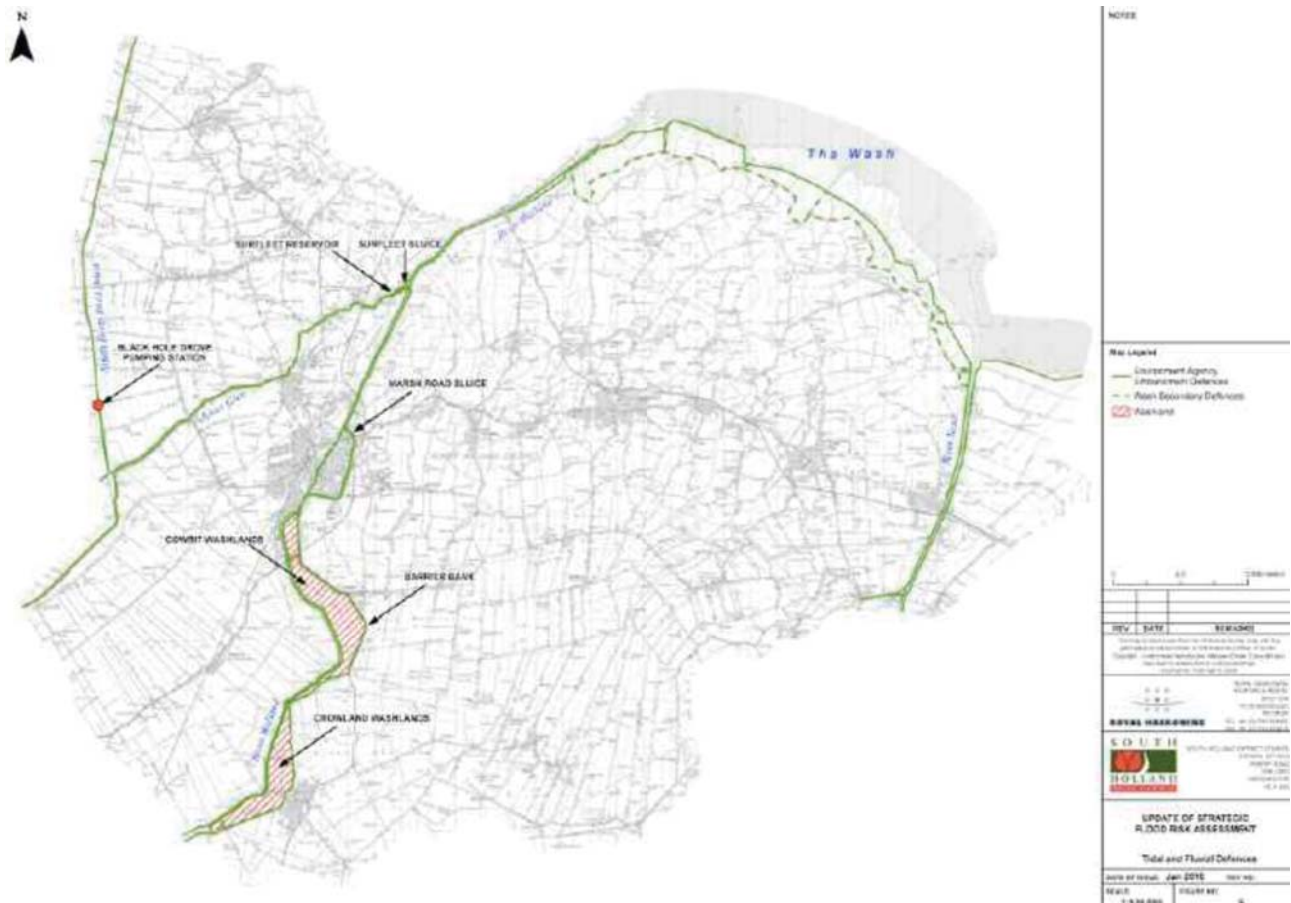
10.2 Flooding Probability Areas

107. 10.2.1 District Overall Allowing for the presence of flood defences and other flood risk management measures, most of the District can be classified as having Medium to Low probability of flooding, see Maps 5, 8 and 9. The High probability areas shown on the maps arise from potential breaching of defences, not from overtopping. As described in Section 4.8 and 4.9.1 this SFRA has assumed a breach could occur if there is inadequate freeboard between the defence crest level and the peak fluvial or tidal water level. The defence lengths having inadequate freeboard are identified in Appendix A. The High probability areas near Pinchbeck and Surfleet are due to inadequate freeboard along parts of the River Glen. The potential flooding in these areas would be fairly shallow, see Map 6. Map 6 also shows the beneficial effect of the secondary defences behind the Wash frontage. It is seen that where the secondary defence would not be wholly successful in containing the flood water, it would nevertheless help restrict the severity of flooding further inland. The High probability area in this instance includes part of Gedney Drove End. Low-lying agricultural land outside the High probability area should be considered as having Medium probability at best. This is because shallow flooding may be expected in events beyond the normal capacity of the internal drainage system. In a 0.1% AP fluvial event, assessed particularly for the Spalding and Sutton Bridge areas, the shallow flooding is likely to be widespread though still concentrated over lower-lying land.

Table 6 – Results Summary

Parameter	Flood event Annual Probability Tidal/Fluvial	Actual Risk and Residual Risk					
		Spalding and Sutton Bridge Areas			Remainder of the District		
		Present Day	2055	2115	Present Day	2055	2155
Maximum flood extent	0.5%/1%	✓	✓	✓	✓	✓	✓
	0.1%/0.1%	✓		✓			
Maximum flood depth	0.5%/1%	✓		✓	✓		✓
	0.1%/0.1%	✓		✓			
Maximum flood flow velocity	0.5%/1%	✓		✓	✓		✓
	0.1%/0.1%	✓		✓			
Maximum flood hazard	0.5%/1%	✓		✓			
	0.1%/0.1%	✓		✓			
Flood extent time contours	0.5%/1%	✓		✓			
	0.1%/0.1%	✓		✓			
Actual Risk due to overtopping alone							
Maximum flood extent	0.1%/0.1%			✓			
Maximum flood depth	0.1%/0.1%			✓			
Maximum flood flow velocity	0.1%/0.1%			✓			
Maximum flood hazard	0.1%/0.1%			✓			
Residual Risk							
Rapid inundation zone	0.5%/1%	✓		✓	✓		✓
	0.1%/0.1%	✓		✓			

If extensive flooding did occur in the District it would probably take many days for the flood water to be drained away through the IDB outfalls.



CONCLUSIONS

The site is located within a defended floodplain as defined in Appendix 1 of the EA's 'Policy and Practice for the Protection of Floodplains' and is considered to be passive until such time as a flood greater than that for which the defences were designed occurs. The likelihood of flooding due to overtopping or a failure of a flood defence embankment is considered to be small.

The probability of this development flooding is very low - the floor levels will be the same as the existing adjacent dwelling house.

If, under very extreme events, level of floodwater from main rivers or arterial systems rose to such an extent that the site was affected, the situation would not be sudden. It is highly probable that sufficient time would be available to take precautionary measures to limit the extent and potential impact of flooding.

The actual risk of flooding is less than 1%.

The impervious area on the site will actually be reduced given the removal of the main hardstanding area of concrete.

Flood resilient measures will be incorporated into the change of use wherever practicable as described in Appendix 1.

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APPENDIX 1

Planning Advice Note PAN 69

Building design can incorporate materials that are either flood resistant (i.e. unaffected by flood water), such as plastics, or materials that are resilient (i.e. they recover relatively undamaged from flooding). Some materials, such as concrete, can be both resistant and resilient, for example solid concrete floors can provide an effective seal against water rising up through the floor, provided they are adequately designed. In addition solid concrete floors generally suffer less damage than suspended floors and are less expensive and faster to restore following exposure to floodwater.

86. Good workmanship and maintenance will limit the amount of water that can seep through masonry walls. Re-pointing may be needed. Water-resistant coatings applied to porous surfaces will also fill any cracks in the masonry or the joints. To avoid trapping water in the wall however, any such coatings should be micro-porous to allow the wall to 'breathe'.

Table 2: Summary of the potential effects of exposure to flood water

Material	General Effects
Masonry, Concrete and Brick	In general masonry and concrete are unlikely to be severely damaged by contact with floodwater. In the case of coastal flooding, salt water may cause surface powdering and flaking of soft brickwork. Lightweight concrete may expand and contract depending on moisture content so wetting and drying may cause some cracking.
Timber	Timber swells and may distort on wetting. In timber framed buildings, swelling of immersed members could cause damage in other parts of the structure, e.g. through stresses on external cladding. Timbers that become wet and cannot dry may be at risk of decay in the long term. Guidance on the selection of timber preservatives is provided in BS5268: Part 5:1989 for structural timber and BS 1186 Part1:1991 for joinery.
Wall finishes	Renderings containing cement are unlikely to suffer damage. Lime based plasters are preferable to gypsum which softens when wet. Similarly, following flooding, any plasterboard will probably be damaged beyond repair and require to be removed.
Metals	Metals are affected by the corrosive effects of sea water so resistant metals rather than mild steel should be used in coastal areas where flood risk is an issue.
Insulation	Close cell insulants will not absorb water but may restrict drying out of a cavity wall. Mineral fibre and other absorptive insulants will retain water and can lose their insulating properties or disintegrate over time.

Source - Design: Guidance on Flood Damage to Dwellings, The Scottish Office, 1996

CONSTRUCTION TECHNIQUES

93. There are two basic approaches that may be appropriate for the protection of buildings against the effects of flooding:

110. Dry proofing aims to prevent flood water from entering a building. It relies on the use of waterproof barriers integral to the structure, across entrances and non-return valves on drains.

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Dry proofing a building however can be difficult and is unlikely to work if buildings are subject to flooding for long periods. Simple measures are unlikely to prevent water penetration for more than a few hours while more complex solutions may protect the building for a day or two. Wet proofing assumes water will enter the building and is based on the use of water resistant and resilient materials within the building and the raising of electrical wiring and sockets above the maximum flood level. This is the most practical approach and there are a number of ways to limit the damage from flooding. Wet proof construction should also allow water to drain easily from the building following a flood and not retain it in walls, floors and air pockets within the building footprint.

Figure 2: Wet proofing – measures to make the building more resilient to flooding

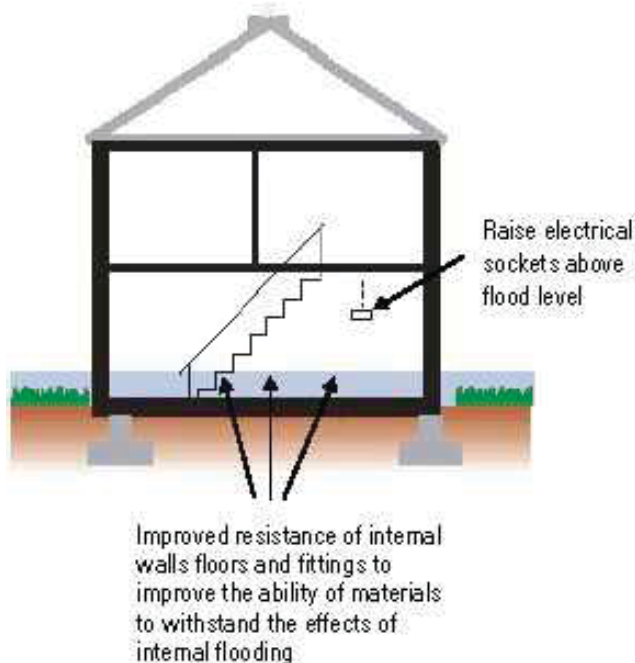
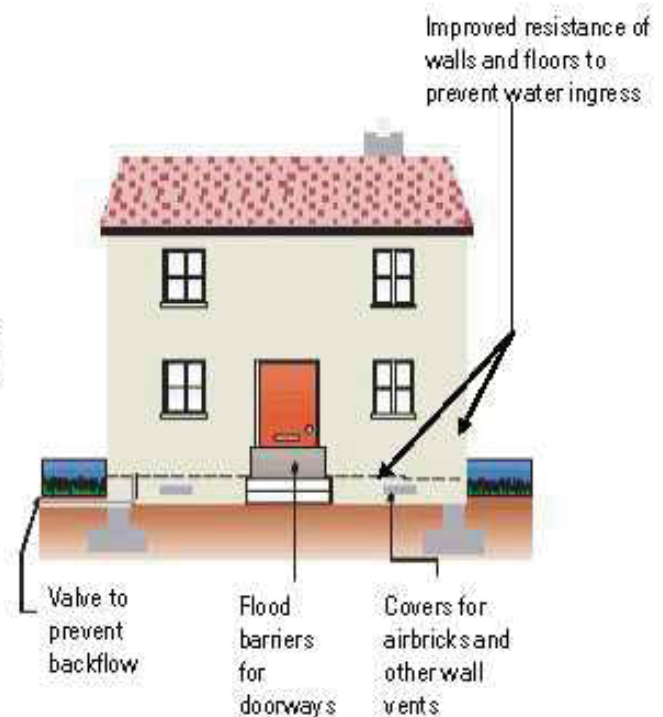


Figure 3: Dry proofing – measures to keep water out of building



BUILDING AND FLOODING CHECK LIST:

Factors to consider before building in areas where flood risk is an issue

1. Background information

111. If flooding is an issue:

112. Is the source of floodwater from watercourses, coastal waters, groundwater or sewers?

113. If the source of flooding is from watercourses or coastal waters, is the annual probability of flooding greater than 0.5% (1:200)?

114. What is the maximum flood level in the 0.5% event?

115. Would the site be inundated rapidly, for example due to a breach in a flood defence, or slowly, for example in the case of groundwater flooding?

2. General issues (adapted from ABI, Assessment of the cost and effect on future claims of installing flood damage resistant measures)

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Building components

Component	Most suitable	Suitable	Unsuitable
Flooring	Concrete, pre-cast or in situ	Timber floor, fully sealed, use of marine plywood.	Untreated timber Chipboard
Floor covering	Clay tiles Rubber sheet floors Vinyl sheet floors	Vinyl tiles Ceramic tiles	
External walls (to maximum flood level)	Engineering brick Reinforced concrete	Low water absorption brick	Large window openings
Doors	Solid panels with waterproof adhesives Aluminium, plastic or steel	Epoxy sealed doors	Hollow core plywood doors
Internal partitions	Brick with waterproof mortar Lime based plasters	Common bricks	Chipboard Fibreboard panels Plasterboard Gypsum plaster
Insulation	Foam or closed cell types	Reflective insulation	Open cell fibres
Windows	Plastic, metal	Epoxy sealed timber with waterproof glues and steel or brass fittings.	Timber with PVA glues and mild steel fittings

- Records of previous flood levels.
- Ground conditions - e.g. permeability and provision of field drains.
- Floodwater pathways into the building - e.g. poorly maintained masonry, ventilation grilles, doors.

3. Floors

- Where possible use dense concrete screeds on solid concrete floor slabs.
- Use treated timber to protect it from rotting if exposed to standing water.
- Use steel joists and wall plates rather than timber.
- Use a damp proofing material around the ends of floor joists.
- Use a sump and pumping system in buildings at risk of groundwater flooding.
- Replace expensive flooring, such as Oak floorboards with treated timber boards.
- Raise floor levels.

4. Walls

- Install air bricks above expected flood level and duct down to solum.
- Use close cell insulation.
- Replace gypsum plaster with more water resistant materials.
- Fix plasterboard horizontally.

5. Interiors

- Replace door hinges with butt hinges that allow door to be removed and placed in a dry area prior to a flood.
- Fit kitchen units with extendable plastic or stainless steel feet so that they will not be damaged by shallow flooding.
- Use raised fitted ovens and fit above highest expected flood level.

6. Services

- Move service meters at least 1 metre (preferably more) above the 0.5% (1:200) flood level if this is known.
- Consider completing electrical wiring from the first floor of the property so it will not require replacement if the property is flooded.
- Can one way valves be placed in drainage pipes to prevent water backing up pipes into the building?

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