

## Appendix G – Guidance Notes for Developers

### How to Use the Strategic Flood Risk Assessment

The Strategic Flood Risk Assessment is the assessment and categorisation of flood risk on a district wide basis in accordance with PPS25. SFRA's refine information on the probability of flooding, taking other sources of flooding and the impacts of climate change into account. The SFRA provides the basis for applying the Sequential Test and the Exception Test where consideration needs to be given to the impact of the flood risk management infrastructure on the frequency, impact, speed of onset, depth and velocity of flooding within the Flood Zones considering a range of flood risk management maintenance scenarios.

A developer should consider flood risk issues at a site as early as possible. The SFRA can be used to provide an indication of the likely flood risk issues at a site from all sources of flooding. Developers should identify whether the development site has been allocated for that type of land use in the Local Development Documents. For allocated sites the SFRA can provide information on the application of the Sequential Test and where undertaken the Exception Test to see if the land use is appropriate.

### When is a Flood Risk Assessment Required?

A Flood Risk Assessment (FRA) will be required to accompany planning applications for:

- any development proposals of 1 hectare or greater in Flood Zone 1
- any development proposals in Medium Probability Flood Zone 2
- any development proposals in High Probability Flood Zone 3

The FRA should identify and assess the risks of all sources of flooding to and from the development, taking into account climate change and demonstrate how the risk will be managed.

A FRA will also be required where the proposed development or change of use to a more vulnerable class may be subject to other sources of flooding or where the Environment Agency, Internal Drainage Board and/or other bodies have indicated that there may be drainage problems.

### Standard Flood Risk Management Guidance for Developers

The broad aim of the Planning Policy Statement 25 is to reduce the number of people and properties within the natural and built environment at risk of flooding. To achieve this aim, planning authorities are required to ensure that flood risk is properly assessed during the initial planning stages of any development.

Responsibility for this assessment lies with developers and they must demonstrate the following:

- Whether the proposed development is likely to be affected by current or future flooding from any source.
- Whether the proposed development will increase flood risk elsewhere.
- Whether the measures proposed to deal with any flood risk are sustainable.

The developer must prove to the Local Planning Authority and the Environment Agency that the existing flood risk or flood risk associated with the proposed development can be satisfactorily managed.

The detail to be provided by a FRA will depend on where the proposed site fits within the development framework, particularly on its justification against the sequential test, described in the SFRA.

Development should follow the standard flood risk assessment approach provided by the Environment Agency and Ciria, as follows:

- National Standing Advice to Local Planning Authorities for Planning Applications - Development and Flood Risk in England' (June 2004)
- CIRIA Report C624 "Development and Flood Risk – Guidance for the Construction Industry" (2004).

The general requirements of a FRA are listed in Appendix E of PPS25 and within the Practice Guide to PPS25. Further guidance on the level of detail required for a FRA can be found in the Environment Agency's Flood Risk Assessment guidance notes available at <http://www.pipernetworking.com/floodrisk/index.html>

## Guidance for Development within Each Flood Zone

An FRA should be commensurate with the risk of flooding to the proposed development. For example, where the risk of flooding of the site is negligible (Zone 1 Low Probability) there is little benefit to be gained in assessing the potential risk to life and/or property as a result of flooding. The particular requirements for FRAs within each of the flood zones delineated within PPS25 are outlined below.

### Flood Zone 1 Low Probability

There are generally no flood risk related constraints placed upon future development within Zone 1 Low Probability according to PPS25; however it is important to recognise that if development is not carefully managed within this zone it may adversely affect the existing flooding regime.

Consideration needs to be given to minor watercourses within proposed development sites, where there may be a flood risk, but due to the fact that the catchment size of the watercourses is below that modelled as part of the development of the Environment Agency Flood Map (i.e. less than 3km<sup>2</sup>) there are no flood outlines available.

The risks of alternative sources of flooding (e.g. groundwater, pluvial) need to be considered. The proposed development should also consider surface water runoff to ensure that there are no detrimental effects to existing development and where possible the runoff is reduced through sustainable drainage systems.

### Flood Zone 2 Medium Probability

After the Sequential Test has been applied and the lowest risk suitable site has been chosen, PPS25 recommends that development within Flood Zone 2 should be restricted to 'essential infrastructure', 'water compatible', 'more vulnerable' or 'less vulnerable' land uses.

Where no suitable alternative sites at lower flood risk is found during the Sequential Test if 'Highly Vulnerable' development should be considered further within Flood Zone 2 it will be necessary to carry out the Exception Test.

PPS states that for the Exception Test to be passed:

1. *it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared.*
2. *the development should be on developable, previously-developed land or, if it is not on previously developed land, that there are no reasonable alternative sites on developable previously-developed land; and*
3. *a FRA must demonstrate that the development will be safe, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.*

The risks of alternative sources of flooding (e.g. groundwater, pluvial) need to be considered. The proposed development should consider surface water runoff to ensure that there are no detrimental

effects to existing development and where possible the runoff is reduced through sustainable drainage systems.

As part of the FRA, it will be necessary to demonstrate that the residual risk of flooding can be effectively managed and a planned evacuation route or safe haven can be provided.

### **Flood Zone 3a High Probability**

After the Sequential Test has been applied and the lowest risk suitable site has been chosen, PPS25 recommends that development within Flood Zone 3a should be restricted to 'Less Vulnerable' and 'Water Compatible' land uses.

Where no suitable alternative sites at lower flood risk is found during the Sequential Test if 'More Vulnerable' development or 'Essential Infrastructure' should be considered further within Flood Zone 3a it will be necessary to carry out the Exception Test (see above for details).

An FRA should include the following:

- The vulnerability of the development to fluvial and/or tidal flooding as well as to flooding from other sources.
- The impact of climate change over the lifetime of the development on the flooding regime, i.e. maximum water levels, flood extents and flow paths.
- The effect of the new development on surface water runoff ensuring that there are no detrimental effects to existing development and where possible that runoff is reduced through the use of appropriate sustainable drainage systems.
- Demonstration that residual risks of flooding, after existing and proposed flood management and mitigation measures are taken into account, are acceptable.
- Demonstration that dry access can be provided to enable the safe evacuation in the event of flooding or where this is not achievable a safe haven can be provided.

### **Flood Zone 3b Functional Floodplain**

After the Sequential Test has been applied and the lowest risk suitable site has been chosen, PPS25 recommends that development within Flood Zone 3b should be restricted to 'water compatible' land uses.

Where no suitable alternative sites at lower flood risk is found during the Sequential Test if 'Essential Infrastructure' should be considered further within Flood Zone 3b it will be necessary to carry out the Exception Test (see above for details).

An FRA should include the following:

- The vulnerability of the development to fluvial and/or tidal flooding as well as other sources, e.g. groundwater, sewer, surface water, critical infrastructure failure.
- The impact of climate change over the lifetime of the development on the flooding regime, i.e. maximum water levels, flood extents and flow paths.
- The effect of the new development on surface water runoff ensuring that there are no detrimental effects to existing development and where possible that runoff is reduced through sustainable drainage systems.
- Demonstration that residual risks of flooding, after existing and proposed flood management and mitigation measures are taken into account, are acceptable.
- Demonstration that dry access can be provided to enable the safe evacuation in the event of flooding or where this is not achievable a safe haven can be provided.

## Additional Guidance

### Undefended Floodplain

Areas at risk of flooding need to be assessed against the 1% annual exceedance probability (AEP) criteria for fluvial flooding and against the 0.5% AEP criteria for tidal flooding. The Environment Agency's hydraulic models may be made available for use by developers to determine the site's vulnerability to flooding. The developer will need to firstly ensure that the models are fit for purpose and sufficiently detailed to provide an accurate understanding of flood risk to the site. If existing models are not available, then a developer will need to assess the extent and requirements of any modelling work that is required. Detailed hydraulic modelling will involve the following:

- Carrying out a hydrological assessment using Flood Estimation Handbook techniques and using gauging records where available.
- Constructing an in-bank model using up to date survey data including structures, e.g. bridges, weirs, culverts and sluices.
- Extending the in-bank model to include floodplains where necessary using appropriate hydraulic modelling approaches to replicate the extent, storage and conveyance of the floodplains, e.g. through extended cross sections, reservoir units or 2-D modelling.
- Calibrating or verifying the hydraulic model where hydrometric monitoring data or flood records are available.
- Carrying out sensitivity analysis to confirm modelling assumptions and assess climate change impacts.
- Mapping of flooding extents

### Defended Floodplain

Development sites within a defended tidal or fluvial floodplain are at particular risk due to the risk of the defences being overtopped or breached, resulting in the rapid onset of fast flowing and deep water flooding with little or no warning.

Residual risk from the breach or overtopping of defences needs to be considered as part of a FRA. Defra's<sup>1</sup> Flood Risk Assessment Guidance for New Development provides guidance on the level of risk related to distance and flood depth for overtopping and breaching scenarios.

The objectives of a breach analysis are as follows:

- to determine the Rapid Inundation Zone where there is a potential risk to life
- to investigate the impact of the proposed development on the flood risk to others
- to test the effectiveness of mitigation measures

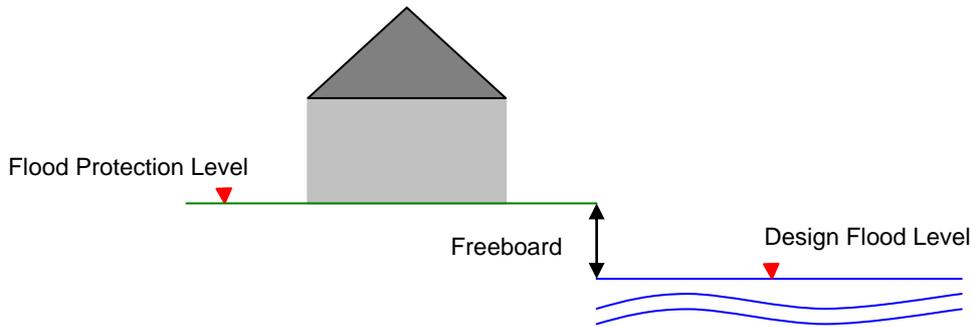
Consideration of flood risk behind defences should take into consideration the standard of protection and design freeboard of the flood defence along with its condition and potential mechanisms of failure. The parameters of a breach in terms of potential location and width as well as the duration of a flood event should be agreed with the Environment Agency prior to any analysis.

### Raised Floor Levels

It may be feasible to reduce the risk to a development through raising the ground level above the design flood level, as shown below:

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<sup>1</sup> Flood Risk Assessment Guidance for New Development Phase 2: Framework and guidance for Assessing and Managing Flood Risk for New Development – Full Documentation and Tools. R&D Technical Report FD2320/TR2. Defra/Environment Agency 2005



Floor levels should be raised above the 1% AEP fluvial flood level plus an allowance for climate change assuming a 20% increase in flow over the next 100 years.

In addition, the flood protection level should include a freeboard above the design flood level. For non-residential development, e.g. commercial, the Environment Agency usually requires a freeboard of 300mm and for residential development a freeboard of 600mm.

### Compensatory Storage

Where development is proposed in undefended areas of floodplain, which lie outside of the functional floodplain, the new building footprint and any ground raising will effectively reduce the flood storage capacity of the site. The potential impacts on flood risk elsewhere need to be considered. Raising existing ground levels may reduce the capacity of the floodplain to accommodate floodwater and increase the risk of flooding by either increasing the depth of flooding to existing properties at risk or by extending the floodplain to cover properties normally outside of the floodplain. Flood storage capacity can be maintained by lowering ground levels either within the curtilage of the development or elsewhere in the floodplain to provide at least the equivalent volume of storage lost to the development at a nearby location and at the same level. Compensatory storage should be provided on a level for level and volume for volume basis.

Compensatory flood storage should not be used as a reason to advocate development within the floodplain when lower risk alternatives are available. Level for level compensation should only be applied in areas where water is stored and flood flow routes should be protected. There may be benefits in altering routes or increasing flood flow capacity; however it should only be carried out after careful assessment of the downstream impacts.

Direct compensation works will not increase the land available for development on a site; it will merely reconfigure it for more convenient use. Therefore, compensatory flood storage schemes cannot be carried out on sites entirely within a floodplain. In order to increase the land available on site, land off site will be required for compensatory flood storage.

For development in a defended flood risk area, the impact on residual flood risk to other properties needs to be considered. New development behind flood defences can increase the residual risk of flooding if the flood defences are breached or overtopped by changing the conveyance of the flow paths or by displacing flood water elsewhere. If the potential impact on residual risk is unacceptable then mitigation should be provided.

### Surface Water Drainage Assessment

Developers should demonstrate that the disposal of surface water from the site will not exacerbate existing flooding from all new development within Flood Zones 3 and 2 and from any development greater than 1Ha in Flood Zone 1 or within areas that are known to suffer from surface water drainage or sewer flooding.

A surface water drainage assessment should be undertaken to demonstrate that surface water runoff from the proposed development can be effectively managed without increasing flood risk elsewhere. A surface water drainage assessment should include the following:

- Assessment of whether the development will increase the overall discharge from the site by calculating the change in area covered by roofs and hard-standing.
- Details of how overland flow from the new development can be intercepted to prevent flooding of adjacent land.
- Details of how additional onsite surface water attenuation can be provided to mitigate against known flooding problems or as a result of incapacity on the drainage systems.
- Demonstration that overland flows will not increase flood risk to both existing development and receiving watercourses.
- Agreement that the rates of discharge from the development are acceptable to the Environment Agency and sewerage authorities.

## Selection of Appropriate Mitigation Measures

The sequential approach should be applied within development sites to locate the most vulnerable elements of a development in the lowest risk areas. Where vulnerable development cannot be allocated within low risk areas then measures need to be put in place to mitigate against the flood risk.

There are several sources of information on potential mitigation measures, as follows:

- Flood Risk Assessment Guidance for New Development, Environment Agency R&D (FD2320)
- Development and Flood Risk – Guidance for the Construction Industry, CIRIA 624

The Environment Agency R&D Guidance on Flood Risk Assessments for new development suggests that mitigation measures can be split into three types:

- Measures that reduce the physical hazard, e.g. through raised defences or flood storage
- Measures that reduce the exposure to the hazard, e.g. raise properties above flood levels
- Measures that reduce the vulnerability to the hazard, e.g. flood warning or emergency planning.

The selection of appropriate mitigation measures depends on the requirements of the development and its sensitivity to flood risk. Any mitigation measure selected should be sustainable in the future by taking into consideration the impact of climate change on flood risk. The residual risk of developing an area vulnerable to flooding with mitigation measures in place should also be considered.

### Flood Defence Walls or Embankments

Flood defences, fully funded by the development can be constructed to protect a new development. However, the impact on the risk of flooding elsewhere with defences in place needs to be assessed and managed, for example, through the provision of compensatory storage. Residual risk of flooding with flood defences also needs to be assessed and managed.

### Flood Storage

Flood storage either offline or online can be used to manage water levels at or downstream of a development site.

### Building Design

Flood management measures only manage the risk of flooding rather than remove it completely. Therefore, buildings should be designed to be flood resistant and flood resilient where they are built behind flood defence systems. Flood resistance is the prevention of flood water entering a building through, for example, flood barriers or raising floor levels. Flood resilience is ensuring the finish (e.g.

type of flooring) and services (e.g. electrics) are such that following a flood the building can be returned quickly to its normal operation. A basic level of flood resistance and resilience can be achieved through good building practice and complying with Building Regulations (ODPM, 2000).

### Flood Warning

The Environment Agency provides flood warnings to a number of existing properties at risk of flooding to enable owners to protect life and manage the effect of flooding of their property. Flood warning should only be provided as a measure to manage residual risk and should not be used as the sole measure to offer protection to a development.

### Access and Egress

PPS25 requires that safe access and escape is available to and from new developments in flood risk areas. Where possible, safe access routes should be located above design flood levels and an evacuation procedure should be in place for an extreme flood event. If safe access cannot be provided for all events then a safe haven of sufficient size to accommodate all occupiers of the development should be provided within the development.

For developments within Zone 3a High Probability and Zone 2 Medium Probability which are not offered protection from raised defences, the following is required:

- Dry escape, above the 100 year flood level taking into account climate change, should be provided for all 'more vulnerable' (including residential) and highly vulnerable' development.
- 'Safe' should be dry for all other uses such as educational establishments, hotels and 'less vulnerable' land use classifications.

For developments within Zone 3a High Probability and Zone 2 Medium Probability which are offered protection from raised defences, the following is required:

- 'Safe' access should preferably be dry for 'highly vulnerable' uses
- 'Safe' access should incorporate the ability to escape to levels above the breach water level.

For major 'highly vulnerable' development, safety will also need to be ensured through the development of a robust evacuation plan. This should clearly define routes to dry (i.e. 'un-flooded') land. This may include routes through flood waters, providing the depth and speed of flow across the evacuation route are below the risk defined by the "some" threshold in Flood Risk to People (Defra, FD2320)

For infrastructure development, safety will also need to be ensured through the development of a robust evacuation plan. This should clearly define dry escape routes (above the 100 year plus climate change flood level) to dry (i.e. 'un-flooded') land.

In exceptional circumstances, dry access (above the 100 year plus climate change flood level) for 'more vulnerable' and/or 'highly vulnerable' development may not be achievable. In these exceptional circumstances, liaison must be sought with the Environment Agency and the Council Emergency Planning Team to ensure that the safety of site tenants can be satisfactorily resolved.