



The Planning System and Flood Risk Management

**Consultation Draft Guidelines for
Planning Authorities**
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Comhshaol, Oidhreacht agus Rialtas Áitiúil
Environment, Heritage and Local Government



Planning Guidelines

Ministers' Foreword

Ireland has benefited greatly from economic growth in recent years, improving our standard of living and quality of life. The planning system plays a major national and local role in ensuring that recent progress is sustained into the future by promoting and channeling development in a manner that is sustainable in economic, social and environmental terms.

The Government's National Spatial Strategy 2002-2020, the National Development Plan 2007-2013, the National Sustainable Development Strategy - Making Ireland's Development Sustainable (2002) and the Planning and Development Act 2000, provide the frameworks and policies under which proper planning and sustainable development can be achieved.

In recent years, we have become increasingly aware of the importance of factoring into the planning system the risk to people, property, the overall economy and the environment from flooding, and the role that good planning has in avoiding and reducing such risk that could otherwise arise in the future. The 2004 Report of the Flood Policy Review Group which was approved by the Government highlighted the need to pro-actively manage flood risk.

There are many areas, including towns and cities, that are already at risk from periodic flooding. The effects of climate change, such as more severe rainfall events and rising sea levels, will increase these risks and may put other areas at risk that may not have flooded in the past. Adapting to the reality of climate change therefore requires us to be even more vigilant in ensuring that risks of flooding into the future are integrated into the planning process, first through the spatial planning process at regional, city and county and local levels, and also in the assessment of development proposals by planning authorities and An Bord Pleanála.

These guidelines require the planning system at national, regional and local levels to:

- (1) Avoid development in areas at risk of flooding by not permitting development in flood risk areas, particularly floodplains, unless where it is fully justified that there are wider sustainability grounds for appropriate development and unless the flood risk can be managed to an acceptable level without increasing flood risk elsewhere and where possible, reducing flood risk overall;
- (2) Adopt a sequential approach to flood risk management based on avoidance, reduction and then mitigation of flood risk as the overall framework for assessing the location of new development in the development planning processes; and

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- (3) Incorporate flood risk assessment into the process of making decisions on planning applications and planning appeals.

The Government places a high degree of importance on planning and development measures as a critically important element of its overall strategic approach to flood risk management, building upon its long-standing acknowledgement in legislation as an important planning issue.

We urge planning authorities, An Bord Pleanála, regional authorities, applicants for planning permission, their agents and developers to study the guidelines and implement them fully. In particular, we would urge elected members to use these guidelines in reviewing development plans, especially in zoning land for development.

While the consideration of flood risk may, for valid and justifiable reasons, constrain development in some areas, these guidelines also recognise the fact that many of the areas where people live and work are already subject to flood risk, and that the needs for regeneration and growth can be reconciled, while taking due account of the need to minimise and mitigate such risks.

These guidelines are being published initially in draft form, with a view to their finalisation in statutory form following consideration of the comments and submissions made during the public consultation. We would strongly urge all interested parties to avail of this opportunity to contribute to policy formulation and make any comment that they consider relevant.



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Minister for the Environment, Heritage
and Local Government



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Overview of the Guidelines

These guidelines introduce comprehensive mechanisms for the incorporation of flood risk identification, assessment and management into the planning process, building upon the longstanding acknowledgement in the planning system of the importance of addressing the issue. Implementation of the guidelines will be achieved through actions at the national, regional, local authority and site specific levels.

At the national level:

- (1) The **Minister for the Environment, Heritage and Local Government** has introduced these guidelines as a comprehensive statement of good planning practice and which will become a key step towards a National Climate Change Adaptation Strategy. The Minister will further monitor the development plans of local authorities to ensure that they are prepared in a manner that is consistent with the guidelines.
- (2) The **Department of the Environment, Heritage and Local Government** will review other publications with regard to design standards for surface water drainage systems in new development such as the Department's "Recommendations for Site Development Works for Housing Areas" and will also review the provisions of the Exempted Development Regulations under planning legislation to encourage greater use of Sustainable Drainage Systems (SuDS) generally including the use of permeable paving techniques and porous surfacing.
- (3) The **Office of Public Works**, as the lead agency for flood risk management in Ireland will, together with the Department of Agriculture, Fisheries and Food, continue its work in developing development flood maps and catchment-based Flood Risk Management Plans (FRMPS) in partnership with local authorities, the Environmental Protection Agency and other relevant departments and bodies in accordance with national flood policy and the EU Floods Directive.
- (4) **DEHLG and OPW** will work with regional and local authorities in assisting with technical aspects of the implementation of these guidelines on an ongoing basis, learning from experience within Ireland and internationally.

At the regional level:

- (5) **Regional Authorities** will be reviewing their Regional Planning Guidelines (RPG's) by the end of 2009 and will be required to prepare regional level strategic flood risk assessment as an integral input to the preparation of the next RPG's and as a framework for ongoing co-ordination of the development plans of local authorities in their areas. The preparation of this element of the RPG's will be co-ordinated with the work ongoing in preparing River Basin

Management Plans (RBMP's) under the EU Water Framework Directive and future work required to prepare Flood Risk Management Plans under the EU Floods Directive.

At City and County level:

- (6) **Planning authorities will introduce flood risk assessment** carried out in accordance with these guidelines as an integral and leading element of the development planning functions under the Planning Code.
- (7) The new **flood risk assessment system will be aligned with the existing Strategic Environmental Assessment (SEA)** process introducing processes for screening for flood risk, scoping any flood risk assessment required and carrying out such assessments similar to the overall system for screening and scoping under SEA provision.
- (8) **City and county development plans will establish the overall flood risk assessment context** for their functional areas including other planning authorities such as Town Councils and any Local Area Plans (LAP's) which may be supplemented by any more detailed site-specific flood risk assessment required to comply with these guidelines at town plan/LAP level.
- (9) **Planning authorities will assess planning applications** for development in accordance with the provisions of these guidelines following the guidance of their own or any OPW strategic flood risk assessment and the application of the sequential approach and, if necessary, the justification test required by these guidelines.
- (10) **Development should not be permitted in flood risk areas, particularly floodplains, except where there are no alternative and appropriate sites available in areas at lower risk that are consistent with the objectives of proper planning and sustainable development.** Where such development has to take place, in the case of urban regeneration for example, the type of development has to be carefully considered and the risks should be mitigated and managed through location, layout and design of the development to reduce flood risk to an acceptable level.
- (11) **Only developments consistent with the overall policy and technical approaches of these guidelines should be approved** and permission should be refused where flood issues have not been, or cannot be, addressed successfully and where the presence of unacceptable residual flood risks to the development, its occupants or users and adjoining property remains. Under the Planning and Development Act 2000, planning permission refused for the reason that the proposed development is in an area which is at risk of flooding excludes compensation.

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At the site-specific level, developers and their agents are required to:

- (12) **Carefully examine their development proposals** to ensure consistency with the requirements of these guidelines including carefully researching whether there has been instances of flooding on specific sites or potential for flooding and declaring any known flood history in the planning application form as required under the Planning and Development Regulations 2006.
- (13) **Engage with planning authorities at an early stage**, utilising the arrangements for pre-planning application consultation with regard to any flood risk assessment issues that may arise.
- (14) **Carry out a site-specific flood risk assessment, as appropriate**, and comply with the terms and conditions of any grant of planning permission with regard to the minimisation of flood risk.

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Chapter 1: Background and Objectives

The Issue

- 1.1 Flooding is a natural process that can happen at any time in a wide variety of locations. Flooding from the sea and from rivers is probably best known but prolonged and intense rainfall can also cause sewer flooding, overland flow and groundwater flooding. When it impacts on human activities, it can threaten people, their property and the environment. Assets at risk can include housing, transport and public service infrastructure, and commercial, industrial and agricultural enterprises. The health, social, economic and environmental impacts of flooding can be significant and have a wide community impact.
- 1.2 The frequency, pattern and severity of flooding are expected to increase flood risk as a result of climate change. Development can also exacerbate the problems of flooding by accelerating and increasing surface water runoff, altering watercourses and removing floodplain storage.
- 1.3 During a period of sustained population and economic growth, when as many as 1 million new homes may be required over the next 20 years, it is clearly important that a reduction in these potential future flood risks be achieved by integrating the assessment of flood risk into the planning process.

Purpose of the Guidelines

- 1.4 These guidelines describe good practice in the consideration of flood risk in planning and development management. Planning authorities (both elected members and officials) should avail of these guidelines in the assessment and management of flood risk and its consideration in preparing development plans and local area plans. They will also be of assistance to regional authorities in preparing Regional Planning Guidelines and to developers and the wider public in considering flood risk in relation to development and planning. They should also be used in determining applications for planning permission.

Status of Guidelines

- 1.5 The Department of the Environment, Heritage and Local Government issued guidance on flooding in Appendix E to the **Development Plan Guidelines** in 2007, as an interim measure pending preparation of these guidelines. Appendix E is superseded by these guidelines, which are one of a series of guidelines aimed at assisting regional and planning authorities in the exercise of their function. The Minister of the Environment, Heritage and Local Government intends to issue the finalised guidelines (i.e. after the public consultation period) under Section 28(1) of the Planning and Development Act 2000, which requires planning authorities and An Bord Pleanála to have

regard to the guidelines in the performance of their functions under the Act. Planning authorities are also required to make the guidelines available for inspection by members of the public.

Objectives of Guidelines

- 1.6 These guidelines aim to integrate flood risk management into the planning process as indicated in Fig. 1 below, to assist in the delivery of sustainable development. This will be achieved by assessing flood risk as early as possible in the planning process and taking it into account at all stages from national and regional planning, through to development plans and local area plans as well as in development design and management.
- 1.7 The core objectives are to:
 - avoid inappropriate development in areas at risk of flooding;
 - avoid new developments increasing flood risk elsewhere, including that which may arise from surface run-off;
 - ensure effective management of residual risks for development permitted in floodplains;
 - avoid unnecessary restriction of national, regional or local economic and social growth;
 - improve the understanding of flood risk among relevant stakeholders; and
 - ensure that the requirements of EU and national law in relation to the natural environment and nature conservation are complied with at all stages of flood risk management
- 1.8 These guidelines aim to encourage a transparent consideration of flood risk in the planning process and introduce and explain a rigorous assessment methodology to ensure a consistency of approach throughout the country in considering flood risk at all stages of the planning process. The guidelines will contribute to the avoidance or minimisation of potential future flood risk through a more systematic approach within a catchment context to help deliver sustainable development.
- 1.9 The key principles are to:
 - avoid the risk, where possible,
 - substitute less vulnerable uses, where avoidance is not possible, and
 - mitigate and manage the risk, where avoidance and substitution are not possible.

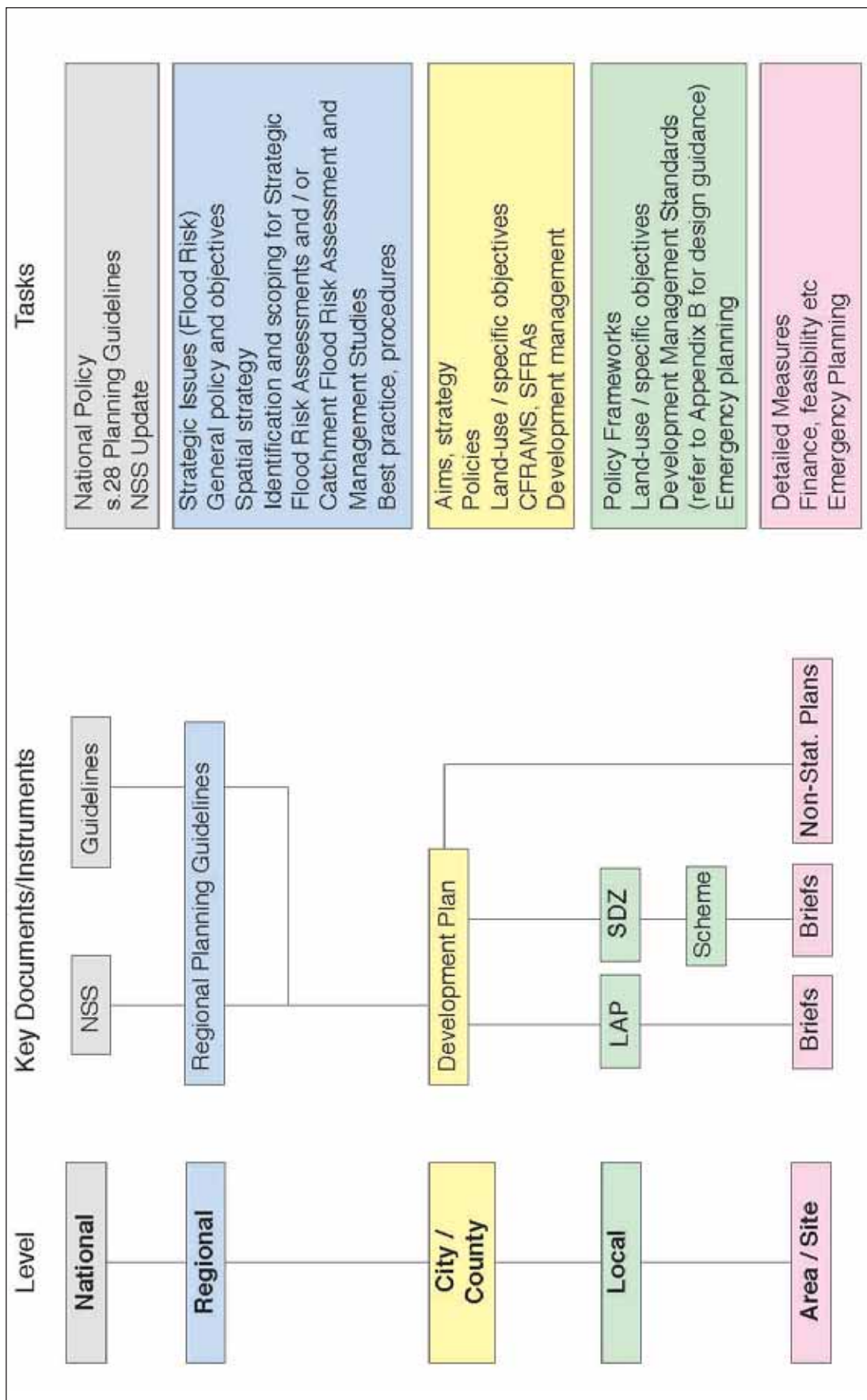


Fig. 1: Integration of Flood Risk Management into Planning Policy

Report of the Flood Policy Review Group

1.10 The Report of the Flood Policy Review Group, published in 2004 following Government approval of its recommendations, including the decision that the OPW should be the lead agency for implementing flood risk management policy in Ireland, highlighted the need to pro-actively manage flood risk. A particular emphasis was placed on the need to avoid or minimise potential future increases in risk. The Report recognised that planning and development management should be a key component of the strategy for achieving this objective, and set out duties on the OPW, DEHLG and local authorities in this regard. It advises Government in relation to policy development and legislative requirements for flood risk management, and develops, coordinates and implements programmes and measures to reduce the national level of flood risk. These guidelines have been developed to facilitate performance of these duties and meet the stated policy objectives.

1.11 A number of other policy documents have been published by the Government in recent years, which cover issues relevant to flooding. These include:

- Sustainable Development: A Strategy for Ireland (1997)
- National Climate Change Strategy (2000)
- Making Ireland's Development Sustainable (2002)
- National Biodiversity Plan 2002-2006
- National Spatial Strategy 2002-2020
- A Framework for Major Emergency Management (2006)
- National Development Plan 2007-2013
- National Climate Change Strategy 2007-2012



Photo 1: Cork Harbour and the proximity of substantial development areas to a major estuary

1.12 The key messages arising from these documents are that:

- the Government recognises the significance of flood risk and the need to integrate flood risk assessment and its management into the planning process in order to deliver a policy of avoidance or minimisation of potential future flood risk, using a combination of approaches comprising a mix of risk evaluation, planning measures, flood forecasting and warning, emergency-response development and capital projects of an engineering nature;
- the need for proper planning and sustainable development may at the same time require in exceptional circumstances some development in flood risk areas provided that the issue of flood risk is managed appropriately;
- the implications for biodiversity should be considered at all stages of flood risk assessment and its management;
- climate change is a dynamic process that requires a precautionary approach of avoidance or a flexible approach to ensure appropriate provision for, or adaptation to, its potential consequences; and
- Government investment in flood risk management under the National Development Plan needs to be focused on the areas of greatest need through a strategically led flood risk management approach.

1.13 In addition, current EU Directives recognise the importance of managing the water environment on a catchment or river basin basis. The Water Framework Directive (WFD)¹ established the concept of river basin management embodied in river basin management plans (RBMPs) to enable all rivers and coastal waters to achieve good ecological status by 2015. The EU 'Floods' Directive² requires the carrying out of a national preliminary flood risk assessment by 2011 and the identification of areas where significant flood risk exists or might be considered likely to occur. Flood-hazard and flood risk maps of these areas are required by 2013 to form the basis for flood risk management objectives and plans for areas with significant flood risks within each unit of management by 2015. This Directive recognises the importance of land use management and spatial planning as a key factor in flood risk management. The implementation of the WFD and "Floods" Directive must be co-ordinated to ensure integrated river basin management.

1.14 The need for compliance with the overarching requirements of EU law in particular appropriate assessment under the Birds and Habitats Directives³ must be addressed at all stages in the assessment and management of high risk habitats (see para. 3.19).

¹ Council Directive 2000/60/EC of 23 October 2000 establishing a framework for Community action in the field of water policy ("the Water Framework Directive") Official Journal L197/30-37

² Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risk: Official Journal L288/27-34.

³ Council Directive 79/409/EEC of 2 April 1979 establishing the Birds Directive on the conservation of wild birds and Council Directive 92/43/EEC of 21 May 1992 establishing the Habitats Directive on the conservation of natural habitats and of wild fauna and flora

Chapter 2: Flooding - Key Concepts

- Flooding is a natural process and can happen at any time in a wide variety of locations. It constitutes a temporary covering of land by water and presents a risk only when people and human assets are present in the area which floods. Assets at risk from flooding can include housing, transport and public service infrastructure, commercial and industrial enterprises, agricultural land and the environmental and cultural heritage.
- Understanding flood risk is an essential step in managing the associated impacts and in making informed decisions. The science is complex, and datasets are currently being enhanced by detailed studies. Therefore, the guidance recommends a staged approach to flood risk assessment, which covers both the likelihood of flooding and the potential consequences.
- Screening, scoping and appropriate flood risk assessments are key steps and are described in this chapter and supporting appendices. Planning authorities will need to commission assessments of flood risk and ensure that the impacts of climate change are accounted for.
- The management of potential future flood risk aims to reduce the potential risks to people, property and the environment through a hierarchy of avoidance, followed by substitution of lower vulnerability uses (where avoidance is not possible) and, only if avoidance and substitution are not possible, reduction and management of the risks through a variety of techniques.

Types and causes of flooding

Different forms of flooding present different forms and degrees of danger to people, property and the environment, due to varying depth, velocity, duration, rate of onset and other hazards associated with flooding. With climate change, the frequency, pattern and severity of flooding are expected to change and become more damaging.

2.2 There are essentially two major causes of flooding:

- **Coastal flooding** which is caused by higher sea levels than normal, largely as a result of storm surges, resulting in the sea overflowing onto the land. Coastal flooding is influenced by the following three factors, which often work in combination:
 - High tide level;
 - Storm surges caused by low barometric pressure exacerbated by high winds; the highest surges can develop from hurricanes; and

- Wave action which is dependent on wind speed and direction, local topography and exposure.
 - **Inland flooding** which is caused by prolonged and/or intense rainfall. Inland flooding can include a number of different types:
 - Overland flow occurs when the amount of rainfall exceeds the infiltration capacity of the ground to absorb it. This excess water flows overland, ponding in natural hollows and low-lying areas or behind obstructions.
 - River flooding occurs when the capacity of a watercourse is exceeded or the channel is blocked or restricted, and excess water spills out from the channel onto adjacent low-lying areas (the floodplain).
 - Flooding from artificial drainage systems results when flow entering a system, such as an urban storm water drainage system, exceeds its discharge capacity, the system becomes blocked, and / or cannot discharge due to a high water level in the receiving watercourse. Flooding arising from a lack of capacity in the urban drainage network has become an important source of flood risk, as evidenced during the Summers of 2007 and 2008.
 - Groundwater flooding occurs when the level of water stored in the ground rises as a result of prolonged rainfall to meet the ground surface and flows out over it, i.e. when the capacity of this underground reservoir is exceeded. Groundwater flooding tends to be very local and results from interactions of site-specific factors. Such flooding may often result in significant damage to property rather than be a potential risk to life.
 - Estuarial flooding may occur due to a combination of tidal and fluvial flows, i.e interaction between rivers and the sea, with tidal levels being dominant in most cases. A combination of high flow in rivers and a high tide will force water back up the river channel tending to increase water levels inland, which may flood over river banks.
- 2.3 A less frequent form of flooding arises from the **failure of infrastructure** designed to store or carry water (e.g. the breach of a dam, a leaking canal, or a burst water main), or to protect an area against flooding (e.g. breach of a flood defence, failure of a flap valve or pumping station or blockage of a pipe or culvert). Because of the sudden onset, the impacts of this form of flooding can be severe (see Para 2.7).
- 2.4 Coastal erosion of both the foreshore and the shoreline itself is intimately linked with coastal flooding. The loss of natural coastal defences, such as sand dunes, due to erosion can increase the risk of flooding in coastal areas. Coastal erosion should therefore be considered in coastal areas within the planning process, although this issue is not within the focus of these guidelines.

2.5 Increase in flooding due to development may be caused:

- Upstream by restricting the capacity and conveyance function of the watercourse and floodplain system, or
- Downstream by decreasing the volume available for flood storage on the floodplain, altering flow routes on the floodplain or by changes to the channel which can increase the flow discharged to downstream locations; and by increasing run-off from reduced permeability surfaces, such as roads, roofs and car parks.

Impacts of flooding

2.6 Impacts on people – Flooding can cause physical injury, illness and loss of life. Deep, fast flowing or rapidly rising flood waters can be particularly dangerous. For example, even shallow water flowing at 2 metres per second (m/sec) can knock children and many adults off their feet, and vehicles can be moved by water of only 300mm depth. The risks increase if the floodwater is carrying debris. Some of these impacts may be immediate, the most significant being drowning or physical injury due to being swept away by floods. Flood water may also hide other hazards for wading pedestrians, such as manhole openings where the covers have been lifted by flood flows.



Photo 2: Clonmel, illustrating the historical relationship between the town, the River Suir and its floodplain

2.7 The 2006 Framework for Major Emergency Management enables the principal response agencies such as An Garda Síochána, the Health Service Executive and local authorities to prepare for and make a co-ordinated response to a variety of major emergencies including flooding. A guidance and protocol document has been developed in conjunction with the OPW for responding to flood events (see <http://www.mem.ie>).

- 2.8 The impact on people and communities as a result of the stress and trauma of being flooded, or even of being under the threat of flooding, can be immense. Long-term impacts can arise due to chronic illnesses and the stress associated with being flooded and the lengthy recovery process. Floodwater contaminated by sewage or other pollutants (e.g. chemicals stored in garages or commercial properties) is particularly likely to cause such illnesses, either directly as a result of contact with the polluted floodwater or indirectly as a result of sediments left behind. Those most likely to be at risk are those outdoors on foot or in a vehicle, in a tent or caravan, or in a building, such as a single-storey bungalow or below ground in a basement.
- 2.9 The ability of people to respond and recover from a flood can vary. Vulnerable people, such as those who are old, disabled or have a long-term illness, are less able to cope with floods than others and are more prone to death or serious injury. Others may have difficulty in replacing household items damaged in a flood and may lack the financial means to recover and maintain acceptable living conditions after a flood. Understanding the social consequences of flooding is fundamental to the appraisal of risk and appropriate mitigation measures. As such, there is increasing interest in a more community-centred approach to flood risk management that recognises the particular circumstances of community and social groups. This type of approach will be crucial to the development of more socially and environmentally responsive and sustainable flood management.
- 2.10 Impacts on property and the environment - Flooding can cause severe damage to properties. Floodwater is likely to damage internal finishes, contents and electrical and other services and possibly cause structural damage. The physical effects can have significant long-term impacts, with re-occupation sometimes not being possible for over a year. The costs of flooding are increasing, partly due to increasing amounts of electrical and other equipment within developments. Sea-water flooding may cause additional damage due to corrosion.
- 2.11 The damage flooding can cause to businesses and infrastructure, such as transport or utilities like electricity and water supply, can have significant detrimental impacts on local and regional economies. The long-term closure of businesses, for example, can lead to job losses and other economic impacts.
- 2.12 Impacts on the environment - Significant detrimental environmental effects of flooding can include soil erosion, bank erosion, land sliding and damage to vegetation as well as the impacts on water quality, habitats and flora and fauna caused by bacteria and other pollutants carried by flood water. Flooding can however play a beneficial role in natural habitats. Many wetland habitats are dependant on annual flooding for their sustainability and can contribute to the storage of flood waters to reduce flood risk elsewhere.

Flood risk

2.13 Understanding flood risk is a key step in managing the impacts of flooding. Flood risk is a combination of the likelihood of flooding and the potential consequences arising. These guidelines recommend a staged approach to flood risk assessment that covers both the likelihood of flooding and the potential consequences.

2.14 Firstly, it is important to define the two components of flood risk in order to apply this guidance in a consistent manner.

- **Likelihood of flooding** is normally defined as the percentage probability of a flood of a given magnitude or severity occurring or being exceeded in any given year. For example, a 1% probability indicates the severity of a flood that is expected to be exceeded on average once in 100 years, i.e. it has a 1 in 100 (1%) chance of occurring in any one year.
- **Consequences of flooding** depend on the hazards associated with the flooding (e.g. depth of water, speed of flow, rate of onset, duration, wave-action effects, water quality), and the vulnerability of people, property and the environment potentially affected by a flood (e.g. the age profile of the population, the type of development, presence and reliability of mitigation measures etc.)

2.15 Flood risk is then normally expressed in terms of the following relationship:

$$\text{Flood risk} = \text{Likelihood of flooding} \times \text{Consequences of flooding}$$

2.16 Flood risk can be measured in monetary terms, as a potential for loss of life or injury, as environmental impacts, or as combinations of all these indicators. Guiding proposed development to areas, where the risks arising from inundation in terms of human impact, economic loss or potential environmental damage is minimised, is a key tenet of this guidance.

2.17 The vulnerability of development to flooding depends on the nature of the development, its occupation and the construction methods used. For example, a sheltered housing complex would be more vulnerable than a retail unit. A broad classification of vulnerability has been developed as shown in the Glossary of Terms. The classification of different land uses and types of development as highly vulnerable, less vulnerable and water-compatible is influenced primarily by the ability to manage the safety of people in flood events and the long-term implications for recovery of the function and structure of buildings (see Glossary of Terms).

2.18 Transport and strategic utilities infrastructure can be particularly vulnerable to flooding because interruption of their function can have widespread effects well beyond the area that is flooded. For example, flooding of primary roads or railways can deny access to large areas beyond those directly affected by

the flooding for the duration of the flood event, as well as causing damage to the road or railway itself. Flooding of water distribution infrastructure such as pumping stations or of electricity sub-stations can result in loss of water or power supply over large areas. This can magnify the impact of flooding well beyond the immediate community and reinforces why **decisions to locate development in floodplain should be taken very carefully** (see paragraphs 2.24 and 2.36 below). This was a key lesson learnt from recent floods in Ireland when national primary roads and railway lines were flooded, and also the Summer 2007 floods in the UK, during which water supply to large areas was cut off for a number of weeks.

Flood risk assessment

- 2.19 The assessment of flood risk requires an understanding of where the water comes from (i.e. the source), how and where it flows (i.e. the pathways) and the people and assets affected by it (i.e. the receptors). The **source – pathway – receptor** model is described in greater detail in Appendix A.

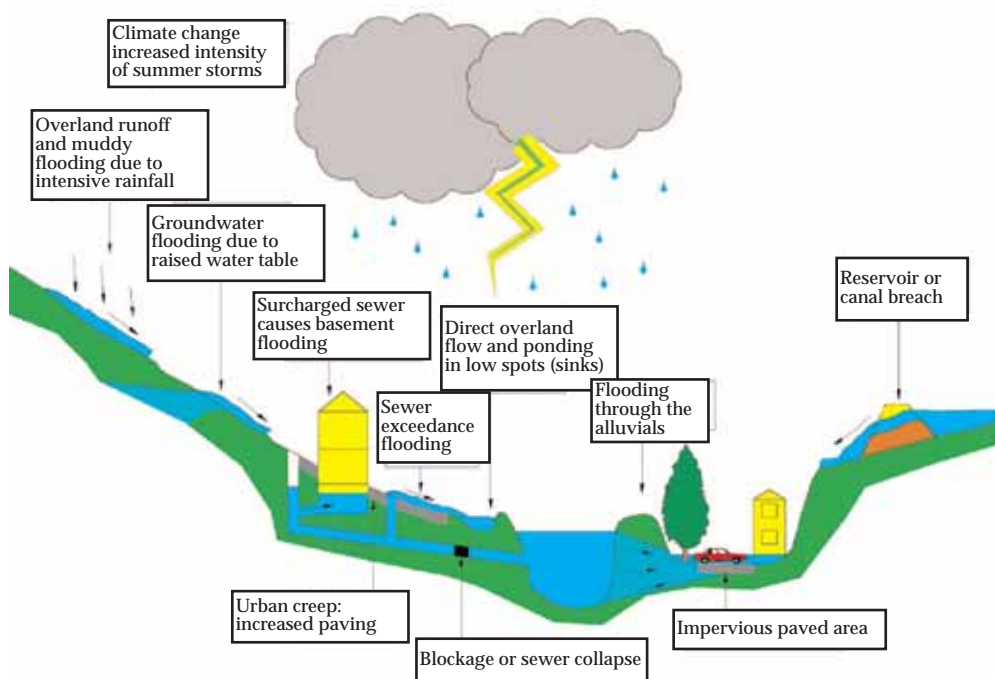


Fig. 2: Sources, pathways and receptors of Flooding

- 2.20 The principal sources are rainfall or higher than normal sea levels, the principal pathways are rivers, drains, sewers, overland flow and river and coastal floodplains and their defence assets and the receptors can include people, their property and the environment. All three elements must be examined as part of the flood risk assessment. Mitigation measures typically used in development management can reduce the impact on people and communities, for example, by blocking or impeding pathways but they have little or no effect on the sources of flooding. The planning process is primarily concerned with the location of receptors, taking appropriate account of potential sources and pathways that might put those receptors at risk.

2.21 In undertaking a flood risk assessment, it is necessary to calculate the probability of flooding occurring, to assess the hazards that will arise (e.g. to identify areas where deep or fast-flowing water would be expected in the event of a flood) and to examine the vulnerability of the receptors and the potential consequences of those hazards. Risks to people, property and the environment should be assessed over the full range of probabilities, including extreme events. The flood risk assessment should cover all sources of flooding, including the effects of run-off from a development on flood risk both locally and beyond the development site.

2.22 A staged approach should be adopted, carrying out only such assessment as is needed for the purposes of decision-making. The stages of assessment are:

- Screening assessment – to identify whether there may be any flooding or surface water management issues related to a plan area or proposed development site that may warrant further investigation;
- Scoping assessment – to confirm sources of flooding that may affect a plan area or proposed development site, to appraise the adequacy of existing information and to scope the extent of the risk of flooding and potential impact of a development on flooding elsewhere and of the scope of possible mitigation measures; and
- Appropriate risk assessment – to assess flood risk issues in sufficient detail and to provide a quantitative appraisal of potential flood risk to a proposed or existing development, of its potential impact on flood risk elsewhere and of the effectiveness of any proposed mitigation measures.

Further information on flood risk assessment and its application within the planning system, along with sources of information to support the assessments, is contained in Appendix A.

Flood zones

2.23 Flood zones are geographical areas within which the likelihood of flooding is in a particular range and they are a key tool in flood risk management within the planning process as well as in flood warning and emergency planning. There are three types or levels of flood zones defined for the purposes of these guidelines:

- Flood zone A – where the probability of flooding is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding) and where a wide range of receptors would be vulnerable;
- Flood zone B – where the probability of flooding is moderate (between 0.1% or 1 in 1000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 year and 0.5% or 1 in 200 for coastal flooding); and

- Flood zone C – where the probability of flooding is low (less than 0.1% or 1 in 1000 for both river and coastal flooding).

- 2.24 These flood zones are determined on the basis of the probability of river and coastal flooding. Floodplains will primarily be found in flood zones A and B, and these zones will identify the spatial extent of a floodplain (see also para. 2.36 below).
- 2.25 The flood zones should be determined, ignoring the presence of flood protection structures. This is because areas protected by flood defences still carry a residual risk of flooding from overtopping or breach of defences and there is no guarantee that the defences will be maintained in perpetuity. This residual risk needs to be factored in to decision-making processes in both a development planning and development management context, as well as in emergency planning.
- 2.26 These flood zones are indicative only of river and coastal flooding. They should not be used to suggest that any areas are free from flood risk, since they take account of only river and coastal flooding, and do not include the effects of other forms of flooding such as from groundwater or artificial drainage systems.

Effects of climate change

- 2.27 The fourth assessment report of the IPCC concluded that warming of the climate is unequivocal¹. There is a growing scientific consensus that these changes are expected to increase flood risk. In addition, climate change could also influence environmental and socio-economic factors such as national prosperity and social cohesion. The expected effects will most likely be felt first by the most vulnerable in society. While the different global emission scenarios and climate-change models may lead to substantially different positions by the end of this century, the trends for the next 20-30 years do not differ significantly.
- 2.28 Rising sea levels and more frequent and more severe coastal storms will significantly increase the risk of coastal and estuarial flooding as well as that of coastal erosion. For example, the flooding that occurred in Dublin in 2002, when a 1 metre surge coincided with one of the highest spring tides of the year, could change from a relatively rare to a more common occurrence. Assuming a correlation between the rate of sea-level rise and the rate of coastal erosion, the current rate of coastal erosion and the consequential economic impacts of flooding are expected to multiply over the next century.
- 2.29 The effects of increases in winter rainfall and in rainfall intensity will vary between river catchments but floods are likely to become more severe and more frequent.

¹ Inter-Governmental Panel on Climate Change (IPCC), 4th assessment report. "Climate Change 2007".

- 2.30 Increases in rainfall intensity will also have a significant effect on local flooding, particularly in urban areas with lower permeability due to the natural ground being covered by roads, hard standings and buildings. Localised urban and sewer flooding similar to the June 1963 floods in south Dublin can therefore be expected to increase significantly. The wet Summers of 2007 and 2008 provided an important reminder of the potential extent of flood impacts as a result of intense rainfall events within an urban environment.
- 2.31 Specific advice on the expected impacts of climate change and on appropriate allowances for sea-level rises, increased river flood flows etc., in relation to flood risk management, are provided on the OPW website (<http://www.opw.ie>). To take account of climate change, new development for uses vulnerable to the effect of flooding needs to be located whenever possible, away from high-risk areas vulnerable to flood events.
- 2.32 The development planning process can be used in Ireland to plan and design for climate change. It is critical that the likely effects of climate change are taken into account in flood risk assessment. Because there remains a great deal of uncertainty, a precautionary approach should be adopted. It is important that:
- The levels of structures designed to protect against flooding, such as flood defences, land-raising or raised floor levels are sufficient to cope with the effects of climate change over the lifetime of the development they are designed to protect, or
 - Structures to protect against flooding and the development protected should be capable of adaptation to the effects of climate change when there is more certainty about the effects and still time for such adaptation to be effective.

Flood risk management

- 2.33 Flood risk management aims to minimise the risks arising from flooding to people, property and the environment. This can be achieved through structural measures that block or restrict the pathways of floodwaters, such as river or coastal defences, or non-structural measures that are often aimed at reducing the vulnerability of people and communities, such as flood warning, effective flood emergency response, or resilience measures (e.g. public preparedness for flood events - see <http://www.flooding.ie>) for communities or individual properties.
- 2.34 Catchment-based Flood Risk Management Plans (FRMPs) are currently being developed by OPW in partnership with local authorities, the EPA, the Department of Agriculture, Fisheries and Food, and other relevant Departments, in accordance with national flood policy and the EU 'Floods' Directive referred to earlier, and these will provide the focal point and strategic direction for flood risk management in Ireland. These Plans, which will be co-ordinated

with the Water Framework Directive (WFD) River Basin Management Plans (RBMPs), will establish a prioritised set of flood risk management measures for their relevant areas, including the use of structural and non-structural responses as outlined above.

- 2.35 Planning can have a significant role to play with respect to flood risk management, in particular in avoiding or minimising future increases in flood risk. The planning process therefore constitutes a parallel, but related and inter-dependent, process to that of flood risk management. As such, the two processes should each have regard to the objectives, direction and constraints of the other to ensure alignment between planning instruments, such as Development Plans and the Flood Risk Management Plans (FRMPs).
- 2.36 A major function performed by the floodplain and wetlands is to hold excess water until it can be released slowly back into a river system or seep into the ground as a storm subsides. Floodplains have, therefore, a valuable function both in attenuating or storing floodwater and through their ability to convey floodwater in a relatively controlled and safe way. Areas of floodplain and wetlands should, therefore, be recognised and preserved to the extent possible as natural defences against flood risk. It is important to identify and, where possible, safeguard areas of floodplain against development in both urban and rural areas. By retaining open spaces for storage and conveyance of floodwater, flood risk to both upstream and downstream areas can be more effectively managed without reliance on flood defences. This is an important element of the now internationally accepted philosophy of “leaving space for water”.

Sustainable drainage systems

- 2.37 Development of previously ‘green’, or permeable, land within an urban area (such as gardens) increases the impermeable area. Rain falling on impervious surfaces is usually directed into receiving watercourse through surface water drainage systems. Although such drainage systems are effective at transferring surface water quickly, they provide only limited attenuation causing the volume of water in the receiving watercourse to increase more rapidly and increasing flood risk. As a consequence sustainable drainage systems (SuDS) can play a role in reducing and managing run-off to surface water drainage systems. In this context the Department is currently reviewing its document “Recommendations for Site development Works for Housing Areas” which traditionally was used to provide guidance on design standards for smaller drainage systems. The aim of this review is to set out best practice in regard to the use of sustainable drainage systems in respect of surface water drainage.
- 2.38 A small-scale yet practical example of a sustainable drainage system (SuDS) is the use of permeable pavements which can help to reduce run-off rates and flow volumes from parking areas as well as access roads. Permeable pavements allow rain-water to infiltrate through the paved surface and into underlying layers and sometimes storage containers allowing gradual release of water

after periods of heavy rainfall. Permeable pavement techniques include the use of porous tarmac or solid block pavers with gaps to provide through flow of water.



Photo 3: Detention Basin, Carrickmines - an example of an application of sustainable drainage systems

- 2.39 With regard to the increasingly frequent trend of paving over entire residential garden areas to provide off street car parking or hard landscaping under the exempted development provisions of the planning acts, the Department intends to review the Exempted Development Regulations to ensure that only those complying with sustainable drainage principles will be exempted thus limiting the run-off which would otherwise contribute to overwhelming the drainage systems

In the interim, in considering planning applications for new or extensions to residential development, which include significant hard surfacing, planning authorities should attach conditions to any grants of planning permissions which minimises and limits the extent of hard surfacing and paving as well as requiring the use of sustainable drainage techniques, including in particular permeable paving or surfaces such as gravel or slate chippings.

Chapter 3: Principles and Key Mechanisms

- The key principles of a risk-based sequential approach to managing flood hazard and potential risk in the planning system are based on a sequential approach and are set out in this chapter. They are:
 1. **Avoid** development in areas at risk of flooding;
 2. If this is not possible, consider **substituting** a land use that is less vulnerable to flooding.
 3. Only when both avoidance and substitution cannot take place should consideration be given to **mitigation and management of risks**.
- Inappropriate types of development that would create unacceptable risks from flooding should not be planned for or permitted.
- **Exceptions** to the restriction of development due to potential flood risks are provided for through the use of the Justification Test, where the planning need and the sustainable management of flood risk to an acceptable level can be demonstrated.

Planning principles

- 3.1 The approach to the integration of flood risk assessment and management in the planning process set out in these guidelines entails the application of a number of core principles. These principles are derived from experience of flood issues in Ireland and from international best practice and perspectives. They should inform and underpin planning policy and guidance at all levels in the planning process.
- 3.2 The principle actions when considering flood risk management in the planning system are:
 - I. Flood hazard and potential risk should be identified and considered at the earliest stage in the planning process. A hierarchy of national, regional, local and site-specific assessment of flood risk will enable a proportionate response to the consideration of flood risk.
 - II. Development should preferentially be located in areas with little or no flood hazard, thereby avoiding or minimising the risk. Development in the context of these Guidelines includes all construction, such as transport and utility infrastructure as well as residential and other buildings.
 - III. Development should only be permitted in areas at risk of flooding, when there are no alternative, reasonable sites available in areas at lower risk

that also meet the objectives of proper planning and sustainable development.

- IV. Where, for wider reasons of sustainability, development has to be located in areas at risk of flooding, an appropriate land use should be selected.
- V. The risks to development in flood-prone areas should be managed to ensure that development is not subject to unacceptable risks.
- VI. A precautionary approach should be applied, where necessary, to reflect uncertainties in the flooding datasets and risk assessment techniques, and the ability to predict the future climate and performance of existing flood defences. Development should be designed with careful consideration of possible future changes in flood risk, including the effects of climate change and / or coastal erosion so that future occupants are not subject to unacceptable risks.
- VII. Decisions on the location of development may be required before development plans have been reviewed with the benefit of this guidance or prior to the availability of flood maps. Pending a full review of development plans in compliance with these guidelines, it would be premature to make any decision to zone land or grant permission for development where flooding is a significant issue, based on previous history, without a rigorous assessment of flood risk in accordance with these guidelines and application of the Justification Test.
- VIII. Land required for current and future flood management, e.g. conveyance and storage of flood water and flood protection schemes, should be pro-actively identified on development plan and LAP maps and safeguarded from development.
- IX. Flood risk to, and arising from, new development should be managed through location, layout and design incorporating sustainable drainage systems (e.g. SuDS).
- X. Strategic environmental assessment (SEA) of Regional Planning Guidelines, development plans and local area plans should include flood risk as one of the key environmental criteria against which such plans are assessed where flood risk has been identified. The SEA process provides an opportunity to assess and consider flood risk with respect to other planning and environmental considerations and should be used to show how the sequential approach to managing flood risks has been executed.
- XI. It is intended to update the Planning Guidelines on SEA to reflect the need for flooding to be identified, assessed and managed in the preparation of SEA for development plans.

- 3.3 The sequential approach for taking account of flood risk is detailed in section 3.4 below and a “Justification Test” for the exceptional cases, is detailed in section 3.9.



Photo 4: Limerick, indicating the relationship between the City and the River Shannon and its estuary

Sequential approach

- 3.4 The aim of the sequential approach is to guide development away from areas at risk from flooding. Sequential approaches are already established and working effectively in other areas in the plan-making and development management processes (e.g. retail planning). A sequential approach is of particular importance at the plan-making stage and in allocating land for development by focussing development possibilities in areas at lower risk of flooding through good spatial planning. The approach is, however, also applicable in the lay-out and design of development within a specific site.
- 3.5 The sequential approach makes use of flood zones (see Box 3.1 below) for river and coastal flooding, ignoring the presence of flood protection structures, and classifications of vulnerability of property to flooding as described in the Glossary of Terms. It is reiterated here that the flood zones will typically be based only on river and coastal flood inundation extents, and the risk potentially arising from other sources of flooding should be considered in all areas and at all stages of the planning process.
- 3.6 In summary, the planning implications for each of the flood zones are:
- **Zone A - High probability of flooding.** This zone defines areas with the highest risk of flooding from rivers (i.e. more than 1% probability or more than 1 in 100) and the coast (i.e. more than 0.5% probability or

more than 1 in 200). Development in this zone should be avoided and/or only considered in exceptional circumstances (through the Justification Test) if adequate land or sites are not available in Zones B or C below. Most types of development would be considered inappropriate in this zone. Only water-compatible development, such as docks and marinas, dockside activities that require a waterside location, amenity open space, outdoor sports and recreation and essential transport infrastructure that cannot be located elsewhere, would be considered appropriate in this zone.

- Zone B - Moderate probability of flooding.** This zone defines areas with a moderate risk of flooding from rivers (i.e. 0.1% to 1% probability or between 1 in 100 and 1 in 1000) and the coast (i.e. 0.1% to 0.5% probability or between 1 in 200 and 1 in 1000). Development should only be considered in this zone if adequate land or sites are not available in Zone C or if development in this zone would pass the Justification Test. Highly vulnerable development, such as hospitals, residential care homes, Garda, fire and ambulance stations, dwelling houses and primary strategic transport and utilities infrastructure, would be considered inappropriate in this zone. Less vulnerable development, such as retail, commercial and industrial uses, sites used for short-let for caravans and camping and secondary strategic transport and utilities infrastructure, and water-compatible development might be considered appropriate in this zone.
- Zone C - Low probability of flooding.** This zone defines areas with a low risk of flooding from rivers and the coast (i.e. less than 0.1% probability or less than 1 in 1000). Development in this zone is appropriate from a flooding perspective (subject to assessment of flood hazard from sources other than rivers and the coast) but would need to meet the normal range of other proper planning and sustainable development considerations.

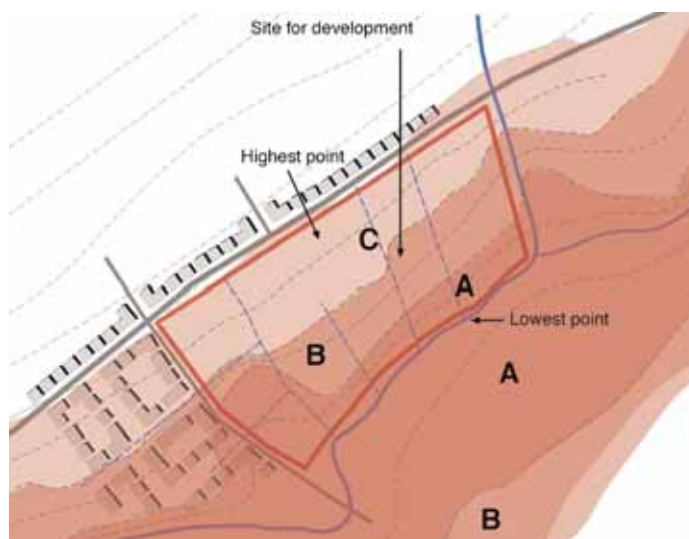


Fig. 3: Flood Zone Risk Mapping
(see practical application of this in Appendix B)

- 3.7 Further detail on the flood zones and the vulnerability of development types is contained in the Glossary of Terms.
- 3.8 The key elements of the sequential approach are shown in Box 3.1, for the purposes of this guidance. The initial identification of flood risk in the application of the sequential approach should be based on the main risks i.e. from the rivers and coast. It should be noted, however, that flooding from sources other than rivers and the coast could increase the probability of flooding in any zone and therefore needs to be considered as part of the flood risk assessment (refer to Appendix A).

Box 3.1 - Key elements of the sequential approach

1. Development should be directed towards areas of low flood probability (Zone C) and, if no sites are available in such areas, development should only be considered in areas of moderate flooding probability (Zone B) and so on.
2. Development vulnerable to flooding should not be permitted in areas at high or moderate probability of flooding (i.e. Zones A and B), unless demonstrated to be necessary on grounds of wider sustainability through the Justification Test.
3. Further sequentially-based decision-making should be applied when undertaking the Justification Test for development that needs to be in flood risk areas for reasons of proper planning and sustainable development:
 - i. Within the zone or site, development should be directed to areas of lower flood probability or hazard and the lowest vulnerability land use zoned or proposed.
 - ii. Where the impact of the development on adjacent lands is considered unacceptable the justification of the proposal or zone should be reviewed.
 - iii. Where the impacts are acceptable or manageable, appropriate mitigation measures within the site and if necessary elsewhere should be considered.

Justification Test

- 3.9 The overall aim of these guidelines is to ensure that development, particularly green-field development, is first and foremost directed towards land that is at low risk of flooding. It is recognised that the existing urban structure of the country contains several cities and towns, parts of which may be at risk of flooding and which have been targeted for growth in the National Development Plan, the National Spatial Strategy, Regional Planning Guidelines and the various City and County Development Plans. These plans have identified various strategically located urban centres and particularly city and town centre areas whose continued growth and development is being encouraged in order to bring about compact and sustainable urban development and more balanced regional development. Furthermore, Development Plan Guidelines, issued by the Minister for the Environment, Heritage and Local

Government under Section 28 of the Planning and Development Act 2000, have underlined the importance of compact and sequential development of urban areas with a focus on town and city centre locations for major retailing and higher residential densities.

Box 3.2 - Justification Test

Where a planning authority is considering the future development of areas at a high or moderate probability of flooding that would include types of development that are inappropriate under the screening process set out in paragraphs 3.6 and 3.7, either in a development plan or development management context, the planning authority must be satisfied that the development is necessary on the basis of all of the following criteria:

PART 1

1. The area is within or adjoining the centre* of a city or town designated for growth in key policy documents such as the National Development Plan, the National Spatial Strategy, any Regional Planning Guidelines in force, planning guidelines/directives under Sections 28/29 of the Planning and Development Act 2000 and/or an operative City/County development plan which has been adopted taking adequate account of these guidelines.
2. The area comprises significant previously developed and/or underutilised lands within the urban envelope.
3. Development of the area is essential to facilitate regeneration or town and city centre expansion, as demonstrated in city and county development plans that have been assessed in accordance with these guidelines.
4. Strategic Environmental Assessment has been undertaken, where applicable, taking full account of flood risk.
5. There are no reasonable and available alternative development areas or sites that meet the wider strategic policy requirements as outlined at 1 above, within low or lower flood probability areas.

* See Glossary for definitions of “town centre” and “edge of town centre”.

PART 2

If the requirements of Part 1 are satisfied, then the following additional detailed criterion should also be met.

The development has been the subject of a sufficiently detailed flood risk assessment, as appropriate to the nature and scale of the development, and the potential risk that may arise, which demonstrates that:

- (a) the development will not increase flood risk elsewhere and, if possible, will reduce overall flood risk;
- (b) the development proposal includes measures to minimise flood risk to people, property and the economy and the environment as far as reasonably possible and to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures.

(See Appendix A)

Note: In the event that land is zoned without the benefit of these guidelines, please refer to Para 5.23.

- 3.10 It is clear that a balance needs to be achieved between accommodating appropriate growth as outlined above and the avoidance of flood risk. The Justification Test has been designed to rigorously assess the appropriateness or otherwise of particular developments that, for the reasons outlined above, are being considered in areas of moderate or higher flood risk.
- 3.11 Development that is inappropriate under the screening process set out in section 3.6 and that does not meet the criteria of the Justification Test should not be considered at development plan stage nor through the development management process.

How does the Justification Test work?

- 3.12 The application of the Justification Test within the sequential approach essentially requires the justification of development in existing urban areas as outlined above, where expansion or consolidation in flood risk areas is being considered. The development must be consistent with the proper planning and sustainable development of an area and must demonstrate that it will not be subject to an unacceptable level of flood risk. The operation of the Justification Test is a key step within the sequential approach and is applied to test both zoning decisions and development applications. It should be noted that detailed studies to support Part 2 of the Justification Test should only be commissioned, after the criteria under Part 1 have been met (See Appendix A, Section 2).

Development in defended areas

- 3.13 A defended area is a location that benefits from an existing flood relief scheme or flood defences that reduce the probability of flooding of the location. Land behind such defences can be particularly vulnerable due to the speed of flooding when overtopping or a breach or other failure occurs. **It is important to note that a residual risk of flooding remains to such defended locations and thus the sequential approach and the Justification Test apply to these areas.** The range of residual risks is described in Appendix A and B. The presence of defences can also increase the probability of flooding from causes other than river and coastal flooding, e.g. by preventing the discharge of overland flow or sewer flooding due to intense rainfall events, which are likely to become more frequent as a result of climate change.
- 3.14 Given this residual risk, planning authorities should apply the Justification Test in each and every case, when considering development vulnerable to flooding in areas that benefit from such flood defences or relief schemes. If the development, including infrastructure, passes Part 1 of the Justification Test, the development of residual flood risk management strategies and measures (refer to Appendix B) can factor in the presence of flood defences and their effectiveness during a flood event.

Flooding and Strategic Environmental Assessment

- 3.15 The Planning Guidelines for Strategic Environmental Assessment (SEA) (DEHLG, 2004) outline an integrated process for SEA and plan-making. SEA is required to be undertaken for Regional Planning Guidelines, development plans and variations, many local area plans and SDZ planning schemes.
- 3.16 The SEA process provides a good practice framework for scoping and considering a range of planning and environmental issues, including flooding in the plan making process. The flood risk assessment should be integrated with this process where a full environmental report is required. This flood risk assessment should be undertaken as early as possible in the process so that the SEA is fully informed of the flood risks and impacts of the proposed zoning or development (See Appendix A).

Important elements of the process and report include:

- scoping, which should identify likely and significant flooding issues;
- consideration of flooding as one of the environmental criteria for the area, if appropriate;
- evaluation of strategic alternatives against the environmental criteria;

- detail on the likely significant effects of the plan on flooding in the plan area;
- aspects of mitigation and management for flooding; and
- monitoring measures for flooding.

- 3.17 SEAs are not mandatory for certain LAPs below a certain scale and non-statutory plans. However, a screening process is required for most LAPs and this should identify any significant flooding issue. The SEA process is triggered where the plan is likely to have a significant effect on the environment regardless of thresholds. While non-statutory plans and studies have an important role to play in promoting integrated and sustainable development, they are not an appropriate means of strategic area planning where flood risk is a significant issue.
- 3.18 In relation to development management, Environmental Impact Assessments (EIA) are required for certain types of development which exceed defined thresholds and for other types and below-threshold developments by reason of likely significant impacts on the environment. For further information, see also sections 5.16 to 5.18.
- 3.19 As indicated in the Department's Circular Letter SEA 1/08 & NPWS 1/08, appropriate assessments are required for plans and programmes potentially affecting Natura 2000 sites under the EU Birds and Habitats Directives. These assessments provide a structured process within which the flood risk assessment can sit. Important aspects of the processes are outlined in more detail in Chapter 4.

Chapter 4: Flooding and Spatial Planning

- Flood risk management should be integrated into spatial planning policies at all levels to enhance certainty and clarity in the overall planning process.
- Screening for flood risk and any further stage of flood risk assessment required are the key steps for Regional Planning Guidelines and development plans and in some cases, local area plans. This should be undertaken as early as possible.
- The existing Strategic Environmental Assessment (SEA) process for plans should be harnessed as a mechanism with which the process of screening for flood risk and any further flood risk assessment, should be aligned.
- Future Regional Planning Guidelines should address flood risk by carrying out screening and scoping flood risk assessments at a strategic level.
- Development Plans should address flood risk by having screening, scoping and appropriate flood risk assessments in place by the time decisions are made about draft development plans and any subsequent amendments.
- The application of the sequential approach and, in some exceptional cases, the Justification Test should be used by planning authorities in successfully incorporating flood risk into the decision-making process on development plans.

Flooding and the National Spatial Strategy

- 4.1 National planning policy supports the consideration of flood risk management as an important part of achieving proper planning and sustainable development. The National Spatial Strategy (NSS) sets out a framework within which a more balanced and sustainable pattern of development can be achieved. Spatial planning at regional and local levels is an essential part of the overall implementation mechanisms for the NSS and planning at these levels should address the suitability of locations for development including considerations relating to flood risk.

Flooding and Regional Planning Guidelines

- 4.2 Regional Planning Guidelines (RPGs) are essential in translating the overall national approach of the NSS to the regional authority level, providing a framework for greater co-ordination of local authorities and their development plans. RPGs were adopted in 2004 and are statutorily reviewed every 6 years. Therefore, the next round of RPGs will need to take account of these guidelines in addressing the issue of flood risk and should:

- Incorporate a **strategic level flood risk assessment**, ideally integrated into the existing SEA process that will now apply to the preparation of future Regional Planning Guidelines;
- Identify **strategic flood risk and spatial planning issues** for the area covered by the RPGs;
- Set out a **policy framework for development plans and local area plans** of planning authorities to address the flood risk issues arising at a regional level; and
- Outline, with due consideration of the national flood risk assessment and management planning programme, any **further requirements for flood risk assessments and/or studies**.

4.3 Regional authorities should work closely with other agencies, such as the OPW, DAFF, DEHLG, local authorities and other agencies, in addressing the spatial planning implications of flooding at the regional level.

Regional level flood risk assessment and SEA

4.4 Flood risk assessment within the RPG process should be strategic in nature (i.e. bearing in mind that more detailed assessments will be carried out when development plans and LAPs are being prepared) and ideally should be an integral part of the SEA process. It will generally comprise the screening and scoping stages outlined in paragraph 2.21 and Appendix A. The Department of the Environment, Heritage and Local Government will, in the context of the next round of RPGs, give advice to regional authorities in undertaking strategic level flood risk assessment.

4.5 Screening and scoping of the SEA will normally include flooding as one of the many environmental issues for the region, drawing upon existing published sources of information such as those identified in Appendix A. At a regional level, the screening exercise should provide sufficient information to scope any further strategic flood risk assessment, if required, and any necessary spatial policies on flood risk. Information on how these differing levels of flood risk assessments are undertaken and relevant sources of information are contained in Appendix A.

Principles for the region

4.6 Having prepared a screening assessment and, if necessary, a strategic flood risk assessment, RPGs should then identify broad development principles and objectives for the region to deal with any flood issues arising from the assessment/s. Planning authorities will then have to ensure that their development plans are consistent with RPG principles and objectives.

Co-ordination of development plans

4.7 Given the nature of flood risk, it is likely that more than one planning authority will be affected by, for example, coastal or river flooding affecting an extensive

floodplain. Effective co-ordination and consistency between the development plans and local area plans of planning authorities will be essential in achieving the overall objectives of the RPGs and in turn, the NSS. RPGs should also identify opportunities where adjoining planning authorities can and should work together to prepare such further joint studies as might be necessary to address the issue of flood risk at a more detailed level to inform their preparation of spatial plans.

Flood risk and the development plan

- 4.8 The development plan plays a central role in the statutory planning process. Development plans provide an integrated and balanced framework for achieving proper planning and sustainable development at the city and county level and are the basis upon which development management decisions are based. The importance of including robust flood risk policies in the development plan cannot be overstated. The development plan must also be informed by national planning policy such as these guidelines and Regional Planning Guidelines addressed above.
- 4.9 The Catchment-based Flood Risk Management Plans (FRMPs) to be produced under the EU 'Floods' Directive, will establish long-term strategies and programmes for managing flood risk within the relevant catchment. These may include identification of areas of floodplain importance for conveyance and natural storage and areas where flood risk management measures may need to be implemented. The preparation of development plans should have regard to FRMPs with respect to land use and future flood risk management measures.

Integrating flood risk management into development plan preparation¹

- 4.10 The general process for preparing the development plan is outlined in previous Planning Guidelines on Development Plans (DEHLG, 2007). Appendix E of those guidelines provided interim advice but has now been superseded by this document and the specific guidance herein. In ensuring that flood risk issues are properly integrated into the development plan preparation and adoption processes, planning authorities should:
- (i) **Implement the approaches set out in these guidelines**, especially in relation to decisions on the suitability of sites and areas for development;
 - (ii) **Carry out a screening exercise at the beginning of the development plan review process and in tandem with the SEA process** to determine whether or not a more detailed flood risk assessment (FRA) will be required, working with OPW, DAFF, DEHLG and making use of existing published sources of information; and

¹ See sections 4.27-4.28 for information regarding integrating flood risk management into LAPs.

- (iii) Where a more detailed flood risk assessment is required, ensure that ***the flood risk assessment, including the use of the sequential approach and any Justification Tests, is applied in identifying any lands for development through the zoning process***, when adopting draft development plans for public display, when deciding to modify draft development plans and in making development plans.

4.11 The OPW is a statutory consultee for development plans and is the lead agency for implementing flood risk management policy in Ireland. As such, planning authorities should have particular regard to observations made by the OPW on flood-related matters.

Getting the draft plan right

4.12 Taking account of the points raised above, planning authorities should make adequate provision in their programming of work to support the necessary screening and flood risk assessment work in the early stages of preparing draft development plans. The aim should be to ensure that the elected members have the information with regard to flood risk assessment, the application of the sequential approach and, if necessary, the Justification Test in coming to decisions about the draft development plan and all subsequent stages. More detailed information about how to go about a screening exercise and what is involved in carrying out a flood risk assessment is contained in Appendix A.

Flood risk assessment and SEA

- 4.13 The SEA process addresses any effects from development plans on the environment and their amelioration, through all stages of the plan-making process. Screening exercises to identify whether full flood risk assessment is required should ideally be carried out in a manner that is integrated with the SEA process rather than constituting another and separate process. Any subsequent stages of flood risk assessment should also be carried out in a way that is integrated with the SEA process. Within the process of preparing the draft development plan, the draft SEA environmental report will consider the environmental effects of the draft plan against environmental criteria for the plan area, including mitigation measures and future monitoring of effects.
- 4.14 As with SEA, it will be important to knit flood risk assessment into the development plan structure, and provide a coherent and transparent approach as to how it has been considered in making spatial planning decisions.
- 4.15 A summary of the likely effects of the plan on the environment, including flooding, will be addressed in the SEA process and summarised in the environmental report element of the overall development plan. The SEA of the plan should have regard to the SEA of the FRMP covering the area of the plan.

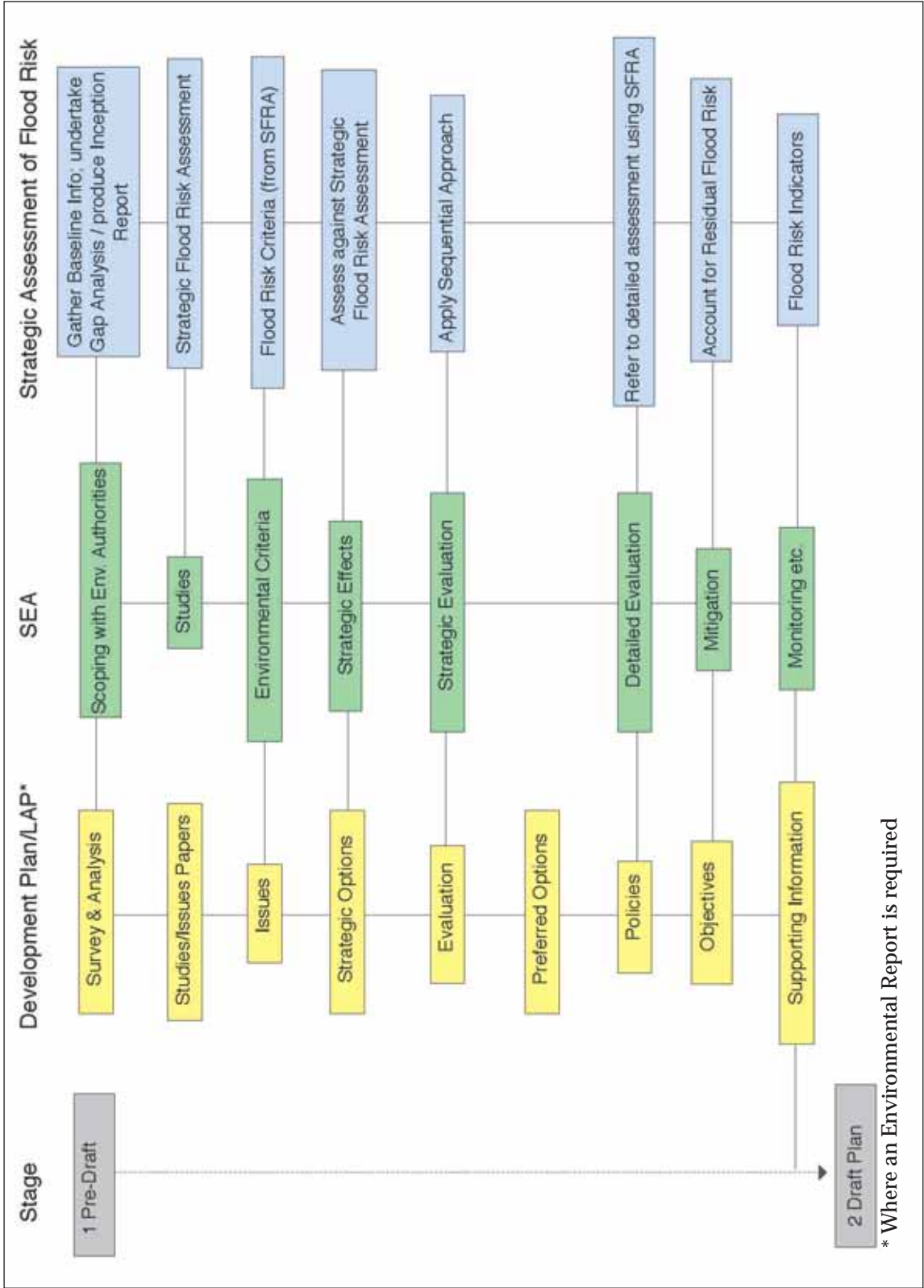


Fig. 4: Development Plan Preparation where flood risk is scoped as an issue

- 4.16 The sequential approach outlined in the previous chapter is to be applied at all levels of plan making. In exceptional circumstances, where it is intended to zone land in a flood risk area for development, which includes types of development that would be inappropriate as defined herein, this decision, and the basis on which it is made, needs to be supported using the Justification Test and the SEA.

Incorporating flooding into the development plan strategy

- 4.17 Development plans should draw upon national and regional level policies relating to flooding in setting out high-level policies and objectives, including any cross-boundary issues identified from the screening stage.
- 4.18 The nature of the plan area and the level of flood risk will determine whether or not flooding will influence the core strategy of the plan. Where it is significant, it should influence the overall spatial strategy such as where to locate new housing, commercial and other developments.

Policies relating to flooding

- 4.19 More detailed flood-related policies and objectives of development plans should give effect to the overall strategic context for, and outlook of, the plan. Development plans should therefore be internally consistent and informed by the sequential approach and methodology outlined in the previous chapter of these guidelines and any principles or matters identified in RPGs.
- 4.20 The plan should be pro-active by including, for example, general policies needed for protecting, improving or restoring floodplains or the coastal margins. Planning authorities should consider whether there are areas where a flood risk management function can be restored through appropriate actions, such as managed re-alignment of existing coastal defences or river restoration projects and provision of flood storage. As well as restoring the flood risk management function, these may provide opportunities to introduce green/open space within congested urban areas, with consequent benefits to amenity and biodiversity as well as helping to reduce the future impact of climate change.

Objectives for flood risk management

- 4.21 Objectives for flood risk management should be based on the broader plan policies but should be more detailed and place-specific in nature. They should have regard to the relevant flood risk management plans that cover the development plan area. Development plan objectives may:
- Identify zones of flood hazard and ensure application of the sequential approach in a transparent manner;
 - Identify areas such as floodplains which are to be protected for reasons of flood risk management and/or related functions such as biodiversity protection;

- Include zoning objectives to preserve riparian strips free of development and of adequate width to permit access for river maintenance;
- Include zoning objectives for different types of development having regard to flood risk stressing the hierarchy of avoidance, followed where necessary by substitution then, as a last resort, by mitigation;
- Incorporate development management guidelines to provide more detailed assessment frameworks for planning applications where flooding is or may be an issue, including highlighting the need for assessment of types of flooding other than river and coastal flooding and of the impacts of run-off from development. This could take the form of a short checklist or specific control standards;
- Require detailed and rigorous Justification Tests based on these guidelines, where more vulnerable development is being considered in flood risk zones; and
- Specify types of use or development and their vulnerability which relate to flood-hazard parameters such as depth and velocity.

4.22 Where development in areas at risk of flooding is proposed in a development plan for broader proper planning and sustainable development, that type of development must still be considered on merit and on a case-by-case basis through the development management process. The plan should include objectives which:

- set out design and development objectives that seek to avoid flood risk to people and property, where possible;
- seek to manage the risks to acceptable levels through the use of flood relief schemes, and/or flood-resistant and flood-resilient construction methods, where avoidance is not possible; and/or
- outline other important design standards and requirements such as sustainable drainage systems and other design features (outlined in Appendix B).

4.23 In addition, the development plan may outline specific objectives such as actions to be carried out in the plan area relating to flood risk management or infrastructure. These actions may be the responsibility of the planning authority or may be required of other parties such as developers, to facilitate development or to protect existing development. Specific objectives may also include further studies or plans to be prepared relating to flood risk management.

Flood risk and objectives for zoning of land for development

4.24 The zoning of land for development is the critical stage for planning authorities to address the issue of flooding. As emphasised above, information on the screening and flood risk assessment should be ready and available to the elected members to assist them in arriving at decisions about where development will be located and how it will be constructed and used over its life-time. These guidelines require planning authorities to establish a clear evidence base in showing how the sequential and hierarchical approach to avoidance, substitution and mitigation of development in flood risk areas has been applied in the decision-making stages of plan preparation and adoption.

What to do with existing undeveloped, zoned areas at risk of flooding

4.25 Information about flooding and flood risk is improving and will improve further as a result of national exercises undertaken by OPW and others, and implementation of these guidelines. Future flood risk assessments required to support the development plan process may highlight existing, undeveloped areas which, on their own merits, were zoned for development in previous development plans but which new information indicates may now, or in the future, be at risk of flooding.

4.26 In such cases as set out above, planning authorities should reconsider the zoning objective for any such lands where flood risk is assessed to be potentially significant and likely to increase in the future. This should be done as part of the overall plan preparation and on the basis of the proper planning and sustainable development of the area, giving appropriate weight to flood risk considerations. Following this reconsideration, local authorities may decide to:

- remove the existing zoning for all types of development on the basis of the unacceptable high level of flood risk;
- replace the existing zoning with a zoning or a specific objective for less vulnerable uses;
- require preparation of a detailed local area plan, informed by a more detailed flood risk assessment to address zoning and development issues in more detail and prior to any development;
- reduce the zoned area and change or add zoning categories to reflect the flood risk; and/or
- specify, in exceptional circumstances and where the criteria of the Justification Test have been met, design of structural or non-structural flood risk management measures as pre-requisites to development in

specific areas, ensuring that flood hazard and risk to other locations will not be increased or, if possible, will be reduced.

Local Area Plans

- 4.27 The preparation of a development plan in accordance with these guidelines should identify the key flooding issues that need to be addressed from a local spatial planning perspective. In other words, the context for subsequent local area plans (LAPs) should be clear. The local area plan is now an important part of the planning process allowing for more detailed and area-based planning. Many LAPs are equivalent in size to smaller development plans and will follow the methodology outlined above for development plans. In other cases, planning authorities should use their discretion in addressing flood risk in a manner more appropriate to small-scale LAPs.
- 4.28 In any event, SEA is mandatory for LAPs covering towns with a population of 10,000 or more. LAPs below this threshold should also be subject to SEA screening, which should highlight any local flooding issues. The flood risk assessment used to inform the development plan should identify the scale and extent of any potential larger flood risk issues. Informal, non-statutory local plans should not be used in areas of significant flood hazard.



Photo 5: Letterkenny, illustrating the relationship between the Gateway town, the River Swilly and its estuary

Chapter 5: Flooding and Development Management

- Development management should follow the sequential approach in aiming to avoid development in areas at risk of flooding.
- Applicants may need to submit an appropriate flood risk assessment with the application and planning authorities should take this fully into account in determining an application.
- Only where development within flood risk areas, that would be defined as inappropriate under the screening process set out in paragraphs 3.6 and 3.7, is considered to be necessary to meet the objectives of proper planning and sustainable development, and no alternative sites of lower risk are available for the development, should that development be subject to the Justification Test.
- Many of the flood risk issues should have been raised within strategic assessments undertaken by local authorities at the plan-making stage. Therefore, as more plans are reviewed and zoning reconsidered, there will be less need for development management to consider the wider application of the sequential approach.
- Pending the introduction of development plans consistent with these guidelines, planning authorities should follow the advice of section 5.24.
- When development plans are consistent with these guidelines, a greater focus will then be directed towards siting and design issues that minimise flood risk to the development, manage residual risks to an acceptable level and avoid adverse impacts elsewhere. Where a strategic flood risk assessment has not been completed, there is potential for planning applications submitted through the development management process to be considered as premature.

The role of good development management

- 5.1 These guidelines aim to achieve best practice in dealing with flooding in development management. Development management for flooding should be based on sound strategy, policies and objectives within the development plan and LAP where appropriate, which set out the basis for considering planning applications in principle and in detail. Efficient processes and communications will be required to ensure full consideration of flooding. Where the development plan or LAP has been adopted before publication of these guidelines and is yet to be reviewed in their light, planning authorities

should use the flood risk information available to identify the flood zones within their area. They should then ensure that planning applicants submit any necessary flood risk assessment so that flood risk issues can be taken into account in accordance with these guidelines.

- 5.2 Where flood risk may be an issue for any proposed development, a flood risk assessment should be carried out that is appropriate to the scale and nature of the development and the risks arising. The flood risk assessment should be sufficiently detailed to quantify the risks and the effects of any necessary mitigation, together with the measures needed to manage residual risks. Information on flood risk assessments and the sources of information are contained in Appendix A.



Photo 6: Habitable floor levels above flood and first floor levels

Stages of development management

- 5.3 In essence, the 2007 DEHLG Development Management Guidelines identify 5 stages in the development management process as follows:

- Pre-application,
- Lodgement of application,
- Processing of application,
- Deciding the application, and
- Appeals.

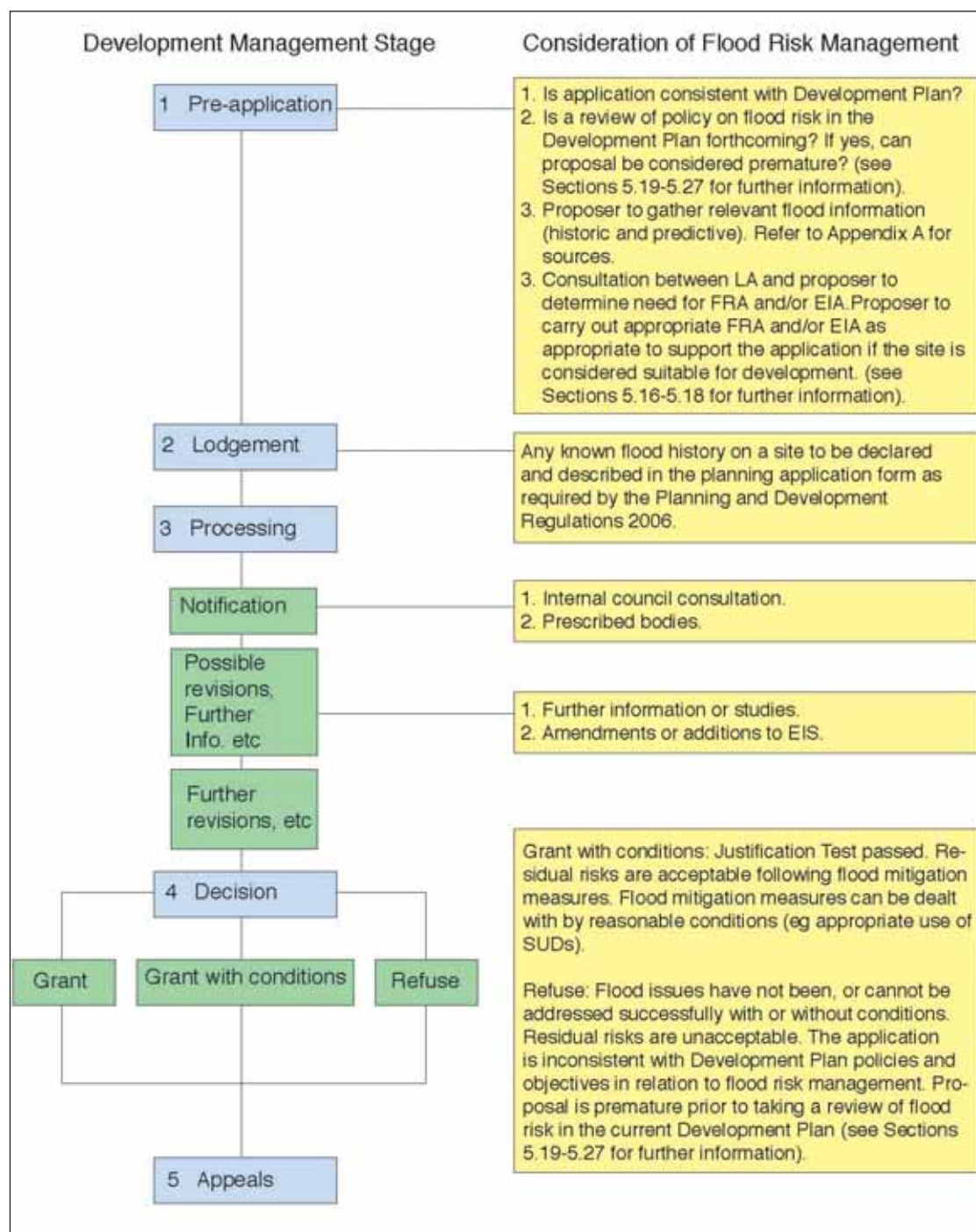


Fig. 5: Consideration of flood risk in the Development Management Process

Pre-application and screening for flood risk

- 5.4 The pre-application stage is critical to the consideration of flood risk in the planning application. It is the responsibility of the applicant at this stage to gather relevant information to screen for flood risk, including that which may arise from sources other than rivers or coastal, and planning authorities should ensure that applicants are aware of any flood risk issues and of the need for them to submit an appropriate flood risk assessment.
- 5.5 Pre-application discussions will be particularly important in identifying the broad range of issues affecting a site and present an opportunity for the

planning authority to ensure that the necessary flood risk screening information or more detailed flood risk assessment is presented for consideration.

- 5.6 Where flood issues are present, the planning authority should highlight the policies and objectives of the development plan in relation to flood risk and, if available information on flood zones.
- 5.7 Ideally, at this preliminary stage, proposals should show the location, broad nature and extent of a proposed development including, where appropriate, the provision of adequate development-free, riparian strips for river maintenance. Where flood risk is present an applicant, in preparing a development proposal, should be advised of the importance of addressing flood risk by adopting a sequential approach in terms of location of uses in areas of lower risk, the consideration of less vulnerable use types and other mitigation through design measures. Sustainable drainage should be integral to the design and formulation of proposals at this stage.

Lodgement

- 5.8 Any known flood history on or affecting the application site should be declared on the application form, as required by the Planning and Development Regulations 2006. An area with no history of flooding does not mean that it is not at risk from flooding. The application should be accompanied, where necessary, by an appropriate flood risk assessment. The need for a flood risk assessment should be identified at the pre-application stage from a flood risk screening assessment, using the available sources of information including those listed in Appendix A.
- 5.9 The flood risk assessment should be incorporated into the EIA process where one is required. The flood risk assessment should be approved/certified by a competent person, qualified and experienced in flood risk assessments (see Appendix A).

Processing

- 5.10 The planning regulations and the Development Management Guidelines (2007) set out in detail the appropriate procedures for processing an application. All applications with flood risk issues should be forwarded to the relevant technical sections of the planning authority for comment. Where these issues are complex in nature, the planning authority may wish to engage appropriate external advice.
- 5.11 In terms of flooding, it will be important to:
 - Notify prescribed bodies of the application, e.g. the fisheries board, if mitigation measures to banks are proposed; and
 - Assess the application, based on the full range of planning considerations.

Assessment of the application

5.12 Assessment of the application should be based principally on the policies and detailed objectives of the development plan, with flood risk considered along with the full range of planning considerations for the application. In assessing development proposals in areas at risk of flooding, planning authorities should adopt a risk-based sequential approach as outlined in Chapter 3 which gives priority to development in areas of lowest risk. Overall, a balanced approach is required which takes account of flood risk while at the same time allowing consideration of appropriate and necessary development. This is achieved through the use of the sequential approach based on flood zones and the two-part Justification Test;

- firstly, on the grounds of proper planning and sustainable development, and
- secondly, to ensure that flood risk to the development will be minimised as far as reasonably possible with residual risks managed to an acceptable level of risk, while avoiding adverse impacts elsewhere.

5.13 Development should not be permitted in flood risk areas except where there are no alternative and appropriate sites available in areas at lower risk that are consistent with the objectives of proper planning and sustainable development. Where such development has to take place, the risks should be mitigated and managed through the location, lay-out and design of the development to reduce them to an acceptable level. For example, the use of sustainable drainage systems can greatly reduce the frequency and impact of local flooding as well as improving water quality and providing amenity benefits. Flood-resistant and flood-resilient construction methods can reduce the impact of flooding when it does occur. More information on flood risk management by design is available in Appendix B. A precautionary approach should be taken to allow for uncertainties in data and risk assessment procedures and to enable adaptability to future changes in risk, including the effects of climate change.

5.14 Where new development in flood risk areas is proposed details of the flood risk, mitigation measures and residual risk should be supplied to the major emergency management committee (MEMC) of the relevant local authority for inclusion in their major emergency risk assessment.

5.15 Where the development plan has not been reviewed in the light of these guidelines, the planning authority should include in its consideration whether existing policies and objectives remain appropriate for developments proposed within areas at risk of flooding. Other important considerations include:

- other relevant planning policy on flooding at the local, national or regional level;

- these guidelines, and in particular the outcome of the Justification Test;
- the particular issues and characteristics of the site and merits of the proposal; and
- where flood risk is an issue and the proposal meets all the criteria of the Justification Test and any major mitigation works have been incorporated into the development proposal as submitted, conditions may still be necessary to deal with issues relating to the residual risks.



Photo 7: Mallow during flooding event in 2007
(courtesy of Gaelic Helicopters Ltd.)

Flood risk assessment and EIS

- 5.16 Development exceeding the specified thresholds for EIA will require the preparation of an EIS. Development below this threshold may also require the preparation of an EIS, should the proposal give rise to any likely significant environmental effects. The need for an EIS should be determined by the planning authority in consultation with the applicant.
- 5.17 It is important to note that flood risk may constitute a significant environmental effect of a development proposal. Indeed, flood risk alone may trigger a below-threshold EIS. Flood risk assessment should be an integral part of any EIA. Appropriate assessment must also be factored in for developments that potentially affects a site designated under Natura 2000.
- 5.18 Important aspects of the process include:
- Screening for flood issues at the initial stage;
 - Scoping of the flood issue;

- Identifying and detailing the likely significant effects of the development in terms of flooding;
- Considering alternative proposals and their impacts on flooding; and
- Outlining mitigation and monitoring measures for flooding.

Decision

5.19 Planning legislation allows for the framing of conditions to deal with flood risk and the refusal of permission for reasons of flood risk without attracting compensation. The Department's 2007 Development Management Guidelines (DEHLG, 2007) provide guidance on the appropriate nature and type of conditions.

5.20 Where flood risk is an issue, the planning authority may consider granting permission subject to conditions to ensure that Part 2 of the Justification Test is satisfied. Overall, conditions should deal with any residual risk and should be guided by the development management objectives set out in the development plan.

Only in very limited circumstances should conditions which require the provision of sustainable drainage systems, major alterations, structural work or significant relocation of development be attached to planning permissions. Ideally, all these matters should be adequately dealt with in the pre-application and processing stages such that any necessary work(s) are included as an integral part of the development proposal.

In most cases, conditions will be required to amend, clarify or further detail flood mitigation measures. These might include, for example, the removal of barriers or buildings on a water conveyancing route, the requirement for flood resistant street furniture and fittings, or, the requirement for detailed flood resistance or flood resilience measures for buildings. Conditions relating to maintenance may include, for example, the regular inspection, maintenance and repair of local or secondary flood defences such as earth bunds or elements of the sustainable drainage system such as swales, basins or ponds. Conditions relating to the ongoing monitoring of flood defences and overall flood risk may also be appropriate.

Where the risk to people is significant, an emergency plan should be prepared for all users of the site, together with the local authority. This should be updated on a regular basis.

5.21 Permission should be refused where flood issues have not been, or cannot be, addressed successfully. The presence of unacceptable residual flood risks to the development, its occupants and adjoining property alone should be sufficient reason for refusal of permission.

- 5.22 Where development proposals include the construction or amendment of bridges, culverts or similar structures the applicant should have regard to the requirements of S.50 of the Arterial Drainage Act, 1945.
- 5.23 It is recognised that flood map data sets, predictive models of flood risk and a strategic assessment of the flood risks across a county or city area may not have been undertaken at the time that a planning decision is required. This does not mean that the sequential approach should not be applied or that a Justification Test need not be undertaken. A precautionary approach should be applied, and either the application should be refused on grounds of prematurity or a flood risk assessment should be undertaken, and the Justification Test applied. A number of scenarios are considered below.

Major proposals in areas of flood risk currently zoned for development without use of the sequential approach

- 5.24 In these circumstances, planning authorities should ensure that an appropriate flood risk assessment is submitted by the applicant and should consider the application in the light of these guidelines as though the land was not zoned for development. This will allow application of the sequential approach and proper consideration of strategic issues. With the current presumption of development through the zoning of the area, a strategic flood risk assessment of the general environs to the development site should be undertaken and the Justification Test carried out. The planning justification would draw upon the rationale set out in the Guidelines. Where the information is not sufficient to fully assess the issues involved, it should be considered as premature prior to a review of flood risk in the current development plan for the area.

Major proposals in areas of flood risk not currently zoned for such development

- 5.25 Flood risk may arise as a significant issue for proposals for a comprehensive, large-scale regeneration or consolidation which was not considered or foreseen in the preparation or adoption of the development plan. Where a major development such as, for example, a town centre expansion or re-development of a dockland area is proposed which also presents significant flood risk issues, it should be considered as premature prior to undertaking a review of flood risk in the current development plan for the area. This will allow application of the sequential approach and proper consideration of strategic issues in a wider context to para 5.23 above and alternatives at the appropriate plan-making stage.

Minor proposals in areas of flood risk

- 5.26 Applications for minor development, such as small extensions to houses, and most changes of use of existing buildings, are unlikely to raise significant flooding issues, unless they introduce a significant additional number of people into flood risk areas or obstruct important flow paths. Since these

concern existing buildings, the sequential approach cannot be used to locate them in lower-risk areas. However, a brief assessment of the risks of flooding should accompany such applications to demonstrate that they would not have adverse impacts or impede access to a watercourse, floodplain or flood protection and management facilities.

Appeals

- 5.27 Should an appeal against a decision be made, An Bord Pleanála should have regard to these guidelines in the consideration and determination of the appeal.

Chapter 6: Conclusion

- 6.1 Under these guidelines, regional authorities and planning authorities have a key role to play in ensuring that an effective policy framework is put in place to ensure that new development is both located and provided in such a manner as to minimise the risk from flooding. Applicants for planning permission, their agents and developers also have a key role to play in working with the policy framework referred to above and in completing development in compliance with planning permissions granted.
- 6.2 The Government is undertaking significant work to enhance the level of detail and coverage of flood maps and other information on flood risks, primarily through the preparation of flood risk management plans and to support the development of the policy framework referred to above. However, in advance of the preparation of these maps and plans for any particular area, it is to be expected that planning authorities should screen for flood risk and, where necessary, undertake further stages of flood risk assessment at relevant stages of the planning and development management processes.
- 6.3 Assessment of flood risk should inform the on-going revision of development plans and local area plans. Planning applications submitted after the publication of these guidelines should be accompanied as appropriate by flood risk assessments, enabling their proper consideration by planning authorities and An Bord Pleanála with regard to flood risk, even though the spatial plan may not yet have been revised in the light of these guidelines.
- 6.4 Planning authorities must strike a fair balance between avoiding flood risk and facilitating necessary development, enabling future development to avoid areas of highest risk and ensuring that appropriate measures are taken to reduce flood risk to an acceptable level for those developments that have to take place, for reasons of proper planning and sustainable development, in areas at risk of flooding.
- 6.5 The Minister will monitor the on-going implementation of these guidelines to ensure that flood risk management is fully integrated into the planning process.

Glossary of Terms

Terms	Definition
Appropriate flood risk assessment	A methodology to assess flood risk issues in sufficient detail and to provide a quantitative appraisal of flood hazard and potential risk to an existing or proposed development, of its potential impact on flood elsewhere and of the effectiveness of any proposed measures.
Breach of defences	A structural failure at a flood defence allowing water to flow through.
Catchment	The area that is drained by a river or artificial drainage system.
Catchment Flood Risk Assessment and Management Studies (CFRAMS)	A catchment-based study involving an assessment of the risk (Flood Risk Management Plans, see FRMP below) of flooding in a catchment and the development of a strategy for managing that risk in order to reduce adverse effects on people, property and the environment.
Climate change	Long-term variations in global temperature and weather patterns, which occur both naturally and as a result of human activity, primarily through greenhouse gas emissions.
Coastal erosion	The gradual wearing away of the coastline through a combination of wave attack and, in the case of coastal cliffs, slope processes (e.g. high groundwater levels). This may include cliff instability, where coastal processes result in the periodic reactivation of landslide systems or promote rock falls.
Coastal flooding	Flooding from the sea which is caused by higher than normal sea levels and/or high waves resulting in the sea overflowing onto the land.
Consequence of flooding	Health, social, economic and environmental effects of flooding, some of which can be assessed in monetary terms, while other less tangible impacts are more difficult to quantify. Consequences depend on the hazards associated with the flooding and the vulnerability of receptors.
Conveyance function	When a river overflows its banks, it continues to flow over the flood plain, conveying water down-stream, as well as storing water where the flood plain may be obstructed and releasing it slowly.

Terms	Definition
Environmental Impact Assessment (EIA)	Pursuant to EU Directive 85/337/EEC (as amended in 1997), EIA is a legislative procedure used for identifying the environmental effects of development projects to be applied to the assessment of the environmental effects of certain public and private projects which are likely to have significant effects on the environment.
Estuarial flooding	Flooding from an estuary, where water level may be influenced by both river flows and tidal conditions, with the latter usually being dominant.
Flash Flood	A flash flood is a rapid flooding of an area of land as a result of intense or extreme rainfall events or failure of infrastructure designed to store or carry water or protect against flooding and is distinguished from general flooding by the sudden onset.
Flooding (or inundation)	Flooding is the overflowing of water onto land that is normally dry. It may be caused by overtopping or breach of banks or defences, inadequate or slow drainage of rainfall, underlying groundwater levels or blocked drains and sewers. It presents a risk only when people, human assets and ecosystems are present in the areas that floods.
Flood Relief Schemes (FRS)	A scheme designed to reduce the risk of flooding at a specific location.
Flood defence	A man-made structure (e.g. embankment, bund, sluice gate, reservoir or barrier) designed to prevent flooding of areas adjacent to the defence.
Flood-detention reservoirs	An embanked area designed to hold floodwater from areas upstream and release it slowly to reduce flooding downstream. Embankments may be constructed across the river or adjacent to the river, with flood flows being diverted into the reservoir area.
Flooding from artificial drainage systems	This occurs when flow entering a system, such as an urban storm water drainage system, exceeds its discharge capacity, becomes blocked or when the system cannot discharge due to a high water level in the receiving watercourse.
Flood hazard	The features of flooding which have harmful impacts on people, property or the environment (such as the depth of water, speed of flow, rate of onset, duration, water quality etc.).

Terms	Definition
Flood hazard assessment	An assessment of the hazards that would arise from flooding, e.g. identifying where flooding would occur, how deep the water would be, how fast it would flow, how rapidly would it rise and how long it would remain.
Floodplain	A floodplain is any low-lying area of land next to a river or stream, which is susceptible to partial or complete inundation by water during a flood event.
Flood Risk	An expression of the combination of the flood probability or likelihood and the magnitude of the potential consequences of the flood event.
Flood Risk Assessment (covers all scales of assessment)	A study to assess the risk of flooding under both present and potential future circumstances , such as changes in climate, land use, development or flood risk management.
Flood Risk Management (FRM)	FRM combines the function of mitigating and monitoring flood risks and may include pre-flood, flood-event or post-flood activities.
Flood Risk Management Plans (FRMP)	Plans which are developed in accordance with national flood policy and the EU Floods Directive and which provide the strategic direction for flood risk management decisions in a catchment. These will describe a range of techniques from traditional river or coastal defences to non-structural responses such as flood warning and resilience measures at property level.
Flood storage	The temporary storage of excess run-off or river flow in ponds, basins, reservoirs or on the flood plain.
Flood zones	A geographic area for which the probability of flooding from rivers, estuaries or the sea is within a particular range as defined within these guidelines.
Flooding Directive	The EU Directive 2007/60/EC of 23 October 2007 on the assessment and management of flood risks which is aimed at integrating the way flood risk is managed throughout the European Union.
Fluvial flooding	Flooding from a river or other watercourse.
Groundwater flooding	Flooding caused by groundwater escaping from the ground when the water table rises to or above ground level.

Terms	Definition
Indicative Floodplain Map (IFM)	A map that delineates the areas estimated to be at risk of flooding during an event of specified flood probability. Being indicative, such maps only give an indication of the areas at risk but, due to the scale and complexity of the exercise, cannot be relied upon to give precise information in relation to individual sites.
Inland flooding	Any flooding away from the sea, the primary cause of which is prolonged and/or intense precipitation (or the failure of water-retaining infrastructure, such as burst water pipes or dam-breaks).
Justification Test	An assessment of whether a development proposal within an area at risk of flooding meets specific criteria for proper planning and sustainable development and demonstrates that it will not be subject to unacceptable risk nor increase flood risk elsewhere. The justification test should be applied only where development is within flood risk areas that would be defined as inappropriate under the screening test of the sequential risk based approach adopted by this guidance.
Land uses highly vulnerable to flooding	<p>Land uses and types of development which include:</p> <ul style="list-style-type: none"> • Garda, ambulance and fire stations and Command Centres required to be operational during flooding; • Electricity-generating power stations and sub-stations; • Hospitals; • Emergency dispersal points; • Dwelling houses, student halls of residence and hostels; • Residential institutions such as residential care homes, children's homes and social services homes; • Traveller sites using caravans or mobile homes; • Mobile or park homes for permanent residential use; and • Dwelling houses designed, constructed or adapted for the elderly or, other people with impaired mobility

Terms	Definition
Land uses less vulnerable to flooding	<p>Land uses and types of development which include:</p> <ul style="list-style-type: none"> • Buildings used for: shops; financial, professional and other services; restaurants and cafés; hot food take-aways; offices; general industry; storage and distribution; non-residential institutions; and assembly and leisure; • Land and buildings used for holiday or short-let caravans and camping, subject to specific warning and evacuation plans; • Land and buildings used for agriculture and forestry; • Waste treatment (except landfill and hazardous waste); • Mineral working and processing; and • Transport infrastructure.
Likelihood (probability) of flooding	<p>A general concept relating to the chance of an event occurring. Likelihood is generally expressed as a probability or a frequency of a flood of a given magnitude or severity occurring or being exceeded in any given year. It is based on the average frequency estimated, measured or extrapolated from records over a large number of years and is usually expressed as the chance of a particular flood level being exceeded in any one year. For example, a 1 in 100 or 1% flood is that which would, on average, be expected to occur once in 100 years, though it could happen at any time.</p>
Mitigation measures	<p>Elements of a development design which may be used to manage flood risk to a development, either by reducing the incidence of flooding both to the development and as a result of it and/or by making the development more resistant and/or resilient to the effects of flooding.</p>
Natura 2000	<p>The EU-wide network of protected areas, recognised as ‘sites of Community importance’ under the EC Habitats Directive (Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora). They comprise “Special Areas of Conservation” (SACs) under the Habitats Directive and “Special Protection Areas” (SPAs) under the Birds Directive (Council Directive 79/409/EC on the conservation of wild birds).</p>

Terms	Definition
Overtopping of defences	Failure of a flood defence or exceedance mechanism, when flood water reaches levels that are higher than the flood defence level and flows over the top of the structure. While the structure may remain stable, however, erosion of the landward face of the defence could cause the defence to collapse.
Pathways	These provide the connection between a particular source (e.g. high river or tide level) and the receptor that may be harmed (e.g. property). In flood risk management, pathways are often 'blocked' by barriers, such as flood defence structures, or otherwise modified to reduce the incidence of flooding.
Pluvial flooding	Usually associated with convective summer thunderstorms or high intensity rainfall cells within longer duration events, pluvial flooding is a result of rainfall-generated overland flows which arise before run-off enters any watercourse or sewer. The intensity of rainfall can be such that the run-off totally overwhelms surface water and underground drainage systems.
Precautionary approach	The approach to be used in the assessment of flood risk which requires that lack of full scientific certainty, shall not be used to assume flood hazard or risk does not exist, or as a reason for postponing cost-effective measures to avoid or manage flood risk.
River basin management plan	As required by the EU Water Framework Directive (2000/60/EC), these plans will establish a strategic plan for the long-term management of the River Basin District, set out objectives for waterbodies, and in broad terms identify what measures are planned to meet these objectives, and act as the main reporting mechanism to the European Commission.
Regional Planning Guidelines (RPG)	These provide the regional context and priorities for applying national planning strategy to each NUTS III region and encourage greater co-ordination of planning policies at the city / county level. RPGs are an important part of the flood policy hierarchy as they can assist in co-ordinating flood risk management policies at the regional level.

Terms	Definition
Resilience	Sometimes known as “wet-proofing”, resilience relates to how a building is constructed in such a way that, although flood water may enter the building, its impact is minimised, structural integrity is maintained, and repair, drying & cleaning and subsequent re-occupation are facilitated.
Resistance	Sometimes known as “dry-proofing”, this relates to how a building is constructed to prevent flood water entering the building or damaging its fabric.
Receptors	Things that may be harmed by flooding (e.g. people, houses, buildings or the environment).
Residual risk	The risk which remains after all risk avoidance, substitution and mitigation measures have been implemented, on the basis that such measures can only reduce risk, not eliminate it.
Run-off	The flow of water, caused by rainfall, from an area which depends on how permeable the land surface is. Run-off is greatest from impermeable areas such as roofs, roads and hard standings and less from vegetated areas – moors, agricultural and forestry land.
Sequential approach	The sequential approach is a risk-based method to guide development away from areas that have been identified through a flood risk assessment as being at risk from flooding. Sequential approaches are already established and working effectively in the plan-making and development management processes.
Scoping flood risk assessment	A generally qualitative or semi-quantitative assessment to confirm sources of flooding that may affect a plan area or proposed development site, to appraise the adequacy of existing information and to provide a qualitative appraisal of the risk of flooding and potential impact of a development on flooding elsewhere and of the scope of possible mitigation measures.
Screening flood risk assessment	A broad-brush assessment to identify whether there are any flooding or surface water management issues related to a plan area or proposed or existing development site that may warrant further investigation.
Source	Source refers to a source of hazard (e.g. the sea, heavy rainfall).

Terms	Definition
Source-Pathway-Receptor Model	For there to be flood risk, the three components of flood risk - the source of the hazard, the receptors affected by the hazard and the mechanism of transfer between the two - must all exist.
Strategic Environmental Assessment (SEA)	Strategic Environmental Assessment (SEA) is the process by which environmental considerations are required to be fully integrated into the preparation and adoption of plans and programmes. The objective of the SEA process is to provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation and adoption of specified plans and programmes with a view to promoting sustainable development.
Strategic Flood Risk Assessment (SFRA)	The assessment of flood risk on a wide geographical area against which to assess development proposed in an area (Region, County, Town).
Sustainable Drainage Systems (SuDS)	A form of drainage that aims to control run-off as close to its source as possible using a sequence of management practices and control structures designed to drain surface water in a more sustainable fashion than some conventional techniques.
Town Centre/ Edge of Centre	<p>The term “town centre” is used to cover city, town and district centres which provide a broad range of facilities and services and which fulfil a function as a focus for both the community and public transport. It excludes retail parks, local centres and small parades of shops of purely local significance.</p> <p>The term “edge-of-centre” is a location within easy walking distance (usually not more than 300 to 400 metres) of the primary retail area of a town centre, and providing parking facilities that serve the centre as well as the new development thus enabling one trip to serve several purposes.</p>

Terms	Definition
Water/flood compatible land uses	<p>Land uses and types of development which include:</p> <ul style="list-style-type: none"> • Flood control infrastructure • Water and sewage treatment plants and pumping stations • Docks, marinas and wharves • Navigation facilities • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location • Water-based recreation and tourism (excluding sleeping accommodation) • Lifeguard and coastguard stations • Amenity open space, 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).
Water Framework Directive (WFD)	<p>A European Community Directive (2000/60/EC) designed to integrate the way we manage water bodies across Europe. It requires all inland and coastal waters to reach “good status” or “good ecological potential” in the case of heavily modified water bodies by 2015 through a catchment-based system of River Basin Management Plans (RBMP), incorporating a programme of measures to improve the status of all natural water bodies.</p>
Vulnerability	<p>The resilience of a particular group of people or types of property or habitats, ecosystems or species, and their ability to respond to a hazardous condition and the damage or degree of impact they are likely to suffer in the event of a flood. For example, elderly people may be more likely to suffer injury, and be less able to evacuate, in the event of a rapid flood than younger people.</p>

Appendix A - Screening for and Carrying out the Flood Risk Assessment

1 FLOOD RISK ASSESSMENT

1.1 Overview

Flood risk assessments (FRAs) aim to identify, quantify and communicate to decision-makers and other stakeholders the risk of flooding to land, property and people. The purpose is to provide sufficient information to determine whether particular actions (such as zoning of land for development, approving applications for proposed development, the construction of a flood protection scheme or the installation of a flood warning scheme) are appropriate.

This Appendix seeks to explain the terminology and the methodology of flood risk assessment so that decision-makers can consider such assessments in an informed manner. It does not seek to duplicate the abundant guidance that is available from other sources but makes appropriate reference to such guidance.

A flood risk assessment (FRA) can be undertaken either over a large area or for a particular site to:

- assess whether flood risk is an issue for the area, and if so, to what degree;
- identify flood zones (if not already available);
- inform decisions in relation to zoning and planning applications;
- develop appropriate flood risk mitigation and management measures for development sited in flood risk areas.

FRAs can be undertaken at a range of scales relevant to the planning process, as discussed in more detail in Section 1.4 herein. The key scales of FRA are:

- Regional for (Regional Planning Guidelines);
- Strategic for City or County Development Plans or Local Area Plans);
- Site Specific (for master plans and individual site planning applications).

FRAs are typically undertaken over a number of stages, with the need for progression to a more detailed stage dependent on the outcomes of the former stage.

1.2 General Principles of Flood Risk Assessment

With all FRAs undertaken for land-use change and new developments, there are some general principles that are applicable and should be followed. These are noted below:

- FRAs should be proportionate to the risk and appropriate to the scale, nature and location of the development.
- FRAs should be undertaken by competent people, as early as possible in the particular planning process. Use should be made of a suitably qualified hydrologist, flood risk management professional or specialist water engineer, with the appropriate skills and experience to undertake a flood risk assessment.
- FRAs should be supported by appropriate data and information, including historical information on previous events, but focusing more on predictive assessment of less frequent or more extreme events. The FRA must take the likely impacts of climate change into account.
- FRAs must address the impact of a change in land use or development on flood risk elsewhere. Any such change or development must not add to and should, where practicable, reduce flood risk.
- FRAs must consider the vulnerability of those that could occupy the development, including arrangements for safe access and egress.
- FRAs should consider the modification to flood risk that infrastructure such as raised defences, flow channels, flood-storage areas and other artificial features provide, together with the consequences of their failure.

1.3 Source-Pathway-Receptor Model

The assessment of flood risk requires a thorough understanding of the sources of flood water (e.g. high sea levels, intense or prolonged rainfall leading to run-off and increased flow in rivers and sewers), the people and assets affected by flooding (known as the receptors) and the pathways by which the flood water reaches those receptors (e.g. river channels, river and coastal floodplains, drains, sewers and overland flow).

The source-pathway-receptor (S-P-R) model has become widely used to assess and inform the management of environmental risks. This is illustrated in Figure A1. FRA thus requires identification and assessment of all three components:

- The probability and magnitude of the source(s) (e.g. high river levels, sea levels and wave heights).
- The performance and response of pathways and barriers to pathways such as floodplain areas and flood defence systems.
- The consequences to receptors such as people, properties and the environment.

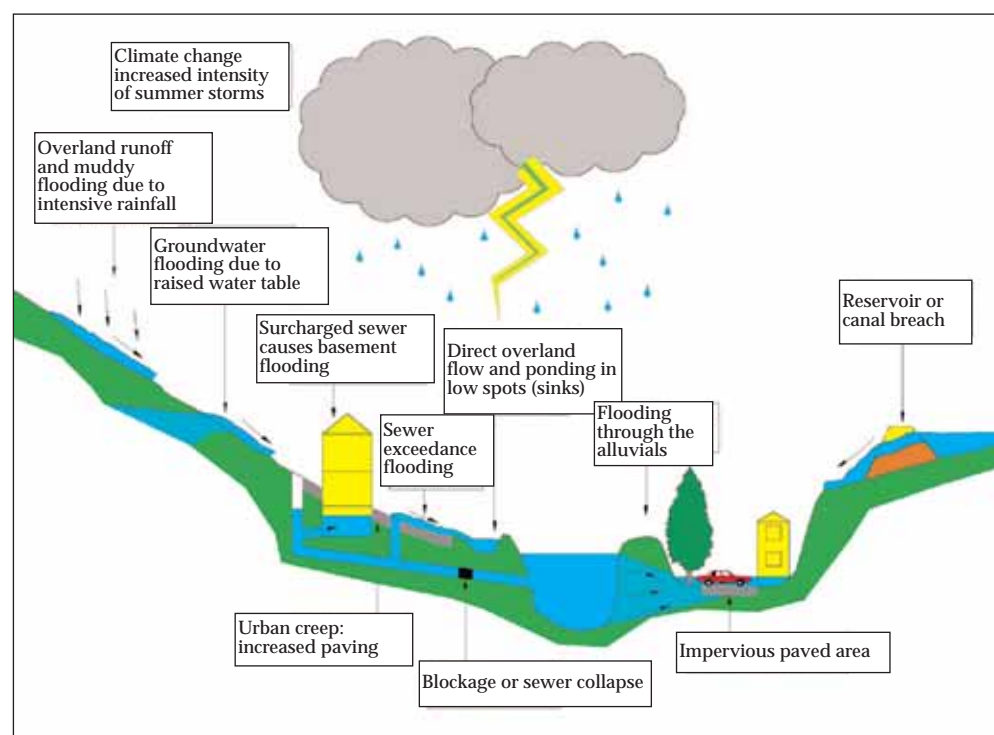


Fig. A1: Source, pathways and receptors of Flooding

The ultimate aim of a FRA is to combine these factors and map or describe the risks on a spatial scale, so that the consequences can then be analysed. FRAs need to consider the situation as it is now and also how it might change in the future. Such consideration should include changes in climate (which impact largely on sources), the construction of flood protection or drainage schemes (which modify the pathways) and the introduction of receptors into areas at risk of flooding.

Further Guidance on Flood Risk Assessments

Standards and methodologies for FRAs, and detailed specifications of work for undertaking a range of FRAs for use in Ireland (i.e., for each stage of FRA at different scales), are available from the OPW (<http://www.opw.ie>).

Comprehensive guidance is also available from research in the UK through the following:

- Practice Guide that accompanies the equivalent planning guidance (PPS25)
<http://www.communities.gov.uk/planningandbuilding/planning/planningpolicyguidance/planningpolicystatements/planningpolicystatements/pps25/>;
- CIRIA Report C624 “Development and flood risk - guidance for the construction industry” (<http://www.ciria.org.uk/acatalog/C624.html>); and
- Defra/Environment Agency Guidance on flood-risk assessment (FD2320) and on flood risks to people (FD2321),
<http://www.defra.gov.uk/enviro/fcd/research/default.htm>.

1.4 Scales Used For Flood Risk Assessment

FRAs are required at different scales by different organisations for many different purposes. A hierarchy of assessments is necessary to ensure a proportionate response to the needs of organisations by avoiding the need for detailed and costly assessments prior to making strategic decisions. This hierarchy is summarised in Table A1.

Table A1: Hierarchy of Flood Risk Assessment

FRA	Code	Purpose	Responsibility
Regional flood risk appraisal	RFRA	RFRA provide a broad overview of the source and significance of all types of flood risk across a region and also highlighting areas where further more detailed study will be required. At this level they are an appraisal and not an assessment.	Regional planning bodies in consultation with the OPW, and LAs. CFRAMs will be an important and prime input to the appraisal.
Strategic flood risk assessment	SFRA	To provide a broad (area wide) assessment of all types of flood risk to inform strategic land-use planning decisions. SFRAs enable the LA to undertake the sequential approach, including the Justification Test, allocate appropriate sites for development and identify how flood risk can be reduced as part of the Development Plan process	LAs in consultation with the OPW, and emergency services. The Flood risk management plan arising from the CFRAM programme will be used heavily to inform the SFRA. In its absence local authorities may need to commission extensive flood risk assessments, albeit at a strategic level. OPW will provide advice on the specifications that should be applied.
Site-specific flood risk assessment	FRA	To assess all types of flood risk for a new development. FRAs identify the sources of flood risk, the effects of climate change on this, the impact of the development, the effectiveness of flood mitigation and management measures and the residual risks that remain after those measures are put in place.	Those proposing the development in consultation with the LA and emergency planners.

Strategic assessments provide the level of spatial resolution which is appropriate to the scale of the flood risk. Strategic should not be mistaken for 'broad brush' or high level. Often a mosaic of techniques should be used across an area, so that the uncertainties on the spatial extent of flooding are reduced to an appropriate level for the decision being made. The greatest contribution to reducing that uncertainty is an accurate digital elevation model of floodplain topography.

SFRAs will provide more detailed information on the broad spatial distribution of flood risk within extensive areas of high flood risk where development is to be considered, and also where it will be necessary to apply the Justification Test. The information may also be used to assess how any environmental objectives relating to flooding, as defined in the strategic environmental assessment, may be affected by change in land use and/or additional development.

In local authority areas where flooding is not a major issue and where development pressures are low, a less detailed approach will be required relative to that necessary in areas where there is high development pressure and flooding is a significant issue. This will be apparent through the staged approach to planning an assessment. This approach is recommended to allow flexibility in the level of assessment required from one local authority area to another.

Where the requirements of the Justification Test need to be satisfied, a detailed assessment should be undertaken to consider the nature of flood hazard, taking account of the presence of flood risk management measures such as flood protection schemes. Such schemes and other infrastructure, which acts as a flood defence, can significantly affect the risk factors and the following indicators that are used in a FRA:

- Flood probability;
- Flood depth;
- Flood velocity;
- Rate of onset of flooding.

1.5 Stages in the Assessment of Flood Risk

Within the planning system flood risk will need to be integrated into the plan-making process. The steps in the Development Plan process and its Strategic Environmental Assessment needs to be supported by appropriate studies into flood risk. This is shown in the flow chart in Section 4 of the Guidance.

There are three principle stages to Flood Risk Assessment. Step 1 - Screening; Step 2 – Scoping; Step 3 - Assessing.

Step 1 - Screening

Screening is the process for deciding whether a plan or project requires a Flood Risk Assessment (FRA).

In order to establish whether a flood-risk issue exists or may exist in the future, the following sources should be consulted.

- Indicative flood maps produced by OPW;
- National coastal protection strategy study flood and coastal erosion risk maps;
- Predictive and historic flood maps, such as those at <http://www.opw.ie>;
- Catchment Flood Risk Assessment and Management Studies (CFRAMS);
- Previous FRAs at national/regional, strategic and site-specific scales, including studies for flood-protection schemes;
- Topographical maps, in particular digital elevation models produced by aerial survey or ground survey techniques;
- Expert advice from OPW & Local Authorities who may be able to provide reports containing the results of detailed modelling and flood-mapping studies, including critical drainage areas, and information on historic flood events, including flooding from all sources;
- Alluvial deposit maps of the Geological Survey of Ireland (which would allow the potential for the implementation of source control and infiltration techniques, groundwater and overland flood risk to be assessed). These maps, whilst not providing full coverage, could be used to identify areas, where alluvium has been deposited, which have flooded in the recent geological past, since that is the source of the alluvium;
- Local libraries and newspaper reports;
- Interviews with local people, local history/natural history societies etc.;
- Walkover survey to assess potential sources of flooding, likely routes for flood waters and the site's key features, including flood defences, and their condition;
- National, regional and local spatial plans, such as the National spatial strategy, regional planning guidelines, development plans and local area plans provide key information on existing and potential future receptors.

The predictive, indicative and historic flood event maps published by OPW or the coastal strategy maps being produced by DAFF are the key starting points. However, these only identify some of more obvious sources of flood risk. Flooding from other sources such as surface water systems or adjoining hillsides are difficult to map, but need to be carefully considered. Techniques have been developed to allow for pre-screening of these risks using topography based cell models.

As part of a FRA, information on the location, standard and condition of existing flood defences should be obtained from those who operate and maintain these assets. Detailed analysis within the FRA will depend on the nature and severity of flood risk, vulnerability and pathways in the area behind the flood defences. For a SFRA, the analysis needs to be sufficiently detailed to allow the application of the sequential approach within the flood risk zone. For a site-specific FRA, it needs to be sufficiently detailed to allow the determination of the actual risk behind the infrastructure.

It is recognised that data sources referred to above may be limited, especially with respect to predictive flood extents. It should be noted that decisions can be made on limited data so long as a precautionary approach is taken.

Assessment of flood risk and subsequent management activities principally relies on estimation of flow, level, and the performance of assets at an appropriate degree of accuracy that will deliver “fit-for-purpose” information for decision-making. This is usually achieved by some form of mathematical modelling of river systems that embrace the source-pathway-receptor concept. However, as is known from experience, modelling is subjective, and poor data and use of inappropriate techniques can undermine the confidence of the decision maker.

If the planning authority considers that there is a potential flood risk issue it should move to Step 2. If the planning authority is satisfied that there is no potential flood risk identified from an assessment of all the sources listed above and bearing in mind the precautionary approach, a FRA will not be required and the process can end at Step 1. It would be prudent in such circumstance for the planning authority to keep a record on the public file of the screening decision and reasons for deciding that FRA is not required.

However in the majority of circumstances, the process will move onto Step 2.

Step 2 - Scoping

The purpose of scoping is to ensure that the relevant flood risk issues are identified so that they can be addressed appropriately in the Flood Risk Assessment (FRA).

Whether it is a strategic flood risk assessment at development plan level or site-based assessment, it is important to scope the necessary level of detail and most appropriate assessment techniques based on the quality and robustness of the available datasets. It is anticipated that planning authorities will need to commission a flood risk assessment as early as possible within the development planning process as part of the SEA and a robust scoping

process is essential to ensure the level of assessment is commensurate with the risks and the available datasets. The scoping phase should include:

1. Confirmation of sources of flooding that may affect a plan area;
2. An appraisal of the availability and adequacy of existing information;
3. Potential impact of development on flooding elsewhere;
4. Scope of possible mitigation measures.

The scoping process may identify that sufficient quantitative information is already available to complete a FRA appropriate to the scale and nature of the changed land use or proposed development. If not, then the FRA will need to carry out such information gathering as part of the assessment process.

Step 3 - Assessing Flood Risk

This is the stage at which the actual Flood Risk Assessment (FRA) is carried out.

It is important that a FRA should consider both the actual and the residual risks.

Actual flood risk is the risk posed to an area, whether it is behind defences or undefended, at the time of the study. This should be expressed in terms of the probability of flooding occurring, taking into account the limiting factors, both natural and manmade, preventing water from reaching the development.

Residual risks are the risks remaining after all risk avoidance, substitution and mitigation measures have been taken. Examples of residual flood risk include:

- The failure of flood management infrastructure such as a breach of a raised flood defence, blockage of a surface water channel or drainage system, failure of a flap valve, overtopping of an upstream storage area, or failure of a pumped drainage system; and
- A severe flood event that exceeds a flood design standard such as, but not limited to, a flood that overtops a raised flood defence.

Assessment of flood defence breaching should generally be undertaken on the basis of a design event of the appropriate design standard (1% AEP¹ for river flooding and 0.5% AEP for flooding from the sea), including an allowance for climate change². Assessment of overtopping of flood defences should generally be undertaken on the basis of the 0.1% AEP event, including an allowance for climate change.

¹ AEP – Annual Exceedance Probability

² See <http://www.opw.ie>

on assessment of storm events that exceed the available capacity of surface water systems and of flash floods.

Model results generated from this screening process provides information on the peak depth of flooding. An example map of rainfall data is included as Figure A3.

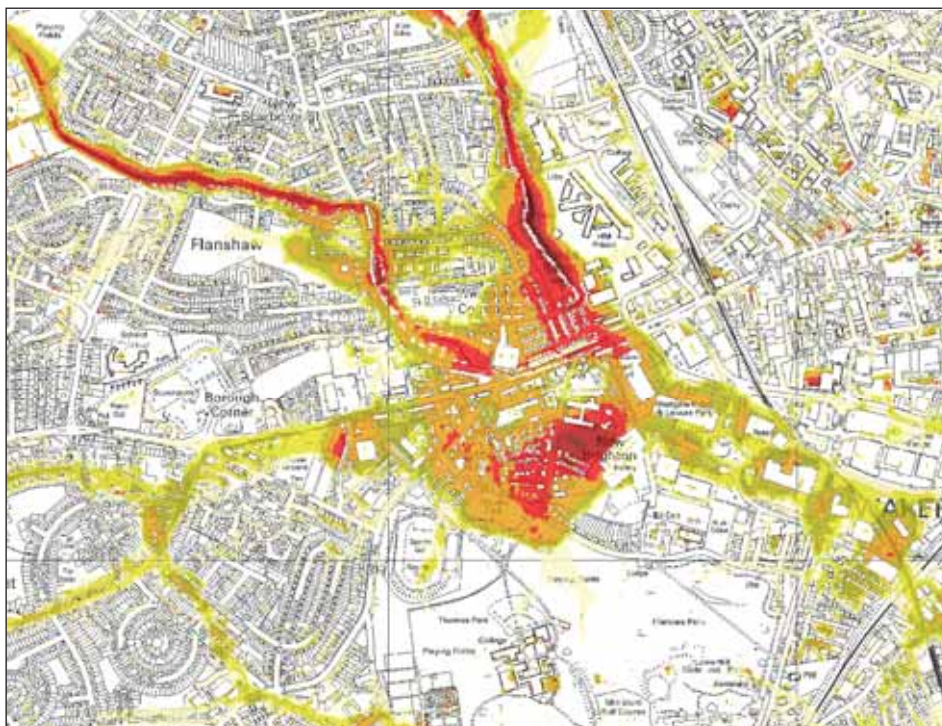


Fig. A3: Example of rapid surface water run off mapping
(Image provided courtesy of City of Wakefield MBC)

Surface water flood risk mapping requires a 3 dimensional representation of the area of interest, in the form of a DTM, and a rainfall hyetograph for a storm of fixed magnitude and duration. The water depths are then applied and the storm water is free to flow over the area. This provides a prediction of those areas where water will collect, or 'pond', and the location and magnitude of flow routes to leading to these areas. The output shown above is then thematically mapped by depth, removing predicted flood depths below a threshold.

1.6 Outputs from FRA Regional Flood Risk Assessments

As a minimum, regional level appraisal should include the following:

- Summary plans/figures (ideally with accompanying digital spatial datasets) showing the broad spatial distribution of flood risk;

- Suggested policies for sustainable flood risk management for incorporation into the Regional Planning Guidelines (RPGs);
- Suitable locational criteria for flood risk management measures for use in areas of high flood risk, that are likely to be considered for development; and
- Guidance on the preparation of City and County level SFRAs and the management of surface water run-off from new developments.

Strategic Flood Risk Assessments - City/County Level

The key outputs from a SFRA and the key steps in their delivery are:

- Plans showing the LA area, principal rivers, and flood zones, including the location of any flood risk management measures, including both infrastructure and the coverage of flood-warning systems and of the natural floodplain, where appropriate, across the local authority area, as well as key development areas in relation to the above;
- An appraisal of the current condition of flood-defence infrastructure and of likely future policy with regard to its maintenance and upgrade;
- An appraisal of the probability and consequences of overtopping or failure of flood risk management infrastructure, including an appropriate allowance for climate change;³
- Maps showing the distribution of flood zones as recommended in Chapter 2 of these guidelines and incorporating the appropriate allowance for climate change;⁴
- Areas at risk of flooding from sources other than rivers and the sea;
- Locations where additional development may significantly increase flood risk elsewhere;
- Identification of specific development areas where specific FRA will be required;
- Guidance on the likely applicability of different sustainable drainage systems (SuDS) techniques for managing surface water run-off at key development sites; and
- Guidance on appropriate development management criteria for zones and sites.

In general, the FRA should aim to provide clear guidance on appropriate risk management measures for adoption on sites within flood zones to minimise the extent to which individual developers need to undertake separate studies of the same problem. It should indicate:

- Whether a proposed development is likely to be affected by current or future flooding from any source;

³ See <http://www.opw.ie>

⁴ See above

- Whether it will increase flood risk elsewhere;
- Whether there are appropriate measures to deal with these effects and risks; and
- Whether the risks will be reduced to an acceptable level to enable the passing of the Justification test if this is appropriate.

In some instances improvements to existing flood defences may be required to manage residual flood risks. Where such flood defence works are considered, the SFRA should include an appraisal of the extent of any works required to provide or raise the flood defence to an appropriate standard.

Site-Specific Flood Risk Assessments

The key outputs from a site-specific FRA and the key steps in their delivery are:

Plans

- A location plan that includes geographical features, street names and identifies the catchment, watercourses or other bodies of water in the vicinity;
- A plan of the site showing:
 - Existing site
 - Development proposals;
- Identification of any structures, which may influence local hydraulics. This will include bridges, pipes/ducts crossing the watercourse, culverts, screens, embankments, walls, outfalls and condition of channel.

Surveys

- Site levels related to Ordnance Datum, both existing and proposed;
- Appropriate cross-section(s) of the site showing finished floor levels or road levels, or other relevant levels relative to the source of flooding, and anticipated water levels and associated probabilities.

Assessments

- Consideration of the flood zone in which the site falls and demonstration that development meets the vulnerability criteria set out in this Guidance;
- Flood alleviation measures already in place, their state of maintenance and their performance;
- Information about all potential sources of flooding that may affect the site – from rivers and the sea, streams, surface water run-off, sewers, groundwater, reservoirs, canals and other artificial sources or any combination of these;

- The impact of flooding on a site including:
 - The likely rate at which flooding might occur (i.e. rapid onset or slow rise of flood water);
 - The speed of flow of flood water;
 - The order in which various parts of the location or site might flood;
 - The likely duration of flood events;
 - The economic, social and environmental consequences of flooding on occupancy of the site.
- Information on extent and depth of previous flood events or on flood predictions;
- An assessment of how safe access and egress can be provided for routine and emergency access under both frequent and extreme flood conditions;
- An assessment of how the layout and form of development can be used to reduce or minimise flood risk;
- Proposals for surface-water management according to sustainable drainage principles, with the aim of not increasing, and where practicable, reducing the rate of run-off from the site as a result of the development;
- The likely impact of any displaced water on third parties caused by alterations to ground levels or raising flood embankments;
- The potential impact on fluvial or coastal morphology and the likely longer-term stability and sustainability of existing defences; and
- The residual risks to the site after the construction of any necessary defences and measures and the means of managing these risks. This should include an assessment of whether the measures either design out the impacts of climate change or are adaptable to any increase in flood level.

In addition to the requirements listed above, when completing a site-based FRA as part of meeting the requirements of the Justification Test, an assessment will be required of on- and off-site opportunities for reducing flood risk overall e.g. flood storage. This will include an appraisal of wider flood risk management measures to which the development can contribute.

An assessment of how surface water run-off will be managed should be addressed in most FRAs. Drainage is a material consideration at the planning stage of a development and due consideration must be given to the impact of the proposed development on the catchment area. This includes an assessment of potential for both flood risk and pollution. Surface water run-off may need to be assessed in all flood zones. The FRA should demonstrate that the surface-water drainage system takes account of SuDS principles, in accordance with the design guidance referenced below. Where SuDS solutions are not possible the FRA should identify the principles behind the chosen approach and demonstrate that the method that gives the best environmental protection available at the site is adopted.

The scope of the FRA will depend on the type and scale of the development and the sensitivity of the area.

The basic requirements for the drainage aspects of FRA are as listed below:

- An examination of the current and historical drainage patterns;
- A concept drawing of the development proposal;
- A brief summary of how the drainage design provides SuDS techniques;
- Summary of SuDS to be incorporated;
- The soil classification for the site;
- Evidence of subsoil porosity tests including where possible at the location of any intended infiltration device;
- Calculations showing the pre- and post-development peak run-off flow rate for the critical rainfall event; and
- Accompanying wastewater drainage proposals.

Guidance on design standards for smaller drainage systems have traditionally been drawn from the An Foras Forbartha publication 'Recommendations for Site Development Works for Housing Areas', which was republished by DEHLG in 1998. This document is currently under review by the DEHLG with the aim of making it more sustainable in respect of surface water drainage which would involve urging local authorities to adopt the Sustainable Drainage Systems (SuDS) approach. This document is available for download at the following link

<http://www.environ.ie/en/Publications/DevelopmentandHousing/Housing/FileDownload,2451,en.pdf>

A number of local authorities have also developed guidance documents to assist applicants in the preparation of their drainage design, including the drainage impact assessment. The most comprehensive of these local authority guidance documents is the 'Greater Dublin Strategic Drainage Study: New Development Policy'

<http://www.dublincity.ie/WATERWASTEENVIRONMENT/WASTEWATER/DRAINAGE/GREATERDUBLINSTRATEGICDRAINAGESTUDY/Pages/NewDevelopmentPolicy.aspx>.

This is a comprehensive document and is complemented by the Greater Dublin Regional Code of Practice for Drainage Works.

<http://www.dublincity.ie/WATERWASTEENVIRONMENT/WASTEWATER/Pages/GDSDSCodeofPractice.aspx>

An additional document on interpretation of this guidance is given in the document “Irish SuDS: guidance on applying the GDSDS surface water drainage criteria” to be found at http://www.irishsuds.com/guidance_criteria.htm.

These are considered key reference material for those undertaking drainage impact assessments.

2 SATISFYING THE JUSTIFICATION TEST

2.1 The Flood Risk Balance Sheet

In any assessment of environmental risk a transparent record of how the risk was assessed and is to be managed is essential. The Flood Risk Balance Sheet (See Table A2), once completed, provides a short summary of the risk assessment and the characteristics of that risk and its likely mitigation. The Flood Risk Balance Sheet is a useful tool and should be used by planning authorities to evaluate alternatives in making their decisions on development plans and local area plans especially in applying the Justification Test.

The FRBS harness a number of indicators that have been developed to allow a comparison of appropriate land uses in each plan area and whether they would satisfy the terms of the Justification Test. These indicators are:

- Development is within existing flood risk area – existing flood warning and evacuation is in place. Importantly how easily will the area recover following an event? New development may lose local services for 12 months if an event occurs;
- Residual risk measures are easily applied and within a norm – Low depths of flooding can be easily designed out by modest alteration of ground or floor levels. 1st floor accommodation has implications for the urban design and place setting of the development;
- Egress and access. Impact on emergency planning provision and whether risks to development would be acceptable – This is a key issue and prime test in meeting the acceptable risk criterion in the Justification Test. Access routes need to be natural and accessible in a flood to the emergency services;
- Change in the number of people at risk as result of development – Introduction of more people will put a greater strain on the emergency services in an event. Whilst they may be accommodated at high elevation they will require support very quickly even after the inundation has stopped;

- Change in number of properties at risk in 1% and 0.1% event before and after. Assumes mitigation measures put in place – From an economic viewpoint development can replace existing property with lower vulnerability land uses and also development that is designed to be flood-resistant or resilient. A reduction in economic risk can be achieved;
- Scale and nature of flood risks – The residual risk maps should indicate likely depths and flow routes. From running the surface water screening assessment the scale and extent of the surface water flood risks can also be considered;
- Impact of mitigation measure on other areas downstream and adjacent – How wide-ranging does the impact assessment need to be to take account of the effects of significant land raising or alteration or blockage of flow routes.

Planning authorities should use these indicators to qualitatively assess each key type of vulnerable land use proposed in each of the policy areas being considered by the SFRA. Each of the indicators should be scored according to the system outlined in the table below to produce a Flood Risk Balance Sheet. The results should be assessed to produce one of five possible outcomes on the acceptability of a particular type of development within a policy area. The five potential outcomes are:

- Counter to strategic approach, flood risk unacceptable. It would be difficult to meet the criteria of the Justification Test. Not recommended;
- Sequentially not preferred but a limited range of land uses might be possible;
- Sequentially not preferred but a wider range of land uses could be brought forward after careful consideration and subject to an appropriate site-specific FRA;
- Acceptable with some detailed consideration of flood-risk issues to be resolved by an appropriate site-specific FRA; and
- Acceptable subject to a satisfactory appropriate site-specific FRA.

Table A2: The Flood Risk Balance Sheet - Scoring of indicators in reviewing acceptability of proposed development

Flood-risk indicator	Ultra-positive ++	Positive +	Neutral =	Negative -	Ultra-negative --
Is the development within existing flood-risk area?		No risk		Risk area within resilient communities	Vulnerable community, which would struggle to recover
What are the scale and nature of flood risks?	Benign and understood				Difficult to warn, unpredictable, may result in operational failure of defences, from multiple sources
What scale of residual risk measures will be required?	None required	Measures could reduce risk to existing development		Standard, no major alteration to layout and form	Flood resistance is dominant in design
How will egress and access be assured? What will be the emergency planning impact?		No special provisions, risks acceptable		Needs to be managed, should be acceptable subject to FRA	Special provision, natural response will not be obvious. Risks may not be acceptable
Will there be a change in number of people at risk?	Significant reduction	Reduction	No change	Increase	Significant increase
Will there be a change in number of properties at risk?	Significant reduction	Reduction	No change	Increase	Significant increase
Will there be an impact of the mitigation measures elsewhere?	Significant reduction in overall flood risk	Reduction	Neutral impact	Increase in flood risk elsewhere	Significant increase in flood risk elsewhere

This simple assessment using the Flood Risk Balance Sheet to document the scale of the risks and their management, will allow a sequential approach to be delivered transparently. The outcome is to summarize the indicator scores into a qualitative assessment of whether the risk is worth taking, or how a regeneration plan would be best assembled and meet the criteria of the Justification Test. This would support appropriate policies and land-use zoning within the development plan or local area plan. It would, in particular, provide the evidence for the planning authority in reviewing any subsequent planning applications which rely use the Justification Test to support alternative land uses in these areas.

It should be noted that an appropriate site-specific FRA, including a drainage impact assessment, should always be required to be submitted with a planning application. This should use the flood risk balance sheet as a means of concluding the outcome of the FRA, and the ability of the proposal to deliver a safe development over the full length of its lifetime.

Appendix B - Addressing Flood Risk Management in Design of Development

1. Introduction

The purpose of this appendix is to provide information on how new development in flood risk areas should be planned, designed and constructed to reduce and manage flood risk and be adaptable to changes in climate.

2. Key Design Considerations

Addressing flood risk in the design of new development should be based on a set of broad considerations. Such considerations ensure that the response to flood risk is balanced within a range of proper planning and sustainable development considerations. Innovation, creativity and high quality approaches will be essential in meeting the design challenges.

2.1 Core Principles

The core principles in planning and designing for flood risk are:

- Locating development away from areas at risk of flooding, where possible;
- Substitution of less vulnerable land uses for the more vulnerable ones that are to be replaced, where the principle of development within flood risk areas has been established; and
- Identifying and protecting land required for current and future flood risk management, such as conveyance routes, flood storage areas and flood protection schemes etc. where the principle of development within flood risk areas has been established.

2.2 Aspects of Planning and Design

Careful consideration of planning and design is one of the primary means of avoiding the impacts of a flood on a specific site. Key aspects of good site layout and design include:

- Understanding the nature and extent of flood risk;
- Achieving the appropriate range and mix of land uses;
- Creating and/or extending a robust and permeable urban structure;
- Creating and/or extending a landscape structure and drainage; and
- Incorporation of key aspects into integrated detailed design.

3. Application of Design Considerations

The following indicative case study illustrates the application of the core principles and aspects of site layout and design.

3.1 Flood Risk

Understanding the nature and extent of flood risk is an essential starting point in achieving an effective design response to flood risk on a typical site. Figure B1 below illustrates the type of flood mapping, showing flood zones, that is necessary as a starting point to the design process.

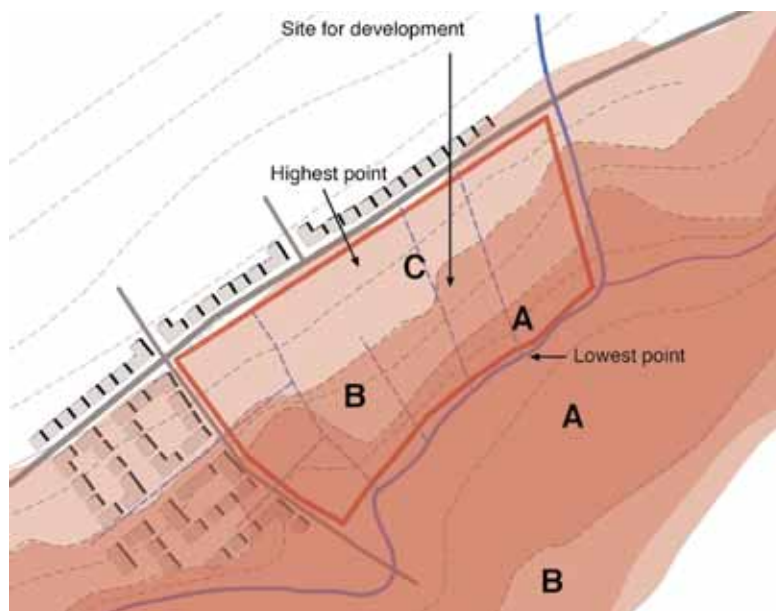


Fig. B1: Flood Zone Risk Mapping

The figure above indicates Zone A as the extent of the site area that has the highest probability of flooding, Zone B has a moderate risk of flooding and Zone C has a low risk of flooding.

3.2 Choosing land uses

Once the spatial dimension of flood risk is understood, land use type and location are informed by the following principal considerations:

- The most vulnerable land uses are located in areas of lower flood risk;
- Less vulnerable land uses (e.g. parks, gardens and open spaces for natural habitats, etc.) are located in areas of higher flood risk;
- A degree of flexibility in the location of land uses to better reflect existing, or future, good urban structure;
- Providing more sustainable mix use by, for example, considering less vulnerable uses at ground floor in areas of greater flood risk.

Figure B2 below illustrates how the application of the principles above onto the flood mapping described in section 3.1 offers a way to match flood risk with appropriate land uses.

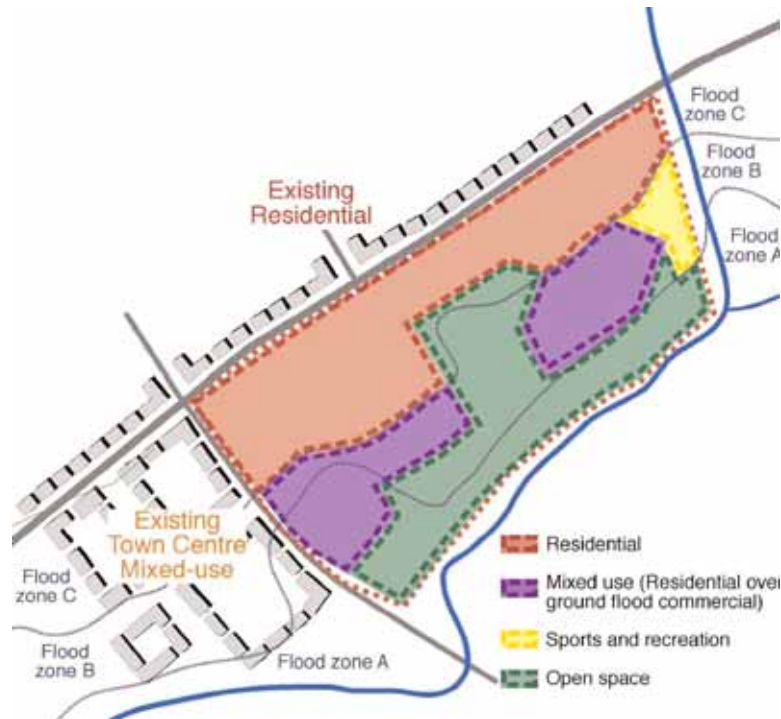


Fig. B2: Land Use

3.3 Creating Good Urban Structure

Creating a good urban structure of a given layout, which relates to the pattern and layout of streets, spaces and urban blocks making up an urban area, is achieved by:

- Understanding and reflection of the existing topography;
- Creation of a permeable and legible structure, which provides clear and direct routes from high risk areas to safer low risk areas;
- Designing for the safe movement of people in or out of the area, especially near areas where flood water might be flowing, and considering the location of safe overland flow routes; (see 3.4 - landscape and drainage aspects);
- Avoiding cul-de-sacs in medium and high risk areas to address the pooling of flood water or the creation of a layout where people would have to move through an area of flood hazard in order to reach safety; and
- Providing secondary defences in areas of low risk such as demountable barriers and altered land/ floor levels.

In the example, areas of medium risk residential uses are accommodated above ground-floor level and an early flood warning system has been incorporated. In areas of high risk, safe refuges at higher levels, resilient utility supplies,

early warning systems, emergency response plans and renewable power supplies have been provided.

For the case study site, Figure B3 illustrates how urban design, access and circulation has been influenced by flood risk considerations.



Fig. B3: Integrating Flood Risk into Urban Design

3.4 Landscape and drainage

Landscape planning and drainage of new development must be closely integrated to play a key role in effective flood-reduction measures. The key elements are:

- Creating a permeable network and hierarchy of green space providing for direct access to areas of lower flood risk;
- Planting and shaping the land surrounding individual buildings and groups of buildings to encourage drainage away from a property;
- The use of “higher-risk” low-lying ground in waterside areas for recreation, amenity and environmental purposes;
- Modest land-raising of a part of the area at high risk of flooding accompanied by compensatory provision of flood storage in areas of existing lower risk of flooding having considered other natural and built heritage issues;
- Recontouring of edge of floodplain;
- Use of earth bunds to provide local flood defence;
- The use of surface runoff attenuation measures / sustainable drainage systems (SuDS) to manage run-off from rain falling on a development can be an effective means of reducing its impact reflecting natural

drainage processes and removing pollutants from urban run-off at source; and

- Avoiding structures in the floodplain.

Figure B4 below illustrates the application of the principles above in a landscape planning context.

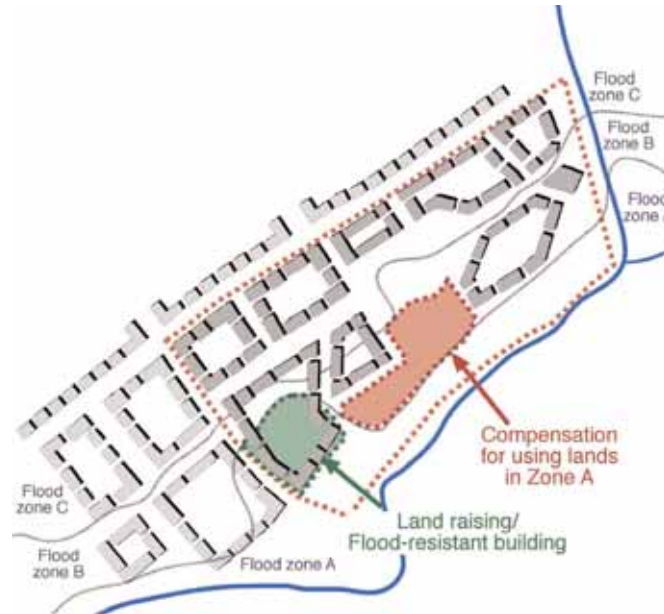


Fig. B4: Landscape Planning and Flood Risk

Figure B5 below illustrates the application of the principles above in a SuDS planning and management context.



Fig. B5: SuDS Planning and Flood Risk

3.5 Site layout

The broader framework planning of the case study site illustrates the importance of getting the context right for more detailed site layout. Important design issues to consider at the more detailed site layout stage include:

- The size, shape and qualities of the landscape and planting; and
- The incorporation of detailed Sustainable Drainage Systems (SuDS) measures into the design.

More detailed issues of building design and construction are dealt with in section 4 of this appendix.

Figure B6 below illustrates examples of the application of detailed measures to an illustrative site example.



Fig. B6: Detailed Site Layout Planning

The main aspects of the scheme illustrated in Figure B6 include:

- The identification of a focal space as part of green open space network with clear routes of movement and escape to higher ground;
- Ease of access to higher land in the event of a flood;
- Clear water conveyancing routes free of barriers such as walls or buildings;
- Choice of durable flood resistant plant species;
- A conventional low-cost earth bund and arrangements to remove rainwater or floodwater seepage from within the bund;

- Signing of floodplain areas should indicate the shared use of the land and identifying safe access routes; and
- Street furniture and fittings designed in conjunction with other measures to reduce vehicles and other debris reaching the watercourse in times of flood.

The design and implementation of SuDS covers a whole range of sustainable approaches to surface water drainage management including:

- Source control measures, including rainwater recycling and drainage;
- Infiltration devices to allow water to soak into the ground, which include individual soakaways and communal facilities;
- Filter strips and swales, which are vegetated features that hold and drain water downhill mimicking natural drainage patterns;
- Filter drains and porous pavements to allow rainwater and run-off to infiltrate into permeable material below ground and provide storage if needed;
- Permeable paving for parking areas including front gardens (see UK Guidance on the Permeable Surfacing of Front Gardens <http://www.communities.gov.uk/publications/planningandbuilding/pavingfrontgardens>; see also in these Guidelines Chapter 2 paragraphs 2.37-2.39 on SuDS);
- Basins and ponds to hold excess water after rain and allow controlled discharge that avoids flooding; and
- Green Roofs.

Examples of SuDS approaches are outlined in the photographs below.



Photo 1: Flood Management System, Hammarby, Sweden



Photo 2: Roof Garden, Sargfabrik, Vienna



Photo 3: Treatment of car park surfaces

A broad overview of the philosophy behind SuDS and techniques that are appropriate under different circumstances is provided in CIRIA publication C609 SuDS – hydraulic, structural and water quality advice. In addition, CIRIA publication C697 the SuDS Manual, provides further detailed information.

4 Building Design and Internal Layout

4.1 Floor Levels

Raising threshold and floor levels above expected flood levels can also be used to reduce the risk of flooding to a property. This is typically achieved by raising floor heights within the building structure through either a suspended floor arrangement or raised internal concrete platforms.

These approaches are most commonly adopted in developments that could be subject to limited flood depths (i.e. less than 2m) and where adjustments could help reduce potential flood losses. When designing an extension or modification to an existing property, an appropriate reduction measure would also be to ensure the threshold levels into a property are above the design

flood level. Care must be taken to ensure access for all is provided in compliance with Part M of the Building Regulations.

4.2 Internal Layout

Internal layout and the careful design of internal space can be an effective measure to reduce the impact of floods. For example, living accommodation, essential services, storage space for provisions and equipment should be designed to be located above the predicted flood level. In addition, siting of living accommodation, particularly sleeping areas, above flood level, may be an appropriate design option in areas at risk of flooding.

With the exception of single storey extensions to existing properties, new single storey accommodation may not be appropriate where predicted flood levels are above design floor levels. In all cases, safe access, refuge and evacuation should be incorporated within the design of development.

5 Designing For Residual Flood Risk

5.1 Residual Risk

It is possible that any flood defences will be exceeded by a flood (or rainstorm in the case of SuDS) that is greater than that which they were designed to resist. There is also no guarantee that such defences will be maintained to the standard of installation intended or that they may not be damaged by some other means. There will thus remain residual risks to development behind the defences.

5.2 Exceedance

All developments in flood risk areas should be tested for exceedance of flood management measures. This can involve:

- identifying and protecting routes of flood water through a development;
- the need for new buildings in flood risk areas to be designed to reduce the consequences of flooding and facilitate recovery from its effects.

This may be achieved through careful “flood-considerate design” in accordance with the Building Regulations.

5.3 Flood-Resistant Construction

Flood-resistant construction incorporates design measures aimed at preventing water from entering a building and can mitigate the damage flood water causes to buildings. Where flood risk mitigation measures are required through the flood risk assessment and application of the justification tests approaches of these guidelines, permanent flood-mitigation measures should always be used in new buildings.

5.4 Flood-Resilient Construction

Flood resilient construction approaches accept that flood water will enter buildings and that this situation should be allowed for in the design of internal building components, services and finishes. These measures should be carefully designed to limit damage caused by floodwater and allow relatively quick recovery. However, these measures on their own are not suitable for areas with potential for a combined risk of quickly rising water levels and/or where speed of flow is likely to be high and dangerous to the stability of buildings and the safety of people.

5.5 Emergency Response Planning

In addition to considering physical design issues, in planning and assessing new development attention must be paid to the issue of effective emergency response planning for flood events in areas of new development. This is normally the responsibility of the developer.

Key elements are:

- the provision of flood warnings, evacuation plans and ensuring public awareness of flood risks to people where they live and work;
- Coordination of responses and discussion with relevant emergency services i.e. Local Authorities, Fire & Rescue, Civil Defence and An Garda Síochána through the SFRA;
- Awareness of risks and evacuation procedures and the need for family flood plans.

5.6 Access and Egress During Flood Events

In general, above-ground flood escape routes should be kept to publicly accessible land, as safeguarding these is difficult if they are located within private property. Such routes should have signage and other flood awareness measures in place, to inform local communities of the impacts of flooding. The location of the most suitable access routes can be decided from the results of the flood risk assessment.

5.7 Further Information

Further and more detailed guidance and advice can be found at <http://www.flooding.ie> and in the Building Regulations.

In the UK, “Improving the Flood Performance of New Buildings” produced by the Department of Communities and Local Government is a valuable resource. In addition, a full technical report prepared for the Association of British Insurers and the Building Research Establishment on Flood Resilient Homes can be downloaded from the ABI website (<http://www.abi.org>). Also, the British Standards Institute (BSI) has introduced a “Kitemark” Certification Scheme for flood-resilient products, and CIRIA has published a number of documents detailing flood-protection products for the home. These can be downloaded from the CIRIA website (<http://www.ciria.org>).

Appendix C - Frequently Asked Questions

What is flooding?

Flooding is when land that is normally dry is covered by water. This can have both beneficial and adverse consequences. Deposition of sediments from river floods form the level floodplains alongside rivers and contribute to its agricultural fertility and its biodiversity. When it affects human activities, it can threaten life, cause social and health impacts, damage buildings and their contents, interrupt communications and lead to pollution that can cause environmental damage.

What causes flooding?

Flooding at the coast is caused by higher sea levels than normal. Inland flooding is due to intense and or prolonged rainfall which exceeds the capacity for it to sink into the ground. As a result, it runs off over land and into rivers and artificial drainage systems. When the capacity of these is exceeded, the result is river and sewer flooding. The roofs of buildings, roads and hard standings prevent water soaking into the ground thus increasing run-off and exacerbating the problems. Flooding can also occur when water that has soaked into the ground fills the underground storage and overflows onto the surface.

How will climate change influence flooding?

Climate change could potentially have a very significant effect on flooding in the longer term. Higher sea levels and wetter winters, with more intense rain storms, together with possible increases in storminess could significantly increase both the frequency and intensity of flooding. For example, floods which currently have a 1 in 100 chance (1% probability) of occurring in any one year could occur much more frequently.

How is flood risk measured?

Flood risk is a combination of the likelihood of occurrence and the consequences of a flood occurring. This is normally expressed as:

Flood risk = probability x consequences

Probability is difficult to estimate because it has to take account of the uncertainty of hydrological predictions based on the analysis of many years of flow records. Consequences are also complex to measure in terms of the potential loss of life, damage to property etc., which depend on the vulnerability of the land-use and property affected by the flood.

What is a source-pathway-receptor model?

A source-pathway-receptor model is a representation of the components of flood risk. The three components are a source of floodwater (prolonged or intense rainfall, high sea levels), the receptors (land, buildings and structures, people) that are

affected by flooding and the pathway (rivers, floodplain, artificial drainage systems, overland flow etc.) by which the flood reaches those receptors. For a risk to arise, all three components must be present and flood risk management is essentially concerned with protecting the receptors and/or modifying the pathways.

What is a flood risk assessment?

A flood risk assessment is the identification, quantification and communication of flood risk using the source-pathway-receptor model. It examines the sources of flooding and the pathways by which floodwaters might reach receptors, such as people, property and the environment to determine the likelihood of them being affected by flooding. It also examines the flood hazards that are likely to arise and the vulnerability of receptors to such hazards. Flood risk can be assessed at different scales, from the national, through regional and local to site-specific.

What is a flood hazard assessment?

A flood hazard assessment is the identification, quantification and communication of the hazards due to flooding. It seeks to identify areas subject to particular hazards, such as deep or fast-flowing water, and to assess the likelihood of them occurring both now and in the future.

What is a strategic flood risk assessment?

A strategic flood risk assessment (SFRA) is an area-wide examination (up to county scale) of the risks of flooding to support spatial planning decisions such as the zoning of particular areas for development. It is an essential element in the adoption of the sequential approach to the consideration of flood risk in spatial planning.

Will it be very costly to model flooding on a county-wide basis?

To ensure a proportionate response, flood risk assessments need only be as detailed as is necessary to obtain the information required to support the decision that is to be made. A staged approach should be adopted, therefore, comprising a screening assessment to identify whether there are flood risks to an area or site, a scoping assessment to confirm the sources of flooding and qualitatively appraise the risks and potential mitigation measures and an appropriate assessment to quantify the risks, appraise the effects of changes and the effectiveness of mitigation measures. At each stage the adequacy of the assessment to support the decision being made should be determined and the next stage should be initiated only if there is insufficient information to support the decision.

What does the SFRA provide?

The strategic flood risk assessment provides tools and methods to assist users in identifying the level of flood risk associated with an area to inform planning decisions. It supports the application of the sequential approach and provides data and maps to help in assessing sites against flood risk criteria. Where development is or would be at risk of flooding, it provides information on the mitigation measures considered deliverable to reduce the actual risk to that development and on the residual risks that would remain and how they might be managed.

What does the SFRA not provide?

The SFRA is an area-wide study and the level of detail is commensurate with its strategic nature. It does not provide suitably detailed site-specific information, such as design flood levels. A site-specific flood risk assessment is still required to cover in more detail all sources of flood risk for individual developments. The level of detail required for a site-specific flood risk assessment depends on the scale and nature of the development and the risks involved.

Where does the SFRA fit in the planning process?

The SFRA is not a statutory planning document. It is a consultation document that should be used to inform a development plan or local area plan, enabling the implementation of the sequential approach and the testing of development zoning against flood risk criteria. It can also be used to assist other planning decisions, such as development management, and emergency planning. In any instance, a site-specific flood risk assessment may be required when deciding on the grant of planning permission.

What is the sequential approach?

The sequential approach uses mapped flood zones alongside considerations of the vulnerability of different types of development to give priority to development in zones of low flood probability. Only if there are no reasonable sites available in zones of low flood probability should consideration be given to development in higher flood probability zones. The sequential approach should also be used within sites to help ensure that the most vulnerable uses are sited in the area of lowest probability.

What is the Justification Test?

Where there are insufficient sites available to locate development outside flood risk areas, it may be necessary, to meet the objectives of proper planning and sustainable development, for development to be sited within flood risk areas. The Justification Test is an examination of such proposals against proper planning and sustainable development criteria and, if these are satisfied, against flood risk criteria to ensure that risks are reduced to an acceptable level and that flood risk is not increased elsewhere.

How is vulnerability defined?

Different types of development are classified as being highly vulnerable, less vulnerable or water-compatible, depending largely on the risks to people who will use the development, the effects of damage to buildings and structures that might be caused by flooding, and the potential environmental damage that could be caused arising from pollution caused by the development were it to flood.

What is the definition of the flood zones in these guidelines?

The flood zones are defined on the basis of the probability of flooding from rivers and the sea. Because of the generally more dynamic nature of coastal flooding

compared to river flooding, a lower probability of coastal flooding is used to define the highest-risk zone.

- Zone A is at highest risk and has a 1 in 100 (or 1%) chance of flooding in any one year from rivers and a 1 in 200 (or 0.5%) chance of flooding from the sea.
- Zone B is at moderate risk of flooding from rivers and the sea and its outer limit is defined by a 1 in 1000 (or 0.1%) chance of flooding in any one year.
- Zone C is the low risk area, with a less than 1 in 1000 (<0.1%) chance of flooding from rivers, estuaries or the sea in any one year.

The definition of these zones does not, however, take account of the potential for flooding from other sources, such as ground water or artificial drainage systems. Flooding from these sources could occur in any of the zones and as such should always be considered, regardless of zone.

What is a flood defence?

Flood defences comprise man-made structures designed to reduce the likelihood of flooding in an area. They can include embankments, bunds, walls, sluice gates, storage reservoirs or diversion channels.

What is the standard of protection?

The standard of protection is the flood event against which the flood defences are designed to protect an area. It is usually expressed as the annual probability of exceedance of a particular flood level, such as the 1% (or 1 in 100) flood.

What is freeboard?

Freeboard is a safety margin to account for uncertainties in water-level prediction and/or structural performance. It is the difference between the height of the flood defence or floor level and the design flood level. Freeboard should account for uncertainty in hydrological predictions, wave action, modelling accuracy, topographical accuracy and the quality of digital elevation models.

What is meant by overtopping?

Overtopping is a mechanism of failure of flood defences. Flood water reaches levels that are higher than the flood defence level and flows over the crest of the structure. While the structure may remain stable, erosion of the landward face could lead to collapse of the defence.

What is a breach?

A breach is a structural failure of a defence, which allows water to flow through. Breach failure can be caused by internal piping failure and failure due to erosion of the landward face as a result of overtopping of the defence crest. Piping failure is due to small seepage paths through an embankment carrying away fine sediment and rapidly expanding due to a combination of external water level, internal water

pressure in the embankment and geotechnical conditions occurring in the soil matrix. Piping can sometimes be initiated by animals burrowing in the embankment.

My site benefits from a high-standard flood defence, should it not be in Zone C?

No. Flood defences can only reduce the risk of flooding, they cannot eliminate it. Therefore, the presence of a flood defence indicates an area at risk, not one that is safe. A flood defence may be overtopped by a flood that is higher than that for which it was designed, or be breached and allow flood water to rapidly inundate the area behind the defence. In addition, no guarantee can be given that flood defences will be maintained in perpetuity. As well as the actual risk, which may be reduced as a result of the flood defence, there will remain a residual risk that must be considered in determining the appropriateness of particular land uses and development. For these reasons, flooding will still remain a consideration behind flood defences and the flood zones deliberately ignore the presence of flood defences.

What is actual risk?

Actual risk is the risk of flooding taking account of all features that act as defences against flooding. These may include custom-made flood defence structures or artificial (such as road or railway embankments) or natural features (such as natural levees, sand dunes or other topographical features). These serve to reduce the actual risk of flooding since they reduce the frequency of flooding to that which will overtop the defence structure.

What is residual risk?

Residual risk is the risk that remains after all mitigation measures to reduce the frequency of flooding have been taken. It can arise through overtopping or breach of the flood defences, usually by a flood that exceeds the design level of the defence.

What is an adequate level of defence?

The level of defence that is required for a particular area is generally commensurate with the degree of damage that would occur in the event of the defence being overwhelmed.

What measures can be taken to protect against flooding?

Primary flood-defence measures include barriers to flow, such as embankments, bunds and walls, and measures to control flow, such as storage reservoirs, sluice gates, channel modification and diversion channels. These operate on a community basis but measures can also be taken to resist flood risk for individual developments or even properties. These include land-raising, raising floor levels or individual flood barriers, or ensuring that development at flood level is compatible with flooding. These are known as dry-proofing and aim to prevent water entering a property.

What is flood resilience?

The alternative to dry-proofing a property (because there are certainly economical and possibly physical limits to this) is to wet-proof a property. This entails allowing

water to enter the property when flooding occurs but ensuring that the design and materials are such that more rapid drying out and reoccupation is possible than using conventional construction methods. This is flood-resilience and, while it does not eliminate damage, it does reduce it to a more acceptable level.

What should minimum floor levels be to mitigate flood risk?

The minimum floor levels for new development should be set above the 1 in 100 river flood level (1 in 200 coastal flood level) including an allowance for climate change, with appropriate freeboard. However, where the consequences of flooding are significant, a higher standard should be considered. In setting floor levels it is important to ensure that access facilities for the disabled are not compromised.

Why is land-raising not an easy option?

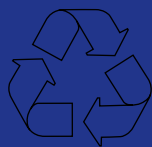
Even in a defended floodplain, land-raising may reduce the potential amount of flood storage or affect a flood-flow route, with consequent effects on flood risk elsewhere. During a flood event that can be contained by the defences, land-raising behind those defences may have little or no impact. However, should overtopping or a breach occur (or the defences be by-passed by flood waters), land-raising could adversely affect the surrounding low-lying areas by causing areas to flood that would not have flooded previously due to loss of floodplain storage. The beneficial effects of land-raising should therefore be balanced against potential increased flood risk elsewhere. New development should be planned in such a way that residual flood risk is equitably shared by new development and maintained or reduced for existing developments.

Can I make a planning application if my site is in an area of flood risk?

Yes. However, development management aims to ensure that planning permission is granted or refused in line with the provisions of the spatial plan that covers the area of the application (the development plan, local area plan or special development area scheme). In drawing up these plans, planning authorities (and special development boards) should take flood risk into account in accordance with the sequential approach and zone land for development that is at low risk of flooding or that can satisfy the Justification Test if no low-risk land is reasonably available that would meet the objectives of proper planning and sustainable development. An applicant for planning permission for development that is not in line with the spatial plan would need to satisfy the planning authority and/or An Bord Pleanála that there are no reasonably available alternative sites at low risk of flooding, that the development can be justified on the grounds of proper planning and sustainable development and that the development would not be subject to unacceptable risks of flooding or increase flood risk elsewhere (Parts 1 and 2 of the Justification Test).

Who can tell me if my land is at risk of flood or where can I go to get this information?

A list of potential sources of information relevant to flooding is provided in Appendix A.



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