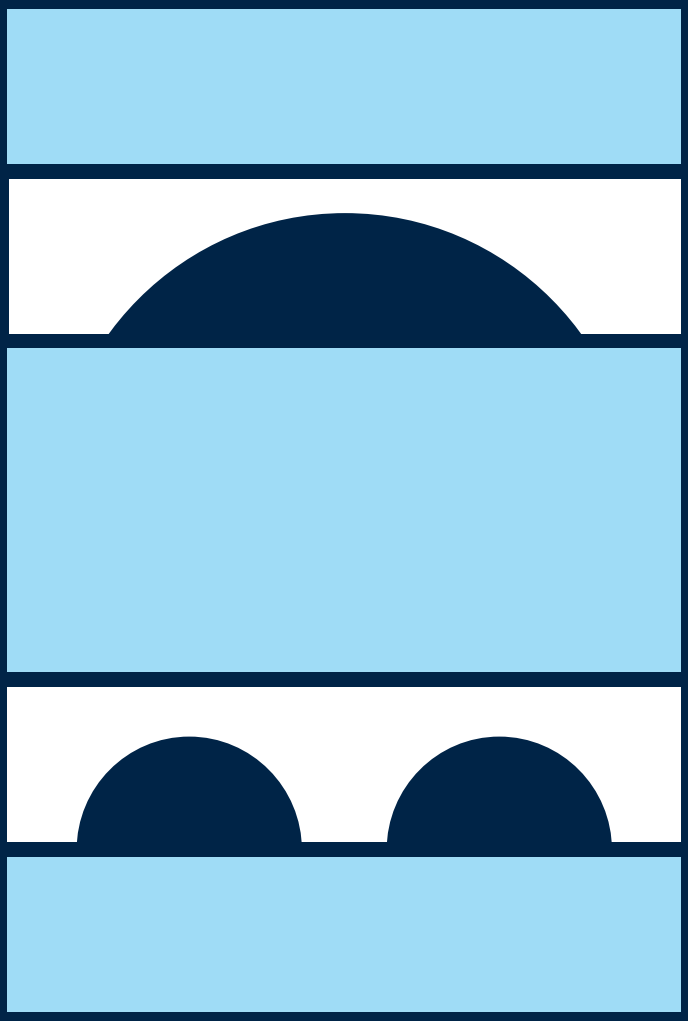
Dublin City Development Plan 2016–2022

Strategic Flood Risk Assessment (SFRA)



Comhairle Cathrach Bhaile Átha Cliath
Dublin City Council

Dublin City Development Plan 2016–2022

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Introduction Strategic Flood Risk Assessment (SFRA)

1.0 Introduction

This report outlines the findings of the Strategic Flood Risk Assessment (SFRA) for the Dublin City Development Plan 2016–2022. The SFRA will be updated during the process and will take on board the findings of the CFRAMS (Catchment Flood Risk and Management Studies) where such information is available.

This Strategic Flood Risk Assessment (SFRA) will provide an area-wide assessment of all types of significant flood risk to inform strategic land use planning decisions. The SFRA enables the Dublin City Council (DCC) to apply 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.

The SFRA was prepared and informed by the DEHLG Guidelines for Planning Authorities (DEHLG & OPW, 2009) on 'The Planning System and Flood Risk Management 'and Technical Appendices, *see Figure 1.1*. These Guidelines were issued under Section 28 of the Planning and Development Act 2000 as amended, and require Planning Authorities to introduce flood risk assessment as an integral and leading element of their development planning functions. It sets out that development plans and local area plans, must establish the flood risk assessment requirements for their functional area.

Fig 1.1: The Planning System and Flood Risk Management Guidelines for Planning Authorities & Technical Appendices, 2009

1.1 Disclaimer

It is important to note that, although prepared in compliance with the requirements of *The Planning System and Flood Risk Management Guidelines for Planning Authorities, 2009*, the SFRA is a work in progress and is based on emerging and best available data at the time of preparing the assessment. In particular, the assessment and mapping of areas of flood risk is based on the draft (rather than finalised) outputs from the Eastern Catchment Flood Risk Assessment and Management Plan [ECFRAM].

Accordingly, all information in relation to flood risk is provided for general policy guidance only, and may be substantially altered in light of future data and analysis, or future flood events. As a result, all landowners and developers are advised that Dublin City Council and their agents can accept no responsibility for losses or damages arising due to assessments of the vulnerability to flooding of lands, uses and developments. Owners, users and developers are advised to take all

reasonable measures to assess the vulnerability to flooding of lands and buildings (including basements) in which they have an interest prior to making planning or development decisions.

The SFRA will be reviewed as part of forthcoming Development Plans and following a significant flood event to ensure that its content and emphasis remains relevant.

1.2 Dublin City Development Plan 2016- 2022

The overall core strategy for Dublin City, and therefore the context of the 2016–2022 Development Plan, builds on the principles established in the previous Dublin City Development Plan 2011–2017.

Dublin City in its entirety lies within the metropolitan area and the Regional Planning Guidelines (RPG) give direction to Dublin City as the 'gateway core' for high-intensity clusters, brownfield development, urban renewal and regeneration. The RPG settlement strategy for the metropolitan area includes a strong policy emphasis on the need to gain maximum benefit from existing assets, such as public transport and social infrastructure, through the continuation of consolidation and increasing densities within the existing built footprint of the city. A further key aspect is that future expansion, whether housing or mixed-uses, occur in tandem with high-quality rail-based public transport and on a phased basis. The development plan incorporates these principles in a settlement hierarchy which prioritises the inner city, Key District Centres (KDCs) and Strategic Development & Regeneration Areas (SDRA's). The majority of SDRA's relate to a zoning objective which seeks the social, economic, physical development or rejuvenation of an area with residential, employment and mixed-uses (Z14). These SDRA's have substantial development capacity, not only for residential uses, and a series of detailed guiding principles incorporating urban design and green infrastructure guidance have been set out for each SDRA in Chapter 15 of the Development Plan. For the inner city, the plan seeks to strengthen and consolidate the robust city-centre mixed-use zoning (Z5), with active promotion of the inner city as an attractive place for urban living, working and visiting; the delivery of housing regeneration projects; the emergence of spatial clusters of economic specialism's; public realm improvements and the strengthening of the retail core, all supported by multiple levels of public transport accessibility in the city centre. It is part of this settlement strategy to fully regenerate the Docklands (via the approved SDZ scheme), and the western end of the central city area including Grangegorman, Heuston environs, and the James' Hospital campus and environs. The KDCs represent the top-tier of urban centres outside the city centre, a number of which form part of the larger SDRA's. Each of the 8 KDCs underpin a wider area and act as strong spatial hubs providing a comprehensive range of commercial and community services to the surrounding populations. All of the designated KDCs closely align to public transport rail corridors, with the exception of two (Finglas and Northside) which perform an important regeneration role for local communities. This development plan will reinforce the KDCs as sustainable anchors for the suburbs.

The core strategy has been informed by the Strategic Environmental Assessment (SEA) & Appropriate Assessment (AA) and this Strategic Flood Risk Assessment, undertaken in a parallel process in tandem with each stage of the development plan.

To deliver the Core Strategy the following mechanisms are used, all of which will be subject to their own level of flood risk assessment, which will be informed by this document:

a. Area-Specific Plans: Dublin City Council will prepare area-specific guidance for the SDRAs and KDCs, using appropriate mechanisms of local area plans and schematic master plans and Local Environmental Improvement Plans (LEIPs).

b. Zoning and Standards: The zoning and standards provisions of the plan have been devised to support the delivery of the core strategy. In particular the zoning provision ensures adequate land to meet the population targets and economic role of the city as the national gateway, intensification along public transport corridors and a mixed use approach to zonings. The standards reinforce this approach with clear guidance for quality residential development, successful neighbourhoods and green infrastructure.

c. Monitoring Indicators: This is a dynamic plan that will be actively implemented. In order to consistently and properly track and measure progress on the implementation of the plan, a set of City Performance Indicators has been devised and these are set out in Appendix 20 of the plan. The SEA and AA, which have informed the policies in the development plan, will also be monitored.

d. Engagement with City Stakeholders: Engagement around the vision and implementation of the plan is essential to achieving a sustainable Dublin.

The SFRA is integrated into the SEA process that is being undertaken alongside the preparation of the Development Plan. The Environmental Authorities specified by the SEA Regulations were consulted at the end of December 2014 during formal SEA scoping with the scope of issues including those relating to flood risk and storm (surface) water management.

1.3 Planning System and Flood Risk Management Guidelines for Planning Authorities, 2009

'The Planning System and Flood Risk Management Guidelines for Planning Authorities and Technical Appendices, 2009', were issued under Section 28 of the Planning and Development Act 2000 as amended, and require Planning Authorities to introduce flood risk assessment as an integral and leading element of their development planning functions. It sets out that development plans and local area plans, must establish the flood risk assessment requirements for their functional area.

The formulation of policies and objectives for Flood Risk Management in areas at risk of flooding must have been developed with regard to *'The Planning System and Flood Risk Management Guidelines for Planning Authorities and Technical Appendices both dated November 2009.*

The Guidelines require the planning system at national, regional and local levels to:

a. Avoid developments in areas at (significant) risk of flooding, particularly floodplains, unless there are proven wider sustainability grounds that justify appropriate development and where the flood risk can be reduced or managed to an acceptable level without increasing flood risk elsewhere.

b. Adopt a sequential approach to flood risk management when assessing the location for new development based on avoidance, reduction and mitigation of flood risk, and

c. Incorporate flood risk assessment into the process of making decisions on planning applications and planning appeals.

1.4 Flood Risk

Flooding is a natural process which cannot be prevented entirely but it can generally be managed to reduce its social and economic consequences and to safeguard the continued functioning of services and infrastructure. Climate change is likely to worsen the situation in areas susceptible to intermittent flooding.

Flood Risk is the likelihood of a particular flood happening (probability), e.g. the 1% annual exceedence probability (AEP) flood has a roughly 1 in 100 year chance of occurring. This does not mean that they only happen every 100 years, in betting terms the odds of such an event happening would be 100/1 in any year.

Flood risk can be expressed in terms of the following:

Flood risk = Probability of Flooding X Consequences of Flooding.

1.5 Flood Zones

Flood zones are geographical areas within which the likelihood of flooding is in a particular risk 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 in *'The Planning System and Flood Risk Management Guidelines for Planning Authorities and Technical Appendices, 2009'*:

- **Zone A:** High probability of flooding – Where the estimated average probability of flooding from rivers and sea is highest (greater than 1% annually or more frequent than 1 in 100 years for river flooding or greater than 0.5% annually or more frequently than 1 in 200 years respectively for coastal flooding). Most forms of development are deemed to be inappropriate here, only water compatible development would normally be allowed.
- **Zone B:** Moderate probability of flooding – Flood risk is between 0.1% (or 1 in 1000 years) and 1 % (or 1 in 100 years) annually for river flooding, and between 0.1% (or 1 in a 1000 years) and 0.5% (or 1 in 200 years) annually for coastal flooding. Highly vulnerable development including hospitals, residential care homes, Garda buildings, car parks, fire and ambulance stations, dwelling houses and primary strategic transport and utilities infrastructure would generally be considered inappropriate unless the requirements of the justification test are met. Less vulnerable development such as retail, commercial and industrial uses should only be considered in this zone if adequate lands or sites are not available in Zone C and subject to a flood risk assessment to the appropriate level of detail to demonstrate that flood risk to and from the development can or will be adequately be managed.

- **Zone C:** Low probability of flooding – Areas where the risk of flooding is less than 0.1% annually (or 1 in 1000 years) for both rivers and coastal flooding. Development is appropriate from a flood risk perspective (subject to flood hazard from sources other than rivers and coast meeting normal proper planning considerations).

It is important to note that *'The Planning System and Flood Risk Management Guidelines for Planning Authorities and Technical Appendices, 2009'* ignore the presence of flood defences when defining flood zones; this is due to the fact that even areas that benefit from an existing flood defence can still be vulnerable due to the speed when overtopping or a breach or other failure takes place. Therefore this residual risk of flooding where appropriate should be assessed as part of the application of the justification test and, if the site is zoned for development, through the site specific flood risk assessment.[1] Proposed develpments in defended areas will depend on the quality of the flood defences.

1.6 Consequences of Flood Risk

The consequences of flooding depends on the hazards associated with the event, including depth of water, speed of flow, rate of onset, duration, wave action effects and water quality. The consequences are also determined by the vulnerability of people, property and the environment potentially affected by a flood. The recovery time following flooding is also important.

'The Planning System and Flood Risk Management Guidelines for Planning Authorities and Technical Appendices, 2009' provide three vulnerability categories based on the type of development which are detailed below:

- Highly vulnerable
- Less vulnerable
- Water compatible

Tables 1.1 and 1.2 taken from *'The Planning System and Flood Risk Management Guidelines for Planning Authorities and Technical Appendices, 2009'* illustrate the types of development that would be appropriate to each flood zone and those that would be required to meet the justification test. Inappropriate development that does not meet the criteria of the justification test should not be considered at the plan-making stage or approved within the development management process.

1 The Planning System and Flood Risk Management Guidelines for Planning Authorities, 2009 Section 3.4

Table 1.1 Classification of vulnerability of different types of development.[2]

Vulnerability Class	Lane uses and types of development which include*:
Highly vulnerable development (including essential infrastructure)	Garda, ambulance and fire stations and command centres required to be operational during flooding; Hospitals; Emergency access and egress points; Schools; Dwelling houses, student halls of residence and hostels; Residential institutions such as residential care homes, children's homes and social services homes; Caravans and mobile home parks; Dwelling houses designed, constructed or adapted for the elderly or, other people with impaired mobility; and Essential Infrastructure, such as primary transport and utilities distribution, including electricity generating power stations and sub-stations, water and sewage treatment, and potential significant sources of pollution (SEVESO sites, IPPC sites, etc) in the event of flooding.
Less vulnerable development	Buildings used for; retail, leisure, warehousing, commercial, industrial and non-residential institutions; 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; Water treatment (except landfill and hazardous waste); Mineral working and processing; and Local Transport Infrastructure
Water compatible development	Flood control infrastructure; 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; and Essential ancillary sleeping or residential accommodation for staff required by uses in this category (subject to a specific warning and evacuation plan).

*Uses not listed here should be considered on their own merits

Table 1.2 Matrix of vulnerability versus flood zone to illustrate appropriate development and that required to meet the Justification Test.[3]

	FLOOD ZONE A	FLOOD ZONE B	FLOOD ZONE C
Highly vulnerable development	JUSTIFICATION TEST	JUSTIFICATION TEST	APPROPRIATE
Less vulnerable development	JUSTIFICATION TEST	APPROPRIATE	APPROPRIATE
Water-compatible development	APPROPRIATE	APPROPRIATE	APPROPRIATE

2 Source: The Planning System and Flood Risk Management Guidelines for Planning Authorities, 2009
3 Source: The Planning System and Flood Risk Management Guidelines for Planning Authorities, 2009

1.7 Structure of a Flood Risk Assessment (FRA)

'The Planning System and Flood Risk Management Guidelines for Planning Authorities and Technical Appendices, 2009' recommend that a staged approach is adopted when undertaking a Flood Risk Assessment (FRA), which include:

Stage 1 - Flood Risk Identification: To identify whether there may be any flooding or storm (surface) water management issues that will require further investigation. This stage mainly comprises a comprehensive desk study of available information to establish whether a flood risk issue exists or whether one is reasonably likely to exist in the future.

Stage 2 - Initial Flood Risk Assessment: If a flood risk issue is deemed to exist arising from the stage 1 Flood Risk Identification process, the assessment proceeds to stage 2 which confirms the sources of flooding, appraises the adequacy of existing information and determines the extent of additional surveys and the degree of modelling that will be required. stage 2 must be sufficiently detailed to allow the application of the sequential approach within the flood risk zone.

Stage 3 - Detailed Flood Risk Assessment: A detailed FRA is carried out where necessary to assess flood risk issues in sufficient detail and to provide a quantitative appraisal of potential flood risk to a proposed or existing development or land to be zoned, of its potential impact on flood risk elsewhere and the effectiveness of any proposed mitigation measures.[4]

For the purposes of the development plan, the Strategic Flood Risk Assessment covers stages 1 and 2, i.e. Flood Risk Identification and Initial Flood Risk Assessment. Due to the nature of flood risk in the city, there were no sites identified that required Detailed (stage 3) assessment through the SFRA. The SFRA has also identified situations, and some specific locations, where stage 3 flood risk assessments will be required to support site specific planning decisions.

1.8 Geographical Scales of a Flood Risk Assessment

Flood risk assessments are undertaken at different scales for the purposes of decision making, and may be at Regional, Development Plan or Local Area Plan level, and also at site specific level.

Regional Flood Risk Assessment (RFRA): provides for a broad overview of the source and significance of all types of flood risk across a region and highlights areas where more detailed study will be required. These appraisals are undertaken by regional authorities. At Regional Level the focus of a FRA will be at stage 1 (Flood Risk Identification), where, in general the need for more detailed flood risk assessment if flagged for city/county and local area plans. Details of the RFRA which covers County Dublin are provided in section 1.9

Strategic Flood Risk Assessment (SFRA): The SFRA provides a broad basis (area-wide or county wide) assessment of all types of known flood risk to inform strategic land use planning decisions. The SFRA allows the Planning Authority to undertake the sequential approach (described below) and identify how flood risk can be reduced as part of the development plan process.

4 The Planning System and Flood Risk Management Guidelines for Planning Authorities, 2009

Where development is planned in flood risk areas, a detailed flood risk assessment may have to be carried out within the SFRA so that the potential for development of the lands and their environmental impact can be assessed. The SFRA will provide more detailed information on the spatial distribution of flood risk to enable adoption of the sequential approach and to identify where it will be necessary to apply the justification test.[5] The Flood Risk Assessment undertaken for the Dublin City Development Plan is at the Strategic Flood Risk Assessment scale.

Site Specific Flood Risk Assessment (site FRA): A site specific FRA is undertaken to assess all types of flood risk for a new development. This requires identification of the sources of flood risk, the effects of climate change on the flood risk, the impact of the proposed development, the effectiveness of flood mitigation and management measures and the residual risks that then remain. The requirement for and scope of site specific flood risk assessments is detailed in this report.

1.9 Regional Flood Risk Assessment

A Regional Flood Risk Appraisal (RFRA) was carried out for the Regional Planning Guidelines (RPG) for the Greater Dublin Area 2010–2022. Chapter 9 of the RFRA sets out the key policy recommendations with regard to avoiding and managing flood risk within the Greater Dublin Area (GDA). The GDA comprises of seven local authority areas: Dublin City, Dún Laoghaire - Rathdown County, Fingal County, South Dublin County, Meath County, Kildare County and Wicklow County Councils. The area to a large part falls within the Eastern River Basin District and Eastern CFRAMS area, encapsulating the rivers and tributaries of the Liffey, Boyne, Dodder, Tolka, Avoca and Vartry.

The RPG confirms that although 'a number of key towns and the City are vulnerable to two key sources of flooding, fluvial and coastal, effective management of flood risk coupled to wider environmental, sustainability and economic considerations mean that it is possible to facilitate the continued consolidation of the existing urban structure of the GDA. The RPG state that 'it is considered that these locations should be encouraged to continue to consolidate and to grow in order to bring about a more compact and sustainable urban development forms while at the same time managing flood risk appropriately'.

The Guidelines set out a number of strategic recommendations including:

FR1: New development should be avoided in areas at risk of significant flooding. Alongside this, the Regional Flood Risk Appraisal recognises the need for continuing investment and development within the urban centres of flood vulnerable designated growth towns and the City and for this to take place in tandem with the completion of CFRAM Studies and investment in comprehensive flood protection and management.

FR2: Development and Local Area Plans should include a Strategic Flood Risk Assessment and all future zoning of land for development in areas at risk of flooding should follow the sequential approach set out in the Departmental Guidance on Flood Risk Management. All Flood Risk Assessments and CFRAM studies should take place in coordination and consultation with adjoining local authorities and regions

5 The Planning System and Flood Risk Management Guidelines for Planning Authorities, 2009

and in coordination with the relevant River Basin Management Plans.

FR3: Local authorities should take the opportunities presented to optimise improvements in biodiversity and amenity when including policies and actions in development plans/local area plans (such as flood plain protection and SUDS) for existing and future developments.

FR4: Plans and projects associated with flood risk management that have the potential to negatively impact on Natura 2000 sites will be subject to a Habitats Directive Assessment (HDA) according to Article 6 of the habitats directive and in accordance with best practice and guidance.[6]

The RPG set out a number of recommendations for the future Development and Local Area Plan including:

- Identify and consider at the earliest stage in the planning process flood hazard and potential risk.
- Identify flood risk areas on the Development Plan and Local Area Plan maps.
- Review existing Development Plans and Local Area Plans to ensure that issues of Flood Risk has been addressed in a manner consistent with the Flood Risk Management Guidelines. Where lands are already zoned for housing or other vulnerable development in flood risk areas, the Council should undertake a re-examination of the zoning in accordance with the sequential approach. Regional Planning Guidelines may need to identify Plans which will require a variation to take account of FRA.
- Include policies which ensure that flood risk areas targeted for development following the sequential approach should be planned, designed and constructed to reduce and manage flood risk and be adaptable to changes in climate.
- Include policies to ensure that flood risk and impact is considered as a key element in the assessment of future waste and mineral planning strategies and developments.
- Include policies that ensure that the location of key infrastructure will be subject to Flood Risk Assessment.
- Include policies on the importance of the inclusion of Sustainable Drainage Systems (SUDS) in future developments, in accordance with the recommendations of the Greater Dublin Strategic Drainage Study Guidelines and Appendix B of the Flooding Guidelines published by the Department of the Environment Heritage and Local Government (DEHLG) and the OPW.[7]

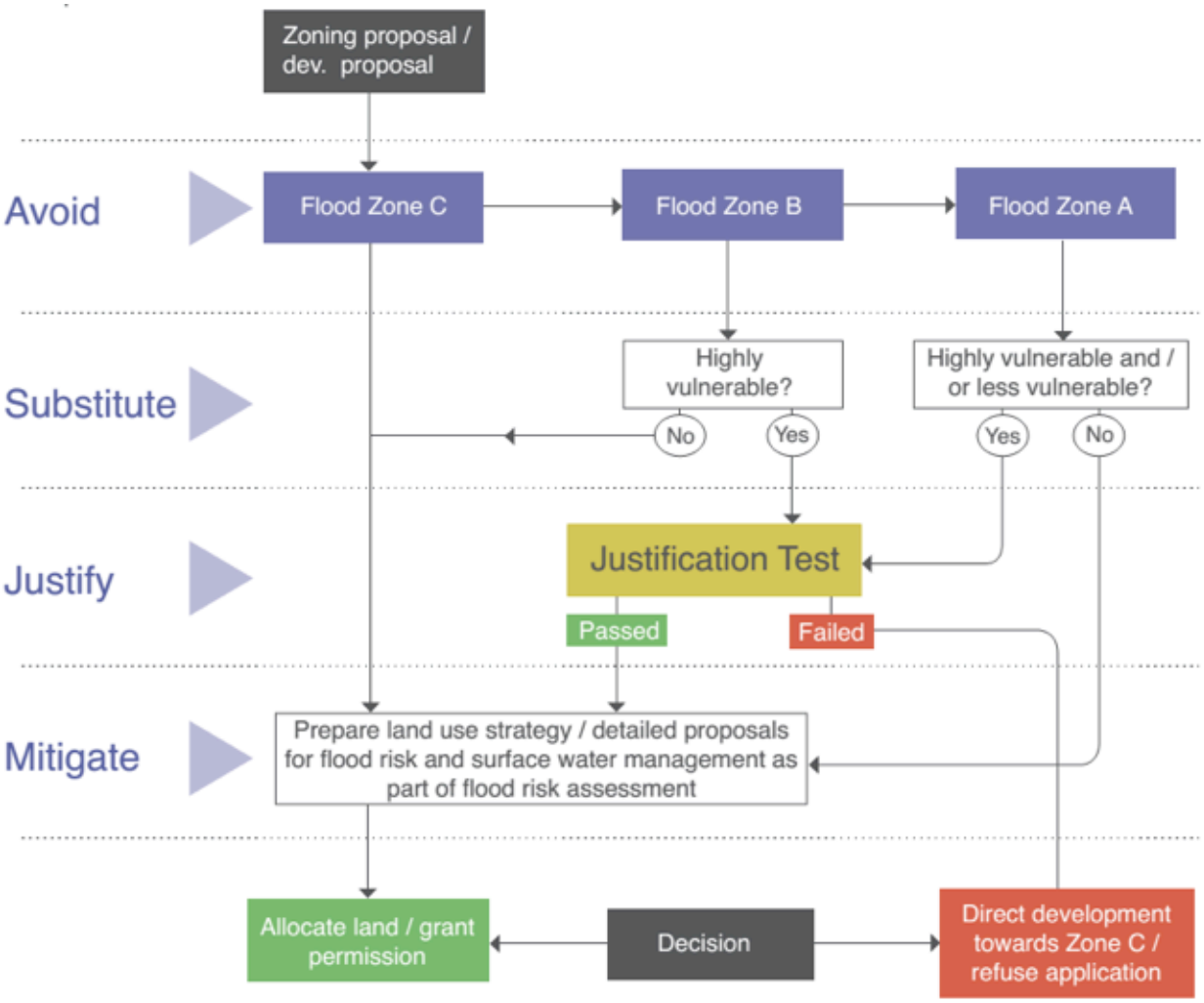
1.10 Sequential Approach to Flood Risk Management & Justification Test

The sequential approach is the key tool in ensuring that development, particulary new developments, first and foremost is directed towards land that is at low risk.[8]

Figure 1.2 taken from *'The Planning System and Flood Risk Management Guidelines for Planning Authorities and Technical Appendices, 2009'* sets out the broad philoposhy underpinnng the sequential approach.

6 Regional Planning Guidelines for the Greater Dublin Area 2010–2022, June 2010
7 The Planning System and Flood Risk Management Guidelines for Planning Authorities & Technical Appendices, 2009
8 Source: The Planning System and Flood Risk Management Guidelines for Planning Authorities, 2009

Fig 1.2: Sequential Approach (from The Planning Systeme and Flood Risk Management Guidelines for Planning Authorities, 2009)



The sequential approach to flood risk makes use of flood risk assessment and of prior identificaiton of flood zones for river and coastal flooding and classification of the vulnerability of flooding of different types of development. This approach highlights the importance of taking into account the risks of other sources of flooding to be taken into account in all areas and at all stages of the planning process.

The sequential approcah is based on the following principles : Avoid – Substitute – Justify – Mitigate – Proceed.

Where possible, development in areas identified as being at high flood risk for that type of development should be avoided. This may necessitate de-zoning lands within the development plan. If dezoning is not possible, then rezoning from a higher vulnerability land use, such as residential, to a less vulnerable use, such as open space may be required. Where rezoning is not possible, development restrictions are provided for through the application of the justificaiton test, as set out below.

1.10.1 Justification Test

The justification test is designed to rigorously assess the apropriateness or otherwise of particular developments that for various reasons are being considered in areas of moderate or high risk of flooding.

The tests comprise of two processes namely the plan making justification test and the development management justification test.

1.10.2 Justification Test for Development Plans

The primary approach for managing flood risk has been to either avoid flood zone A or B, or substitute a lower vulnerability development. However, it is only when both avoidance and substitution cannot take place should consideration be given to mitigation and management of risks, with can only be provided for through the justificaiton test.

The plan making justification test has been carried out as part of the SFRA using mapped flood zones. It applies where Dublin City Council has reviewed the need for development of areas at a high or moderate risk of flooding for uses which are vulnerable to flooding and which would generally be inappropriate, as set out in Table 1.2, and where avoidance or substitution is not appropirate. Where land use zoning objectives have been retained, DCC are satisfied that it has clearly demonstated that the designation for development has satisfied the Justifiation Test for Development Plans. In such cases, all of the following criteria must be satisfied:

1. The urban settlement is targeted for growth under the National Spatial Strategy, Regional Planning Guidelines, statutory plans, as defined above or under the provisions of the Planning and Development Act 2000, as amended.
2. The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:
    - **i.** Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement;
    - **ii.** Comprises significant previously developed and/or under-utilised lands;
    - **iii.** Is within or adjoining the core of an established or designated urban settlement;
    - **iv.** Will be essential in achieving compact and sustainable urban growth and
    - **v.** There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement.
3. A flood risk assessment to an appropriate level of detail has been carried out as part of the Strategic Environmental Assessment as part of the development plan preparation process, which demonstrates that flood risk to the development can be adequately managed and the use or development of the lands will not cause unacceptable adverse impacts elsewhere.

N.B. The acceptability or otherwise of levels of any residual risk should be made with consideration for the proposed development and the local context and should be described in the relevant flood risk assessment.

Circular letter PL2/2014 from DECLG dated 13th August 2014 in Appendix (2) states that for existing developed areas at risk of flooding, and proposed regeneration areas, the Planning Authority or Development Plan must "specify the nature and design of structural or non-structural flood risk management measures prior to future development in such areas to ensure that flood hazard and flood risk to the area and other locations is not increased, or if practible, will be reduced." In many cases through this SFRA, flood risk to existing development has been identified and appraised. The extent and depth of flooding has been assessed and it has been determined that risks can be managed through development control measures, as detailed in the later sections of this SFRA. However, there are a number of areas where further development would be considered premature until ongoing or planned defence works or mitigation measures have been completed.

02

Stage 1 - Flood Risk Identification

2.0 Development of Flood Zone Maps

Due to the number of flood investigation and management studies that have focused on Dublin City there are a number of datasets which record either historical or predicted flood extents. The aim of the flood risk identification stage of the SFRA is to identify flood risk based on the data available, including historical records, considering all sources of flooding, and to appraise the quality and usefulness of the data.

A wide range of data was collected and reviewed for completeness, applicability, quality and confidence in its accuracy. One of the key outcomes of the SFRA is to produce a flood zone map which, along with other planning considerations, will inform land zoning decisions. The quality of outline may vary across the study area depending on the origin and quality of available data, but the best available or readily derivable information has been used to form the composite map (copy of composite flood zone map in Appendix 5). In all cases, the outlines have been reviewed against each other, any additional available data and against local engineering knowledge and have been refined where appropriate. In particular, the datasets that have been used are the Dodder, Fingal East Meath and draft Eastern CFRAM flood extents/zones, River Tolka and River Wad Flooding Studies, Irish Coastal Protection Strategy Study (ICPSS) tidal flood outlines, records of historical flood events, walkover survey and consultation with local authority area engineers.

The various sources of data are briefly discussed in the following paragraphs, which also give an indication of how each dataset was used in the SFRA study. More detail regarding each of the datasets is available from the relevant study specific reports.

The primary source of predictive flood information is the Office of Public Works (OPW) Catchment Flood Risk Assessment Management (CFRAM) Plans, which include the Dodder and Fingal East Meath Pilot studies, and the ongoing Eastern CFRAM study. These studies have mapped fluvial and coastal flood risk, and have looked at the benefits of flood defences. The Eastern CFRAM study has draft status, but has been subject to several rounds of review by Dublin City Council, and has been presented at a series of public consultation days. Although still draft, it is considered that the outputs are robust enough to form the basis of the flood zone maps for the relevant rivers, with additional review by DCC engineers. Further information on the CFRAM studies is available at www.cfram.ie.

The River Tolka flooding study carried out a detailed analysis on the River Tolka. The principal output was an analysis of the flood risk based on extreme flood events and included options for flood prevention and protection for properties at risk. A similar assessment had been carried out for the Wad River through the River Wad drainage study. In both cases, flood extents were available for use in developing the flood zone maps.

The Irish Coastal Protection Strategy Study (ICPSS) and the Dublin Coastal Flood Protection Project (DCFPP) also provide extreme sea levels and coastal flood maps, but have been largely superseded by the CFRAM maps. The ICPSS outlines were cross-checked against the other available datasets.

Information on pluvial flood risk comes from the EU Interreg IVB FloodResilienCity

Project. For the project, a City–wide Model provided a high level assessment of pluvial flood risk across Dublin and five 'Pilot Areas' were identified for further detailed investigation of potential pluvial flood risk i.e. Type 2 modelling.

Strategies and Actions for Flood Emergency Risk Management (SAFER) was an EU Interreg IIB funded project for Dublin City. It developed tide event forecasting, emergency response procedures and coastal flood maps from available information in 2008 to inform decision making on emergency response procedures. The coastal flood maps developed as part of the SAFER project have been largely superseded by the CFRAM maps.

Information on historical flood events provided a useful cross-check on the developing flood zones and allowed verification of the outputs. Details of recent flood events are provided in Section 2.2. This was coupled with engineer's knowledge of the watercourses and their catchments.

It should be noted that a number of Local Area Plans (LAPs)/Strategic Development Zones (SDZs) have been adopted in the past few years that have included a SFRA to Stage 2, including the George's Quay LAP, Naas Road LAP, Pelletstown LAP, North Fringe LAP, Grangegorman SDZ, and more recently the Docklands (North Lotts & Grand Canal Dock) SDZ planning scheme and the findings of these assessments are reflected in the City SFRA.

The OPW's Preliminary Flood Risk Assessment (PFRA) mapping provides indicative flood extents for fluvial, coastal, groundwater and storm (surface) water risks; however, the PFRA was not used in developing the flood zone map for the City SFRA as there were more detailed studies as outlined above in Dublin City.

2.1 Main Sources of Flooding

Over the last few decades the risk of flooding has continued to increase in Ireland. Much of this has been attributed to (i) climate change, resulting in increased and more intense rainfall (e.g. more thunderstorms), increased sea water levels, and (ii) increasing levels of urbanisation. Coastal erosion or accretion can also increase the risk of flooding in some areas. The main types of flooding are from (i) tidal/coastal flooding which arises from the sea or estuaries, (ii) river or fluvial flooding which arise from rivers or streams, (iii) pluvial or storm (surface) water flooding which arises directly from rainfall, (iv) groundwater flooding (v) dam breach and (vi) sewer/infrastructural failure.

2.1.1 Coastal and Tidal Flooding

Storms or other extreme weather conditions combined with high tides can cause sea levels to rise above normal, and force sea water on to the land thus causing coastal flooding.

Following recent extreme tide and flood events, and also predictions of a rise in sea levels due to climate change, Dublin City Council carried out a review of the capacity of the existing coastal flood defences to provide protection against tidal flooding to urban areas resulting from extreme weather conditions in the short to long term. The review was carried out as part of the Dublin Coastal Flooding Protection Project and was published in 2005.

The Dublin Coastal Flood Protection report identified a number of locations

where the current level of flood defences was below that required for current and future predicted sea levels. As described in Appendix 1, some works have since been completed, some are ongoing with further works in the final design stages as recommended by the Dublin Coastal Flooding Protection Project.

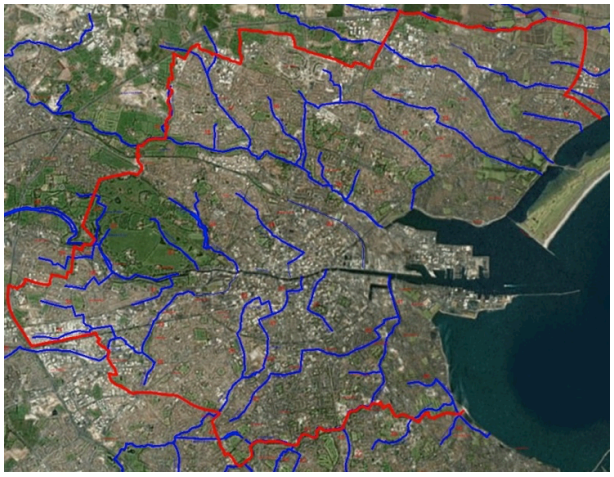
The Triton and Tidewatch early warning systems are based on sensors in Dublin Bay providing continuous information on sea-level changes and then sending alarm messages to relevant personnel in the Council. The former provides a 1 day advance warning of high tides and the latter provides a 3 day advance warning of same. These early warning systems then provide the necessary information to inform the subsequent emergency response strategy.

The early warning systems outlined above, in conjunction with capital works such as the South Campshire Flood Protection Project, the existing Spencer Dock sea gate and the existing flood defences along the River Dodder, provide alleviation to coastal flood risk. The area around the South Campshires will be protected from coastal flooding to the 0.5% AEP (Annual Exceedance Probability) level plus an allowance for sea level rise due to climate change. Other portions of the Docklands SDZ are currently protected to the 0.5% AEP tidal flood level, but do not include an allowance for sea level rise so will require long term monitoring to ensure the standard of protection is maintained.

2.1.2 Fluvial (River) Flooding

There are three main rivers in Dublin City, the Tolka, the Liffey and the Dodder. There are also many smaller rivers (underground) including the Wad, Poddle, Santry, Mayne and the Camac. Flooding from the rivers arises when the capacity of the channel is exceeded and water flows out over the river banks. This is normally linked to prolonged rainfall and storm (surface) water runoff entering the channel. Flooding from the rivers can also occur if the channel or the inlet to a culvert becomes blocked. Dublin City Council is currently reviewing the condition of the screens to the culverts on all its rivers. As part of this assessment, an analysis of the screens will be carried out to determine fitness for purpose, functionality and impacts of culvert / screen blockage.

Fig 2.1: Rivers of Dublin City



2.1.3 Flooding from Flood Defence Overtopping or Breach

Owing to an extensive and frequent history of flooding in some parts of the city, there are a number of flood relief schemes in Dublin. These include large scale DCC managed schemes on the River Dodder, and some smaller works which have been constructed, or are due for construction on smaller watercourses. It should be noted that whilst existing development clearly benefits from the construction of defences, it is against sustainability objectives, and the general approach of the OPW, to construct

defences with the intension of releasing land for development.

It is also not appropriate to consider the benefits of schemes which have not been constructed, and which may only be at pre-feasibility or design stage.

Residual risk is the risk that remains after measures to control flood risk have been carried out. Residual risk can arise from overtopping of flood defences and/or from the breach from structural failure of the defences.

The concept of residual risk is explained in *'The Planning System and Flood Risk Management Guidelines for Planning Authorities and Technical Appendices, 2009'* as follows:

"Although flood defences may reduce the risk of flooding, they cannot eliminate it. 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 defence 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."

Overtopping of flood defences will occur during flood events greater than the design level of the defences. Overtopping is likely to cause more limited inundation of the floodplain than if defences had not been built, but the impact will depend on the duration, severity and volume of floodwater. However, and more critically, overtopping can destabilise a flood defence, cause erosion and make it more susceptible to breach or fail. Recovery time and drainage of overtopping quantities should also be considered.

Overtopping may become more likely in future years due to the impacts of climate change and it is important that any assessment of defences includes an appraisal of climate change risks.

Breach or structural failure of flood defences is hard to predict and is largely related to the structural condition and type of flood defence. 'Hard' flood defences such as solid concrete walls are less likely to breach than 'soft' flood defences such as earth embankments.

Breach will usually result in sudden flooding with little or no warning and presents a significant hazard and danger to life. There is likely to be deeper flooding in the event of a breach than due to overtopping.

The assessment of breach should be proportionate to the likelihood of the defence failing, taking into account the age, maintenance regime, construction type and the presence of any demountable or mechanically operated components. Where major development is planned any impact on residual risk profile adjacent to the site should be undertaken.

Whilst it is important that residual risks are recognised and appropriate management measures put in place, it is also important to acknowledge the benefits that a flood relief scheme provides to those living and working behind it. In this regard, although *'The Planning System and Flood Risk Management Guidelines*

for Planning Authorities and Technical Appendices, 2009' requires flood zones to be undefended, consideration should be given to the benefit provided by flood defences, but only once the justification test has been applied and passed. The benefit of defences has been reviewed in relation to specific sites, detailed in Appendix 3, and is addressed more generally in the development management guidance provided in Section 4.11.

2.1.4 Pluvial Flood Risk (Monster Rain)/Storm (Surface) Water Flooding

Pluvial Flooding results when heavy, often sudden rainfall, causes flooding before it can infiltrate the ground, or enter a natural or man-made drainage system or a watercourse or a conveyance system (e.g. canal) because the system is already full to capacity. Pluvial flooding is associated with storm (surface) water flooding, which is a combination of true pluvial flooding, sewer flooding (due to heavy rainfall), groundwater flooding and flooding from urban watercourses.

The pure storm (surface) water system is managed by Dublin City Council. The combined storm (surface) water and foul) system and foul drainage system are managed by Irish Water. Current indications are that a very large investment is required to upgrade the storm (surface) water system in order to cope with projected increases in rainfall due to climate change and possible developments in Dublin City and adjoining County Councils to the year 2100. It is Dublin City Council's intention to develop a plan for these networks in liaison with Irish Water where required.

2.1.5 Groundwater Flooding

Groundwater flooding can occur when groundwater rises up from the underlying water table. Water emerges at the ground surface or into basements, flooding both surface and subsurface infrastructure. This tends to occur after much longer periods of sustained rainfall or very high tides. Higher rainfall means that more water will infiltrate into the ground, causing the water table to rise. Groundwater flooding tends to occur in low lying areas, where with additional groundwater flowing towards these areas, the water table can rise to the surface causing flooding. High river, estuary or tide levels can prevent groundwater escaping into them in times of significant rainfall thus causing ground water flooding.

2.1.6 Dam Failure

It should be noted for the SFRA that there is a minor risk of infrastructural failure associated with a possible dam burst at Poulaphuca, which dams the River Liffey. The Upper Liffey catchment is designed to hold the 10,000-year flood volume for the Upper Liffey where reasonably practicable. This dam is one of four major sources of Dublin's Water Supply. The Dam at Leixlip carries a lesser flood risk. The River Dodder is clay dammed by the two Bohernabreena Reservoirs, which is also a part of the Dublin Water Supply System. The Spillways to these two dams were increased in capacity to carry the "Probable Maximum Flood" in 2005 thus reducing the risk of Dam failure.

The earth embankment dams on the River Dodder at Bohernabreena are maintained by Irish Water. The dams are regularly inspected by an All Reservoirs Panel Engineer and the drainage is inspected on a weekly basis to ensure that no excess water is passing through or underneath the dam. The lower reservoir can be lowered in advance of a forecasted rain event to increase upstream storage capacity.
The reinforced concrete dams on the River

Liffey are maintained and operated by the ESB. ESB staff at Turlough Hill can release water prior to a forecasted rainfall event to increase upstream storage capacity. Water released from Poulaphouca takes approximately 18 hours to reach the City Centre. This is timed to ensure it does not coincide with exceptionally high tide levels in the City Centre. ESB managerial and operational staff are stakeholders in Dublin City Council's Flood Emergency Plan and are consulted during Flood Watch & Flood Monitoring situations. The ESB maintains regular contact with the City Council and briefs Dublin City Council with regard to discharges at Poulaphouca and Leixlip. The Council's Flood Emergency Plan (a Sub-Plan of Dublin City Council's Major Emergency Plan) is currently being reviewed and all stakeholders including the ESB are being consulted on the revised Plan.

2.1.7 Infrastructural Failure/Overload

Flooding can also be caused from a failure of the sewerage system. Most sewage flooding incidents are as a result of overloaded sewers following heavy rainfall or blockages. Flooding can also occur from a failure of infrastructure designed to store or carry water as in the case of a dam or leaking canal, a burst water main or a collapsed sewer.

2.1.8 Climate Change

Climate change should be considered when assessing flood risk and in particular residual flood risk. Areas of residual risk are highly sensitive to climate change impacts as an increase in flood levels will increase the likelihood of defence failure.

'The Planning System and Flood Risk Management Guidelines for Planning Authorities and Technical Appendices, 2009' recommends that a precautionary approach to climate change is adopted due to the level of uncertainty involved in the potential effects.

Advice on the expected impacts of climate change and the allowances to be provided for future flood risk management in Ireland is given in the OPW Draft Guidance.[9] Two climate change scenarios are considered. These are the Mid-Range Future Scenario (MRFS) and the High-End Future Scenario (HEFS). The MRFS is intended to represent a "likely" future scenario based on the wide range of future predictions available. The HEFS represents a more "extreme" future scenario at the upper boundaries of future projections. Based on these two scenarios the OPW recommended allowances for climate change in relation to river flows and sea levels are given in Table 2.1 overleaf. These climate change allowances are particularly important at the development management stage of planning, and will ensure that proposed development is designed and constructed to take into account best current knowledge.

Rising sea levels and more frequent and more severe storms will significantly increase the risk of coastal flooding and estuarial flooding as well as coastal erosion.[10] *'The Planning System and Flood Risk Management Guidelines for Planning Authorities and Technical Appendices, 2009'* note that there is a great deal of uncertainty in relation to the potential effects of climate change and therefore a precautionary approach should be adopted.

9 OPW Assessment of Potential Future Scenarios, Flood Risk Management Draft Guidance, 2009
10 The Planning System and Flood Risk Management Guidelines for Planning Authorities, 2009

In this regard the Guidelines recommend:

- Recognising that significant changes in the flood extent may result from an increase in rainfall or tide events and accordingly adopting a cautious approach to zoning land in these potential transitional areas;
- Ensuring 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 (normally 85–100 years) and
- Ensuring that structures to protect against flooding and the development protected are 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.[11]

At this, the development planning stage, a detailed knowledge of the impact of climate change on flood levels is not required to inform the strategic allocation of land. Instead, and in the absence of detailed projections of climate change impacts, flood extents can be assessed by using the extent of the flood zone B outline to indicate where climate change may result in greater extents in the future.

Table 2.1 Allowances for Future Scenarios (100-Year Time Horizon)

Criteria	MRFS – to be considered for most development scenarios	HEFS – to be considered in relation to high value, high vulnerability development which cannot be relocated
Extreme Rainfall Depths	+20%	+30%
Flood Flows	+20%	+30%
Mean Sea Level Rise	+500mm	+1000mm

Further work on the impacts of climate change on flood levels is being undertaken as part of the Eastern CFRAM study for some rivers within the city. When complete, this study will include both current and potential future water levels across the river system, and these levels can be used to inform design criteria.

Until that information is available, guidance on climate change allowances is provided in this report in the justification test tables in Appendix 3 and in the specific guidance on development management in relation to flood risk in Chapter 4.

Chapter 3 of the Dublin City Development Plan 2016–2022 sets out the achievements and challenges facing Dublin City Council in relation to Climate Change. The Plan sets out policies and objectives which include prioritising measures to address climate change by way of both effective mitigation and adaptation responses, to reduce energy consumption, reduce energy loss and support the supply of

11 The Planning System and Flood Risk Management Guidelines for Planning Authorities, 2009 (page 17)

energy from renewable resources. The plan also contains objectives to implement the National Climate Change Adaption Framework (2012) by adopting a Climate Change Adaptation Strategy for Dublin City, and to support the Dublin City Councils forthcoming Climate Change Strategy for Dublin City. The Plan also sets out the policies in relation to Climate Change and Flooding, see Policy CC5 which seeks 'to address flood risk at strategic level through the process of strategic flood risk assessment, and through improvements to the city's flood defences'.

Dublin City Council's objective is to:

- Seek to understand how climate change might impact flood risk to communities and businesses.
- Assess how climate change impacts of flood risk may affect the Council's objectives for managing flooding over the longer term.
- Explore what options could be used to manage those impacts of climate change on flood risk, and,
- Raise awareness within communities and businesses on the causes and potential impacts of climate change and how they can reduce these by taking various courses of action.
- Prepare the Climate Change Strategy for Dublin City to year 2100 and link to City Development Plan.
- Review Climate Change Policy with the Development Plan or following major new information.

Table 2.2 Summary of Recent Flood Events in Dublin [12]

Date	Source of Flooding	Areas impacted
October 2011	**Fluvial, Pluvial & Coastal:** Extreme rainfall combined with heavy rainfall previous day, leading to soil saturation. Dublin Airport recorded 9 hour rainfall of 66.8mm, with Casement Airport recording a daily total of 82.2mm.	Severe flooding in many parts of Dublin City & east coast, with many homes and businesses under water.
2nd July 2009 (Midnight to 9am)	**Pluvial:** Spells of heavy, thundery rain affected the east and northeast of the country. 38.2mm of rainfall was recorded at Dublin Airport.	Several areas within the Dublin City Council boundary were affected. One of the worst affected areas was Donnycarney in North Dublin, where the storm (surface) water collection system draining to the Wad River culvert was overwhelmed at the Malahide Road, resulting in flooding at Collins' Avenue and Clanmoyle Road. Reports also of spot flooding at Raheny, Clontarf, Drumcondra, Finglas Sandymount, Cabra, Finglas and Glendhu Park in Ashtown.

12 Source: Met Eireann Major Weather Events

Date	Source of Flooding	Areas impacted
9th August 2008	**Pluvial:** Dublin Airport recorded 36mm of rainfall in the worst hour, 43mm in two hours and over 76mm in five hours. Records from the south city only indicate 40% of this precipitation.	Within two hours of commencement of precipitation numerous calls were placed with Dublin Fire Brigade, the Dublin Traffic Control Centre and the City Council's Drainage Division. 19 areas of North Dublin had severe flooding, many of these areas had no previous known history of such flooding. Over 150 residential properties were inundated, as well as commercial premises, public buildings, major roadways etc. Areas of Cabra, Finglas and Glendhu Park in Ashtown were badly flooded.
1st February 2002	**Coastal:** Rain led to high groundwater levels which was coupled with the highest tide ever recorded. This caused sea defences to be overtopped.	Over 1,100 buildings recorded as flooded. Cost estimate of damages - €60M.
13th November 2000	**Fluvial:** Heavy rainfall in November, preceded by a very wet October, led to the ground being well saturated and unable to absorb the rain that fell over a 30 hour period on the 12th & 13th November 2000.	Significant disruption and damage, especially in the area of the Lower Tolka catchment.
25th August 1986	**Fluvial:** Hurricane Charlie - The heaviest rain fell on the mountains south of Dublin. At Kippure an estimated 280mm fell, about double the normal rainfall in that area for the whole month of August. Record for the greatest fall of rain in a day, measuring 200mm, established at Kilcoole, south of Greystones.	Extensive storm and flood damage across the City, coupled with extreme tides giving coastal flooding.
9th-11th June 1963	Pluvial: Thunderstorms were widespread.	Considerable flooding occurred in the area between Dundrum, Blackrock and Sandymount. The high value recorded at Ballsbridge indicated this area must have had exceptional rainfall.

2.3 Existing Flood Management Infrastructure and Strategies

Flood Risk Management aims to minimise the risks arising from flooding to people, property and the environment. Flood Risk Management can include structural interventions that block or restrict the pathways of floodwaters, such as river or coastal defences, or non-structural measures often aimed at reducing the vulnerability of people and communities such as flood warning, flood level monitoring, effective flood emergency response or resilience measures.

Dublin City Council and its partners such as the OPW, other Local Authorities, Met Éireann, Department of the Environment, Community & Local Government and Irish Water have implemented several measures and projects to address the main flood

risks in the Dublin City Area to allow for continuing development of the City and to protect as far as reasonably practicable existing vulnerable areas. These include:

- Participation by Dublin City Council, following the flood event in 2002, in the SAFER (Strategies and Actions for Flood Emergency Risk Management) project with 5 European Partners. The project was initiated in 2002 and ran until 2008. This saw the development of a tide event warning system, emergency response procedures and coastal flood maps to inform decision making on emergency response procedures.
- Participation by Dublin City Council in a four-year programme from 2008–2012 to make the capital a flood resilient city. The Flood Resilient City (FRC) project was an EU funded project supporting local authorities in eight cities in North-West Europe to combat flooding in urban areas and exchange information on best practice. It built on the previous EU-funded SAFER project, an outcome of which was the establishment of an operational coastal (tidal surge) early warning system for Dublin. The FRC project led to the development of pluvial flood hazard maps (depth and velocity maps in isolation) and flood risk maps to identify Dublin City's overall vulnerability to pluvial flood risk. As part of the project five 'Pilot Areas' were selected to identify and trial pluvial flood risk assessment and management techniques for development and use in future programmes of work.
- Implementation of the Triton and Tidewatch early warning systems which, based on sensors in Dublin Bay, provide continuous information on sea-level changes and then send alarm messages to relevant personnel in the Council. The former provides a 1-day advance warning of high tides and the latter provides a 3-day advance warning of same. These early warning systems provide the necessary information to inform the subsequent emergency response strategy.
- Construction of new flood alleviation walls, embankments, floodgates along the tidal and lower fluvial stretches of the River Dodder from Ringsend Bridge to just below Ballsbridge. An allowance for estimated climate change to 2100 is included in the design.
- Construction of Flood Gate at Spencer Dock.
- Construction of River Tolka Flood Alleviation Scheme.
- Construction of Wad River Flood Alleviation Scheme, Clanmoyle Road Phase.
- Construction of swales or large flood retention ponds at Glendhu Park and Park Road, Ashtown, Killala Road and Drumcliffe Road, Crumlin and beside Ballygall Crescent, Finglas.
- Development of the South Campshires Flood Protection Project, currently under construction, comprising the construction of a flood wall along the South Quays extending 1.1km from Butt Bridge to junction of Sir John Rogerson's Quay with Cardiff Lane.
- Completion of the River Dodder Catchment Flood Risk Assessment and Management Study (CFRAMS) on the Dodder River. This resulted in recommendations for further flood protection measures along the river, upstream of the tidal section, which are ongoing.

- Eastern CFRAM study which includes the Rivers Liffey, Santry, Poddle, Camac and coastal areas and is ongoing at present. Draft flood plans are at public consultation stage.
- Construction of Pumping Station at Spencer Dock (SDPS) with associated rising mains and new services tunnel under the River Liffey. Construction also of new trunk sewers to serve the SDPS.
- Construction of separate foul and storm (surface) water drainage infrastructure in South Docklands.
- New Study of City Centre Sewerage System currently being progressed.
- Dublin City Council's Flood Emergency Plan (a Sub-plan of Dublin City Council's Major Emergency Plan). Rescue agencies - Civil Defence and the Fire Brigade – are stakeholders in the Plan with extensive experience and resources, in terms of trained personnel and high bodied vehicles suitable for navigating through flood waters during a flood event.
- Development & implementation of Sustainable Urban Drainage Systems (SUDS) policies throughout the City. Ongoing improvement and development of storm (surface) water Infrastructure.
- Continuous development of Dublin's Flood Forecasting & Flood Warning Systems.

2.4 Flood Risk Summary

Having regard to all the information sources available to Dublin City Council, it is concluded that Dublin City Council is subject to flood risk from fluvial, coastal and pluvial flooding, which may be exacerbated by high groundwater levels, and the assessment will therefore proceed to Stage 2. In many cases, the level of risk is moderated by the presence of flood defences or other flood management infrastructure. However, the residual risks associated with these structures remains and also needs to be considered. Risks from climate change are also likely to be significant along the coast and up tidally influenced rivers.

03

Stage 2 - Initial Flood Risk Assessments

3.0 Introduction

The purpose of this stage is to confirm sources of flooding that may affect the plan area, to appraise the adequacy of existing information and to scope the need for additional assessment. Where flood zone maps exist, they will be reviewed and updated as required, and where flood zone maps are not available, they will be prepared using best available information.

3.1 Settlement Zoning Review

Having developed flood zone maps and established the areas of flood risk within the plan area, the next step is to apply the sequential approach to land-use planning. The areas within flood zone A and B (high and moderate risk of flooding) were overlaid on the current land-use zoning objective maps for the City, which identified where flood risk management and future development may cause potential conflicts. In the cases where some areas are within either flood zone A or B, the need for a further review of flood risk and specific zoning objectives is required. If the proposed land-use zoning was found to be water-compatible and located within either flood zone A or B there was no requirement for the justification test; however if highly vulnerable uses were proposed for flood zones A and or B then the justification test was applied.

The purpose of the land-use zoning objectives are to indicate to property owners and members of the public the types of development the Planning Authority considers most appropriate in each land use category. Zoning is designed to reduce conflicting uses within areas to protect resources.

Each land-use zoning objective has been reviewed and an appraisal made of the associated vulnerability of the particular use. A clarification on the requirement of the application of the justification test was then made. This took into account the fact that some objectives span a range of possible uses, which could be water compatible, less vulnerable or highly vulnerable. The summary table (Table 3.1) is provided as a general guide and the specific development types within the zoning objective must be considered individually.

Table 3.1 Land Use Zoning and Vulnerabilities

Zoning Objective Use	Vulnerability	Justification Test Required
Z1: To protect, provide and improve residential amenities	High, with water compatible elements	For development in Flood Zone A or B
Z2: To protect and/or improve the amenities of residential conservation areas	High, with water compatible elements	For development in Zone A or B
Z3: To provide for and improve neighbourhood facilities	High/Less/water compatible	For highly vulnerable uses in Flood Zones A & B For less vulnerable development in Flood Zone A

Zoning Objective Use	Vulnerability	Justification Test Required
Z4: To provide for and improve mixed services facilities	High/Less/water compatible	For highly vulnerable uses in Flood Zones A & B For less vulnerable development in Flood Zone A
Z5: To consolidate and facilitate the development of the central area, and to identify, reinforce and strengthen and protect its civic design character and dignity	High/Less/water compatible	For highly vulnerable uses in Flood Zones A & B For less vulnerable development in Flood Zone A
Z6: To provide for the creation and protection of enterprise and facilitate opportunities for employment creation	High/Less with water compatible elements	For highly vulnerable uses in Flood Zones A & B For less vulnerable development in Flood Zone A
Z7: To provide for the protection and creation of industrial uses and facilitate opportunities for employment creation	High/Less with water compatible elements	For highly vulnerable uses in Flood Zones A & B For less vulnerable development in Flood Zone A
Z8: To protect the existing architectural and civic design character, to allow only for limited expansion consistent with the conservation objective	High/Less with water compatible elements	For development in Flood Zone A & B
Z9: To preserve, provide and improve recreational amenity and open space & green networks	Water Compatible	Development is generally appropriate
Z10:To consolidate and facilitate the development of inner city and inner suburban sites for mixed-uses, with residential the predominant use in suburban locations, and office/retail/ residential the predominant uses in inner city areas	High/Less with water compatible elements	For development in Flood Zone A & B
Z11:To protect and improve canal, coastal and river amenities	Water Compatible	Development is generally appropriate
Z12:To ensure existing environmental amenities are protected in the predominantly residential future use of these lands	High/Less/Water Compatible	For development in Flood Zone A & B
Z14:To seek the social, economic and physical development and/or rejuvenation of an area with mixed uses of which residential and 'Z6' would be the predominant uses	High/Less with water compatible elements	For highly vulnerable uses in Flood Zones A & B For less vulnerable development in Flood Zone A
Z15:To protect and provide for institutional and community uses	High/Less with water compatible elements	For development in Flood Zone A & B

3.2 Application of the Justification Test for the Development Plan 2016–2022

The justification test tables are included in Appendix 3 to the rear of this report. The detail in the individual tables is to supplement the general guidance which is provided in Chapter 4 and is the strategic response that has been considered within the development plan and provides guidance as to how a more detailed site specific flood risk assessment should be approached. The list at the end of this chapter shows the various river reaches and areas of the city that were reviewed. The various rivers were sub-divided into various flood cells, based either on the flood mechanism within the cell (for example, fluvial, tidal or overland) and with consideration to the development potential within the area. There are a number of cells where flood risk and current/potential development has been reviewed and found to be water compatible (such as Bull Island), so not requiring the justification test to be applied, and this is detailed in the relevant table.

There are other cells where potential future development has been found to be at risk of flooding. Where the justification test parts 1 and 2 have been passed, flood risk has been summarised and an indication of the required flood mitigation measures has been provided. These typically range from avoiding flood zone A and/or B, to working through the general guidelines on flood risk assessment, as provided in section 4, often with particular considerations specific to that flood cell.

In all cases where flood risk to existing development has been identified, parts 1 and 2 of the justification test have been passed. However, there are some areas of the city where risks are higher and a strategic scale flood relief scheme needs to be completed prior to allowing development, or redevelopment, to take place. There are other locations where risks are lower and it is likely that development will largely be limited to small residential extensions only. Provided flow paths are preserved, this development has generally been found to be justified.

List for Justification Test Tables

1. Dublin Port South of the Liffey from Tom Clarke Bridge
2. Dublin Port North of the Liffey to Tom Clarke Bridge
3. Liffey: O'Connell Bridge to Tom Clarke Bridge
4. Liffey: Sean Heuston Br. - O'Connell Bridge
5. Liffey: Sean Heuston Br. - Sarah Bridge, South Circular Road
6. Liffey: Sarah Bridge, South Circular Road - Anna Livia Br. Chapelizod
7. Liffey: Anna Livia Br. Chapelizod - County Boundary
8. Coastal: Sandymount
9. Dodder: Liffey to Ballsbridge
10. Dodder: Ballsbridge to Donnybrook Bridge
11. Dodder: Donnybrook Bridge - Dundrum Road
12. Dodder: Dundrum Road - Bushy Park Boundary
13. Poddle: Inside Canal
14. Poddle: Culverts outside Canal
15. Poddle: Grand Canal to Sundrive Road

16. Poddle: Sundrive Road - Kimmage Road West

17. Lower Camac: South Circular Road to Liffey

18. Middle Camac: Davitt Road to South Circular Road

19. Upper Camac: Old Naas Road Boundary to Davitt Road

20. Tolka: Dublin Port to Drumcondra Bridge

21. Tolka: Drumcondra Bridge to St. Mobhi Road

22. Tolka: St. Mobhi Road - Finglas Road

23. Tolka: Finglas Road - County Borough Boundary

24. Wad: Clontarf Road to Collins Avenue East

25. Wad: Collins Avenue East to Collins Park

26. Clontarf Alfie Byrne Road to Wooden Bridge

27. Santry River: James Larkin Road to DART Railway Line and Dollymount Wooden Bridge to Clontarf Road Coastal Zone

28. Santry River: DART Railway - Boundary

29. Mayne: Dublin Belfast Railway Line - M50

30. Bull Island

04

Development Management and Flood Risk

4.0 Introduction

In order to guide both applicants and planning officials through the process of planning for and managing flood risk, the key features of a range of development scenarios have been identified (relating the flood zone, development vulnerability and presence or absence of flood defences). For each scenario, a number of considerations relating to the suitability of the development are summarised below, and are shown as process flow charts in Appendix 4. The aim of the flow charts is to provide a guide through the flood risk assessment process and to indicate which approaches to managing flood risk are expected in different circumstances. However, it is accepted that flood risk and its management is a complex and highly site specific phenomenon so the specific requirements of the assessment should be agreed with the Dublin City Council prior to commencing work.

It should be noted that this section of the SFRA begins from the point that all land zoned for development has passed the justification test for development plans, and therefore Part 1 of the justification test for development management. In addition to the general recommendations in the following sections, Appendix 3 should be reviewed for specific recommendations for the watercourses within Dublin City.

As detailed in chapter 2, the flood zone maps have been developed using the most appropriate data available to Dublin City Council at the time of preparing the Development Plan. The flood zone maps have been created specifically to inform the application of the justification test and to guide development policy within the city. However, it should be borne in mind that the input data was developed at a point in time and there may be changes within the catchment that mean a future study, or more localised assessment of risk may result in a change in either flood extent or depth. This means a site specific flood risk assessment may result in locally appropriate information which could show a greater or less level of risk than is included in the flood zone maps. This is to be expected and it will require discussion between the developer and the DCC Planning and Engineering teams to ensure the assessment is appropriate and relevant to the site in question.

4.1 Requirements for a Flood Risk Assessment

An appropriately detailed Flood Risk Assessment (FRA) will be required in support of any planning application. The level of detail will vary depending on the risks identified and the proposed land use. Flood risk from sources other than fluvial and tidal should be reviewed, as should the impacts of climate change. All proposed development, including that in Flood Zone C, must consider the impact of storm(surface) water flood risks and demonstrate compliance with the minimum required finished floor levels (FFL), detailed in the following sections of this report. This can be a simple review of site topography and available datasets on the DCC website, and the assessment recorded on the planning application form. Groundwater flood risk for each portion of a development below ground should be evaluated in a FRA. This should be reported in a storm (surface) water management plan.

For sites within flood zone A or B, a site specific “Stage 2 - Initial FRA” will be required, and may need to be developed into a “Stage 3 - Detailed FRA”. The extents of flood zone A and B are delineated through this SFRA. However, future studies

may refine the extents (either to reduce or enlarge them) so a comprehensive review of available data should be undertaken once a FRA has been triggered.

The FRA may be a relatively straight forward, qualitative appraisal of risks accompanying the drainage design. Alternatively, the findings of the Eastern CFRAM study and the various other studies that have been carried out in Dublin City may be drawn upon to inform finished floor levels and provide details on flood depth, velocity and impacts of defence breach. This information will all be essential in understanding residual flood risks and in developing emergency plans. The applicants should satisfy themselves as to the veracity of this information. In other circumstances a detailed modelling study and flood risk assessment may need to be undertaken.

Any proposal that is considered acceptable in principle shall demonstrate the use of the sequential approach in terms of the site layout and design and, in satisfying the justification test (where required), the proposal will demonstrate that appropriate mitigation and management measures are put in place.

Specific requirements for a FRA in varying circumstances are detailed in the following sections.

4.2 Consideration of 'Storm (surface) Water' in All Areas

All proposed development, including that in flood zone C, shall have regard to storm (surface) water management policies contained in the Greater Dublin Strategic Drainage Study, chapter 9 of the Development Plan (Volume 1) and relevant information in this SFRA. In this regard, all the other development scenarios must pass through this stage before completing the planning and development process, and should be accompanied by an appropriately detailed storm (surface) water assessment or flood risk assessment where the development is shown to be at flood risk.

There are extensive networks of storm (surface) water runoff routes across the city, as indicated in the FloodResilienCity Maps in Appendix 6 (Volume 7). When commencing a storm (surface) water management plan, these maps should be consulted and appropriate incorporation of storm (surface) water management applied. In particular, attention should be given to development in low-lying areas which may act as natural ponds for collection of runoff.

There are two key objectives to this stage of assessment:

- Ensuring no increase in storm (surface) water risk elsewhere, which is achieved through managing runoff from the site and ensuring appropriately designed drainage systems.
- Ensuring risks from storm (surface) water are managed. This can be achieved through consideration of threshold levels, maintaining flow paths and preventing obstruction of areas where storm (surface) water ponds.

It is essential that overland flow routes are retained and development does not obstruct or divert them without full appraisal of the consequences for other sites and developments and that identified risks are fully mitigated.

4.2.1 Storm (Surface) Water Assessment and Management

The Storm (Surface) Water Assessment shall be carried out for all sites and reported either in a standalone report, including drainage design drawings and supporting calculations, or it may form part of a more detailed flood risk assessment, which will also consider other flood risks.

A specific requirement of the EU Water Framework Directive is that storm (surface) water discharge is controlled and managed so that any impact on its receiving environment is mitigated. This can be achieved through the use of Sustainable Drainage Systems (SUDS). SUDS can reduce the rate of runoff through a combination of infiltration, storage and conveyance (slowing down the movement of water). Sustainable drainage can be achieved through the use of green infrastructure such as green roofs and pervious pavements, rainwater harvesting, soakaways, swales and detention basins, ponds and wetlands.

In order to reduce flooding and improve water quality, all developments in the City Council's administrative area are required to implement the policies of the Greater Dublin Strategic Drainage Study (GDSDS) in relation to surface-water and flood risk management. This is done by ensuring new development does not obstruct existing flood plains or routes and by limiting the runoff from new development to green-field rates.

It is noted that the GDSDS requires consideration of a 10% increase in rainfall intensity to take into account the possible impacts of climate change. However, the OPW Draft Guidance on Climate Change (see Section 2.1.8) contains more recent recommendations in this regard. Drainage and storm (surface) water design should therefore take into account the MRFS and HEFS in the same way as fluvial or tidal risk assessments. Guidance on the application of climate change allowances is provided in Section 4.10.

4.2.2 Sustainable Drainage within Private Development

In recent years in Ireland, there has been a move away from the traditionally designed hard engineering drainage solutions such as concrete underground attenuation tanks and piped drainage systems in favour of multi-function, sustainable solutions for the management of storm (surface) water in urban environments. The use of SUDS provides the additional benefits of improving the aesthetic character of the urban environment, enhancing biodiversity, and improving air quality. Sustainable drainage solutions that are visible to the public also allow for a stronger connection between the public and the natural environment, and therefore a greater awareness of water management issues.

A variety of sustainable drainage components, such as swales, retention ponds, constructed wetlands, permeable surfacing, green roofs, soakaways and rainwater harvesting systems, have successfully been incorporated into private development in the Dublin City Council area since the publications of the GDSDS.

In certain areas such as the Docklands and the possible high percentage of site coverage of the developments that may be proposed, it is acknowledged that some of the above solutions will not be appropriate for incorporation into developments. It is also acknowledged that it may not be appropriate to provide

all the storage required for tidal attenuation using sustainable drainage techniques. The installation of some "hard-engineering" components may therefore be inevitable in development sites with a high proportion of site coverage. However, in order to achieve the Dublin City Council development plan objectives of enhanced biodiversity and improved water quality, sustainable drainage solutions are required in all development.

The following SUDS components should be considered for installation within the private area of all development:

- Green Roofs
- Rainwater Harvesting
- Permeable Surfacing
- Soak-ways and Rain Gardens
- Rilles
- Local Pumping

Sustainable storm (surface) water management designs should comply with current best practice guidance and include a full maintenance package. In order to ensure their viability as sustainable solutions, the communication of maintenance requirements at handover or property transfer stage is of utmost importance.

4.2.3 Sustainable Drainage of Public Areas

In addition to the incorporation of sustainable storm (surface) water management techniques within private development sites, particular emphasis will be placed on the incorporation of SUDS into public realm infrastructure. The use of sustainable storm (surface) water management in streetscapes ties in with Dublin City Council's biodiversity and green infrastructure strategies and has proven to be very cost effective in cities in the US and Europe.

The following storm (surface) water management solutions should be considered for surface-water management of public spaces:

- Permeable Surfaces in Pedestrian Areas
- Bio-retention Areas
- Rilles
- Sunken Squares.

Where sustainable storm water management solutions are incorporated into public spaces, it is important that their operation is communicated to the public through the use of appropriate signage.

This was successfully done in the Portland Green Streets program which provides a great model for sustainable storm water management and green infrastructure implementation. It may be possible to design some new streets such that the traditional piped storm (surface) water sewer and gully system will not be required, thus providing cost savings at construction stage and also in terms of long-term maintenance.

It should be noted however that provision for storm (surface) water storage during tide-locking will be required in order to manage storm (surface) water in public spaces. If sustainable storm (surface) water management techniques are not incorporated to their fullest potential in order to achieve this, the requirement for the laying of large storm (surface) water sewers cannot be avoided.

Some new initiatives are currently being tested by Dublin City Council including the Beta Project or 'Rainbox Box Planter'. This project, which commenced in April 2014, looks at how DCC can green streets and better manage rainwater coming from people's homes by exploring the idea of rain box planters. Currently rainfall in large areas discharges into a combined sewer system which costs DCC in the conveyance, pumping and treatment of this water. The rain box planter project aims to trial an alternative public green infrastructure solution. The specially designed planter prevents rainfall from entering the sewer network, it is estimated that the planters reduce runoff to the sewer by about 90% in summer and 60% in the winter.

A number of swales have been construced to date, for example, in Glendhu Park and Park Road. Swales are a depressed land form, a gradual depression, similar to a ditch, but much wider and deeper. The use of a swale is to carry or hold flood waters. Swales can allow infiltration of water and nutrients down slope of it into the ground.

Fig 4.1: Swales Constructed at Glendhu Park, Cabra

4.3 Development in Flood Zone C

Where a site is within flood zone C, but adjoining or in close proximity to flood zone A or B there could be a risk of flooding associated with factors such as future scenarios (climate change) or in the event of failure of a defence, blocking of a bridge or culvert. Risk from sources other than fluvial and coastal must also be addressed for all development in flood zone C. Where a site is located on a 'dry island' (i.e. is fully surrounded by flood zone A or B) it is particularly important that flood risks are fully investigated and particular consideration is given to emergency response and evacuation routes; it should not be assumed that development on a 'dry island' is appropriate.

As a minimum, the applicant should confirm whether it is possible to screen out possible indirect sources of flood risk and where they cannot be screened out it should present mitigation measures. Where this is not possible an appropriately detailed FRA should be undertaken. The most likely mitigation measure will involve setting finished floor levels to a height that is above the 1 in 100 year fluvial or 1 in 200 year tidal flood level, with an allowance for climate change and freeboard. Design elements such as channel maintenance

or trash screens may also be required. Evacuation routes in the event of inundation of surrounding land should also be detailed.

The impacts of climate change should be considered for all proposed developments. This is particularly important for development near areas at risk of tidal flooding. A development which is currently in flood zone C may be shown to be at risk when 0.5m is added to the extreme (1 in 200 year) tide. Design considerations should be proportionate to the type of development (including design life and future adaptability), but may include raising finished floor levels. For highly vulnerable, long term developments which are difficult to adapt or relocate (such as hospitals and power stations), consideration of the High End Future Scenario (1m sea level rise) should be given.
It may also be appropriate to consider residual risks arising from culvert/structure blockage, particularly where it is identified that the site in question forms part of a flow route. Identification of flow routes across the site will not necessarily prohibit development, but should be incorporated into the landscaping and design of the development. This will prevent ingress of water to the development itself and ensure risks to neighbouring sites are unchanged.

4.4 Applications for Minor Development in Areas at Risk of Flooding

Section 5.28 of *'The Planning System and Flood Risk Management Guidelines for Planning Authorities, 2009'* identifies certain types of development as being 'minor works' and therefore exempt from the justification test. Such development relates to works associated with existing developments, such as extensions, renovations and rebuilding of the existing development, small scale infill and changes of use.

Despite the 'sequential approach' and 'justification test' not applying, as they relate to existing buildings, an assessment of the risks of flooding should accompany such applications. This must demonstrate that the development would not increase flood risks, by introducing significant numbers of additional people into the flood plain and/or putting additional pressure on emergency services or existing flood management infrastructure. The development must not have adverse impacts or impede access to a watercourse, floodplain or flood protection and management facilities. Where possible, the design of built elements in these applications should demonstrate principles of flood resilient design (See *'The Planning System and Flood Risk Management Guidelines for Planning Authorities Technical Appendices, 2009',* Section 4 - Designing for Residual Flood Risk).

Generally the approach to deal with flood protection would involve raising the ground floor levels above the level of extreme high tides. However in some parts of the plan area, which are already developed, ground floor levels for flood protection could lead to floor levels being much higher than adjacent streets, thus creating a hostile streetscape for pedestrians. This would cause problems for infill development sites if floor levels were required to be significantly higher than those of neighbouring properties. In this regard, for the key sites in the plan area it has been recognised that ground floor levels below predicted high tide levels could be allowed, in limited circumstances, on a site by site basis, for commercial and business developments. However, if this is the case, then these would be required to be flood resistant construction using water resistant

materials and electrical fittings placed at higher levels. For high risk areas it would also be necessary to impose planning restrictions.

For commercial operations, business continuity must be considered, and steps taken to ensure operability during and recovery after a flood event for both residential and commercial developments. Emergency access must be considered as in many cases flood resilience will not be easily achieved in the existing build environment.

The requirement for providing compensatory storage for minor developments has been reviewed and can generally be relaxed, even where finished floor levels have been raised. This is because the development concerns land which has previously been developed and would already have limited capacity to mitigate flooding. However, a commentary to this effect must be substantiated in the FRA.

4.5 Major development within Flood Zone A and B

Two broad classes of major development have been identified for the purposes of this assessment. The first is new development which is located in 'greenfield' (currently undeveloped) parts of the city. The second is larger scale infill and regeneration, which, given the urban nature of the city, will form the majority of major development proposals.

It is not appropriate for new, highly vulnerable development to be located on greenfield land in flood zones A or B, whether it is highly or less vulnerable. In the main, such areas are parks and public open space within the wider built environment which provide flood storage and reduce risks to existing development. There would be little or no opportunity to compensate for the loss of such storage areas, and development within them would be contra to a number of the policies and objectives within this Development Plan. Such proposals do not pass the justification test. Instead, a less vulnerable use should be considered.

Regeneration of areas within flood zone A and B has, in the main, been justified and the approach for managing risks to such development is provided below.

4.6 Highly Vulnerable Development in Flood Zone A or B

Development which is highly vulnerable to flooding, as defined in *'The Planning System and Flood Risk Management Guidelines for Planning Authorities and Technical Appendices, 2009'* includes (but is not limited to) dwelling houses, hospitals, emergency services and caravan parks and requires a particularly rigorous consideration of flood risks and robust flood management measures.

The DECLG Circular Letter PL2/2014 states that "notwithstanding the need for future development to avoid areas at risk of flooding, it is recognised that the existing urban structure of the country contains many well established cities and urban centres which will continue to be at risk of flooding". In addition, the Dublin City Development Plan has recognised urban centres whose continued consolidation, growth, development or generation, including for residential use, is being encouraged to bring about compact and sustainable growth.

Within this SFRA, small scale infill housing, extensions or changes of use have been

considered and, subject to a site specific flood risk assessment, can generally be considered appropriate provided they constitute a continuation of the existing quantum of development. There are a number of exceptions to this finding, so the detail contained in Appendix 3 should be consulted for more site specific information.

In cases where minor development has been justified, the outline requirements for a FRA and flood management measures have been detailed in this SFRA in both the following sections and the site specific assessments in Appendix 3. Of prime importance is the requirement to manage risk to the development site and not to increase flood risk elsewhere. This should give due consideration to safe evacuation routes and access for emergency services during a flood event.

Key points for consideration in terms of highly vulnerable development in Flood Zone A & B are:

- The minimum finished floor level for a residential development should be the 1 in 100 year fluvial or 1 in 200 year tidal flood level, with a suitable allowance for climate change (see Section 4.10) and a suitable freeboard. The freeboard should be at least 300mm but in tidal risk areas could be higher, particularly where wave action or combined fluvial/tidal events are present.
- Where a site is defended, these defences must protect to at least a 1 in 100 year (fluvial) or 1 in 200 year (tidal) standard of protection (SoP), with freeboard included in the defence height. If the SoP is lower, the site should be considered to be undefended.
- If the site is defended, and a freeboard allowance has been incorporated into the design of the defences, there is no requirement for the finished floor level of the development to include freeboard as well, but the finished floor level of the development should be raised to the 1 in 100 year level. This must be assessed in a detailed FRA.
- The emergency procedures in the event of a flood are critical; evacuation routes should be provided to higher ground. If evacuation is not possible, containment may be considered, and the associated issues that this presents, such as duration of stay and the potential for rescue, must be addressed. If neither option is possible, then the development proposal cannot go ahead.
- Proposals for development that results in a loss of fluvial floodplain within undefended flood zone A must also demonstrate that compensatory storage can be provided on a level for level basis.
- Where development can alter the residual risk profile in the adjacent area, say in the event of a breach of a defence this impact should be assessed in the FRA.

Having determined the finished floor level, the design should be reviewed against the wider development context, including the level of surrounding properties, utilities and landscaping. If the design is in keeping, it may proceed through the planning process. If the design is not in keeping, a further review of the design proposal is required and a lower vulnerability use should be substituted (at least on the ground floor) which may be constructed to a lower finished floor level, and risks re-appraised.

4.7 Less Vulnerable Development in Flood Zone A or B

Less vulnerable development includes retail, leisure and warehousing and buildings used for agriculture and forestry. This category includes less vulnerable development in all forms, including refurbishment or infill development, and new development both in defended and undefended situations.

The design and assessment of less vulnerable development should be the 1% AEP fluvial or 0.5% tidal events as standard, with climate change and a suitable freeboard included in the setting of finished floor levels.

In contrast with highly vulnerable development, there is greater scope for the developer of less vulnerable uses to accept flood risks and build to a lower standard of protection (SoP), which is still high enough to manage risks for the development in question. However, any deviation from the design standard of 1%/0.5% AEP, plus climate change, plus freeboard, needs to be fully justified within the FRA.

4.8 Defended sites

In a defended site the requirement to provide freeboard and climate change allowances on the finished floor levels can be relaxed if the defences already include the allowance. Where the defence does not include for climate change, such as along the Tolka, the specific risks to the development should be appraised and an appropriate response taken. For example, a retail outlet with a relatively short design life (i.e. up to approximately 20–30 years) would not necessarily need to be raised above climate change levels, but a high-tech or long term investment development project may need to be raised above the current design flood level.

In a defended site it may be possible to lower the finished floor levels even further if risks are fully appraised and the development design and operation is resilient and an increase in risk can be accepted. This appraisal should include consideration of defence failure, which is likely to be through breach or overtopping. The breach assessment should consider the likelihood of breach (the age, construction and maintenance of the defences). If breach is considered to be a risk then the impacts of breach should be discussed in the FRA. As a conservative estimate it may be assumed that the in-channel levels are projected across the floodplain, and as such a 'worst case' inundation depth will be calculated. The Eastern CFRAM study, when finalised, will also include analysis of the impact of defence breach for some watercourses. With this information a decision to accept or avoid the potential risks can be made. Acceptance should reflect emergency planning and business continuity within the development. It may reflect the design life of the development, the proposed use, the vulnerability of items to be kept in the premises, the insurability of the development, the occupants and users, emergency plan and inclusion of flood resilience and recovery measures.

In such a way, further acceptance of flood risks may allow the finished floor level to be set below the 1 in 100 year level, but should not allow depths of flooding greater than 600mm, even in the event of defence breach. This step will require a detailed assessment of risks at the site specific scale, including residual risk, flood depths and inundation times.

In a defended site, compensatory storage is not required as the floodplain was removed through implementation of the flood defence scheme.

Further details regarding the location, condition and standard of protection offered by the various defences within the city is provided in Appendix 1.

4.9 Undefended Sites

In an undefended site there is less scope for accepting 'below design level' finished floor levels than in a site which is defended. However, with consideration of the design life of the development, the proposed use, the vulnerability of items to be kept in the premises and long term adaptability, it may be acceptable to design finished floor levels to current, rather than climate change standards. An appropriate freeboard allowance would still be required.

It is also a requirement that loss of floodplain within flood zone A should be compensated for on a level for level basis within the site bounds for the 1 in 100-year event. Within currently developed areas the impact of loss of storage should be investigated for the 1 in 1000-year event, and further compensatory storage provided if the development is shown to have a significant impact on flood risk elsewhere.

4.10 Incorporating Climate Change into Development Design

As detailed throughout this SFRA, consideration and incorporation of the potential impacts of climate change into development layout and design is essential. The following summary provides an indication of allowances that should be considered when assessing the impacts of climate change. It should be noted that this information is intended as a guide only and there may be instances where it is appropriate for a greater or lesser allowance to be provided, particularly as climate change projections are further refined. The guidance does not necessarily relate directly to the vulnerability of the development used within *'The Planning System and Flood Risk Management Guidelines for Planning Authorities and Technical Appendices, 2009'*, but should be assessed on a case by case basis. For watercourses that fall within the Eastern CFRAM study area, water levels for future scenarios are being developed. For other watercourses a conservative approach would be to take the 0.1% AEP event levels as representing the 1% AEP event plus climate change. Where access to the hydraulic river model is readily available a run with climate change could be carried out, or hand calculations undertaken to determine the likely impact of additional flows on river levels.

For most development, including residential, nursing homes, shops and offices, the medium-range future scenario (20% increase in flows and/or 0.5m increase in sea level and/or 20% increase in rainfall depth) is an appropriate consideration.

Where the risk associated with inundation of a development is low and the design life of the development is short (typically less than 30 years) the allowance provided for climate change may be less than the 20% flow / 0.5m sea level /20% rainfall depth. However, the reasoning and impacts of such an approach should be provided in the site specific FRA.

Conversely, there may be development which requires a higher level response to climate change. This could include major facilities which are extremely difficult to relocate, such as hospitals, Seveso sites or

power stations, and those which represent a high-economic and long term investment within the scale of development across the city. In such situations it would be reasonable to expect the high-end future scenario (30% increase in flow and/or 1m in sea level and/or 30% increase in rainfall depth) to be designed to. In the case of coastal locations, and as climate projections are further developed, it may be prudent to demonstrate adaptability to even higher sea levels.

4.11 Flood Mitigation Measures at Site Design

For any development proposal in an area at moderate or high risk of flooding that is considered acceptable in principle, it must be demonstrated that appropriate mitigation measures can be put in place and that residual risks can be managed to acceptable levels.

To ensure that adequate measures are put in place to deal with residual risks, proposals should demonstrate the use of flood-resistant construction measures that are aimed at preventing water from entering a building and that mitigate the damage floodwater causes to buildings. Alternatively, designs for flood resilient construction may be adopted where it can be demonstrated that entry of floodwater into buildings is preferable to limit damage caused by floodwater and allow relatively quick recovery.

Various mitigation measures are outlined below and further detail on flood resilience and flood resistance are included in *'The Planning System and Flood Risk Management Guidelines for Planning Authorities and Technical Appendices, 2009'.* [13]

It should be emphasized that measures such as those highlighted below should only be considered once it has been deemed 'appropriate' to allow development in a given location, and following the FRA steps detailed above. 'The Planning System and Flood Risk Management Guidelines for Planning Authorities and Technical Appendices, 2009', do not advocate an approach of engineering solutions in order to justify the development which would otherwise be inappropriate.

4.12 Site Layout and Design

To address flood risk in the design of new development or regeneration of previously developed sites, a risk based approach should be adopted to locate more vulnerable land use to higher ground while water compatible development i.e. car parking, recreational space can be located in higher flood risk areas. Highly vulnerable land uses (i.e. residential housing) should be substituted with less vulnerable development (i.e. retail unit).

The site layout should identify and protect land required for current and future flood risk management. Waterside areas or areas along known flow routes can be used for recreation, amenity and environmental purposes to allow preservation of flow routes and flood storage, while at the same time providing valuable social and environmental benefits.

13 The Planning System and Flood Risk Management Guidelines for Planning Authorities and Technical Appendices, 2009

4.13 Ground Levels, Compensatory Storage and Building Use

Modifying ground levels to raise land above the design flood level is a very effective way of reducing flood risk to the particular site in question. However, in most areas of fluvial flood risk, conveyance or flood storage would be reduced locally and could have an adverse effect on flood risk off site. There are a number of criteria which must all be met before this is considered a valid approach:

- The FRA should establish the function provided by the floodplain. Where conveyance is a prime function then a hydraulic model will be required to show the impact of its alteration.
- Compensatory storage should be provided on a level for level basis to balance the total volume that will be lost through infilling where the floodplain provides static storage.
- The provision of the compensatory storage should be in close proximity to the area that storage is being lost from (i.e. within the same flood cell).
- The land proposed to provide the compensatory storage area must be within the ownership/control of the developer.
- The land being given over to storage must be land which does not flood in the 1% AEP event (i.e. flood zone B or C).
- The compensatory storage area should be constructed before land is raised to facilitate development.
- Within currently developed areas, such as the urban cores, the impact of loss of storage should be investigated for the 1 in 1000-year event, and further compensatory storage provided if the development is shown to have a significant impact on flood risk elsewhere.

In some sites it is possible that ground levels can be re-landscaped to provide a sufficiently large development footprint. However, it is likely that in other potential development locations there is insufficient land available to fully compensate for the loss of floodplain. In such cases it will be necessary to reconsider the layout or reduce the scale of development, or propose an alternative and less vulnerable type of development. In other cases, it is possible that the lack of availability of suitable areas of compensatory storage will mean the target site cannot be developed.

Raising finished floor levels within a development is an effective way of avoiding damage to the interior of buildings (i.e. furniture and fittings) in times of flood. Finished floor levels should typically be set as follows, although they may be moderated in line with the guidance for specific classes of development as discussed above:

- Fluvial risk - a minimum of the 1 in 100 year flood level, with an allowance for climate change impacts (20% increase in flows typically), and freeboard (300mm).
- Tidal risk - The FRA should assess the 1 in 200 year tidal flood level, with a suitable allowance for climate change (typically 0.5m) and a suitable freeboard (typically 300mm but could be higher where wave action or combined fluvial/tidal events occur).

Alternatively, assigning a water compatible use (i.e. garage/car parking) or less vulnerable use to the ground floor level, along with suitable flood resilient construction, is an effective way of raising vulnerable living space above design flood levels. It can however have an impact on the streetscape. Safe access and egress is a critical consideration in allocating ground floor uses.

Depending on the scale of residual risk, resilient and resistance measures may be an appropriate response but this will mostly apply to less vulnerable development.

4.14 Raised Defences and Site Landscaping

Construction of raised defences (i.e. flood walls and embankments) traditionally has been the standard response to flood risk, and has been widely used as part of a strategically led flood relief scheme. However, this is not a preferred option on an ad-hoc basis as a residual risk remains. Instead, master planning larger scale developments to include flood mitigation with the landscape of the new development should be encouraged.

4.15 Ground Floor and Basement Access Protection

In relation to basements and ground level access protection the following Flood Resilience and Adaptation Measures are recommended:

- **Doorway and access threshold levels** are an important factor in determining the susceptibility of domestic and commercial properties and below ground infrastructure to pluvial and other types of flooding. This can be especially important in flat areas where, although the depth of ponding may be relatively shallow, it can be extensive and potentially affect many properties if doorway and access thresholds are close to street level or even below street level. For low doorway accesses to domestic properties, raising of the threshold step may be practical in some instances but not always – in such circumstances temporary door-guards should be considered but these will require advance warning for installation.
- **Doorway accesses** to public, commercial and residential properties are often at ground level to facilitate access. Shallow ramping may be sufficient to keep pluvial floodwater out of the building.
- **Vehicular accesses** may also ramp down to underground car parks or basement loading areas for example. Again raised ramping or floodgates across the entrance may be sufficient to mitigate the risk.
- **Drainage augmentation** across entrances may assist but in itself may not be sufficient to deal with surface flows arising from high intensity rainfall.
- Particular care should be taken where there are street level accesses to **below-ground infrastructure** such as underground or low-level transportation systems. In such circumstances rapid inundation could pose a threat to life as well as potentially causing major disruption and damage.
- **Access protection** should be considered as a potential ‘early win’ particularly for one-off situations where shallow ramping is feasible and relatively inexpensive to install. If the number of properties with low thresholds is extensive then provision of financial

incentives to support property resistance measures can be considered, however, no centrally funded scheme is yet available for this.

- **Alarm Systems** should be strongly considered for semi-basements and should be mandatory for one storey or multiple storey basements. Training of residents and building personnel in alarms and escape routes and escorting all visitors out of sub-basement zones should be a requirement.

4.16 'Green Corridor'

It is recommended that, where possible, and particularly where there is greenfield land adjacent to the river, a 'green corridor', at least 10m wide, is retained on all rivers and streams. This will have a number of benefits, including:

- Retention of all, or some, of the natural floodplain;
- Potential opportunities for amenity, including riverside walks and public open spaces;
- Maintenance of the connectivity between the river and its floodplain, encouraging the development of a full range of habitats;
- Natural attenuation of flows will help ensure no increase in flood risk downstream;
- Allows access to the river for maintenance works;
- Retention of clearly demarcated areas where development is not appropriate on flood risk grounds, and in accordance with *'The Planning System and Flood Risk Management Guidelines for Planning Authorities and Technical Appendices, 2009'.*

The width of this corridor should be determined by the available land and topographical constraints, such as raised land and flood defences, but would ideally span the full width of the floodplain (i.e. all of flood zone A).

05

Flood Risk Management Policies/Objectives

Flood Management Policies	
Chapter 3 Addressing Climate Change	
CC1:	To prioritise measures to address climate change by way of both effective mitigation and adaptation responses in accordance with available guidance and best practice.
CC5:	To address flood risk at strategic level through the process of strategic flood risk assessment, and through improvements to the city's flood defences (see appendix 11).
Chapter 9 – Sustainable Environmental Infrastructure	
SI8:	To mitigate the effects of floods and droughts, subject to Environmental Assessment.
SI9:	To assist the Office of Public Works in developing catchment based Flood Risk Management Plans for rivers, coastlines and estuaries in the Dublin city area and have regard to their provisions/recommendations.
SI10:	To have regard to the Guidelines for Planning Authorities on the Planning System and Flood Risk Management and Technical Appendices, November 2009,published by the Department of the Environment, Community, and Local Government as may be revised/updated when assessing planning applications and in the preparation of plans both statutory and non-statutory.
SI11:	To put in place adequate measures to protect the integrity of the existing Flood Defence Infrastructure in Dublin City Council's ownership and identified in the Strategic Flood Risk Assessment and to ensure that the new developments do not have the effect of reducing the effectiveness or integrity of any existing or new flood defence infrastructure and that flood defence infrastructure has regard also to nature conservation and amenity issues.

Flood Management Policies	
SI12:	To implement and comply fully with the recommendations of the Strategic Flood Risk Assessment prepared as part of the Dublin City Development Plan.
SI13:	Development of basements or any above ground buildings for residential use below the estimated flood levels for Zone A or Zone B will not be permitted.
SI14:	To protect the Dublin City coastline from flooding as far as reasonably practicable, by implementing the recommendations of the Dublin Coastal Flood Protection Project and the Dublin Safer Project.
SI15:	To minimise the risk of pluvial (intense rainfall) flooding in the city as far as is reasonably practicable and not to allow any development which would increase this risk.
SI16:	To minimise the flood risk in Dublin City from all other sources of flooding, including fluvial, reservoirs and dams and the piped water system.
SI17:	To require an environmental assessment of all proposed flood protection or flood alleviation works

Flood Management Objectives	
SIO8:	All development Proposals shall carry out to an appropriate level of detail a Site Specific Flood Risk Assessment (site FRA) that shall demonstrate compliance with: ■ The Planning System and Flood Risk Management, Guidelines for Planning Authorities, Department of the Environment, Community and Local Government, November 2009, as may be revised/updated and the Strategic Flood Risk Assessment (SFRA) as prepared by this development plan. ■ The Site Specific Flood Risk Assessment (site FRA) shall pay particular emphasis to residual flood risks, site specific mitigation measures, flood resilient design and construction, and any necessary management measures (The SFRA and Appendix B4 of the above mentioned national guidelines refers). Attention shall be given in the site FRA to building design and creating a successful interface with the public realm through good design that addresses flood concerns but also maintains appealing functional streetscapes. All potential sources of flood risk must be addressed in the site SSFRA.
SIO9:	Proposals which may be classed as 'minor development' for example small scale infill, small extensions to houses or the rebuilding of houses or paving of front gardens to existing houses, most changes of use and small scale extensions to existing commercial and industrial enterprises in flood zone A or B should be assessed in accordance with *'The Guidelines for Planning Authorities on the Planning System and Flood Risk Management & Technical Appendices, 2009'* as may be revised/updated, with specific reference to Section 5.28 and in relation to the specific requirements of the Strategic Flood Risk Assessment. The policy shall be not to increase the risk of flooding and to ensure risk to the development is managed.

Flood Management Objectives	
SIO10:	That recommendations and flood maps arising from the Fingal East Meath CFRAM study, the Dodder CFRAM study and the Eastern CFRAM study are taken into account in relation to the preparation of statutory plans and development proposals. This will include undertaking a review of the Strategic Flood Risk Assessment for Dublin City following the publication of the Final Eastern CFRAM Study, currently being produced by the OPW.
SIO11:	To work with neighbouring Local Authorities when developing cross boundary flood management work programmes and when considering cross boundary development.
SIO12:	To ensure each flood risk management activity is examined to determine actions required to embed and provide for effective climate change adaptation as set out in the Dublin City Council climate change adaption policy and in the OPW *Climate Change Sectoral Adaptation Plan Flood Risk Management* applicable at the time.

SUDS Policies	
SI18:	To require the use of Sustainable Urban Drainage Systems in all new developments, where appropriate, as set out in the Greater Dublin Regional Code of Practice for Drainage Works. The following measures will apply: ■ The infiltration into the ground through the development of porous pavement such as permeable paving, swales, detention basins. ■ The holding of water in storage areas through the construction of green roofs, rainwater harvesting, detention basins, ponds, wetlands. ■ The slow down of the movement of water.

SUDS Objectives	
SIO13:	To provide additional and improved surface water networks to both reduce pollution and allow for sustainable development.
SIO14:	To require that any new paving of driveways or other grassed areas is carried out in a sustainable manner so that there is no increase in storm water run-off to the drainage network.

Chapter 10 Green Infrastructure, Open Space and Recreation Policies	
GI2:	That any plan/project, either individually or in combination with other plans or projects that has the potential to give rise to significant effect on the integrity of any European Site(s) shall be subject to an appropriate assessment in accordance with Article 6(3) and 6(4) of the EU Habitats Directives.
GI4:	To co-ordinate open space, biodiversity and flood management requirements, in progressing a green infrastructure network.
GI9:	To incorporate open space into the green infrastructure network for the city providing a multi-functional role including urban drainage, flood management, biodiversity, outdoor recreation and carbon absorption.
GI14:	To promote the development of soft landscaping in public open spaces, where feasible, in accordance with the principles of Sustainable Urban Drainage Systems.

Objectives	
GIO29:	To encourage trees to be incorporated in (a) the provision of temporary green. spaces (e.g. pop up parks) either planted into the soil or within moveable containers as appropriate and (b) within sustainable urban drainage systems (SUDS) as appropriate.

06

Responsibility for Flood Risk Management

6.0 Introduction

Flood events can be caused by a complex set of interactions of flood source(s), pathway(s) and receptor(s), the responsibility for managing which can often lie with a number of different organisations or individuals.

6.1 Role of the Department of the Environment, Community and Local Government (DECLG)

The Minister for the Environment, Community and Local Government in conjunction with the Competent Irish Flood Authority, the OPW, in 2009 jointly published *'The Planning System and Flood Risk Management Guidelines for Planning Authorities and Technical Appendices, 2009'*, which aimed at ensuring a more consistent and rigorous and systematic approach to fully incorporating flood risk assessment and management into the planning system.

6.2 Role of Office of Public Works

The Office of Public Works (OPW), part of the Department of Finance, is the lead State body for the co-ordination and implementation of Government policy on the management of flood risk in Ireland. The OPW is also the national authority for the implementation of the EU Directive on the Assessment and Management of Flood Risks [2007/60/EC]. SI122/2010, and the previously discussed CFRAM studies. Through this programme of work, OPW has become a source of flood risk data, including flood maps and reports.

The OPW funds investment in capital works projects and measures to reduce the likelihood of flooding in areas at risk of flooding. This investment is provided for major urban fluvial and tidal flood relief projects (carried out by the OPW directly or by Local Authorities acting on the OPW's behalf) and for localised minor flood mitigation works which are undertaken by Local Authorities with funding provided by the OPW.

OPW Flood Defence Schemes are generally carried out under the Arterial Drainage Act 1945 and the Arterial Drainage Amendment Act 1995, although in recent years some phases of schemes have been carried out by the Local Authorities under the Planning and Development Regulations.

The OPW Minor Flood Mitigation Works & Coastal Protection Scheme provides funding to Local Authorities to undertake minor flood mitigation works or studies, costing less than €0.5 million, to address localised fluvial flooding and coastal protection problems within their administrative areas.

On behalf of the DECLG, the OPW also allocate funding in exceptional circumstances for repairs to infrastructure as a result of storm damage. This occurred in 2014 following the storms in the period from 13th December 2013 to 6th January 2014.

6.3 Role of Irish Water

From January 2014 *Irish Water* became responsible for all public water services, involving the supply of drinking water and effective management of wastewater. Their Water Services Strategic Plan (2015) sets out the strategic objectives for the delivery of water services over the next 25 years up to 2040.

Some of the combined sewers (pipes for collection of both wastewater and

rainfall runoff from roads and other hard surface areas) do not have the capacity to cope with heavy rainfall and this can result in flooding. During intense rainfall, the combined sewer overflows (CSOs) discharge excess flows into nearby watercourses. *Irish Water* is proposing a number of strategies to deal with these issues, including identifying and recording properties at risk of flooding from combined sewers and implementing measures to reduce and mitigate the risk, and also to deliver measures to reduce the pollution impact from combined sewer overflows. It is also noted that in their plan *Irish Water* recognise that climate change will cause greater frequency of extreme weather events and it will be important to adapt their assets to be resilient to climate change impacts and to mitigate their impact by reducing their carbon footprint.

The storm (surface) water drainage network and fluvial and tidal flood alleviation works remain the responsibility of the relevant Local Authority or the OPW. *Irish Water's* responsibility in this area relates only to flooding from the combined sewers that are generally found in older urban areas.

6.4 Role of Dublin City Council

Dublin City Council will introduce flood risk assessment in accordance with *'The Planning System and Flood Risk Management Guidelines for Planning Authorities and Technical Appendices, 2009'*, as an integral and leading element of the development planning function under the Planning and Development Act 2000 (as amended). Dublin City Council will establish the overall flood risk assessment for their functional area and any local area plans (LAPs) which may be supplemented by more detailed Site Specific Flood Risk Assessments.

Dublin City Council is responsible for the repair and maintenance of flood and coastal defence structures in the ownership and management of the Local Authority.

Dublin City Council have produced a number of guidance leaflets on flooding, which are available to download on www.dublincity.ie

'Dublin City Council Flood Forum – Property Flood Protection Guide'.
'Dublin City Council Basement Flooding'.

Dublin City Council works closely with the DECLG and the OPW in the planning of new developments in flood risk areas of Dublin City. Through Section 50 Consents, the OPW is required to approve new bridges and culverts, or changes to existing structures on watercourses within Dublin City.

6.5 Role of Developers

Developers are obliged to carefully examine their development proposals to ensure consistency with the requirements set out in *'The Planning System and Flood Risk Management Guidelines for Planning Authorities and Technical Appendices, 2009'* and within this SFRA. This includes carefully researching whether there have been instances of flooding on specific sites and declaring any known flood history in the planning application form as required. Developers are encouraged to engage with the Local Authority at an early stage with regard to any flood risk assessment issues that may arise. They are required to carry out a Site Specific Flood Risk Assessment, as appropriate to the development proposal and location, and comply with the terms and conditions of any grant of planning permission with regards to the minimisation of flood risk.

6.6 Property Owners, Businesses and Residents

It is the responsibility of householders and businesses to look after their property, including protecting it from flooding. It is important that householders, whose homes are at risk of flooding, take steps to ensure that their home is protected. Dublin City Council recognises the vital role individuals, communities and businesses have in managing flood risk and the requirement for more information to be available to support these initiatives.

6.7 Riparian Owners

Property or land owners who own land which is adjacent to a watercourse, or which has a watercourse running through it, are riparian owners and have certain legal responsibilities to maintain the watercourse. Where a watercourse marks the boundary between adjoining properties, it is normally presumed the riparian owner owns the land up to the centre line of the watercourse.

07

Summary & Review

7.1 Flood Policy, Legislation & Flood Mapping

Dublin City Council has undertaken a Strategic Flood Risk Assessment (SFRA) to inform the Dublin City Development Plan 2016–2022. The purpose of this work is to provide a broad assessment of flood risk to inform strategic land-use planning decisions, in accordance with '*The Planning System and Flood Risk Management Guidelines for Planning Authorities and Technical Appendices, 2009'*; these Guidelines were issued under the Planning and Development Act 2000, and recognise the significance of proper planning to manage flood risk.

Under the EU 'Floods' Directive, the national Catchment Flood Risk Assessment and Management (CFRAM) programme is being rolled out to review flood risk across the country and produce flood hazard mapping and flood risk management plans for tidal and main rivers. Dublin City is covered by the ongoing Eastern CFRAM study, which includes the Rivers Liffey, Santry, Poddle, Camac as well as the City coastal zones. Earlier pilot studies were carried out for the River Tolka, Mayne and Dodder catchments. Minor streams and rivers may require new studies.

There are a number of completed, ongoing and proposed flood relief schemes in Dublin which provide protection against various combinations of tidal, fluvial and storm (surface) water flooding. The standard of protection (SoP) provided by the various schemes is variable, but generally 1% AEP for recently constructed and proposed fluvial defences and 0.5% AEP for tidal defences. Some of the ongoing/planned schemes also include an allowance for climate change, but this is not uniform.

The information provided by the above, and other local studies, is a useful source of data for the SFRA.

7.2 Definition of Flood Zones and Flood Risk

Within Dublin City, five main sources of flood risk have been identified. The natural causes are:

- Coastal & estuarine flooding of areas adjacent to the coast or tidal estuaries.
- Fluvial or riverine flooding due to the river banks overtopping and / or flood defence collapse.
- Pluvial flooding resulting from water run-off and ponding in low spots following intense rainfall.

In addition, flooding can occur from human activities including:

- Dam break & extreme operation flooding associated with dam failure, either actual failure or high discharge release when in danger of over topping.
- Drainage flooding due to failure or inadequacies of the sewerage system.

Flood zones are used to indicate the likelihood of a flood occurring. Based on the definitions in *'The Planning System and Flood Risk Management Guidelines for Planning Authorities and Technical Appendices, 2009'*, flood zone A indicates a high probability of flooding, flood zone B a moderate probability and flood zone C a low probability of flooding from fluvial or tidal sources. The flood zones are based on an undefended scenario and do not take into account the presence of flood protection structures such as flood walls or embankments. This is to allow for the

fact that there is a residual risk of flooding behind the defences due to overtopping or breach and that there may be no guarantee that the defences will be maintained in perpetuity.

Flood risk is a product of the likelihood (or probability) of a flood occurring and the potential consequences. Therefore, the assessment of flood risk requires an understanding of the sources, the flow path of floodwater and the people and property that can be affected. This has been reviewed in relation to each watercourse within Dublin City and in the context of tidal/coastal flooding.

The flood zone maps have been developed as composite datasets, drawing on the best available information across the city. This has ranged from finalised study outputs, the draft Eastern CFRAM study flood extents, engineering knowledge, historical records and site walkover.

Climate change is one of the biggest potential risks over the lifetime of the defences. The flood zones do not take the impact of climate change into account directly, although an indication of the scale of likely changes is gained from a comparison of the extents of flood zone A and B, with flood zone B being an indication of the future extent of flood zone A. For this reason, it is important that the standard of protection (SoP) provided by the defences is reviewed over time, and if necessary, increased to ensure the 1 in 100-year standard of protection is maintained. The CFRAM study, when completed, will include recommendations for the likely impact of two climate change scenarios.

7.3 Flood Management Policies

This SFRA of the Dublin City Development Plan includes a review of the land-use zonings in relation to flood risk and also recommends flood risk management policies and objectives. *'The Planning System and Flood Risk Management Guidelines for Planning Authorities and Technical Appendices, 2009'* recommend a sequential approach to the management of flood risk where the preferred option is the avoidance of development in areas of flood risk; where this is not possible development type should be substituted to a less vulnerable or water compatible land use. Proposed development zoning in an area of flood risk has been subject to the justification test to demonstrate that development is necessary for strategic growth of the area and that flood risk can be mitigated and managed appropriately; all zoned areas have been reviewed and have passed the justification test for development plans.

The SFRA provides details of the justification test for 30 reaches, which cover the full length of main open channel watercourses. In some locations, the proposed land uses are water compatible, so justification is not required. In others, the level of risk present has required specific guidance to be provided. This identifies the need for further study (either site specific FRA or the appraisal of a wider scale flood management solution) and the scope and scale of mitigation works that will be required for development to proceed in accordance with the justification test for development management.

At site specific level, all development proposals, regardless of location, will require a consideration of flood risk and where necessary an appropriately detailed flood

risk assessment. This assessment can be completed within the planning application form, or as a Stage 1 'Identification of Flood Risk', where the flood risks and topography of the site are unlikely to cause flooding of the site. For areas in Flood Zone A & B and areas of Flood Zone C where storm (surface) water or ground water flooding potential is identified, a "Stage 2 - Initial FRA" will be required and depending on the scale and nature of the risk a "Stage 3 - Detailed FRA" may be required. The requirement for all applications to have Stage 1 assessment is important, as, for example, a large site located in flood zone C may be appropriate in terms of vulnerability, but might be at potential risk of storm (surface) water flooding or a risk from climate change impacts.

Any proposal that is considered acceptable in principle shall demonstrate the use of the sequential approach in terms of the site layout and design and where flood risk is identified, in satisfying the justification test for Development Management, the proposal will demonstrate that appropriate mitigation and management measures are put in place.

7.4 SFRA Review and Monitoring

An update to the SFRA will be triggered by the six year review cycle that applies to Local Authority development plans. In addition, there are a number of other potential triggers for an SFRA review and these are listed in Table 7.1.

There are a number of key outputs from possible future studies and datasets, which should be incorporated into any update of the SFRA as availability allows. Not all future sources of information should trigger an immediate full update of the SFRA; however, new information should be collected and kept alongside the SFRA until it is updated.

Detailed, site specific FRAs may be submitted to support planning applications. Whilst these reports will not trigger a review of the flood zone maps or SFRA, they should be retained and reviewed as part of the next cycle of the development plan.

Table 7.1 SFRA Review Triggers

Trigger	Source	Possible Timescale
Catchment Flood Risk Assessment and Management (CFRAM) Flood Hazard Mapping	OPW under the Floods Directive	2015
Eastern River Basin Flood Risk Assessment and Management (CFRAM) Plan	OPW	2017, and 6 yearly reviews
Completion of major flood relief schemes which may reduce the requirement for detailed Site Specific FRA	Dublin City Council	Unknown
Flood maps of other sources, such as drainage networks	Various	Unknown
Significant flood events	Various	Unknown
Changes to Planning and/or Flood Management Policy	DCCAE, DHPCLG* / OPW	Unknown

* Note: Department of Communications, Climate Action & Environment (DCCAE)
Department of Housing, Planning, Community & Local Government (DHPCLG)

7.5 Conclusion

This SFRA has been developed to inform the preparation of land-use zoning and objectives for the Dublin City Development Plan 2016–2022, which have been reviewed against the recommendations set out in *'The Planning System and Flood Risk Management Guidelines for Planning Authorities and Technical Appendices, 2009'.* The land-use zonings allocations aim to avoid areas of high flood risk and where this is not achieved, but the proposed zoning has passed parts 1 and 2 of the justification test, recommendations have been made in part 3 of the justification test, relating to flood risk. It is noted the flood zones are based on best currently available data, but that a more detailed, site specific, flood risk assessment may produce locally varying flood outlines. There are a number of triggers which may prompt a review of the SFRA, or will require a slight change in specification for site specific flood risk assessments, including the publication of the Final Eastern CFRAM study and completion of various ongoing schemes.

Glossary of Terms – Flood Risk Assessment

Appropriate Assessment: An assessment based on best scientific knowledge, by a person with ecological expertise, of the potential impacts of the plan on the conservation objectives of any Natura 2000 Environmentally Protected sites (including Natura 200 sites not situated in an area encompassed by the plan or scheme) and the development, where necessary of mitigation or avoidance measures to preclude negative effects.

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 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. CFRAMS precede the preparation of Catchment Flood Risk Management Plans (see entry for FRMP).

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.

Detailed 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.

Dublin Coastal Flood Protection Project: The Dublin Coastal Flooding Protection Project stated in May 2003, and resulted in a detailed analysis of flood risk to Dublin and of measures that can be undertaken to alleviate the risk; one of the measures that came forward is the use of an Early Warning System for coastal flooding.

Easter River Basin District: incorporates all or part of twelve counties, Westmeath, Meath, Cavan, Kildare, Offaly, Fingal, South Dublin, Dún Laoghaire - Rathdown, Wicklow, a small portion of Wexford and Louth and Dublin City for the implementation of the Water Framework Directive.

Finished Floor Level (FFL): The finished level of the upper surface of the floor inclusive of all services, ducting and the like.

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 flood.

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 Risk Assessment (FRA): FRA can be undertaken at any scale from the national down to the individual site and comprises 3 stages: Flood risk identification, initial flood risk assessment and detailed flood risk assessment.

Flood Risk Identification: A desk-based study to identify whether there may be any flooding or storm (surface) water management issues related to a plan area or proposed development site that may warrant further investigation.

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 traditional river or coastal defences to non-structural responses such as flood warning and resilience measures at property level.

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).

Flood Plain: 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 Storage: The temporary storage of excess run-off, or river flow in ponds, basins, reservoirs or on the floodplain.

Flood Zones: A geographic area for which the probability of flooding from rivers, estuaries or the sea is within a particular range.

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 transposed into Irish Law under SI122/2010.

Fluvial flooding: Flooding from a river or other non-tidal watercourse.

Groundwater flooding: - Flooding caused by groundwater escaping from the ground when the water table rises to or above ground level.

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.

Initial flood risk assessment: A qualitative or semi-quantitative study to confirm sources of flooding that may affect a plan area or proposed development site, to appraise the adequacy of existing information, to provide a qualitative appraisal of the risk of flooding to development, including the scope of possible mitigation measures, and the potential impact of development on flooding elsewhere, and to determine the need for further detailed assessment.

Freeboard: factor of safety applied for water surfaces. Defines the distance between normal water level and the top of a structure, such as a dam, that impounds or restrains water.

Green Infrastructure: This term is used in two ways. It can describe a network of connected, high quality, multifunctional open spaces, corridors, and the links in between that provide environmental services and multiple benefits for people and wildlife. It is also used to describe a broad range of design measures, techniques and materials that have a sustainable character and have a beneficial environmental impact such as solar panels, wind turbines etc.

Green Roof: A roof with living vegetation growing in a substrate or growing medium, also referred to as eco-roofs, vegetated roofs, or living roofs.

Habitat: A place in which a particular plant of animal lives. Often used in the wider sense referring to major assemblages of plants and animals found together.

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.

Likelihood (probability) of flooding: 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.

Ordnance Datum (or OD) Malin - is a vertical datum used by an ordnance survey as the basis for deriving altitudes on maps. A spot height may be expressed as AOD for "above ordnance datum". Usually mean sea level (MSL) is used for the datum. In the Republic of Ireland, OD for the Ordnance Survey of Ireland is Malin Ordnance Datum: the MSL at Portmoor Pier, Malin Head, County Donegal, between 1960 and 1969. Prior to 1970, Poolbeg Ordnance Datum was used: the low water of spring tide at Poolbeg lighthouse, Dublin, on 8 April 1837. Poolbeg OD was about 2.7 metres lower than Malin OD.

Mitigation: The term is used to describe an action that helps to lessen the impacts of a process or development on the receiving environment. It is used most often in association with measures that would seek to reduce negative impacts of a process or development.

Natura 2000: 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" (SPA s) under the Birds Directive (Council Directive 79/409/EC on the conservation of wild birds).

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 storm (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 (RBMP): 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 Flood Risk Appraisal - A desk-based study to provide a broad overview of the source and significance of flooding across a region and identify potential conflicts with existing and proposed areas of development, thus highlighting areas where further studies will be required at county or city scale as part of development plan preparation.

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.

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 reoccupation 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.

Rilles: Rilles are long narrow ditches.

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.

Site-specific Flood Risk Assessment: An examination of the risks from all sources of flooding of the risks to and potentially arising from development on a specific site, including an examination of the effectiveness and impacts of any control or mitigation measures to be incorporated in that development.

Source: refers to a source of hazard (e.g. the sea, heavy rainfall).

Strategic Environment Assessment: This is a statutory process of assessment to examine the likely significant environmental effects of a plan or programme, prior to their adoption. It identifies consequences of actions prior to implementation and requires appropriate mitigation measures to remove identified impacts as part of the plan or programme. The SEA process came into force in July 2001 from an EU Directive (EU Directive 2001/42/EC).

Strategic Flood Risk Assessment: The assessment of flood risk on a wide geographical area against which to assess development proposed in an area (Region, County, Town).

Storm (surface) water management: This activity focuses on the assessment and management of flood risk within the urban environment from sources primarily resulting from intense rainfall. Storm (surface) water management should understand the performance of the urban drainage network, where exceedance flow routes would form and what impact this would have. Solutions to storm (surface) water flood risk can involve green infrastructure provision to capture and direct these exceedance flows to lower vulnerable areas or open space. New development can provide solutions to reducing runoff not only from the proposed development but also from existing areas.

This should be considered in the SFRA in critical areas where development is planned upstream of flooding hotspots.

Storm (Surface) water Assessment report: This report assesses the effect of excess surface water generated by the proposed development. Discharges to the drainage network or watercourse are normally limited to those of greenfield sites. The 100 year rainfall event generally has to be contained on site with only greenfield site discharges to the drainage network or watercourse.

Sustainable Development: Sustainable development is a very important term in planning and development policies and is used to describe the character of development that minimises negative impacts on the environment and its natural resources. The definition of Sustainable Development comes from the Brundtland Commission (1983) which states it as development "that meets the needs of the present without compromising the ability of future generations to meet their own needs". The Brundtland Commission was convened as a world commission on the environment amid growing concern for the deterioration of the natural environment, the depletion of natural resources and consequences for social and economic development.

Sustainable Drainage Systems (SUDS): A form of drainage that aims to control runoff as close to its source as possible using a sequence of management practices and control structures designed to drain storm (surface) water in a more sustainable fashion than some conventional techniques.

Vulnerability: The resilience of a particular group of people or types of property or habitats, ecosystems or species to flood risk, 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.

Water Framework Directive (WFD): 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.

Source: Most of the definitions above are from the 'The Planning System and Flood Risk Management Guidelines for Planning Authorities and Technical Appendices, 2009.

Appendix 1

Existing Flood Defence Infrastructure

A. **Tolka River:** The River Tolka Flooding Study was used to calculate the 100 river flow and 200 year tidal events. A summary of upgrade work along the length of the river Tolka are as follows:

- East Point Business Park Bridge to John McCormack Bridge: 200-year tidal flood contained by embankment on the north side & joint bank and retaining wall defence on south side.
- John McCormack Bridge to Railway Bridge: Retaining walls left and right sides looking downstream contain 200-year tidal flood.
- Railway Bridge to Annesley Bridge: Retaining walls left and right contain 200-year tidal flood.
- Annesley Bridge to Luke Kelly Bridge: Retaining walls left and right contain 200-year tidal flood event with the exception of one 50m stretch on the north side.
- Luke Kelly to New Distillery Road Bridge: Retaining walls left and right contain 200-year flood event.
- New Distillery Road Bridge to Drumcondra Bridge: Retaining wall north side protect this stretch from 100-year flow. Parkland on south side allowed to flood and will do so at fifty year flood level.
- Drumcondra Bridge to New Woodville: Retaining walls left and right contain 100-year flow.
- New Woodville Bridge to Griffith Park Footbridge: Combination of existing retaining walls and new set back embankments contain 100-year flow.
- Griffith Park Footbridge to Dean Swift Bridge: Retaining walls on both banks contain 100-year flow.
- Dean Swift Bridge to Glasnevin Bridge: Combination of retaining walls and embankments left and right contain 100-year flow.
- Botanic Gardens: Retains its natural floodplain.
- Finglas Road Bridge to Finglas Wood Bridge: Tolka Valley Road protected by large embankment on north side. Southside protected past 50-year event by existing retaining wall.
- Finglas Wood Bridge to Ratoath Road Bridge: Large 50-year floodplain out of bank. On north side protected by embankment and a small stretch of retaining wall, and on south side protected by retaining wall.
- Ratoath Road Bridge to Scribblestown Road Bridge: Large 50-year flood plain contained on both sides by retaining walls.

B. **Dodder River:** The Dodder, including the estuary, is the subject of ongoing flood defence works. The 200-year flood event including for climate change to the year 2100 is taken as 4.15m at the confluence with the Liffey, this increases as we go up the estuary due to the river influence.

- Confluence with Liffey to Ringsend Bridge: right hand side looking downstream (north in this case) is protected to the 200-year level to the year 2100. Left hand side is defended to 200-year level with the exception of South Dock Road which is defended to a 200-year level to 2060.
- Ringsend Bridge to London Bridge: Retaining walls and embankments left and right contain 200- year tidal level an allowance for climate change. All outlets are tidal flapped.

- Londonbridge: - parapets have been raised to cater for estimated 200 year tidal, with an allowance for climate change. Flood defences include upstream glass panels.
- London Bridge to Newbridge: Both sides of the river are defended to the 200-year level plus with an allowance for climate change by embankments and retaining walls. All outlets are tidal flapped. A number of flood gates to be closed in extreme flood events.
- Newbridge: Current parapets will contain the 200 estimated year tidal and river event. However they will have to be strengthened in the future to cater for the potential impacts of climate change.
- Newbridge to Ballsbridge: Right hand side defended by retaining walls and flood gates which cater for the estimated 200-year tidal event with an allowance for climate change. Glass panels have to be installed at Beatty's Avenue to provide an additional element of protection. Left hand side defended by series of retaining walls and embankments to 100m upstream of railway bridge. One flood gate downstream of railway bridge. Upstream flood defences currently being upgraded.
- Ballsbridge to Angelsea Bridge: Series of embankments and retaining walls. Upgrades necessary to bring to 100-year flood defence level on going.
- Anglesea Bridge to Clonskeagh weir: Retaining walls afford good protection left and right. Some levels will need to be raised for full protection. This is programmed for 2016.
- Clonskeagh weir to Clonskeagh Bridge: Level of south bank is sufficient to contain 100 year flood. North bank development of Smurfit site and future flood works required to protect to 100-year flood level, however existing banks and walls beside river offer some flood protection.
- Clonskeagh Bridge to Milltown Bridge: Series of lengthy embankments and retaining walls protect property and roads on both sides of the river, further works required to bring this to the 100-year flood level.
- Milltown Bridge to Classons Bridge: Embankments both sides to Packhorse Bridge. Shanagary apartments embankment and boundary wall, Milltown Road wall from Shanagarry to Classons Bridge. All of these provide significant flood protection, however further works are required to bring up to the national 100-year standard.
- Classons Bridge to Orwell Road Bridge: Pair of long embankments protecting right hand side. Orwell Gardens situated inside embankments and protected by river wall; identified as requiring upgrading. Dartry Park embankment protecting left hand side, although height of Orwell weir is an issue.
- Orwell Road Bridge to Pearse Bridge: Orwell flood plain, small embankment at rear. Embankment from Orwell to Pearse Bridge.
- Pearse Bridge to Bushy Park: Floodplain to steep embankment including pond. River embankment and Bushy Park wall to County Borough Booundary.

C. **River Liffey:** The Liffey is the subject of recently started works. A good portion of the Liffey fluvial area in the Dublin City Council area is well defended by the steep Liffey valley. Most of the city is relatively well defended by the quay walls. There are however a number of low points such as the campshires, Victoria Quay, Wolfe Tone Quay and Matt Talbot Bridge.

- East Wall Road Bridge to Sean Heuston Bridge: City on both sides defended by quay walls. South Campshires is a low point. Matt Talbot Bridge is the lowest bridge. Works ongoing on South Campshires from Butt Bridge to Cardiff Lane to protect to estimated 200-year flood event plus climate change allowance. Victoria Quay subject to significant flooding in a 10-year event.
- Sean Heuston Bridge to Sarah Bridge: Defended by combination of embankments and retaining walls.
- Sarah Bridge to Laurence Road: Massive embankment on right hand side protecting to 10,000-year level.
- Laurence Road to Chapelizod Road Bridge: Good level of protection given by retaining wall. Defended by embankment and park areas on north side. Islandbridge; some risk of flooding in a 100-year event from millrace.
- Chapelizod Road Bridge to city boundary: Poor protection on north side. Martin's Row area defended by retaining walls which require upgrading. Industrial estate downstream. Some areas at risk in 100-year event, existing embankment critical.

D. **The River Poddle** is largely culverted in the city area north of the Grand Canal. Existing embankments and walls are significant flood defences; these require some extra defences in Mount Argus, St. Martin's drive, Poddle Park and Ravensdale Park as well as storage in South Dublin County Council to provide estimated flood protection to the 100-year flood level.

E. **The River Santry:** Existing embankments, walls (including garden and private boundary walls) and bridge parapets, are significant flood defences. The reduction in flow area upstream of Harmonstown Road is a flood protection. Extra defences are required to provide estimated flood protection to the 100-year flood level at Raheny Village, design of these is ongoing.

F. Existing river embankments, walls and bridges on the **Camac, Phoenix Park streams, and Naniken** provide significant flood defence; however feasibility of further works to bring these up to the national standard is being investigated.

G. **Sandymount**

- All existing coastal defences, rock armour, sandbanks, embankments, promenades and sea walls provide significant flood protection to roads, property and buildings behind them, by keeping out the tide and breaking up waves which might otherwise overtop them.
- Booterstown marsh to Merrion Gates: Existing sea wall and embankment protects railway line.
- Merrion Gates: New flood wall and flood gate protects railway line and local houses to 200-year event.

- Merrion Gates to Promenade: Existing garden walls and sea wall protect houses and roadway from flooding to 200-year event.
- Promenade: Rock armour, promenade and old sea wall reduce flooding risk. 17 openings need flood protection to cater for 200-year event plus wave action.
- Promenade to Sean Moore Park: Existing sea wall provides significant flood alleviation. Needs to be raised and strengthened or new promenade plus lesser rising of wall to protect up to 200-year flood event plus wave over topping.
- Sean O'Moore Park: Southern end is flood plain for tidal overtopping. New steps and wheel chair access provide significant flood alleviation to Marine Drive.

H. Clontarf to Kilbarrack

- All existing coastal defences, rock armour, sandbanks, embankments, promenades, breakwaters, North Bull and sea walls provide significant flood protection to roads, property and buildings behind them, by keeping out the tide and breaking up waves which might otherwise overtop them.
- Alfie Byrne Road to Wooden Bridge: Existing sea wall, rock armour, promenade and existing walls and embankments provide significant flood alleviation to Clontarf Road, houses and businesses adjoining them. Proposals are being developed to upgrade these subject to local approval.
- Dollymount, Wooden Bridge to Causeway: Existing sea walls and embankments as well as Bull Island reduce flood risk in this area. A flood alleviation scheme to protect the roadway and some buildings to a level of 4.25m Malin Head is programmed to start this year.
- Causeway to Kilbarrack Road: Existing seawall, promenade, cycle track, Bull Island and pedestrian wall provide flood defence to roadway up to 200 year flood event. Some wave over topping can occur in high winds with easterly component.

I. Dublin Port

- Sean Moore Park to Irishtown Nature Park: Existing rock armour, embankments and low walls are flood defences.
- Irishtown Park to South Bull Wall: Existing rock armour, embankments sea walls and low walls are flood defences.
- South Bull Wall: This is a significant coastal defence which breaks up waves which would increase flood risk in portions of the City.
- South Bull Wall to Wastewater Treatment Plant: Existing rock armour, embankments, jetty, weir, sea walls and low walls are flood defences. The storm tanks of the Wastewater Treatment Plant may require additional defences.
- Wastewater Treatment Plant to Eastlink Bridge: Existing rock armour, embankments, sea walls and low walls are flood defences. The storm tanks of the Wastewater Treatment Plant may require additional defences.
- Eastlink to Alexandra Basin: Existing quay walls are flood defences.

- Alexandra Basin to Passenger Terminal: Existing Quay walls and low walls are flood defences. Alexandra Basin and Passenger Terminal to provide increased flood protection as part of Dublin Port Development Plan.
- Passenger Terminal to Tolka Estuary: Existing rock armour, embankments, sea walls and low walls are flood defences.
- Tolka Estuary to Alfie Byrne Road: Existing rock armour, embankments, sea walls and low walls are flood defences.

J. **Canals:** Walls, bridges, locks, weirs and embankments on the Royal and Grand canals including the Grand Canal Dock are significant flood protection structures.

- The OPW Flood Hazard Map shows information on a map about places that may be at risk from flooding. See **www.floodmaps.ie** for details. See section 5.2.4.7 on Flood Management. **www.ecframs.ie** gives current flood extent maps on the Liffey, Poddle, Camac, Santry and Dodder Rivers as well as Dublin Port, Sandymount and Clontarf and should be consulted for any Flood Risk Assessment in these areas.
- Estimated sea level rise and increased river flows arising from climate change will affect all of the above assessments and will be continually appraised with regard to allowances given by the OPW who are the National Competent Authority for the Republic of Ireland.

Appendix

2

DECLG Circular Letter

PI2/2014 Dated 13th August 2014

Comhshaol, Pobal agus Rialtas Áitiúil
Environment, Community and Local Government

To: Directors of Planning Services, City and County Councils

CC: Chief Executives, City and County Councils
An Bord Pleanala

13 August 2014

Circular PL 2/2014

(i) Use of OPW Flood Mapping in assessing planning applications, and

(ii) Clarifications of advice contained in the 2009 DECLG Guidelines for planning authorities – "The Planning System and Flood Risk Management"

Dear Director,

I wish to refer to the above two matters as follows:

(i) Use of OPW Flood Mapping in assessing planning applications

The Draft Indicative Preliminary Flood Risk Assessment (PFRA) Maps produced by the Office of Public Works (OPW) in 2010 were prepared for the purpose of an initial assessment, at a national level, of areas of potentially significant flood risk, as required by the EU Floods Directive 2007/60/EC. As was indicated in the OPW Guidance Notes attached to the draft PFRAs, *"the maps provide only an indication of areas that may be prone to flooding. They are not necessarily locally accurate and should not be used as the sole basis for defining Flood Zones, or for making decisions on planning applications".*

Furthermore, the OPW Guidance Notes state that *"local site inspections, and/or making use of the knowledge of staff familiar with a particular area, are essential to determine if the maps for a given area are reasonable. For the purposes of flood zoning, or making decisions on planning applications, it is strongly recommended that a Stage II Flood Risk Assessment (Initial Flood Risk Assessment), as set out in the (2009 DECLG) Guidelines, is undertaken (where there are proposals for zoning or development, and where the area may be prone to flooding, as described above)".*

As a second stage in the implementation of the requirements of the EU Floods Directive, the OPW is currently working on the preparation of more accurate mapping for areas of potentially significant risk under a programme of Catchment Flood Risk Assessment and Management Studies (CFRAMS). Draft CFRAM flood maps have been provided to relevant local authority engineers, for their respective areas, in their role as project partners

on the six national CFRAM studies. The objective of providing local authority access to these draft CFRAM flood maps at this early stage is to help assess the quality and accuracy of the "first run" draft maps, and to benefit from local knowledge in identifying any inconsistencies or necessary improvements in the mapping accuracy, along with OPW engineers and other technical reviewers, before they are issued for public consultation and subsequently finalised.

Similar to the draft PFRA maps, the draft CFRAM flood maps, in their current form, remain subject to an unknown amount of change before they can be robustly relied upon for any decision-making processes. It would therefore be premature to rely solely on these draft outputs for planning and development management purposes. In this regard, it would be prudent both for planning authorities and for planning applicants to have due regard to the issue of flood risk and to the information provided in the maps, and that where a flood risk is indicated in an area under consideration for development, to request that the applicant undertakes site-specific flood risk assessment by an appropriately qualified Chartered Engineer.

In essence, planning authorities are requested to be prudent in the use the draft PFRA or CFRAM flood maps as the sole basis for deciding on planning applications (i.e. to refuse applications), to make use of site inspections and/or knowledge of local areas, to request a site-specific flood risk assessment by an appropriately qualified engineer where appropriate and to also generally use their professional judgement in this regard.

The approach to be adopted by planning authorities in assessing planning applications as outlined in section 6.4 of the 2009 DECLG Guidelines still continues to apply:

"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.".

(ii) Clarifications of advice in the 2009 DECLG Guidelines for planning authorities – "The Planning System and Flood Risk Management"

The attached Appendix outlines four clarifications which should be incorporated in the 2009 DECLG Guidelines, as follows:

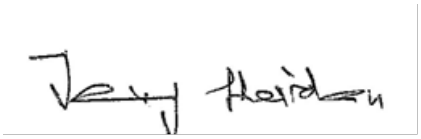
- minor revision to section 3.7 – page 26 of the Guidelines,
- the insertion of a new footnote 4 to paragraph 2(v) of box 4.1 (Justification test) – page 37 of the Guidelines,
- the insertion of a new section 4.27a after the existing section 4.27 under the heading "Existing developed zoned areas at risk of flooding" – page 40 of the Guidelines,
- minor revisions to section 5.28 – page 52 of the Guidelines.

The purpose of these revisions is to give further advice and detail to planning authorities, at the development plan (or variation) stage, in considering the zoning of areas of existing

'vulnerable uses' such as housing, and which now find themselves in flood zone A&B. This will generally apply in the older developed areas of towns and cities.

The revised text indicates that during the preparation of the development plan (or a variation of a development plan) in areas located in flood zone A&B, where the existing use zoning is classified as a "vulnerable use", the planning authority should consider if the existing use zoning of the 'vulnerable use' is still the appropriate zoning for the area. Where the planning authority considers that the existing use zoning is still appropriate, the planning authority must specify the nature and design of structural or non- structural flood risk management measures required prior to future development in such areas, in order to ensure that flood hazard and risk to the area and to other adjoining locations will not be increased, or if practicable, will be reduced.

Similarly where the area relates to the regeneration of a residential area and is located in a flood risk zone A&B, the planning authority should in the first instance consider the relocation of the residential use, and where, in the opinion of the planning authority, this is not feasible, the development plan (or any variation) must specify the above matters.



Terry Sheridan,

Principal Officer,

Planning Section.

Appendix

Clarifications of advice in the Guidelines for Planning Authorities - The Planning System and Flood Risk Management Guidelines (November 2009)

(i) Revised section 3.7 – page 26 of the Guidelines

Justification Test

3.7 Notwithstanding the need for future development to avoid areas at risk of flooding, it is recognised that the existing urban structure of the country contains many well established cities and urban centres which will continue to be at risk of flooding. At the same time such centres may also have been targeted for growth in the National Spatial Strategy, Regional Planning Guidelines and the various City and County Development Plans taking account of historical patterns of development and their national and strategic value. In addition, development plans have identified various strategically located urban centres and particularly city and town centre areas whose continued consolidation, growth, development or regeneration, including for residential use, 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.

(ii) Insertion of new foot note 4 to Box 4.1, paragraph 2(v) – page 37 of the Guidelines

(v)There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement. 4

4 This criterion may be set aside where section 4.27b applies.

(iii) Insertion of new Section 4.27a – page 40 of the Guidelines

Existing, developed, zoned areas at risk of flooding

4.27a In some instances, particularly in older parts of cities and towns, an existing land use may be categorised as a "highly vulnerable development" such as housing, be zoned for residential purposes and also be located in flood zone A/B. Additional development such as small scale infill housing, extensions, or changes of use that could increase the risk or number of people in the flood-prone area can be expected in such a zone into the future. In these instances, where the residential / vulnerable use zoning has been considered as part of development plan preparation, including use of the Justification Test as appropriate, and it is considered that the existing use zoning is still appropriate, the development plan must specify the nature and design of structural or non-structural flood risk management measures required prior to future development in such areas in order to ensure that flood

hazard and risk to the area and to other adjoining locations will not be increased or, if practicable, will be reduced. Planning authorities should consider the issues and opportunities raised in section 4 of Appendix B (Technical Appendices) in this regard, and may consider including certain objectives or conditions as part of the zoning.

Regeneration areas
As indicated in section 3.7, development plans have identified various strategically located urban centres and particularly city and town centre areas whose continued consolidation, growth, and development or regeneration is being encouraged.

Where an existing residential area is proposed for residential regeneration, and is located in a flood zone A/B, the planning authority should in the first instance consider the relocation of the residential use and where in the opinion of the planning authority this is not feasible, the development plan (or any variation) must specify the matters above, i.e. the nature and design of structural or non-structural flood risk management measures required prior to future development in such areas to ensure that flood hazard and risk to the area and other locations will not be increased or, if practicable, will be reduced, with a particular emphasis on the overall design of the area following the core principles set out in section 2.1 of Appendix B on planning and design for flood risk.

Where more extensive regeneration is to take place, including site clearances, and where new mixed development is proposed i.e. a docklands site, again the planning authority must specify the nature and design of structural or non-structural flood risk management measures required prior to future development in such areas to ensure that flood hazard and risk to the area and other locations will not be increased or, if practicable, will be reduced, with a particular emphasis on the overall design of the area to integrate flood risk management as a central core of the design, ensuring that as far as possible vulnerable uses are not located in flood zone A/B areas.

(iv) Revised section 5.28 – page 52 of the Guidelines

Assessment of minor proposals in areas of flood risk

5.28 Applications for minor development, such as small scale infill, small extensions to houses or the rebuilding of houses, and most changes of use of existing buildings and or extensions and additions to existing commercial and industrial enterprises, are unlikely to raise significant flooding issues, unless they obstruct important flow paths, introduce a significant additional number of people into flood risk areas or entail the storage of hazardous substances. Since such applications concern existing buildings or developed areas, the sequential approach cannot be used to locate them in lower-risk areas and the Justification Test will not apply. However, a commensurate 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. These proposals should follow best practice in the management of health and safety for users and residents of the proposal.

Appendix

3

Justification Test Tables

Assessment Index

1. Dublin Port South of the Liffey from Tom Clarke Bridge
2. Dublin Port North of the Liffey to Tom Clarke Bridge
3. Liffey: O'Connell Bridge to Tom Clarke Bridge
4. Liffey: Sean Heuston Br. - O'Connell Bridge
5. Liffey: Sean Heuston Br. – Sarah Bridge, South Circular Road
6. Liffey: Sarah Bridge, South Circular Road - Anna Livia Br. Chapelizod
7. Liffey: Anna Livia Br. Chapelizod - County Boundary
8. Coastal: Sandymount
9. Dodder: Liffey to Ballsbridge
10. Dodder: Ballsbridge to Donnybrook Bridge
11. Dodder: Donnybrook Bridge – Dundrum Road
12. Dodder: Dundrum Road – Bushy Park Boundary
13. Poddle: Inside Canal
14. Poddle: Culverts outside Canal
15. Poddle: Grand Canal to Sundrive Road
16. Poddle: Sundrive Road – Kimmage Road West
17. Lower Camac: South Circular Road to Liffey
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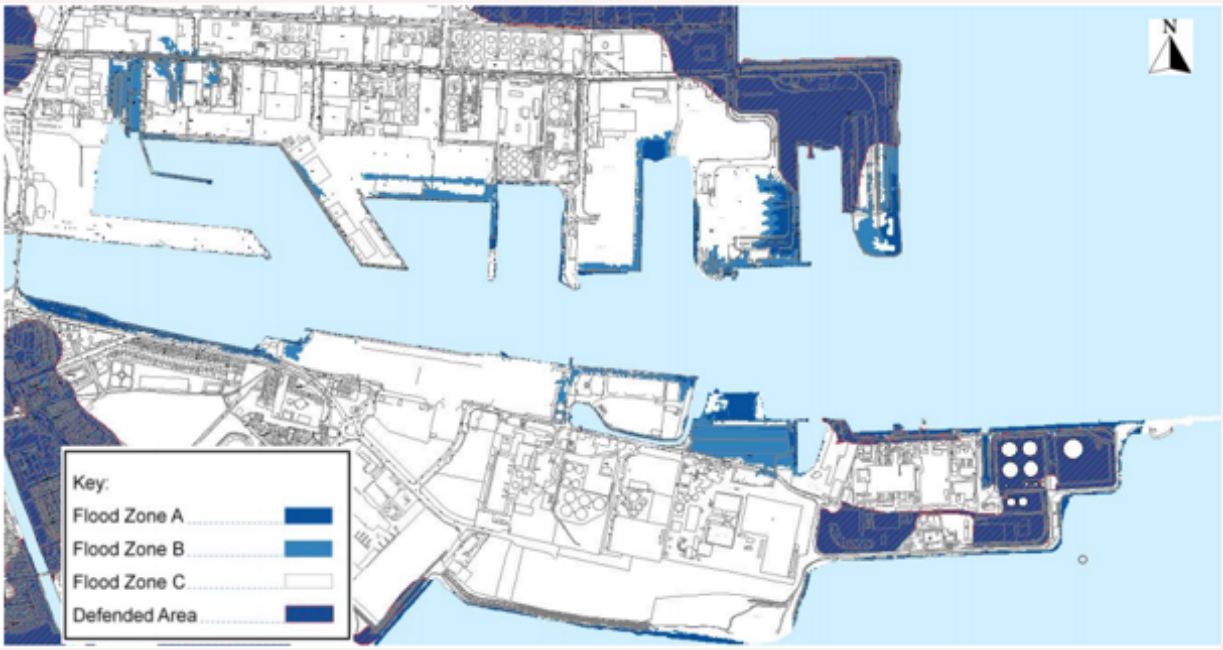
20. Tolka: Dublin Port to Drumcondra Bridge
21. Tolka: Drumcondra Bridge to St. Mobhi Road
22. Tolka: St. Mobhi Road – Finglas Road
23. Tolka: Finglas Road – County Borough Boundary
24. Wad: Clontarf Road to Collins Avenue East
25. Wad: Collins Avenue East to Collins Park
26. Clontarf Alfie Byrne Road to Wooden Bridge
27. Santry River: James Larkin Road to DART Railway Line and Dollymount Wooden Bridge to Clontarf Road Coastal Zone
28. Santry River: DART Railway – Boundary
29. Mayne: Dublin Belfast Railway line – M50
30. Bull Island

Site: 1. Dublin Port South of the Liffey from Tom Clarke Bridge



Dublin City Council Development Plan 2016–2022 (zoning map key at back of tables)

Site: 1. Dublin Port South of the Liffey from Tom Clarke Bridge	
Site Description	The area is heavily developed by industrial units to the north some related to Dublin Port activities. There are a number of chemical sites in this area. To the south there are a number of greenfield areas such as Ringsend, Sean Moore and Irishtown Nature Parks. To the west of the area there is some residential use. Most of the area is reclaimed from the sea. Developments are likely to be industrial with some residential. The areas at high risk are in the vicinity of the stormwater tanks at the Ringsend Wastewater Treatment Plant and the inlet in the centre of the ESB Power Generating Station.
Benefitting from Defences (flood relief scheme works)	The portion of the sea wall along the western end of Pigeon House Road offers some protection to properties to the south of it. The rest of the area is largely undefended. Much of the residential development is also defended from tidal flooding from the River Dodder Estuary.
Sensitivity to Climate Change	The area is highly sensitive to climate change and an increase of 0.5m on top of the 200 year tide level would put much of it underwater. A 1m rise in sea level should be assessed for high vulnerability / high risk developments, including Seveso and other industrial uses.
Residual Risk	Any proposed developments in the protected areas on the west of Pigeon House Road will require a detailed assessment of current defences and will have to consider the impact of a defence breach, particularly where it relates to high vulnerability industrial development.
Historical Flooding	The flood maps attached are consistent with previous flooding of this section of Dublin Port. The road to the east of the toll plaza is at high flood risk as well as a portion of roadway in front of Portview House.
Storm (surface) water	All storm (surface) water in this area needs to be carefully managed and provision made for significant rainfall events during high tides. A one year high tide event should be assumed during a 100-year rainfall event. Should development be permitted, best practice with regard to storm (surface) water management should be implemented across the development area to limit storm (surface) water runoff to current values. All Developments shall have regard to the Pluvial Flood Maps in their Site Specific Flood Risk Assessment, see Flood ResilienCity Project, Volume 2 City Wide Pluvial Flood Risk Assessment at http://www.dublincity.ie/main-menu-services-water-waste-and-environment-drains-sewers-and-waste-water/flood-prevention-plans

Commentary on Flood Risk:
The flood extents indicate flow paths generally coming directly out of the tidal region.
The flood maps are based on the OPW CFRAM Study and checked against historic flooding in the area.

Development Options:
Industrial development, including a mix of infill and redevelopment / regeneration would be the obvious continuation of land use from the adjoining exiting development, particularly in the area east of the Irish Glass Bottle site. There are also existing Seveso sites, which could see further development in the future. Some residential development may take place to the west.

Site: 1. Dublin Port South of the Liffey from Tom Clarke Bridge

Justification Test for Development Plans

1. Section 1 is covered elsewhere in this SFRA justifying all of Dublin City

2. The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:

(i) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement
Answer: Yes: This area is essential for the future expansion and operation of Dublin Port and its related operations. The area comprises mainly brownfield sites. To the south there are a number of greenfield areas such as Ringsend, Sean Moore and Irishtown nature Parks. To the west of the area there is some residential use. Most of the area is reclaimed from the sea. Likely developments are industrial with some residential. There are a number of Seveso sites located in this area. Some of the area forms a portion of Strategic Development and Regeneration Areas 6 Docklands. These are important brownfield sites with the potential to deliver a significant quantum of mixed uses and create synergies to regenerate their respective areas.

(ii) Comprises significant previously developed and/or under-utilised lands
Answer: Most of the lands would comprise industrial uses directly related to the Port use. There would be large sites in the Port area, mainly comprising of brownfield sites and some greenfield sites. There are also a number of greenfield sites including Ringsend, Sean Moore and Irishtown nature Parks. A portion of the lands include the SDRA 6 Docklands Area as described above.

(iii) Is within or adjoining the core of an established or designated urban settlement
Answer: Yes: This area is essential for the future expansion and operation of Dublin Port and its related operations. Some of the area forms part of Strategic Development and Regeneration Areas 6 Docklands. These are important brownfield sites with the potential to deliver a significant quantum of mixed uses and to create synergies to regenerate their respective areas. The Development Plan prioritises renewal and regeneration of these areas by a series of guiding principles (see Section 15.1.1.6 of the Written Statement)

(iv) Will be essential in achieving compact and sustainable urban growth
Answer: Yes: This area is essential for the future expansion and operation of Dublin Port and its related operations. Some of the area forms part of Strategic Development and Regeneration Areas 6 Docklands. These are important brownfield sties with the potential to deliver a significant quantum of mixed uses and to create synergies to regenerate their respective areas. The Development Plan prioritises renewal and regeneration of these areas by a series of guiding principles. (see Section 15.1.1.6 of the Written Statement)

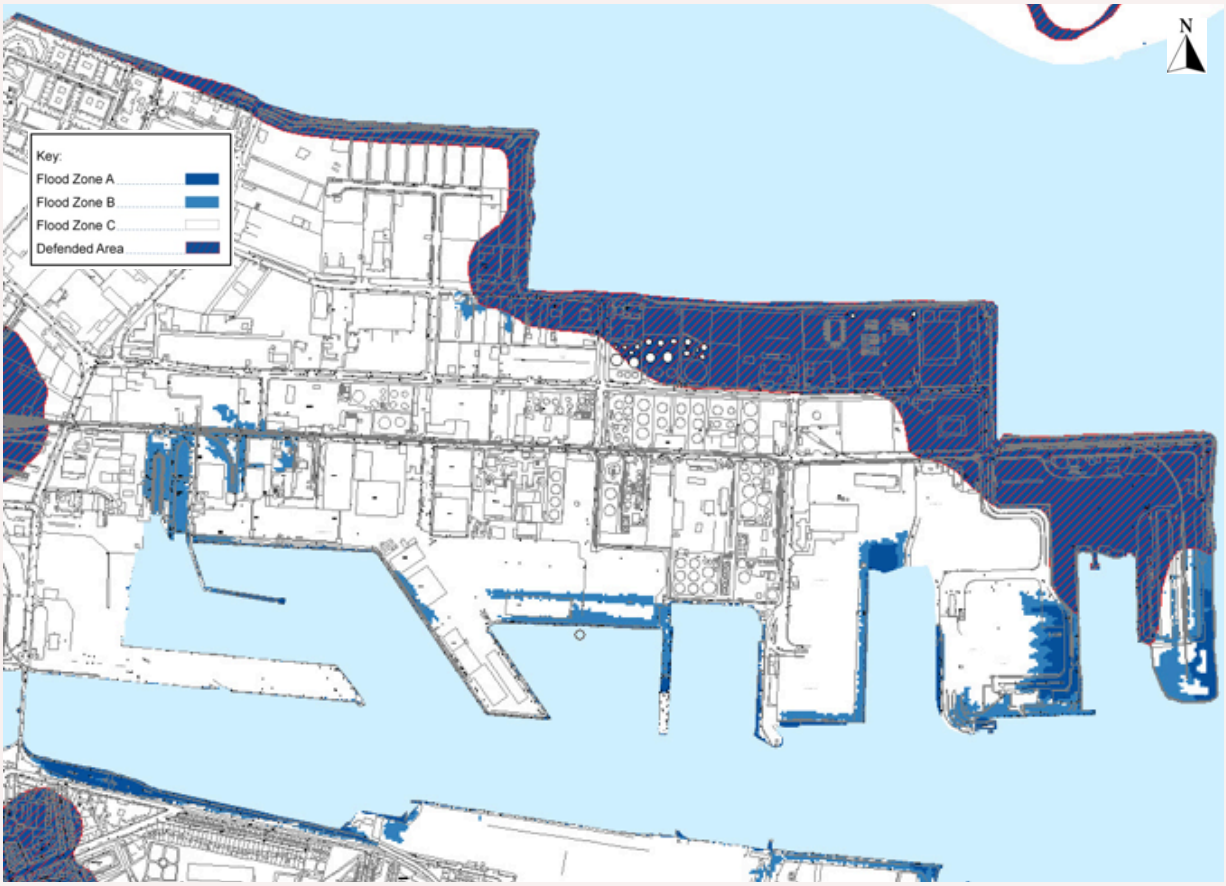
(v) There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement.
Answer: There are no suitable alternative lands for the particular uses or development type in areas at lower risk of flooding, within or adjoining the urban settlement.

Site: 1. Dublin Port South of the Liffey from Tom Clarke Bridge

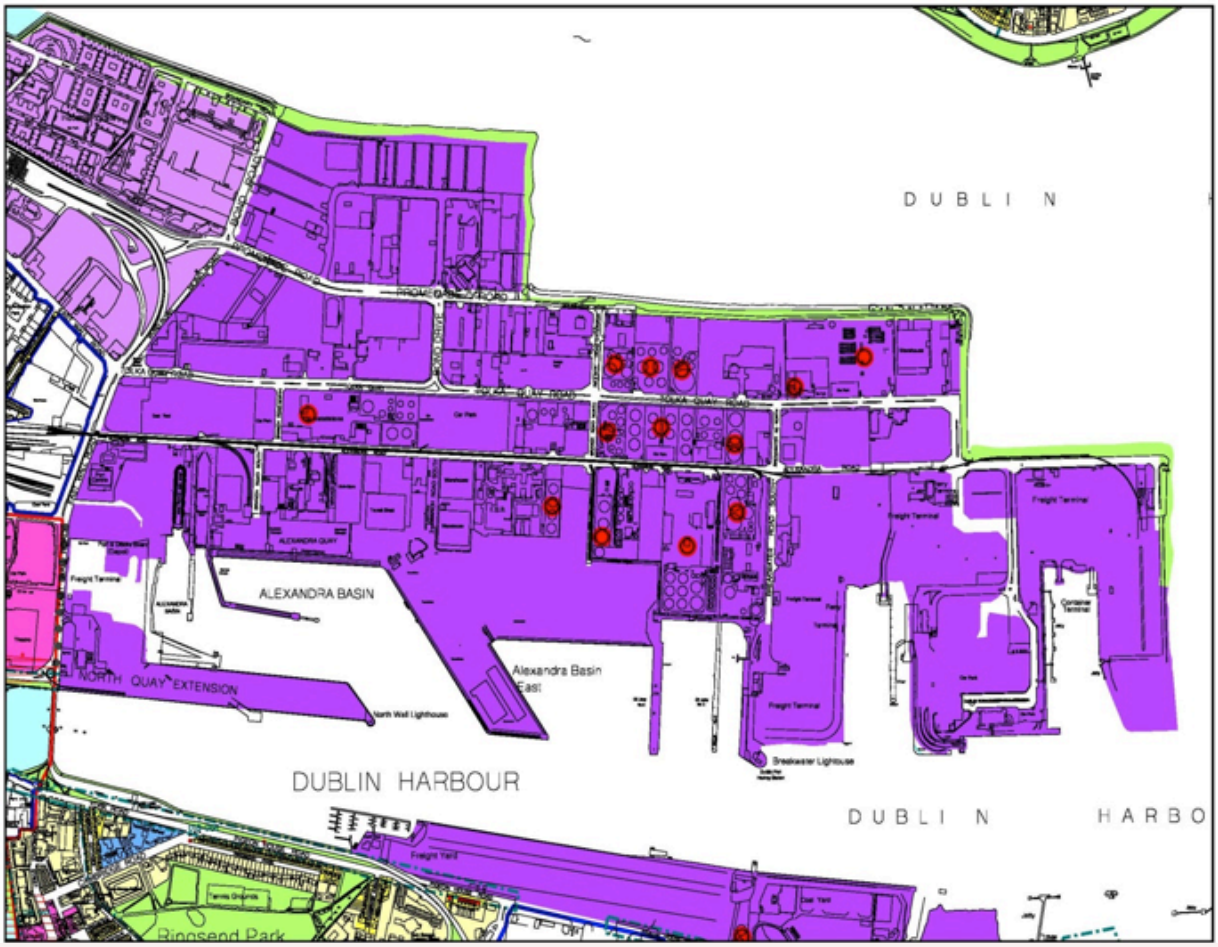
3. Strategic Flood Risk Assessment for Flood Zones A and B (for defended Flood Zones A and B see section 4.8)

- Some of the lands shown in the above flood cell are directly connected with Dublin Port and its related facilities. The lands are zoned Z7 in the Development Plan which is to provide for the protection and creation of Industrial uses and facilitate opportunities for employment creation. The types of uses that generally go into this area would be heavy industrial port related uses. There are a number of existing Seveso sites located in the Port area, and fuel storage depots etc. Part of the lands above is included in the Docklands Strategic Development and Regeneration Area (SDRA 6) which will provide a significant amount of mixed uses.
- Use Classes considered as 'Vulnerable Development' shall not be permitted in Flood Zone A or B (this includes Essential Infrastructure such as primary transport and utilities distribution including electricity generating power stations and sub stations, water and sewage treatment, and potential significant sources of pollution (SEVESO sites, IPPC sites etc).
- Within this area it is essential that the impact of sea level rise by 0.5m for ordinary sites and 1.0m for critical / highly vulnerable infrastructure and high risk chemical sites is carried out as detailed in this SFRA. For some developments it may be appropriate to include a more detailed assessment of likely climate change impacts, including the frequency of lower high tide return periods with wave action.
- As the flood risks are tidal, mitigation through land raising (or bunding for smaller developments) will have no impact on neighbouring development, so compensatory storage will not be required. The focus of the FRA will be to ensure the safety and long-term operability of the development and safety of operatives.
- Where development will be in the defended area, consideration should be given to the likelihood of the defencesfailing (either through overtopping or breach) and how the operation will ensure it can retain functionality / recover following an extreme flood event. Buildings should be of flood resilient construction.
- Proposals for residential development should be treated in accordance with the guidance in this SFRA.
- FRA's should be carried out for all basements and underground structures with respect to any human access.

Site: 2. Dublin Port North of the Liffey to Tom Clarke Bridge



Site: 2. Dublin Port North of the Liffey to Tom Clarke Bridge



Dublin City Council Development Plan 2016–2022 (zoning map key at back of tables)

Site Description	The area is heavily developed by industrial units related to Dublin Port activities. There are a number of chemical sites in this area. Likely developments are industrial infill or brownfield. The areas at highest risk are to the south in the vicinity of Alexandra Basin and near the passenger terminal of Dublin Port. These areas will see significant reductions in flood risk as a result of proposed Port development works.
Benefitting from Defences (flood relief scheme works)	To the north and east of this area existing embankments and rock armour significantly reduce the flooding risk from high tides and wave action. The south of this area requires direct access to shipping and thus relies on ground level as a flood defence. Wave action is much lower in this area.
Sensitivity to Climate Change	High – An increase of 0.5m on top of the 200-year tide level would put most of this area under water.

Site: 2. Dublin Port North of the Liffey to Tom Clarke Bridge	
Residual Risk	The protected areas to the north require existing embankments and rock armour to be monitored on a regular basis and particularly after a very high tide or significant storm event. Residual risks associated with failure would be high, and will increase with sea level rise and more frequent storms.
Historical Flooding	The flood maps attached are consistent with previous flooding of this section of Dublin Port.
Storm (surface) water	All storm (surface) water in this area needs to be carefully managed and provision made for significant rainfall events during high tides. A one year high tide event should be assumed during a 100-year rainfall event. Should development be permitted, best practice with regard to storm (surface) water management should be implemented across the development area, to limit storm (surface) water runoff to current values. All Developments shall have regard to the Pluvial Flood Maps in their Site Specific Flood Risk Assessment, see Flood ResilienCity Project, Volume 2 City Wide Pluvial Flood Risk Assessment at http://www.dublincity.ie/main-menu-services-water-waste-and-environment-drains-sewers-and-waste-water/flood-prevention-plans

Commentary on Flood Risk:
The flood extents indicate flow paths generally coming directly out of the tidal region. The flood maps were produced based on the OPW CFRAM Study and checked against historic flooding in the area.

Development Options:
Industrial development (some infill) would be the obvious continuation of land use from the adjoining exiting development. Any development could reasonably be accommodated within the extents of Flood Zone C, and it is possible that with consideration of landscaping, additional development land could be released; however the influence of sea level rise by 0.5m for ordinary sites and 1.0m for critical infrastructure and high risk chemical sites has to be considered and mitigated against. Commercial/Industrial development may be allowed in Flood Zone B if appropriate but subject to comments on likely climate change above. Commercial/Industrial development in Flood Zone A will not be allowed. No residential development will be allowed in this area.

Justification Test for Development Plans

1. Section 1 is covered elsewhere in this SFRA justifying all of Dublin City

2. The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular

(i) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement
Answer: Yes: This area is essential for the future expansion and operation of Dublin Port and its related operations. The area comprises mainly brownfield sites. There would also be a number of Seveso sites located in this area.

(ii) Comprises significant previously developed and/or under-utilised lands
Answer: Most of the lands would comprise industrial uses directly related to the Port use. There would be large sites in the Port area, but these mainly comprise of brownfield sites.

(iii) Is within or adjoining the core of an established or designated urban settlement
Answer: Yes: This area is essential for the future expansion and operation of Dublin Port and its related operations.

Site: 2. Dublin Port North of the Liffey to Tom Clarke Bridge

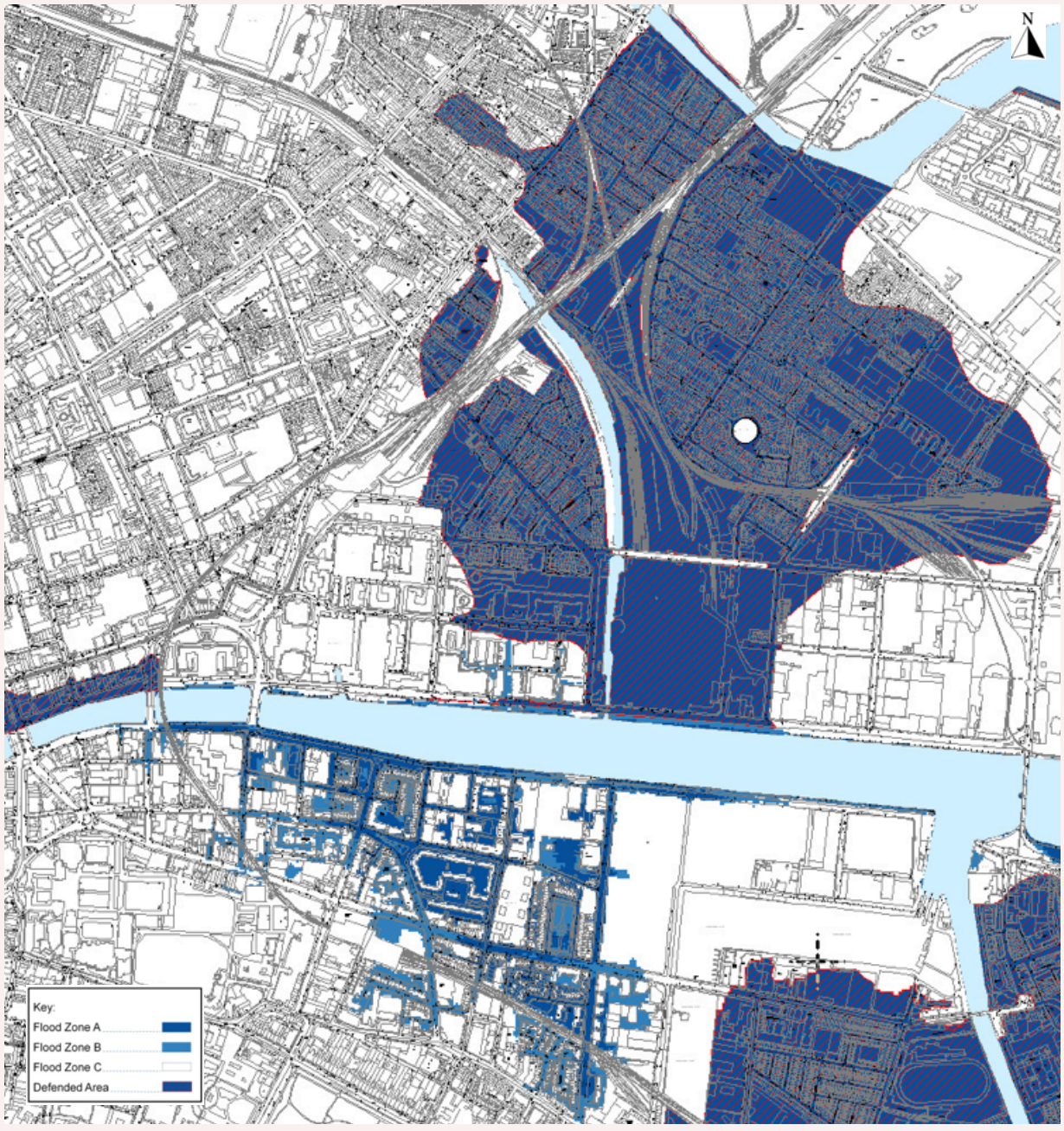
(iv) **Will be essential in achieving compact and sustainable urban growth**
Answer: Yes: This area is essential for the future expansion and operation of Dublin Port and its related operations.

(v) **There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement**
Answer: There are no suitable alternative lands for the particular uses or development type in areas at lower risk of flooding, within or adjoining the urban settlement. This area is essential for the future expansion and operation of Dublin Port and its related operations.

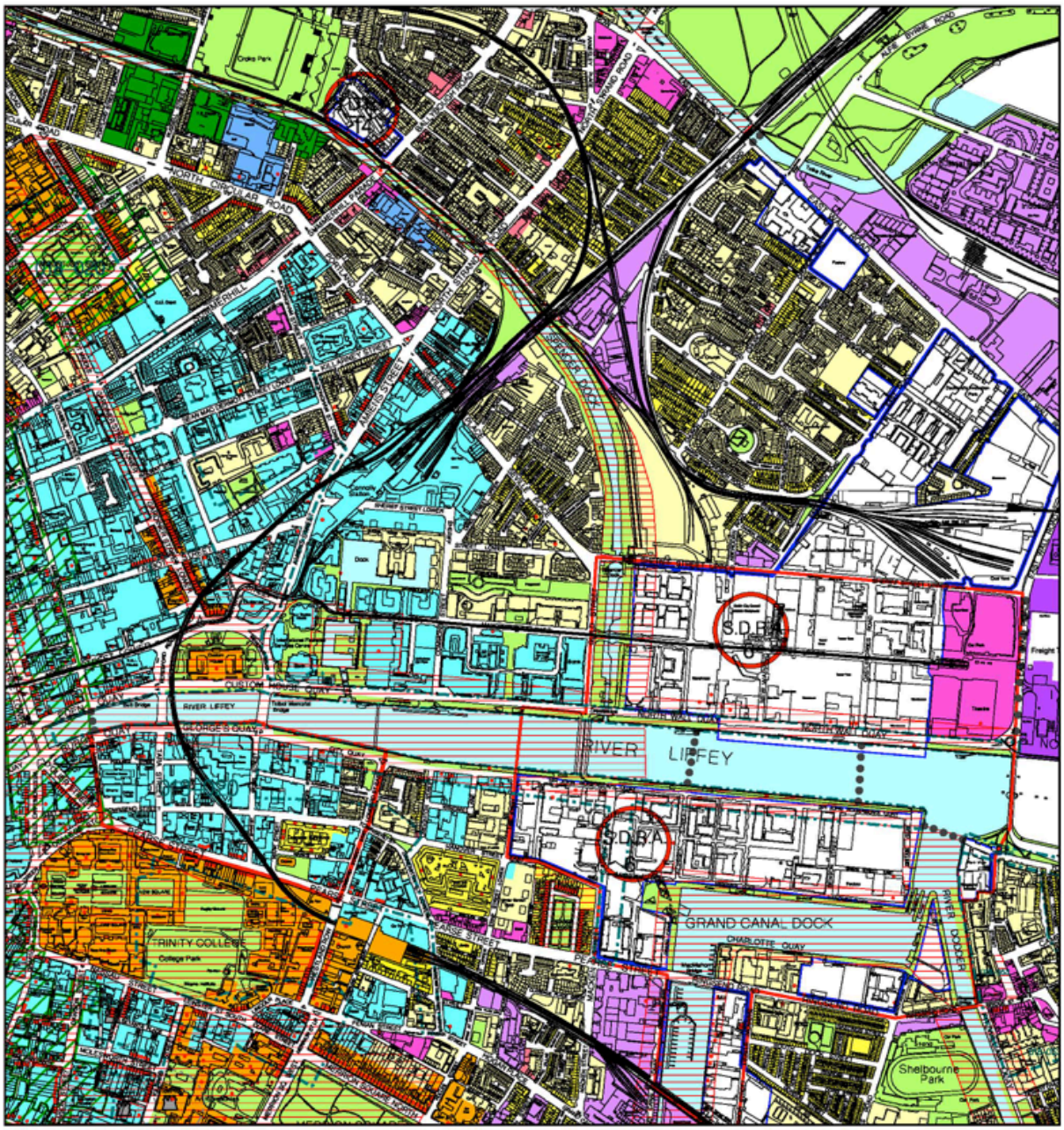
3. Strategic Flood Risk Assessment for Flood Zones A and B (for defended Flood Zones A and B see section 4.8)

- Use Classes considered as 'Vulnerable Development' shall not be permitted in Flood Zone A or B (this includes Essential Infrastructure such as primary transport and utilities distribution including electricity generating power stations and sub stations, water and sewage treatment, and potential significant sources of pollution (SEVESO sites, IPPC sites etc).
- Within this area it is essential that the impact of sea level rise by 0.5m for ordinary sites and 1.0m for critical / highly vulnerable infrastructure and high risk chemical sites is carried out. For some developments it may be appropriate to include a more detailed assessment of likely climate change impacts, including the frequency of lower return periods and wave action.
- As the flood risks are tidal, mitigation through land raising (or bunding for smaller developments) will have no impact on neighbouring development, so compensatory storage will not be required. The focus of the FRA will be to ensure the safety and long-term operability of the development.
- Where development will be in the defended area, consideration should be given to the likelihood of the defences failing (either through overtopping or breach) and how the operation will ensure it can retain functionality / recover following an extreme flood event. Buildings should be of flood resilient construction.
- FRA's should be carried out for all basements and underground structures with respect to any human access.

Site: 3. Liffey: O'Connell Bridge to Tom Clarke Bridge



Site: 3. Liffey: O'Connell Bridge to Tom Clarke Bridge



Dublin City Council Development Plan 2016–2022 (zoning map key at back of tables)

Site Description	The area on the south side (right bank) includes Sir John Rogerson's Quay, City Quay, George's Quay and Burgh Quay and areas south of these roughly to the railway line. On the north side (left bank) it includes North Wall Quay, Custom House Quay, Eden Quay and areas north of these including areas adjacent to the Royal Canal flooded in 2002. The areas include the Docklands Strategic Development Zone (SDZ) and the Royal Canal exit to the Liffey Estuary. Development in this area is a mixture of high density Commercial and Residential.

Site: 3. Liffey: O'Connell Bridge to Tom Clarke Bridge	
Benefitting from Defences (flood relief scheme works)	Some areas to the west of this area have existing Quay Walls but their design standards and capacity for flood defence is unknown. Georges Quay has recently had flood defences constructed to a level of 4.0m Malin head. A new sea lock (triple gate) was installed at Spencer Dock to reduce the risk of tidal waters flooding houses and commercial building to the north of it. This sea lock is maintained by Waterways Ireland. City Quay and Sir John Rogerson's Quay to Cardiff Lane have flood defences programmed for construction in 2015 and 2016.
Sensitivity to Climate Change	Climate change impacts of +0.5–1.0m on sea levels would have a significant impact on the area.
Residual Risk	Any proposed developments in the protected areas on Georges Quay and elsewhere require residual risk from overtopping or other cause to be mitigated against. Where defences are formal, of recent construction and maintained by DCC / OPW, the risk of breach is likely to be low and assessment can be quantitative rather than involving detailed modelling.
Historical Flooding	The flood maps attached are consistent with previous flooding of this section of the Liffey Estuary.
Storm (surface) water	All storm (surface) water in this area needs to be carefully managed and provision made for significant rainfall events during high tides. A one year high tide event should be assumed during a 100-year rainfall event. Should development be permitted, best practice with regard to storm (surface) water management should be implemented across the development area, to limit storm (surface) water runoff to current values. All Developments shall have regard to the Pluvial Flood Maps in their Site Specific Flood Risk Assessment, see Flood ResilienCity Project, Volume 2 City Wide Pluvial Flood Risk Assessment at http://www.dublincity.ie/main-menu-services-water-waste-and-environment-drains-sewers-and-waste-water/flood-prevention-plans

Commentary on Flood Risk:
The flood extents indicate flow paths generally coming directly out of the tidal region, some are through quay walls and underground chambers near quay walls.
The flood maps were produced based on the OPW CFRAMS Study and checked against historic flooding in the area. The south Campshires area which has a flood defence under construction from Butt Bridge to Cardiff Lane is the most at risk area. The North Campshires will require flood defences to combat 0.5–1.0m estimated climate change in the future. This is being further reviewed under the Eastern CFRAM Study, and recommendations for defence works will be reported on in the resulting Flood Risk Management Plan.

Development Options:
High density Commercial and Residential development (some infill and some redevelopment) would be a natural extension of existing development. Development will be required within both Flood Zones A and B so the Justification Test has been applied. Development will be permitted in Flood Zone C.

Site: 3. Liffey: O'Connell Bridge to Tom Clarke Bridge

Justification Test for Development Plans

1. Section 1 is covered elsewhere in this SFRA justifying all of Dublin City

2. The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:

(i) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement
Answer: Yes: This part of the City is a key redevelopment area. Part of the area identified above (where the Flood Cell is identified) forms part of the George's Quay Local Area Plan, 2012. The George's Quay LAP area is framed by the iconic River Liffey to the north and by the unique built heritage footprint of Trinity Campus to the south. The area is highly connected to other parts of Dublin and beyond with two of the busiest heavy rail stations in Dublin, Tara Street Station and Pearse Street station serving the area. This area is strategically located and important for a number of reasons including (i) its role as a location of headquarter and Government Departments, (ii) adjoining Trinity College and its associated innovation centres and (iii) located at the bridging point between the City centre and Docklands, means that this area is of significant economic importance to both the City, the Region and the State. The LAP area has capacity to facilitate significant new employment centres as it can provide locations for high quality new office, mixed use and innovation space in the heart of the City centre, attracting new economic activity and headquarter facilities. The area to the east of the George's Quay LAP, is the Grand Canal Dock area which forms part of the North Lotts and Grand Canal Dock Strategic Development Zone (SDZ), which was approved by An Bord Pleanala in 2014. The SDZ offers a coherent spatial and urban planning approach and is considered the most appropriate and effective mechanism to deliver the remaining parts of this area of economic and social importance to the city and State. This area also forms part of the Strategic Development and Regeneration Area 6 (SDZ and Wider Docklands Area, see section 15.1.1.6 of the written statement), which are areas capable of delivering significant quantums of homes and employment for the City, either through the development of green field sites or through the regeneration of the existing built City. The SDZ Docklands site is zoned Z14 within the Development Plan, where the overall focus is To seek the social, economic and physical development and/or rejuvenation of an area with mixed use, of which residential and "Z6" [enterprise and employment use] would be the predominant use.

(ii) Comprises significant previously developed and/or under-utilised lands
Answer: While the George's Quay Area is largely developed there are a few large key development sites within the LAP, which would be mostly brownfield sites. Within the SDZ boundary (which forms part of SDRA 6, see section 15.1.1.6 of the written statement), there are also a number of large development sites. In total the SDZ area comprises 66 hectares, between North Lotts and Grand Canal Dock, the remaining sites for redevelopment equate to 22ha, which represents significant development potential for major economic and community expansion.

(iii) Is within or adjoining the core of an established or designated urban settlement
Answer: Yes: This area is located adjacent to the core of the City, and located in a strategic position in close proximity to major transport infrastructure. The George's Quay area is strategically located adjacent to the retail core, where large numbers of former industrial or entertainment sites provided the opportunity for comprehensive office development. The North Lotts Grand Canal Dock SDZ lands extend north and south of the river at a strategic location; North Lotts immediately adjoins the IFSC and Grand Canal Dock is in close proximity to the city's central business district and south city retail core area.

Site: 3. Liffey: O'Connell Bridge to Tom Clarke Bridge

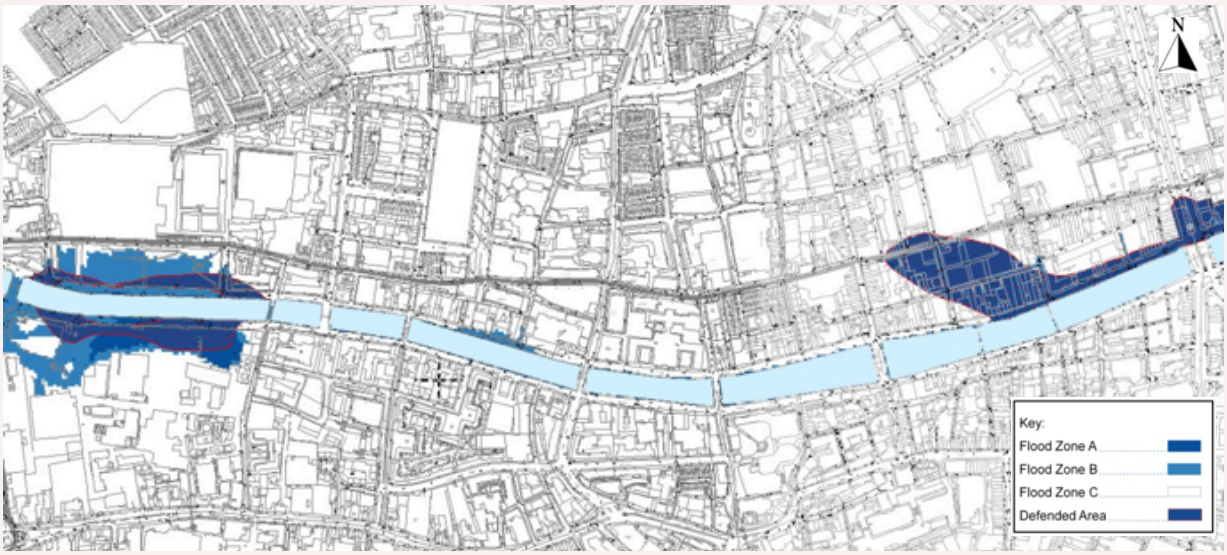
(iv) **Will be essential in achieving compact and sustainable urban growth**
A**nswer: Yes:** This area is a key redevelopment area in the city. Part of the lands above form part of the George's Quay LAP and part of the lands form part of the SDZ for the North Lotts Grand Canal Dock. This area is key in achieving compact and sustainable urban growth.

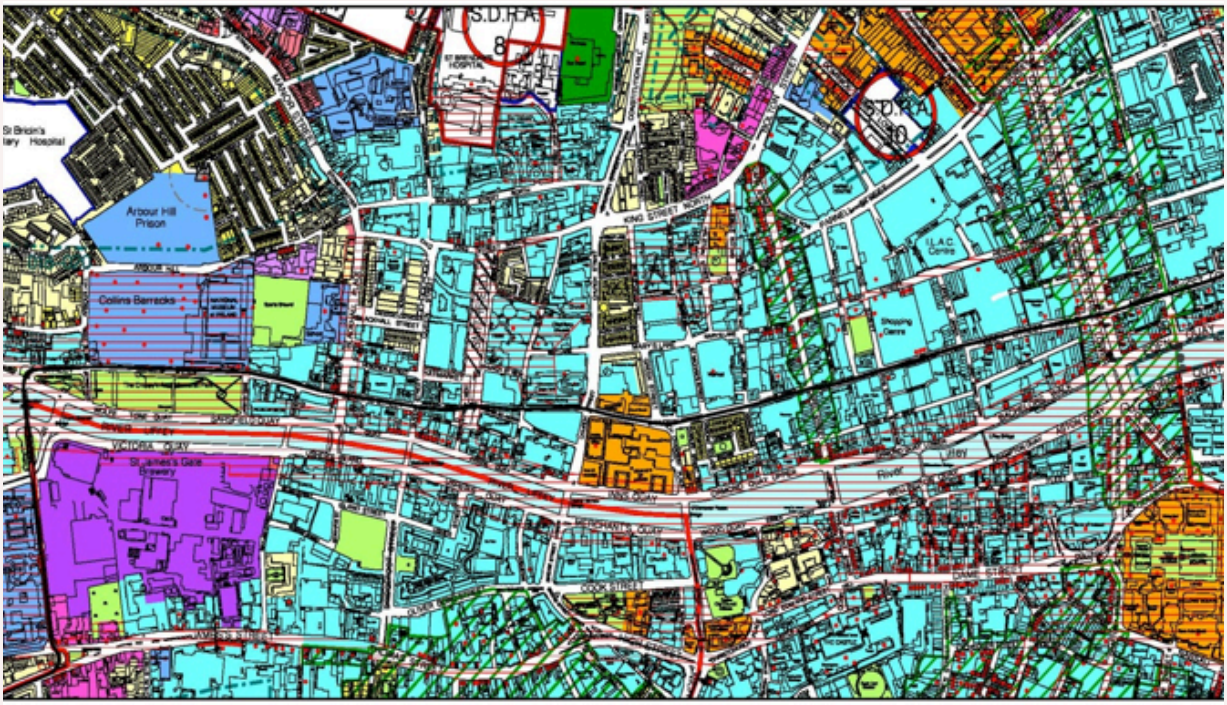
(v) **There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement.**
Answer: There are no suitable alternative lands for the particular uses or development type in areas at lower risk of flooding, within or adjoining the urban settlement. This area is essential for the future expansion of Dublin City.

3. Strategic Flood Risk Assessment for Flood Zones A and B (for defended Flood Zones A and B see section 4.8)

- Where possible, small scale redevelopment and refurbishment should be focused behind flood defences where flood risks are more limited. Such development should be accompanied by a site specific assessment flood risk assessment which should consider the likelihood and impact of defence failure, which may be through overtopping (either due to an extreme event in the current situation or through sea level risk linked to climate change). Where appropriate, consideration should be given to the impacts of demountable sections of flood defence not being erected. Whilst it is unlikely that the findings of such an assessment will indicate development should not go ahead, an emergency plan may be required, fully considering the issue and receipt of flood warnings and emergency evacuation routes and procedures as well as how the operation will ensure it can retain functionality / recover following an extreme flood event.
- Management of risks may be through design of access levels, flood resilient construction techniques and avoiding locating vulnerable development at ground flood level. Climate change risks will need to be considered, but it may not be possible to fully mitigate against these in an already developed situation.
- The assessment and design should include appropriate consideration of sea level rise and climate change impacts.
- Compensatory storage is not required as risks along the Quays are linked to tidal flooding.
- FRA's should be carried out for all basements and underground structures with respect to any human access.

Site: 4. Liffey: Sean Heuston Br. - O'Connell Bridge





Dublin City Council Development Plan 2016–2022 (zoning map key at back of tables)

Site: 4. Liffey: Sean Heuston Br. - O'Connell Bridge	
Site Description	The area on the south side includes Burgh Quay, Aston Quay, Crampton Quay, Burgh Quay, Wellington Quay, Essex Quay, Wood Quay, Merchants Quay, Usher's Quay, Ushers Island and Victoria Quay and areas south of these. On the north side it includes Wolfe Tone Quay, Ellis Quay, Arran Quay, Inn's Quay, Ormond Quays Upper & Lower, Bachelor's Walk and areas north of these. Development in this area is a mixture of high density Commercial and Residential.
Benefitting from Defences (flood relief scheme works)	All of this area has existing Quay Walls but their design standards and capacity for flood defence is unknown. Dutch Dam defences have been incorporated into openings in the Quay Walls along the boardwalk. These are raised out of the ground to combat high tides and generally afford 750mm of flood protection.
Sensitivity to Climate Change	The River Liffey at this location is tidally influenced, but won't be as vulnerable to climate change as it would at the downstream limits. However, increases in river levels could have significant consequences if quay walls are overtopped more frequently.
Residual Risk	Given the unknown standard of defences, risk should be assessed based on a fully undefended scenario so no specific assessment of defence failure will be required.
Historical Flooding	The flood maps attached are consistent with previous flooding of this section of the Liffey Estuary. The main flood risk zones are sections of the north and south quay roads & some roadways off these as outlined on above map, Victoria Quay, sections of the Diageo site, Wolfe Tone Quay and sections of the Esplanade.
Storm (surface) water	All storm (surface) water in this area needs to be carefully managed and provision made for significant rainfall events during high tides. A one year high tide event should be assumed during a 100-year rainfall event. Should development be permitted, best practice with regard to storm (surface) water management should be implemented across the development area, to limit storm (surface) water runoff to current values. All Developments shall have regard to the Pluvial Flood Maps in their Site Specific Flood Risk Assessment, see Flood ResilienCity Project, Volume 2 City Wide Pluvial Flood Risk Assessment at http://www.dublincity.ie/main-menu-services-water-waste-and-environment-drains-sewers-and-waste-water/flood-prevention-plans

Commentary on Flood Risk:
The flood extents indicate flow paths generally coming directly out of the tidally influenced River Liffey. Some flow routes are through quay walls and underground chambers and pipelines near quay walls. All known outlets have been flapped to reduce the tidal influence on other types of flooding. The flood maps were produced based on the OPW CFRAM Study and checked against historic flooding in the area. Fluvial influences in the Liffey Estuary are estimated to contribute significantly to flood water levels upstream of Rory O'More Bridge.

Development Options:
The main flood cell is located along Victoria Quay on the South Side of the River, which is currently zoned Z7 and currently forms part of St. James Gate Brewery in the Development Plan 'To provide for the protection and creation of industrial uses and facilitate opportunities for employment creation'.

The areas shown along Wolfe Tone Quay generally coincide with Z9 zoning which is to preserve, provide and improve recreational amenity and open space & green networks. Water compatible uses will be permitted in this area or uses permissible under the Z9 objective.

Uses to the South side of the River should be compatible with the Z7 zoning for the site. However, any development could reasonably be accommodated within the extents of Flood Zone C and should not need to extend into Flood Zone A or B.

Site: 4. Liffey: Sean Heuston Br. - O'Connell Bridge

Justification Test for Development Plans

1. Section 1 is covered elsewhere in this SFRA Justifying all of Dublin City

2. The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:

(i) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement
Answer: Yes: This area forms part of the central area of the City, and comprises on the south side includes Burgh Quay, Aston Quay, Crampton Quay, Burgh Quay, Wellington Quay, Essex Quay, Wood Quay, Merchants Quay, Usher's Quay, Ushers Island and Victoria Quay and areas south of these. On the north side it includes Wolfe Tone Quay, Ellis Quay, Arran Quay, Inn's Quay, Ormond Quays Upper & Lower, Bachelor's Walk and areas north of these. Development in this area is a mixture of high density Commercial and Residential.

(ii) Comprises significant previously developed and/or under-utilised lands
Answer: Most of the lands within Flood Zone A and B are already built up or comprises of brownfield sites.

(iii) Is within or adjoining the core of an established or designated urban settlement
Answer: Yes: This area forms part of the Central Core of the City.

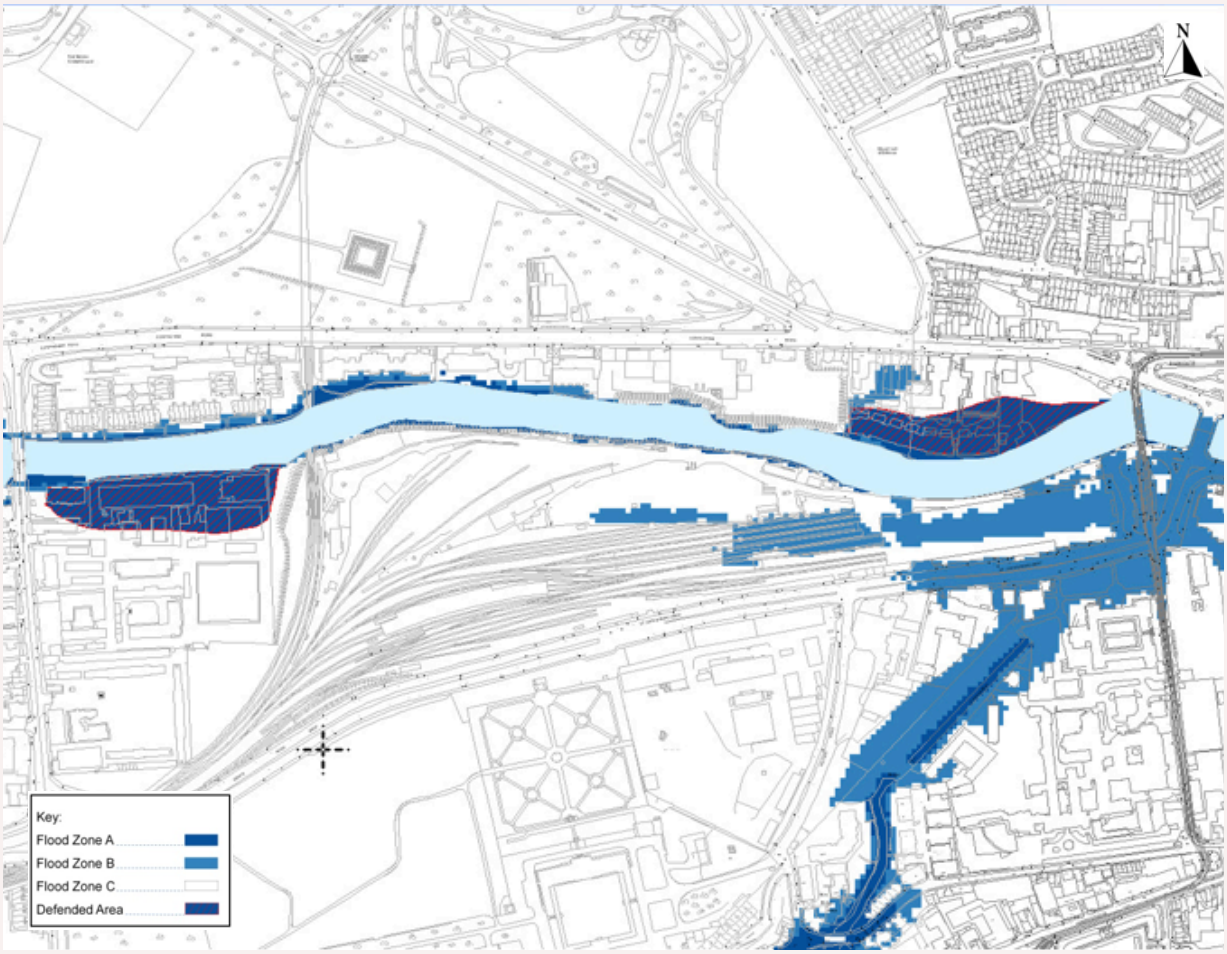
(iv) Will be essential in achieving compact and sustainable urban growth
Answer: Yes: This area is essential to achieving compact and sustainable urban growth.

(v) There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement
Answer: There are no suitable alternative lands for the particular uses or development type in areas at lower risk of flooding, within or adjoining the urban settlement. There are only limited areas idenitifed as being in Flood Zones A and B and they are considered essential to achieving a consolidated urban centre and to comply with the NSS and RPG.

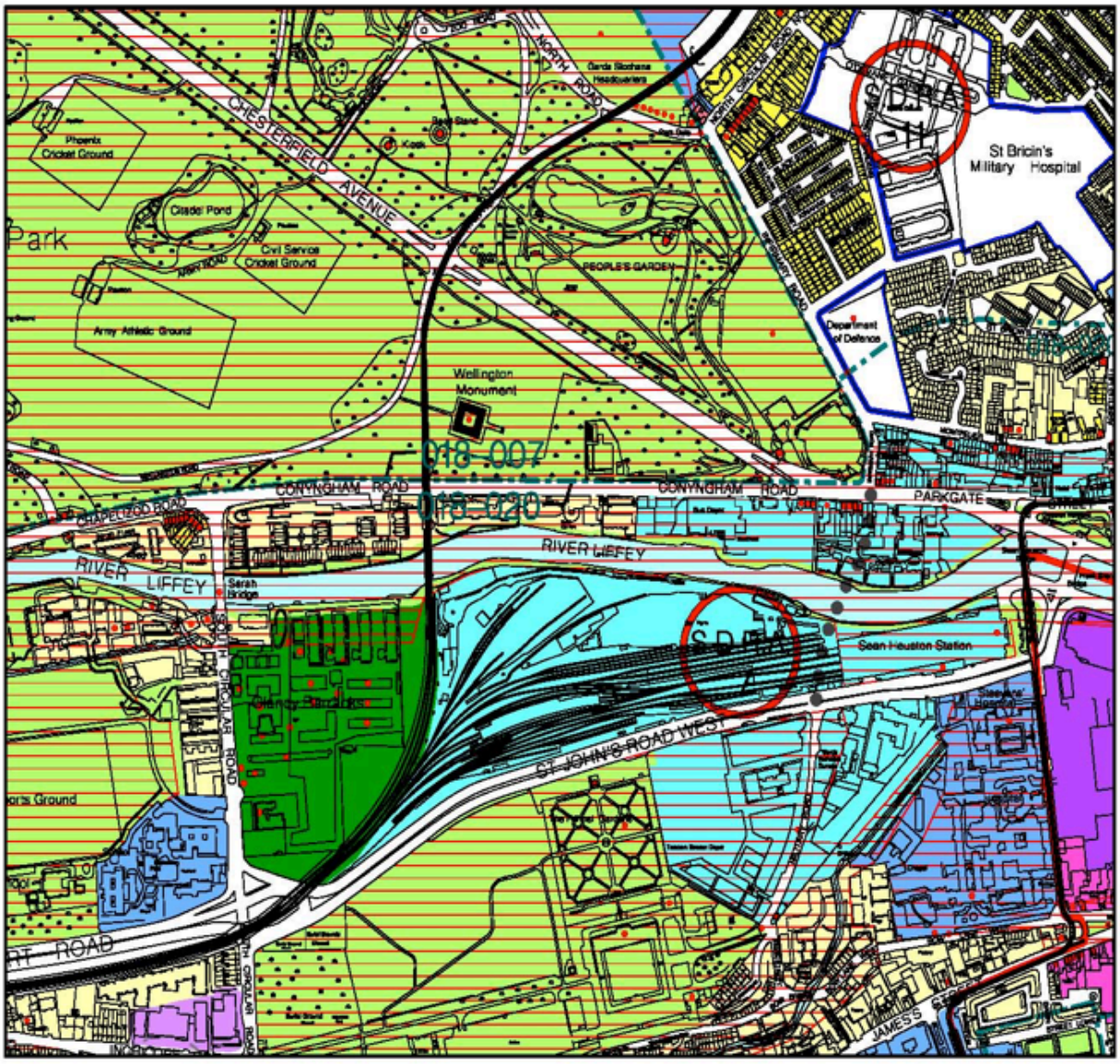
3. Strategic Flood Risk Assessment for Flood Zones A and B (for defended Flood Zones A & B see section 4.8)

- To a large extent the areas indicated as being within Flood Risk Areas are generally built out or are existing brownfield sites and the opportunities for future development are limited.
- Climate change risks should be assessed and appropriately mitigated in all development.
- It is an objective of DCC in conjunction with the OPW to look at identified flood cells as above, and to look at overall flood alleviation scheme for the catchment. However, the extents of the Flood Zones are not significant enough to prevent infill development and well planned larger scale regeneration from occurring.
- FRA's should be carried out for all basements and underground structures with respect to any human access.

Site: 5. Liffey: Sean Heuston Br. – Sarah Bridge, South Circular Road



Site: 5. Liffey: Sean Heuston Br. – Sarah Bridge, South Circular Road



Dublin City Council Development Plan 2016–2022 (zoning map key at back of tables)

Site Description	The area on the south side includes Heuston Station to St. John's Road West, Riverbank House at Clancy Quay, the Camac outfall tunnel to the Liffey Estuary, the south city interceptor sewer in the south bank of the Liffey Estuary and areas south of these. On the north side it includes Parkgate, Conyngham Road and developments between these and the river estuary. Development in this area is a mixture of Commercial and high density Residential. Heuston Station and Irish Rail Infrastructure are a major part of this area.
Benefitting from Defences (flood relief scheme works)	Some of this area has existing Quay Walls to ground level but their design standards and capacity for flood defence is unknown and is therefore not used when estimating flood risk. In addition, their capacity is limited to the channel dimensions. Existing embankments would also need to be assessed before any further development is carried out behind them.

Site: 5. Liffey: Sean Heuston Br. – Sarah Bridge, South Circular Road	
Sensitivity to Climate Change	Moderate to high – the river in this location has combined fluvial and tidal influences which could result in greater increases in water level than elsewhere.
Residual Risk	Not applicable as existing defences are the channel walls to ground level.
Historical Flooding	The flood maps attached are consistent with previous flooding of this section of the Liffey Estuary. The main flood risk zones are sections of the north and south quays adjacent to the Liffey Estuary and areas connected with the Camac River junction.
Storm (surface) water	All storm (surface) water in this area needs to be carefully managed and provision made for significant rainfall events during high tides. A one year high tide event should be assumed during a 100-year rainfall event. Should development be permitted, best practice with regard to storm (surface) water management should be implemented across the development area, to limit storm (surface) water runoff to current values. All Developments shall have regard to the Pluvial Flood Maps in their Site Specific Flood Risk Assessment, see Flood ResilienCity Project, Volume 2 City Wide Pluvial Flood Risk Assessment at http://www.dublincity.ie/main-menu-services-water-waste-and-environment-drains-sewers-and-waste-water/flood-prevention-plans
Commentary on Flood Risk: The flood extents indicate flow paths generally coming directly out of the tidal region, some are through quay walls and underground chambers and pipelines near quay walls. The flood maps were produced based on the OPW CFRAM Study and checked against historic flooding in the area. Flooding from the River Camac is discussed in its assessment area.	
Development Options: The main flood cells are located just north and south of the River Estuary, which is currently zoned for a mix of different zonings, including to the south of the river, Z15 which is to protect and provide for institutional and community uses, Z5 which is to consolidate and facilitate the development of the central area, and to identify, reinforce, strengthen and protect its civic design character and identity. Part of the lands around Kilmainham are zoned Z1 in the Plan which is to protect, provide and improve residential amenities. Part of the lands to the north of the Quays within Flood Zone A would be zoned Z5 in the Plan (see above). No new development should be allowed in these green areas. Irish Rail developments should have cognisance of current estuary planning levels. All existing embankments should be evaluated for new developments behind them. New bridges and tunnels should be evaluated for critical sea level rises. High density Commercial, Industrial, Infrastructural and Residential development (some infill) would be a natural extension of existing development. However, any development could reasonably be accommodated within the extents of Flood Zone C and should not need to extend into Flood Zone A or B.	

Site: 5. Liffey: Sean Heuston Br. – Sarah Bridge, South Circular Road

Justification Test for Development Plans

1. Section 1 is covered elsewhere in this SFRA Justifying all of Dublin City

2. The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:

(i) **Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement**
Answer: Yes: This area forms part of the central area of the City. The lands form part of an established built up part of the City close to Strategic Rail Infrastructure. The area around Heuston is identified as Strategic Development and Regeneration Area (SDRA 7 Heuston & Environs; See section 15.1.1.10 of the Written Statement) under the Core Strategy, which are important brownfield sites with the potential to deliver a significant quantum of mixed-uses and create synergies to regenerate their respective areas. An urban design land use framework plan for the regeneration of the Heuston area was produced in 2003. Since the publication of the 2003 report this area has undergone significant redevelopment, including much of the Heuston South Quarter and development at Clancy Barracks. A number of significant land banks still remain to be developed and for these the guiding principles have been set out in section Chapter 15 of the Written Statement.(see section 15.1.1.10 of the written statement)

(ii) **Comprises significant previously developed and/or under-utilised lands**
Answer: Most of the lands within Flood Zone A and B are already built up or comprise of brownfield sites.

(iii) **Is within or adjoining the core of an established or designated urban settlement**
Answer: Yes: This area forms part of the Central Core of the City.

(iv) **Will be essential in achieving compact and sustainable urban growth**
Answer: Yes: This area is essential to achieving compact and sustainable urban growth.

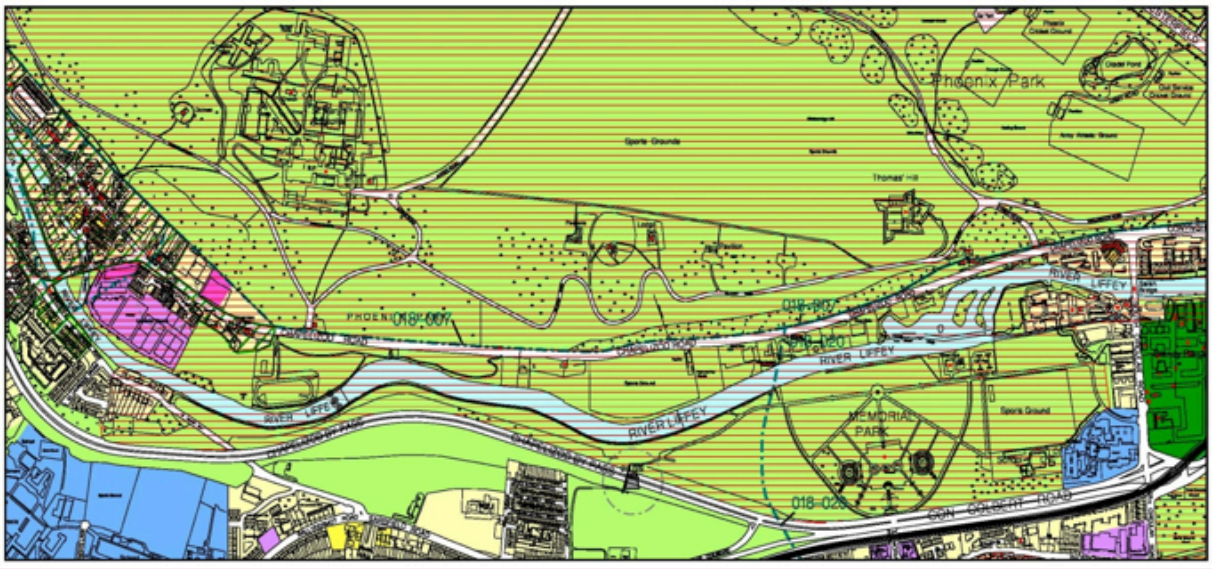
(v) **There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding** within or adjoining the core of the urban settlement
Answer: There are no suitable alternative lands for the particular uses or development type in areas at lower risk of flooding, within or adjoining the urban settlement. Areas idenitifed as being in Flood Zones A and B are considered essential to achieving a consolidated urban centre and to comply with the NSS and RPG.

Site: 5. Liffey: Sean Heuston Br. – Sarah Bridge, South Circular Road

3. Strategic Flood Risk Assessment for Flood Zones A and B (for defended Flood Zones A and B see section 4.8)

- To a large extent the areas indicated as being within Flood Risk Areas are generally built out or are existing brownfield sites and the opportunities for future development are limited. The extents of Flood Zone A and B are not significant along much of this reach of the Liffey, with most flood risk arising from the River Camac.
- There are a number of identified flood cells along this stretch of the River Liffey, and cover areas currently zoned Z5 which is to consolidate and facilitate the development of the central areas and to identify, reinforce and strengthen and protect its civic design character and dignity. There are some areas zoned Z1 which is to protect, provide and improve residential amenities.
- Given the combined tidal and fluvial influences in this section of the River Liffey, a joint probability assessment should be carried out to determine finished floor levels. The assessment should take into account the combined impacts of a peak tide and a peak flow occurring at the same time. Given that an event such as this would have a greater rarity that either event occurring individually a pragmatic approach should be taken to applying the findings. For example, whilst it would be appropriate to consider joint probability levels in the redevelopment of brown field sites, for individual or infill developments such allowances may prohibit connection with the existing streetscape.
- The River Camac is currently subject to assessment under the Eastern CFRAM Study, which is reviewing the need for, and potential options to manage flood risk. Development at the downstream end of the Camac (around Heuston Station and St. James's Gate) should take into account the findings of the CFRAM Study. In this regard, until the Flood Risk Management Plan has been published, and any recommendations implemented, large scale development in this area should be proceeded with caution.
- FRA's should be carried out for all basements and underground structures with respect to any human access.

Site: 6. Liffey: Sarah Bridge, South Circular Road - Anna Livia Br. Chapelizod



Dublin City Council Development Plan 2016–2022 (zoning map key at back of tables)

Site Description	The area on the south side includes Islandbridge, National War Memorial Park, Liffey Valley Park and the lower section of St. Laurence Road. On the north side it includes Chapelizod Road and developments between this and the river estuary. Development in this area is mainly Residential with some high density Residential at Islandbridge. Parkland and a number of boat clubs comprise water compatible development. There is an industrial estate on the north side of the river to the east of Anna Livia (Chapelizod Bridge). The Magazine Stream outlet from Phoenix Park is also in this area.
Benefitting from Defences (flood relief scheme works)	Some of this area has existing Quay Walls above ground level but their design standards and capacity for flood defence is unknown and is therefore not used when estimating flood risk. In addition, their capacity is limited to the channel dimensions.

Site: 6. Liffey: Sarah Bridge, South Circular Road - Anna Livia Br. Chapelizod	
Sensitivity to Climate Change	Moderate to high. This area is tidal generally up to the Islandbridge weir. However an increase in sea level would extend this influence further up stream and put some more of this area underwater. There is some fluvial influence in this area at very high tide and the joint occurrence of a peak tide and peak flow presents a greater risk than either event occurring alone.
Residual Risk	Not applicable generally as existing defences are the channel walls and other walls are not considered as viable flood defences.
Historical Flooding	The flood maps attached are consistent with previous flooding of this section of the Liffey Estuary and River. The main flood risk zones are portions of the north and south quays adjacent to the Liffey Estuary and areas connected with the Magazine river junction.
Storm (surface) water	All storm (surface) water in this area needs to be carefully managed and provision made for significant rainfall events during high tides and high river flows. A one year high tide event should be assumed during a 100-year rainfall event. Should development be permitted, best practice with regard to storm (surface) water management should be implemented across the development area to limit storm (surface) water runoff to current values. All Developments shall have regard to the Pluvial Flood Maps in their Site Specific Flood Risk Assessment, see Flood ResilienCity Project, Volume 2 City Wide Pluvial Flood Risk Assessment at http://www.dublincity.ie/main-menu-services-water-waste-and-environment-drains-sewers-and-waste-water/flood-prevention-plans

Commentary on Flood Risk:
The flood extents indicate flow paths generally coming directly out of the tidal and fluvial regions, some are through quay walls and underground chambers and pipelines near quay walls. At Islandbridge the mill race has tidal influence. The industrial estate east of Anna Livia Bridge embankment requires assessment for any further development in this area.

The flood maps were produced based on the OPW CFRAM Study and checked against historic flooding in the area.

Development Options:
The main flood cells are located just north and south of the River Estuary, which is currently zoned a mixture of some Z1 which is to protect, provide and improve residential amenities, and where it flows through the War Memorial Gardens, the land is zoned Z9 which is to preserve [provide and improve recreational amenity, open space and green networks] in the Development Plan. As the river flows into Chapelizod, part of the lands are zoned Z6 which is to provide for the creation and protection of enterprise and facilitate opportunities for employment creation. The river also flows through areas zoned for residential uses (Zone Z1 and Z2). No new development should be allowed in these green areas (Z9 zonings) except for water compatible ones such as boat clubs. All existing embankments should be evaluated for new developments behind them. New bridges and tunnels should be evaluated for critical sea level rises.

Commercial, Industrial, and Residential development (mainly infill) would be a natural extension of existing development downstream of Anna Livia bridge. However, any development could reasonably be accommodated within the extents of Flood Zone C and should not need to extend into Flood Zone A or B.

Site: 6. Liffey: Sarah Bridge, South Circular Road - Anna Livia Br. Chapelizod

Justification Test for Development Plans

1. Section 1 is covered elsewhere in this SFRA Justifying all of Dublin City

2. The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:

(i) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement
Answer: Yes: The areas located in Flood Zones A and B are primarily parkland floodplains and water sports with some built up, especially around Islandbridge where there the area is made up of an established residential area, with some industrial and commercial properties. There would be limited large development sites within this area, possible development of these sites will be infill or extensions onto existing properties. This area is an established recreational and built up part of the city.

(ii) Comprises significant previously developed and/or under-utilised lands
Answer: Most of the lands within Flood Zone A and B are already built up or comprise of brownfield sites.

(iii) Is within or adjoining the core of an established or designated urban settlement
Answer: Yes: The area comprises an existing built up residential suburb of Dublin.

(iv) Will be essential in achieving compact and sustainable urban growth
Answer: Yes: The area comprises an existing built up residential suburb of Dublin

(v) There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement
Answer: There are no suitable alternative lands for the particular uses or development type in areas at lower risk of flooding, within or adjoining the urban settlement. Areas idenitifed as being in Flood Zones A and B are considered essential to achieving a consolidated urban centre and to comply with the NSS and RPG.

3. Strategic Flood Risk Assessment for Flood Zones A and B (for defended Flood Zones A and B see section 4.8)

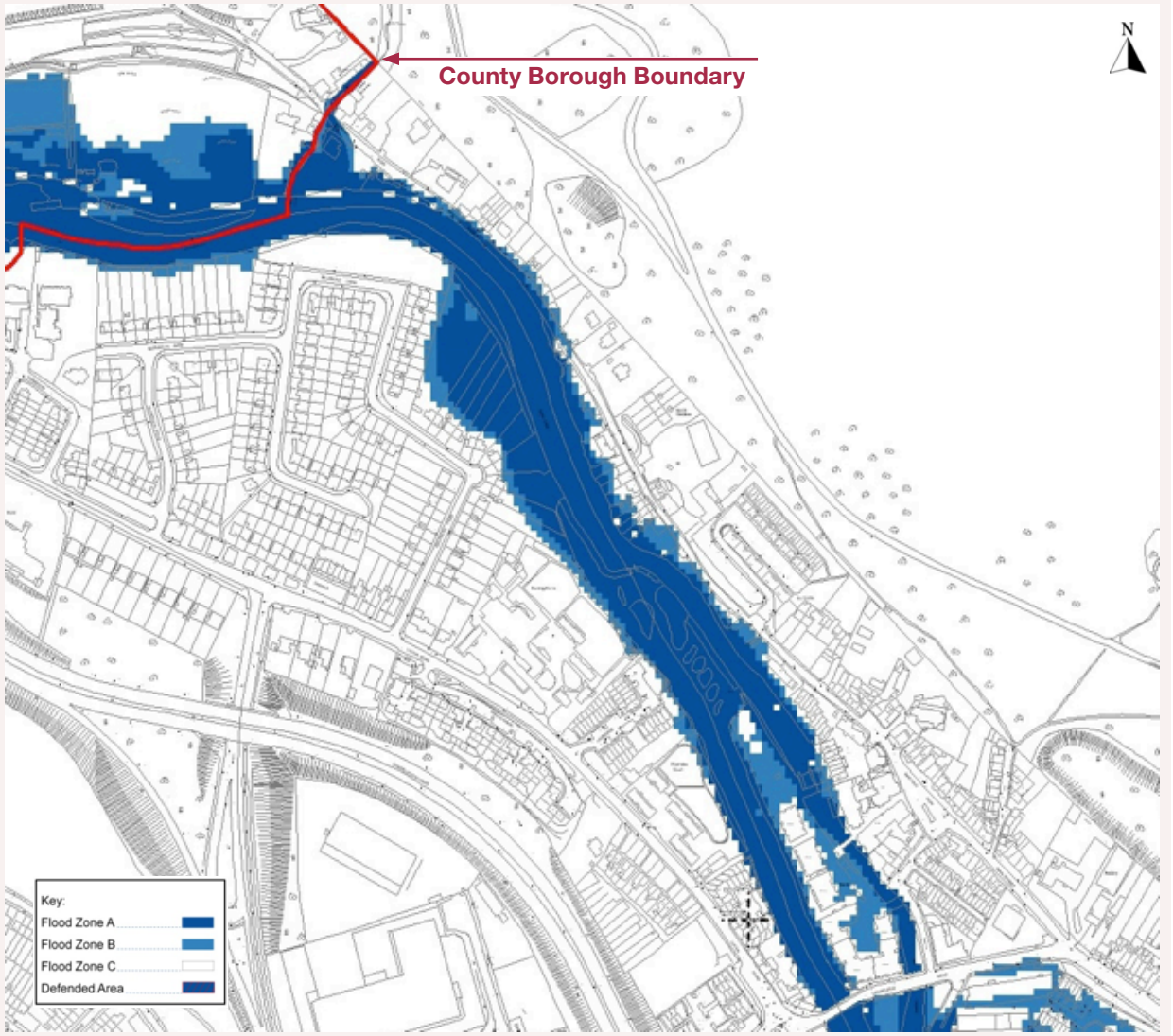
- To a large extent the areas indicated as being within Flood Risk Areas are generally built out or are existing brownfield sites and the opportunities for future development are limited. Much of the land within Flood Zones A and B is zoned for water compatible uses, and this should be retained.
- Where development will be in the defended area, consideration should be given to the likelihood of the defences failing (either through overtopping or breach) and how the operation will ensure it can retain functionality / recover following an extreme flood event. Buildings should be of flood resilient construction. This is particularly applicable behind informal embankments which are of unknown condition. The impact of failure of these defences should be assessed as part of a flood risk assessment; at the simplest, this may be through projection of in-channel levels across the floodplain to give depth of inundation. A precautionary (higher) finished floor level should be applied to compensate for residual risks.

Site: 6. Liffey: Sarah Bridge, South Circular Road - Anna Livia Br. Chapelizod

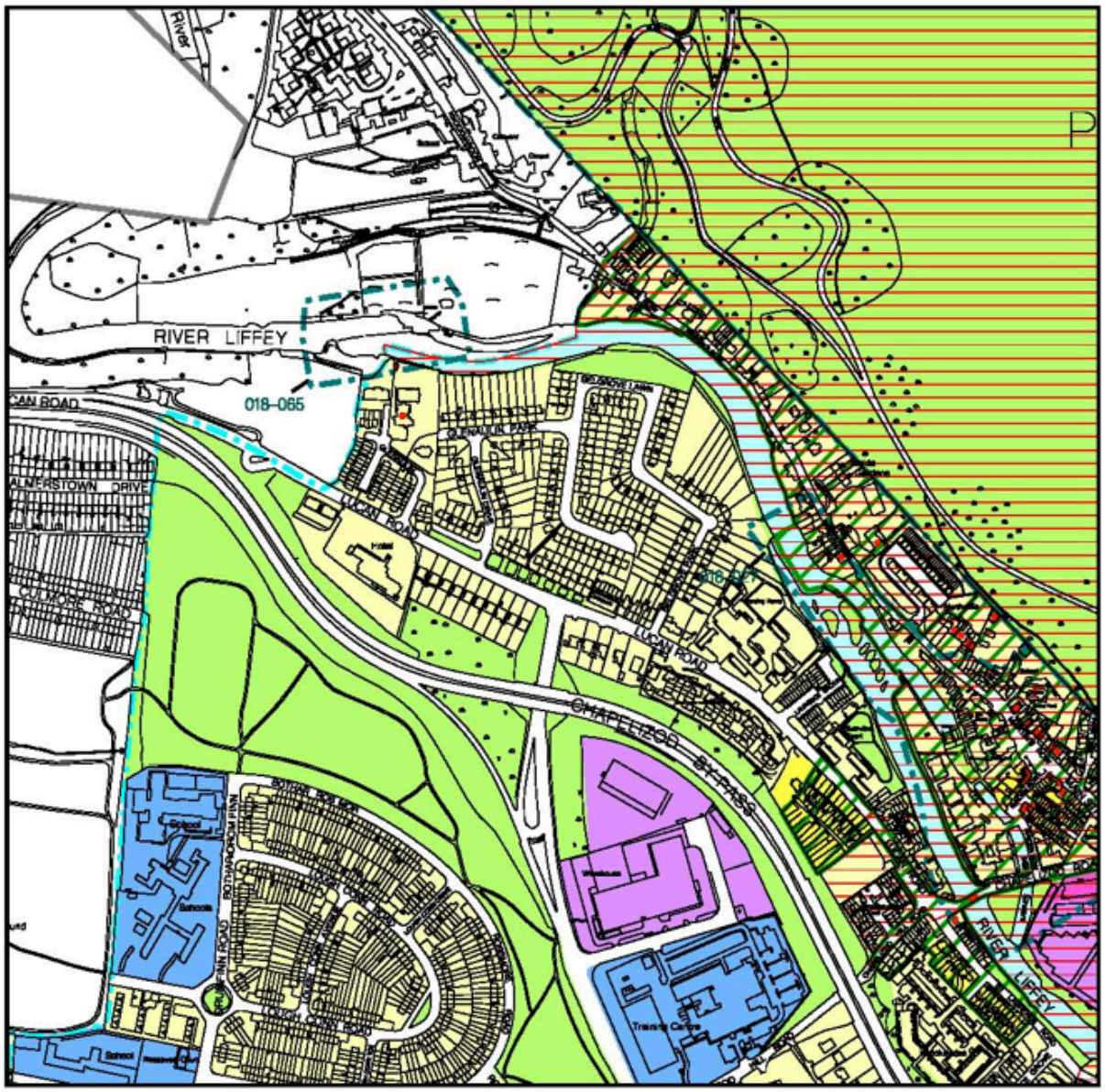
- Given the combined tidal and fluvial influences in this section of the River Liffey, a joint probability assessment should be carried out to determine finished floor levels. The assessment should take into account the combined impacts of a peak tide and an associated river flow occurring at the same time. Given that an event such as this would have a greater rarity that either event occurring individually a pragmatic approach should be taken to applying the findings using joint probability. For example, whilst it would be appropriate to consider joint probability levels in the redevelopment of brownfield sites, for individual or infill developments such allowances may prohibit connection with the existing street scape.

- It is an objective of DCC in conjunction with the OPW to look at identified flood cells as above, and to look at overall flood alleviation scheme for the catchment. Where flood risk (either existing or residual) is high it would be considered premature to proceed with development until the Liffey CFRAM Study is complete.

Site: 7. Liffey: Anna Livia Br. Chapelizod - County Boundary



Site: 7. Liffey: Anna Livia Br. Chapelizod - County Boundary



Dublin City Council Development Plan 2016–2022 (zoning map key at back of tables)

Site Description	The area on the south side includes Lucan Road, Laurence Brook, Belgrove Park and Glenaulin. On the north side it includes Chapelizod Village, St. Martin's Road and developments between these and the River Liffey. In the middle it includes the Island between the Millrace and the Liffey. Development in this area is mainly residential with some high density residential on the Island. Some commercial development and underground car parks are also present. A number of boat clubs are also evident for fishing and water sports. A large weir between Laurence Brook and Martins Row provides a significant difference in water levels in low flows but is often drowned out in higher flows. Flood waters from the Furry Glen stream out of the Phoenix Park meet the Liffey adjacent to the City boundary.

Site: 7. Liffey: Anna Livia Br. Chapelizod - County Boundary	
Benefitting from Defences (flood relief scheme works)	Some of this area has existing concrete and other walls but their design standards and capacity for flood defence is unknown.
Sensitivity to Climate Change	This area is in the fluvial zone so impacts arising from climate change will be less than in the tidal risk areas, but could be significant where walls are overtopped with increased water levels.
Residual Risk	There are some walls on the north bank which are of unknown standard of design and protection. Risk of failure (through overtopping / breach) of the defences should be assessed. Some areas in Glenaulin and Belgrove directly adjacent to the river are experiencing significant erosion to back gardens and this should be taken into account in any proposed development to them.
Historical Flooding	The flood maps attached are consistent with previous flooding of this section of the Liffey River. The main flood risk zones are portions of the north and south river banks with low lying house levels and underground car parks on the Island and adjacent to St. Martin's Road. Pluvial flooding down the steep hill onto St. Martin's Road combined with high river flows can add to fluvial flooding in the area. The Furry Glen stream can also cause flooding particularly at the northern end of St. Martin's Road.
Storm (surface) water	All storm (surface) water in this area needs to be carefully managed and provision made for significant rainfall events during high river flows, particularly a 100-year rainfall event. Should development be permitted, best practice with regard to storm (surface) water management should be implemented across the development area, to limit storm (surface) water runoff to current values. All Developments shall have regard to the Pluvial Flood Maps in their Site Specific Flood Risk Assessment, see Flood ResilienCity Project, Volume 2 City Wide Pluvial Flood Risk Assessment at http://www.dublincity.ie/main-menu-services-water-waste-and-environment-drains-sewers-and-waste-water/flood-prevention-plans

Commentary on Flood Risk:
The flood extents indicate flow paths generally coming directly out of the river or seeping through structures from the river, some are through river walls and underground chambers and pipelines near river walls. Water backs up from the river in the Island bypass weir during significant flood events.
The flood maps were produced based on the OPW CFRAM Study and checked against historic flooding in the area.

Development Options:
The main flood cells are located on the Island, on the southern end of Chapelizod Village and St. Martin's Road nearest the Liffey bypass of the River and to the rear of the Lucan Road nearest Anna Livia bridge. No new development should be allowed in these areas unless protected or water compatible. All existing embankments and walls should be evaluated for proposed new developments behind them.

Commercial, Industrial, and Residential development (mainly infill) would be a natural extension of existing development upstream of Anna Livia bridge. Any development could reasonably be accommodated within the extents of Flood Zone C provided estimated climate change is catered for.

Site: 7. Liffey: Anna Livia Br. Chapelizod - County Boundary

Justification Test for Development Plans

1. Section 1 is covered elsewhere in this SFRA justifying all of Dublin City

2. The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:

(i) **Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement**
Answer: Yes: The areas located in Flood Zones A and B are primarily built up, especially around Chapelizod where the area is an established built up residential area, with some industrial and commercial properties. There would be limited large development sites within this area, the possibly development of these sites will be infill or extensions onto existing properties. This area is an established built up part of the City.

(ii) **Comprises significant previously developed and/or under-utilised lands**
Answer: Most of the lands within Flood Zone A and B are already built up or comprise of brownfield sites.

(iii) **Is within or adjoining the core of an established or designated urban settlement**
Answer: Yes: The area comprises an existing built up residential suburb on Dublin.

(iv) **Will be essential in achieving compact and sustainable urban growth**
Answer: Yes: The area comprises an existing built up residential suburb on Dublin

(v) **There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding** within or adjoining the core of the urban settlement.
Answer: There are no suitable alternative lands for the particular uses or development type in areas at lower risk of flooding, within or adjoining the urban settlement. Areas idenitifed as being in Flood Zones A and B are considered essential to achieving a consolidated urban centre and to comply with the NSS and RPG.

3. Strategic flood risk assessment for Flood Zones A and B (for defended Flood Zones A and B see Section 4.8)

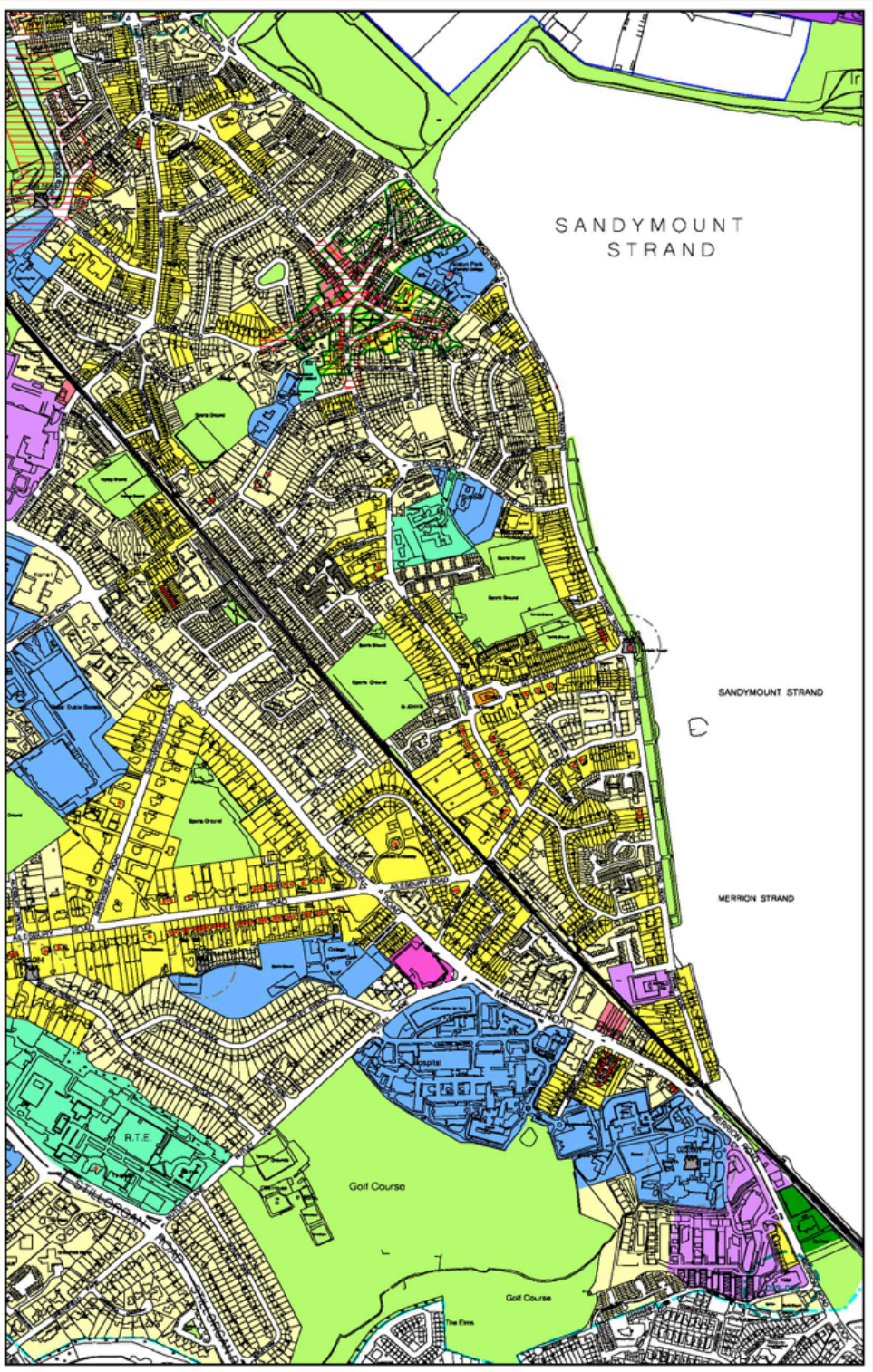
- Much of the land within Flood Zones A and B are open space, which is a water compatible use and should be retained.
- Residential Developments within Flood Zone A and B are likely to be limited to small infill development or extensions onto existing residential properties subject to a Site Specific Flood Risk Assessment, which is likely to indicate that basement sleeping accommodation is unacceptable.
- There should be no new residential developments within Flood Zone A or B (whether large scale or one-off developments to the rear of existing properties) subject to a Site Specific Flood Risk Assessment.

Site: 7. Liffey: Anna Livia Br. Chapelizod - County Boundary

- Where development will be in the defended area, consideration should be given to the likelihood of the defences failing (either through overtopping or breach) and how the operation will ensure it can retain functionality / recover following an extreme flood event. Buildings should be of flood resilient construction. This is particularly applicable behind informal embankments which are of unknown condition. The impact of failure of these defences should be assessed as part of a flood risk assessment; at the simplest, this may be through projection of in-channel levels across the floodplain to give depth of inundation. A precautionary (higher) finished floor level should be applied to compensate for residual risks.
- It is an objective of DCC in conjunction with the OPW to look at identified flood cells as above, and to look at overall flood alleviation scheme for the catchment. Where flood risk (either existing or residual) is high it would be considered premature.
- Redevelopment of the industrial units upstream of Chapelizod Road will require particularly careful consideration to ensure risks are mitigated to an acceptable level.
- It is recognised that there are existing basements in the area. Any proposals for new basements should take into account the specific requirements of this SFRA, and should include assessment of the impacts of defence failure on operability, with particular consideration to the required speed of emergency response.

Site: 8. Coastal: Sandymount

Site: 8. Coastal: Sandymount



Dublin City Council Development Plan 2016–2022 (zoning map key at back of tables)

Site: 8. Coastal: Sandymount	
Site Description	The area includes Beach Road and Strand Road from Sean Moore Park to the Merrion Gates and includes some of the Elm Park Stream flooding with a high tide. The area extends inland generally to the DART Line from Merion Gates to the Dodder River and Newbridge Avenue and south of Leahy Terrace on the north of the area. All of this area has been reclaimed from the sea in the last 200 years. Development in this area is mainly low to medium density residential with some commercial, some schools, care centres and sports areas.
Benefitting from Defences (flood relief scheme works)	The area behind Beach Road and Strand Road is generally very low and is protected by the existing seawall above ground level. This combined with new works adjacent to Merrion Gates and Marine Drive protects many of the inland areas at flood risk. These areas are shown as hashed on the above map. The seawall provides differing standards of protection along its length so a uniform assessment of its benefit cannot be provided. There are 14 openings in this sea wall which, following receipt of a tidal surge warning are normally blocked with sandbags to reduce the flood risk inland, however as these are very temporary defences they are not considered in this assessment. Some works are planned to put flood gates on these 14 openings and to install a new higher sea wall between the Promenade and Sean Moore Park, however seeking local views on these, acquiring planning permission and funding will take at least a year for the flood gates and a number of years for the new flood wall.
Sensitivity to Climate Change	Extreme, due to the proximity to the sea and varying level of the flood defences and the very low level of buildings inland of existing flood defences.
Residual Risk	Residual risks associated with overtopping / breach and ingress through gaps in the defences are high. See comments in Specific FRA (below) in relation to the assessment of same.
Historical Flooding	The defended flood maps attached are consistent with previous flooding of this section of Sandymount, however the maps attached show potential for flooding in an undefended scenario.
Storm (surface) water	All storm (surface) water in this area needs to be carefully managed and provision made for significant rainfall events during high tides. A one year high tide event should be assumed during a 100-year rainfall event. Should development be permitted, best practice with regard to storm (surface) water management should be implemented across the development area, to limit storm (surface) water runoff to current values. Some existing developments have pumped pipelines to the sea. All Developments shall have regard to the Pluvial Flood Maps in their Site Specific Flood Risk Assessment, see Flood ResilienCity Project, Volume 2 City Wide Pluvial Flood Risk Assessment at http://www.dublincity.ie/main-menu-services-water-waste-and-environment-drains-sewers-and-waste-water/flood-prevention-plans

Site: 8. Coastal: Sandymount

Commentary on Flood Risk:
The flood extents indicate flow paths generally coming directly out of the tidal region by over ground routes following direct inundation from the sea. Extra flood defences are required raising the level of the existing sea wall and closing openings during times of high tides particularly with strong easterly winds. Flooding from wave overtopping is a significant risk in this area.

The flood maps were produced based on the OPW CFRAM Study and checked against historic flooding in the area.

Development Options:
Residential development, either small scale infill or extensions to existing buildings, with some infill commercial development would be a natural extension of existing development.

Justification Test for Development Plans

1. Section 1 is covered elsewhere in this SFRA justifying all of Dublin City

2. The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:

(i) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement
Answer: Yes: The areas located in Flood Zones A and B are primarily built up and established, with some industrial and commercial properties. There would be limited large development sites within this area, the possibly development of these sites will be infill or extensions onto existing properties. This area is an established built up part of the city reclaimed from the sea.

(ii) Comprises significant previously developed and/or under-utilised lands
Answer: Most of the lands within Flood Zone A and B are already built up or comprise of brownfield sites.

(iii) Is within or adjoining the core of an established or designated urban settlement
Answer: Yes: The area comprises an existing built up residential suburb on Dublin.

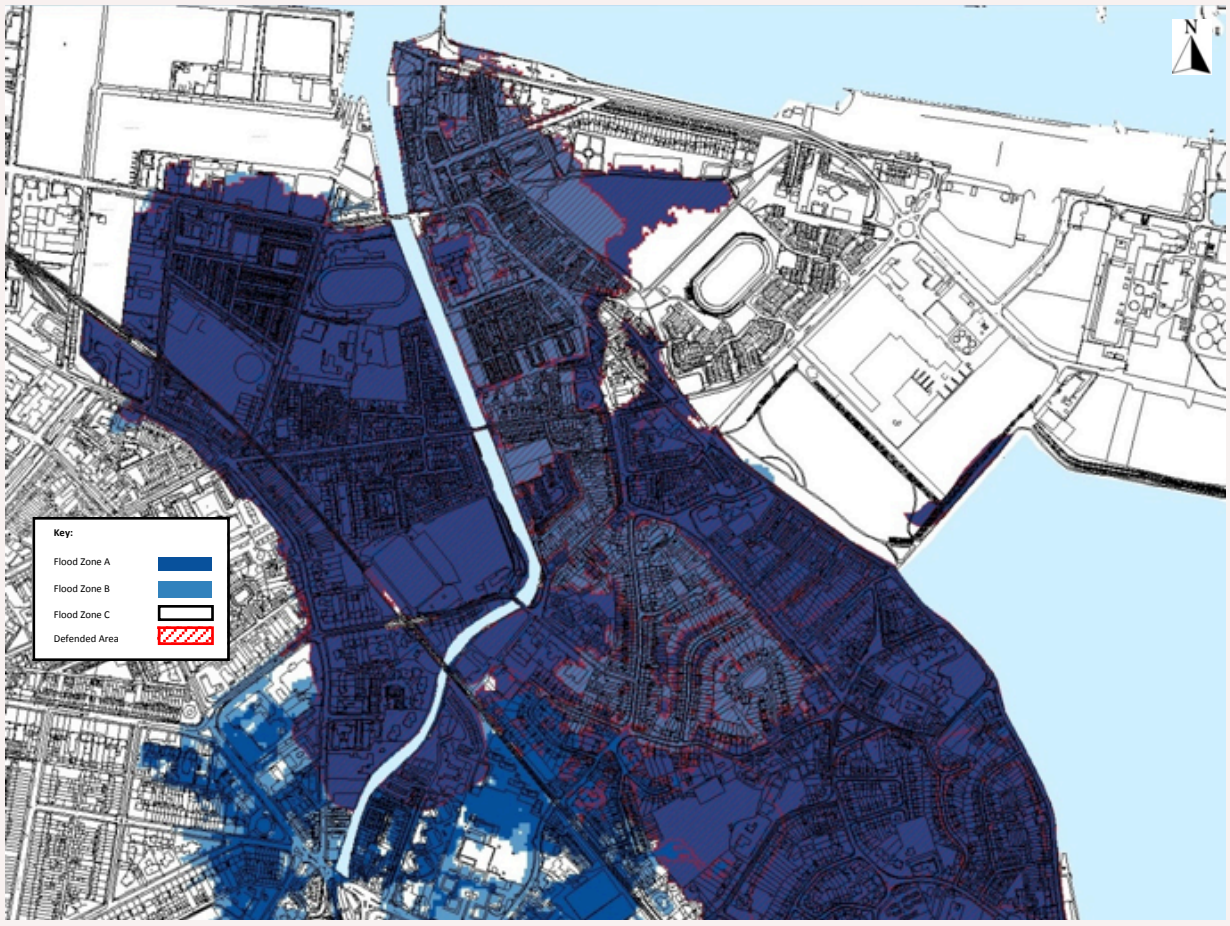
(iv) Will be essential in achieving compact and sustainable urban growth
Answer: Yes: The area comprises an existing built up residential suburb on Dublin

(v) There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement
Answer: There are no suitable alternative lands for the particular uses or development type in areas at lower risk of flooding, within or adjoining the urban settlement. Areas idenitifed as being in Flood Zones A and B are considered essential to achieving a consolidated urban centre and to comply with the NSS and RPG.

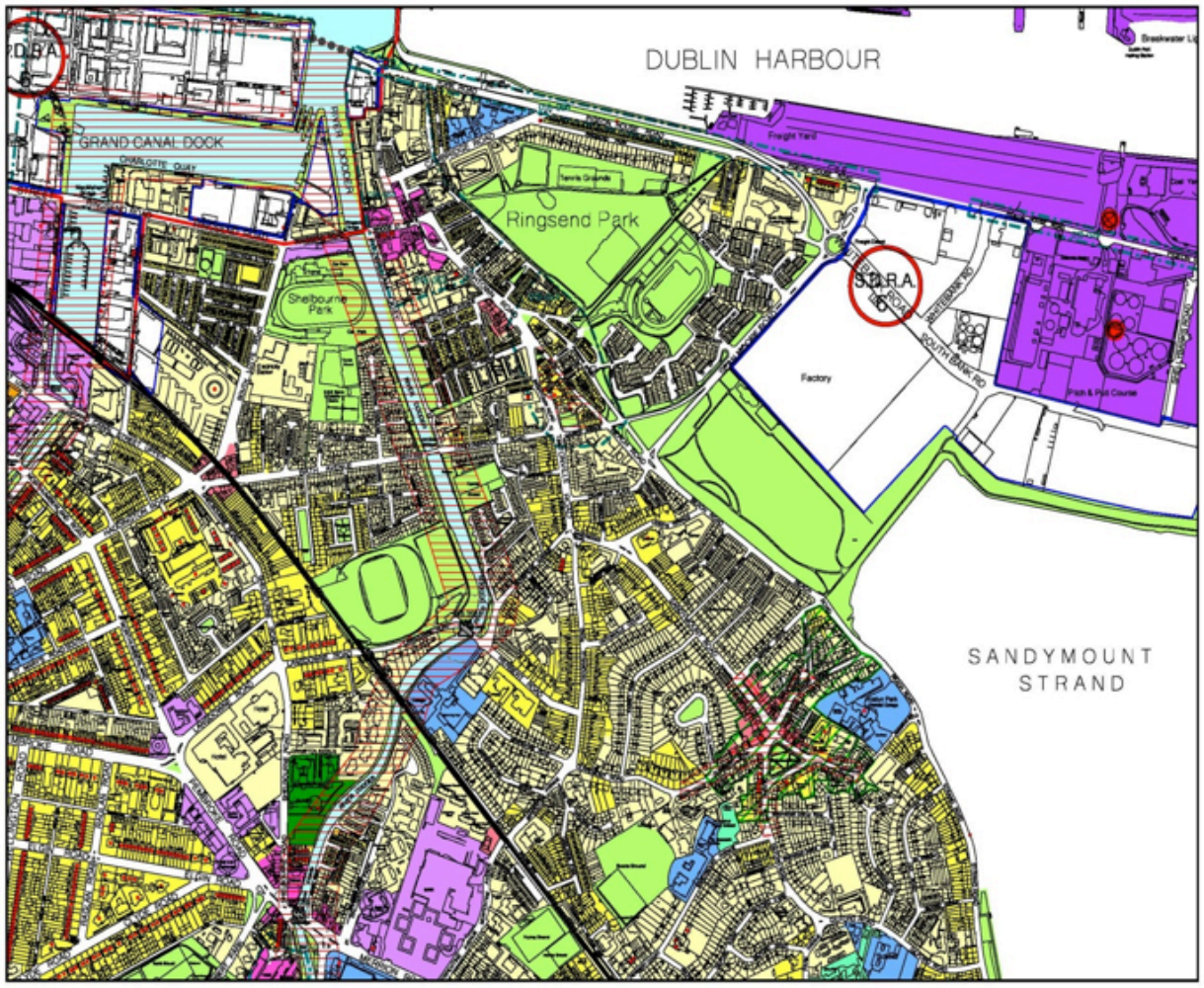
3. Strategic Flood Risk Assessment for Flood Zones A and B (for defended Flood Zones A and B see Section 4.8)

- Given the high risk of tidal inundation in Sandymount, coupled with the varying standard of the flood defences and the high vulnerability nature of the current land use, the specific flood risk assessment has found that further development in Flood Zone A and B should not be progressed prior to proposed flood defences or mitigating measures being completed. Small scale development, such as extensions may be acceptable, but larger scale development is premature until works have been completed.

Site: 9. Dodder: Liffey to Ballsbridge



Site: 9. Dodder: Liffey to Ballsbridge



Dublin City Council Development Plan 2016–2022 (zoning map key at back of tables)

Site Description	The area on the Dodder Estuary goes from the Liffey with Portview House and Thorncastle Street on its east side with Britain Quay, Grand Canal Dock and Camden Lock on its west side up to Ringsend Bridge. It then has Fitzwilliam Quay and Stella Gardens on its east and Shelbourne Park and Derrynane Gardens on its west to London Bridge. Lansdowne Tennis Club, Lansdowne Wood, Newbridge Avenue and Herbert Road are on its east and O'Connell Gardens and the AVIVA stadium to its west side to Newbridge. Marian College is on its east and the rear of Lansdowne Road to its west to the railway bridge. The Sweepstakes Site, Dodder View Cottages and Beatty's Avenue are on its east and Ballsbridge Gardens, Ballsbridge Wood, Lansdowne Woods, Oval Shopping Centre, Estate Cottages and rear of part of Shelbourne Road on its west side to Ballsbridge. It is currently tidal to 30m above Ballsbridge. Development in this area is a mixture of high density Commercial and Residential with infill development of both. There are a number of schools, a Post Office, Eirgrid National Office, AIB head office, greyhound track, shopping centres and individual shops.

Site: 9. Dodder: Liffey to Ballsbridge	
Benefitting from Defences (flood relief scheme works)	Flood defences incorporating the estimated 200-year tide level, plus 650mm for climate change, plus 300mm freeboard, plus allowance for fluvial surcharge at high tide have been constructed from Ringsend bridge to Ballsbridge except the section from the Oval Shopping centre to Ballsbridge which is currently under construction. These defences incorporate the latest design and together with 10 flood gates, which are generally closed the day before significant high tides, protect a large flood risk area which includes Stella Gardens, Irishtown Road, Derrynane Gardens, Bath Avenue, South Lotts, Lansdowne Village, Newbridge Avenue, Marian College, AVIVA Stadium, Lansdowne Road, Sweepstakes Site, Dodder View cottages, Beatty's Avenue, Oval Shopping Centre, Ballsbridge Gardens, Ballsbridge Wood and Lansdowne Woods from extreme tidal flood events while also significantly reducing fluvial flood risk. However, some risk remains from fluvial events exiting the river upstream of Ballsbridge. The potential for tidal inundation directly from the sea still exists, as discussed in the Sandymount Coastal table.
Sensitivity to Climate Change	An increase of 0.65m for climate change, on top of the 200-year tide level, has been catered for in all of the flood wall and embankment designs.
Residual Risk	A structural inspection of all new defences is carried out each year and the defences are of known standard of protection. For the majority of developments, residual risk assessment can be limited to a qualitative assessment of risks. If particularly highly vulnerable or long term development is proposed it would be prudent to review residual risks in more detail. This should include assessment of risks linked to coastal inundation as well as from the Dodder itself.
Historical Flooding	The flood maps attached are consistent with previous flooding of this section of the River Dodder in 1923 and 2002. The highest tide ever recorded on 3rd January 2014 apart from some small seepage at Fitzwilliam Quay through an old section of defences was completely catered for by the new flood defences.
Storm (surface) water	All storm (surface) water in this area needs to be carefully managed and provision made for significant rainfall events during high tides. A five year high tide event should be assumed during a 100-year rainfall event. Should development be permitted, best practice with regard to storm (surface) water management should be implemented across the development area, to limit storm (surface) water runoff to green/brownfield values. Separation of surface and foul should be carried out where possible. All Developments shall have regard to the Pluvial Flood Maps in their Site Specific Flood Risk Assessment, see Flood ResilienCity Project, Volume 2 City Wide Pluvial Flood Risk Assessment at http://www.dublincity.ie/main-menu-services-water-waste-and-environment-drains-sewers-and-waste-water/flood-prevention-plans

Site: 9. Dodder: Liffey to Ballsbridge

Commentary on Flood Risk:
The flood extents indicate flow paths generally coming directly out of the tidal region of the Dodder. These can be compounded with local pluvial flooding or high river flows if heavy rainfall runoff coincides with a high tide. On the seaward (east) side, risk associated with direct inundation from the sea also arises. The flood maps were produced based on the OPW CFRAM Study and checked against historic flooding in the area.

Development Options:
The main flood cells are located to the east and west of the River Estuary, which is currently zoned for a variety of different zonings, including residential uses (Z1 and Z2), part Z15 lands which would be for institutional and community uses, some Z9 (including Shelbourne Park) which would be to protect amenity and open space, and also some pockets of Z6 zoned land which would be to provide for the creation and protection of enterprise and facilitate opportunities for employment creation. Below the railway bridge flood defences are in place protecting existing and proposed developments up to the 200-year flood level. Above this to Ballsbridge new flood defences are under construction to protect to this standard. All existing embankments should be evaluated for new developments behind them. New bridges should be evaluated for critical sea level rises.

Commercial, Industrial, and Residential development (mainly infill) would be a natural extension of existing development. However, any development could reasonably be accommodated within the extents of Flood Zone C and should be evaluated in Flood Zone A or B whether currently defended to this level or not.

Justification Test for Development Plans

1. **Section 1 is covered elsewhere in this SFRA justifying all of Dubli**n City

2. **The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:**

(i) **Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement**
Answer: Yes: This area is essential for the future expansion of the city. Development in this area is a mixture of high density Commercial and Residential with infill development of both. There are a number of schools, a Post Office, Eirgrid National Office, AIB head office, greyhound track, shopping centres and individual shops.

(ii) **Comprises significant previously developed and/or under-utilised lands**
Answer: There would be a number of sites to be redeveloped in this area but these would be primarily brownfield sites.

(iii) **Is within or adjoining the core of an established or designated urban settlement**
Answer: Yes: The lands form part of an established suburb of the City.

(iv) **Will be essential in achieving compact and sustainable urban growth**
Answer: Yes: (see response to (iii) above)

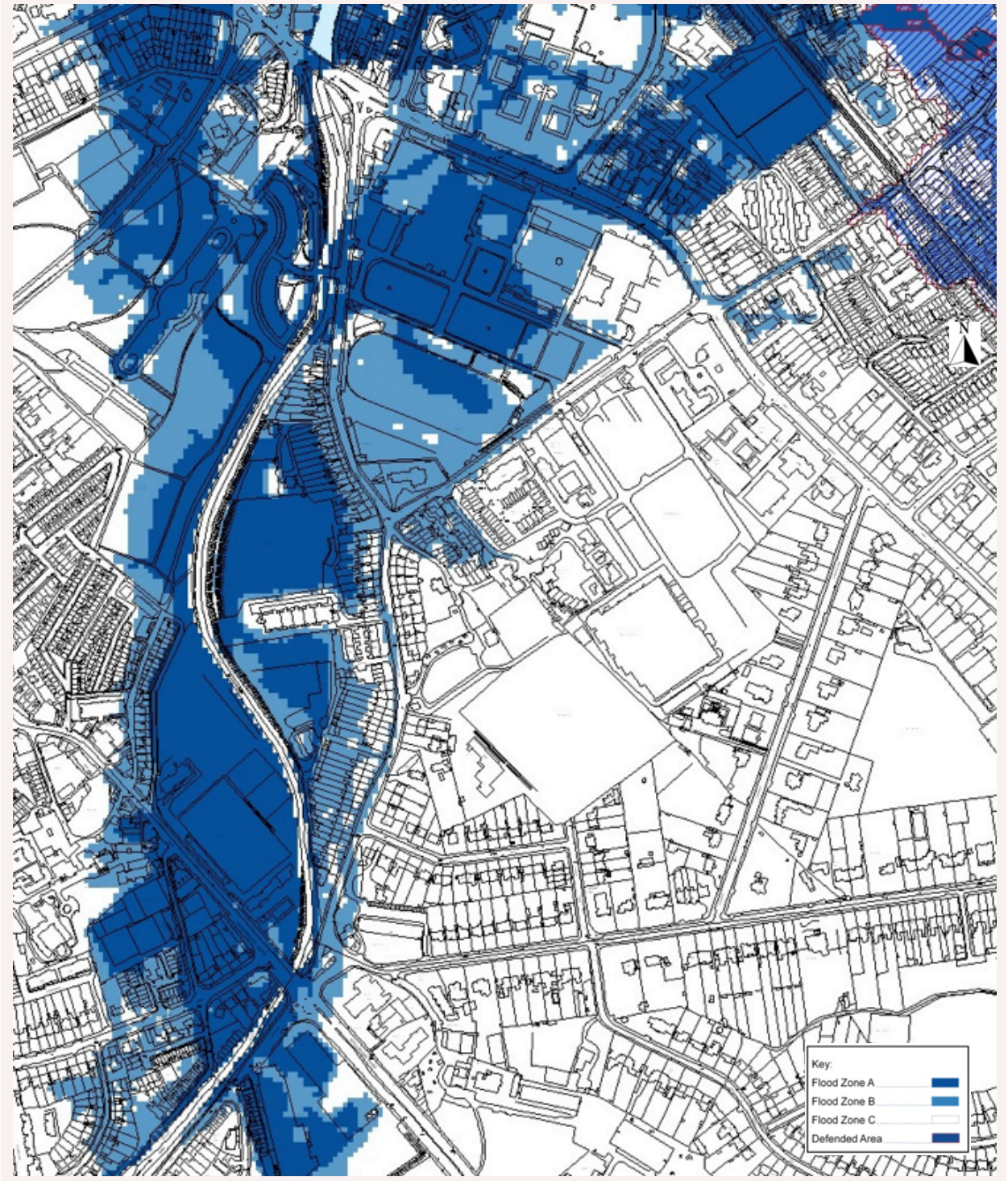
(v) **There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement**
Answer: There are no suitable alternative lands for the particular uses or development type in areas at lower risk of flooding, within or adjoining the urban settlement.

Site: 9. Dodder: Liffey to Ballsbridge

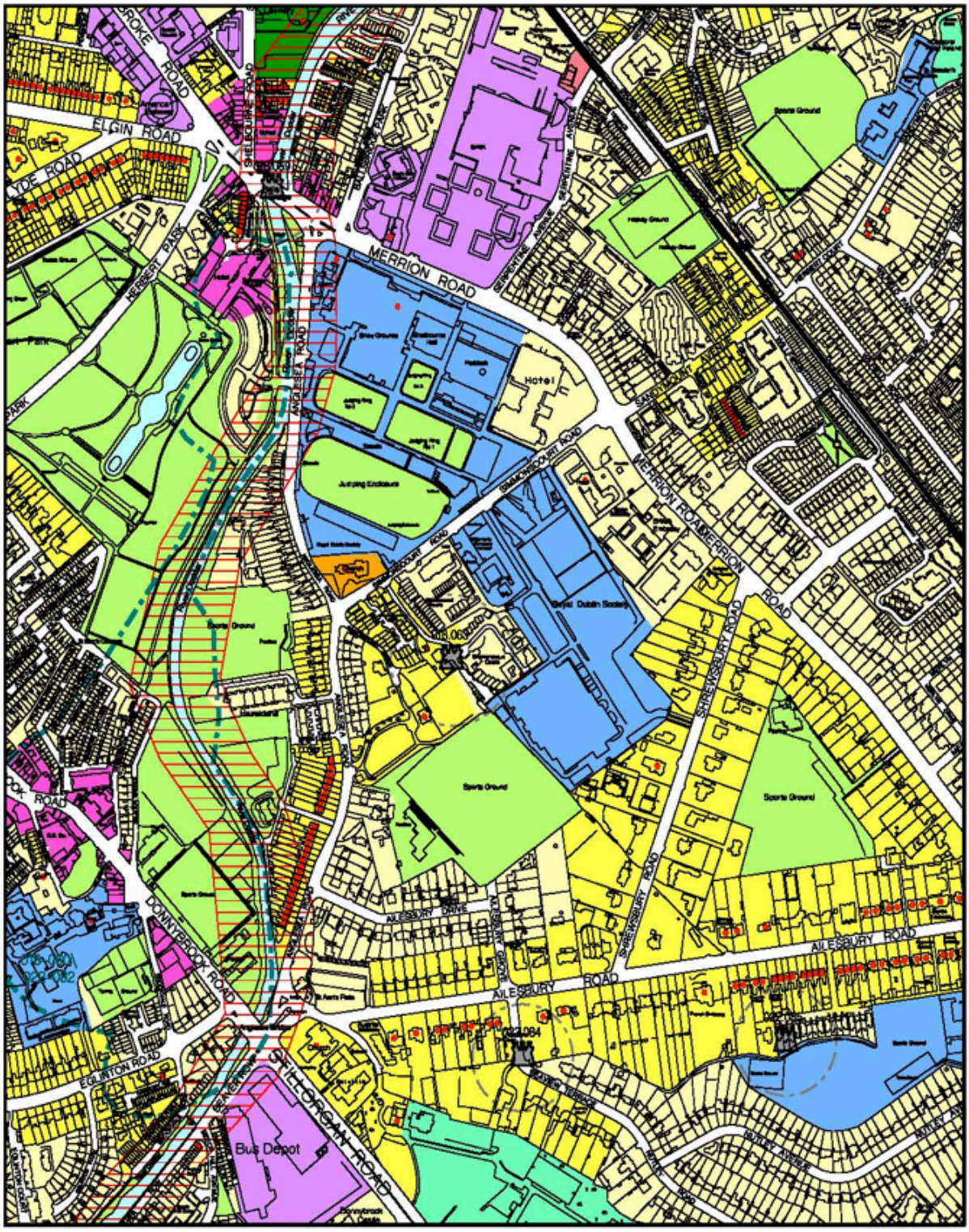
3. Strategic Flood Risk Assessment for Flood Zones A and B (for defended Flood Zones A and B see Section 4.8)

- On the west side of the Dodder, development proposals should follow the general requirements for FRAs in the SFRA. On the east, potential flood mechanisms are more complex and the FRA should be prepared with consideration of the risks from the Dodder and from the sea.
- Even in areas which are defended from the tidal extents of the Dodder, given the high risk of tidal inundation in Sandymount, coupled with the varying standard of the flood defences and the high vulnerability nature of the current land use, the specific flood risk assessment has found that further development in Flood Zone A and B should not be progressed prior to the completion of flood defences on the Dodder to Ballsbridge and at Sandymount or other mitigation measures, where relevant. Small scale development, such as extensions, is acceptable, but larger scale development is premature in areas with lower defence status until flood works have been completed.

Site: 10. Dodder: Ballsbridge to Donnybrook Bridge



Site: 10. Dodder: Ballsbridge to Donnybrook Bridge



Dublin City Council Development Plan 2016–2022 (zoning map key at back of tables)

Site: 10. Dodder: Ballsbridge to Donnybrook Bridge	
Site Description	This area on the Dodder river goes from the tidal weir upstream of Ballsbridge to Donnybrook (Anglesea Bridge). To the east it includes Anglesea Road and areas between it and the river as well as some Flood Zones outside of this. To the west it includes Embassy House, Herbert Park and Old Wesley Rugby Football Club. Herbert Park Bridge, the RDS, Merrion Cricket Club and the Licensed Vintners HQ are in this area. This area has only fluvial and pluvial rainfall influences. Development in this area is a mixture of high density Commercial and Residential with infill development of both. There are a number of hotels, large residential buildings as well as high profile buildings and embassies in its area of significant flooding influence.
Benefitting from Defences (flood relief scheme works)	Flood defences incorporating 100-year river flow, plus 300mm freeboard have been constructed in 100m of the Licensed Vintners Association grounds. The concrete wall in Lansdowne Lane has been increased in height to above the October 2011 flood levels as a temporary flood measure. Flood works are ongoing in Herbert Park and upstream of Ballsbridge on both sides of the river. Flood defences to the estimated 100-year flood level plus 300mm freeboard are programmed to be completed by Q2 2016 in this area. An analysis of the partially completed flood works to date has not been carried out as the level of protection is changing as further works are being completed. The works to date would also reduce the risk of flooding due to overland flows downstream. There will be no flood gates in this section of the Dodder. No defences have been taken into consideration in the flood zones except for the very large embankment in the Merrion Cricket Club.
Sensitivity to Climate Change	An increase of 20% on top of the estimated 100-year fluvial level is planned to be catered for by storage upstream of where the Tallaght Stream joins the Dodder.
Residual Risk	A structural inspection of all new defences is carried out each year and the defences are of known standard of protection. For the majority of developments, residual risk assessment can be limited to a qualitative assessment of risks. If particularly highly vulnerable or long term development is proposed it would be prudent to review residual risks in more detail.
Historical Flooding	The flood maps attached are consistent with previous flooding of this section of the River Dodder in 1986 and 2011.
Storm (surface) water	All storm (surface) water in this area needs to be carefully managed and provision made for significant rainfall events during high river flows. Should development be permitted, best practice with regard to storm (surface) water management should be implemented across the development area, to limit storm (surface) water runoff to current values. Separation of storm (surface) water and foul sewage flows should be carried out where possible. All Developments shall have regard to the Pluvial Flood Maps in their Site Specific Flood Risk Assessment, see Flood ResilienCity Project, Volume 2 City Wide Pluvial Flood Risk Assessment at http://www.dublincity.ie/main-menu-services-water-waste-and-environment-drains-sewers-and-waste-water/flood-prevention-plans

Site: 10. Dodder: Ballsbridge to Donnybrook Bridge

Commentary on Flood Risk:

The flood extents indicate flow paths generally coming directly out of the river channel. These can be compounded with local pluvial flooding if heavy rainfall coincides with high river flows. Backing up of the local combined and storm (surface) water network can occur when heavy rainfall coincides with high river flows. Some fluvial flood routes are modelled to leave this section of the river estuary and end up in Stella Gardens and South Lotts. These have been reduced by ongoing works but will not be completely stopped until the bulk of the flood defences in this section are in place.

The flood maps were produced based on the OPW CFRAM Dodder Pilot Study and checked against historic flooding in the area. The fluvial risk in this area is defended to the estimated 50-year risk currently which will increase to estimated 100-year fluvial levels by Q2 2016 when flood defence works are programmed to be completed to Donnybrook (Anglesea) Bridge.

Development Options:

The main flood cells are located to the east and west of the River; existing parkland and green spaces should be retained. All existing embankments and walls should be evaluated for new developments behind them.

Commercial, Industrial, and Residential development would be a natural extension of existing development. However, any development could reasonably be accommodated within the extents of Flood Zone C and should not need to extend into Flood Zone A or B unless defended.

Justification Test for Development Plans

1. Section 1 is covered elsewhere in this SFRA justifying all of Dublin City

2. The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:

(i) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement
Answer: Yes: This area is an established residential suburb of Dublin City. This area on the Dodder river goes from the tidal weir upstream of Ballsbridge to Donnybrook (Anglesea Bridge). To the east it includes Anglesea Road and areas between it and the river as well as some flood Zones outside of this. To the west it includes Embassy House, Herbert Park and Old Wesley Rugby Football Club. Herbert Park Bridge, the RDS, Merrion Cricket Club, and the Licensed Vintners HQ are in this area. Development in this area is a mixture of high density Commercial and Residential with infill development of both. There are a number of hotels, large residential buildings as well as high profile buildings and embassies. This area is considered essential to the expansion of City.

(ii) Comprises significant previously developed and/or under-utilised lands
Answer: The River along this stretch primarily flows through built up established residential suburbs of Donnybrook and Ballsbridge and contains a number of high profile sites, including the Royal Dublin Society (RDS), Herbert Park, Old Wesley Rugby Football Club, Merrion Cricket Club, and the Licensed Vintners HQ to name a few. Most of the lands in this area would be built up residential and or Park (Herbert Park). The Flood Cell also covers some lands owned by the RDS which is zoned Z15 in the Plan to provide for institutional, educational, recreational community, green infrastructure and health uses.

(iii) Is within or adjoining the core of an established or designated urban settlement
Answer: Yes: The lands form part of an established suburb of the City.

Site: 10. Dodder: Ballsbridge to Donnybrook Bridge

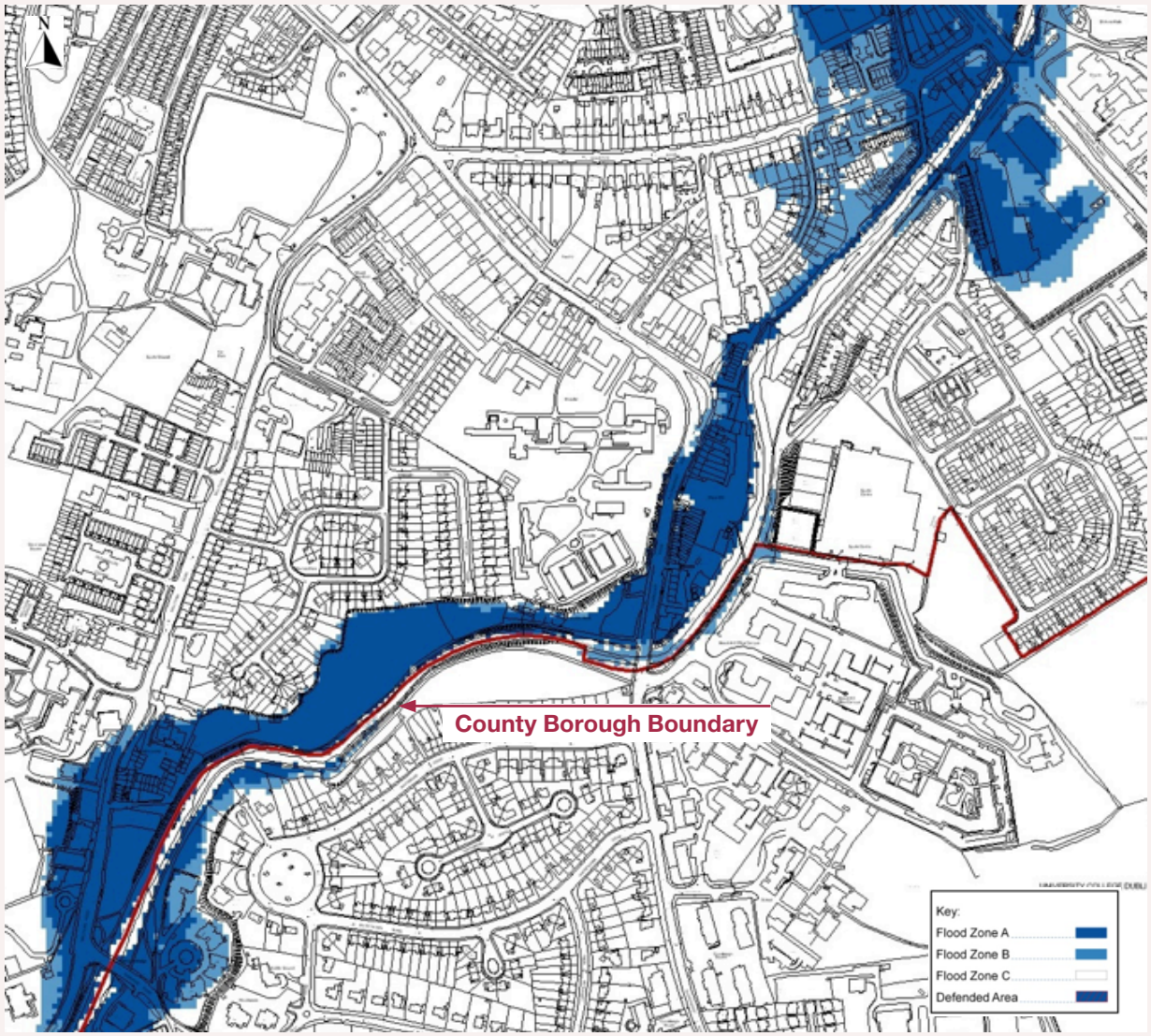
(iv) **Will be essential in achieving compact and sustainable urban growth**
Answer: Yes (see response to (iii) above)

(v) **There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement**
Answer: There are no suitable alternative lands for the particular uses or development type in areas at lower risk of flooding, within or adjoining the urban settlement.

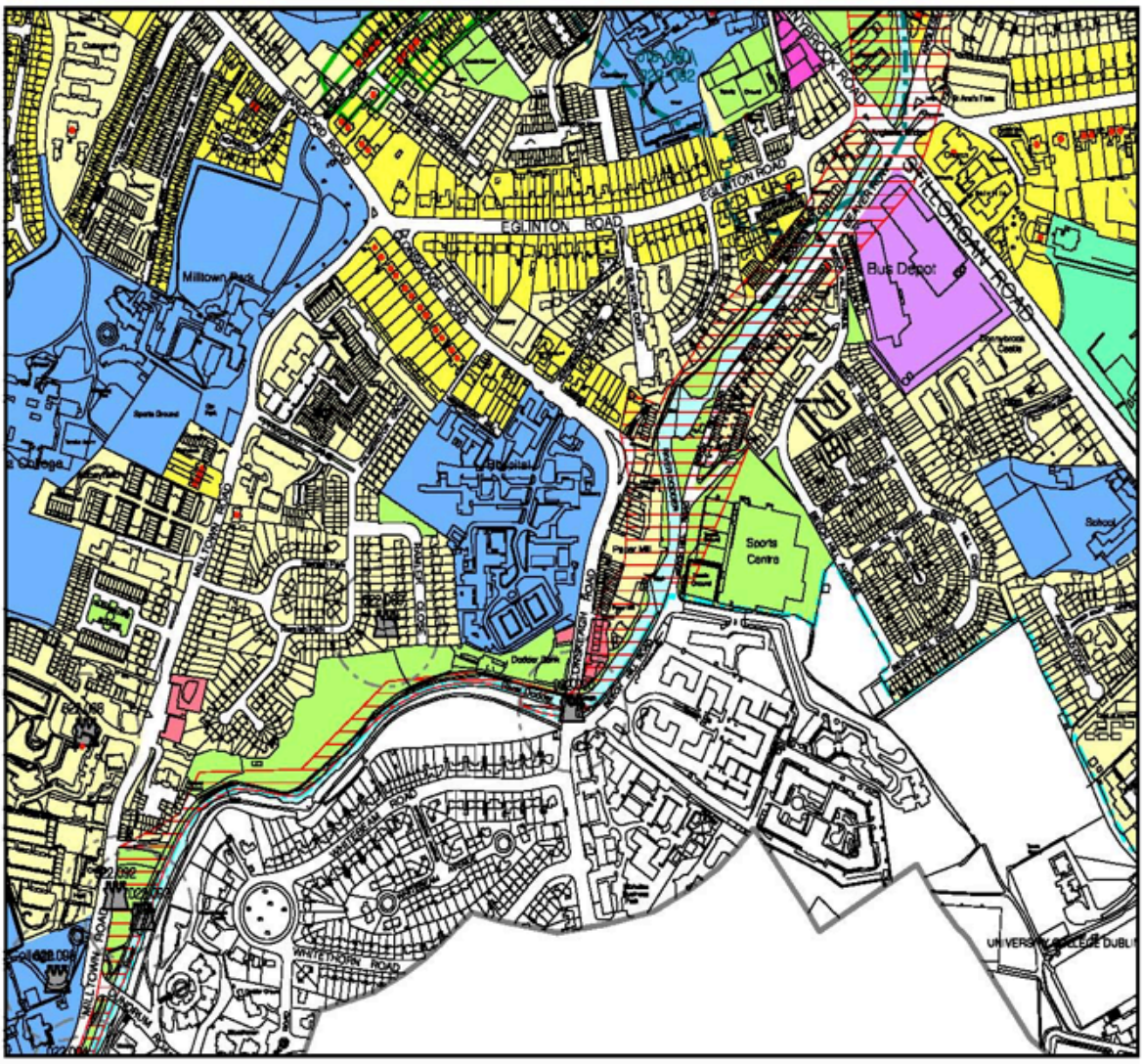
3. Strategic Flood Risk Assessment for Flood Zones A and B (for defended Flood Zones A and B see Section 4.8)

- Much of the flood cell is, or will be, defended against fluvial flooding from the Dodder. As the progression of the flood defence works is ongoing, any site specific FRA should include a review and commentary on up-to-date risks. Where the defences have been completed, the FRA should follow the general guidance for development in defended locations. Where the defences have not been completed, all but very small scale extensions and changes of use would be considered premature subject to a site specific flood risk assessment.

Site: 11. Dodder: Donnybrook Bridge – Dundrum Road



Site: 11. Dodder: Donnybrook Bridge – Dundrum Road



Dublin City Council Development Plan 2016–2022 (zoning map key at back of tables)

Site Description	This area on the Dodder river goes from Donnybrook (Anglesea) Bridge to Clonskeagh Bridge to Dundrum Road Bridge. To the southeast it includes Beaver Row and Beech Hill Road (in Dun Laoghaire/Rathdown County Council). To the northwest it includes the rear of lower part of Eglington Road, Dunbar, Brookvale Road, two Smurfit Weirs, Ashton's Pub and the Smurfit Site. Upstream of Clonskeagh Bridge it includes Clonskeagh House, Scully's Field, Strand Terrace in Milltown. The southern floodplains are in Dun Laoghaire/Rathdown County Council and they should be consulted on any proposed development in or adjacent to their area. The area has only fluvial and pluvial rainfall influences. Development in this area is a mixture of high density Commercial and Residential with infill development of both.

Site: 11. Dodder: Donnybrook Bridge – Dundrum Road	
Benefitting from Defences (flood relief scheme works)	There are no existing flood defences above ground level in this area and therefore no defended areas in the Zoned maps. Flood defences up to the first Smurfit weir are planned to be carried out by Q4 2016.
Sensitivity to Climate Change	An increase of 20% on top of the estimated 100-year fluvial level is planned to be catered for by storage upstream of where the Tallaght Stream joins the Dodder. A 30% increase in fluvial flows should be used when assessing the viability of any critical development/infrastructure.
Residual Risk	As no existing defences are utilised this is not currently applicable, but assessment of residual risks will be required when new flood defences are in place.
Historical Flooding	The flood maps attached are consistent with previous flooding of this section of the River Dodder in 1986 and 2011.
Storm (surface) water	All storm (surface) water in this area needs to be carefully managed and provision made for significant rainfall events during high river flows. Should development be permitted, best practice with regard to storm (surface) water management should be implemented across the development area, to limit storm (surface) water runoff to current values. Separation of storm (surface) water and foul sewage flows should be carried out where possible. All Developments shall have regard to the Pluvial Flood Maps in their Site Specific Flood Risk Assessment, see Flood ResilienCity Project, Volume 2 City Wide Pluvial Flood Risk Assessment at http://www.dublincity.ie/main-menu-services-water-waste-and-environment-drains-sewers-and-waste-water/flood-prevention-plans

Commentary on Flood Risk:
The flood extents indicate flow paths generally coming directly out of the river channel. These can be compounded with local pluvial flooding if heavy rainfall coincides with high river flows. Backing up of the local combined and storm (surface) water network can occur when heavy rainfall coincides with high river flows. Some fluvial flood routes are modelled to leave upstream of the Lower Smurfit weir and carry on down Beaver Row flooding Simmonscourt Terrace before draining slowly back into the river. Pluvial flooding in the past has exacerbated this flooding. Another flood route is from Strand Terrace through Scully's Field and down to Clonskeagh House, across the Clonskeagh Road into the Smurfit site and back into the river. Any development to alter these flood routes needs to be carefully planned.

These flood maps were produced based on the OPW CFRAM Dodder Pilot Study and checked against historic flooding in the area.

Development Options:
The main flood cells in this area are located in parkland, the Smurfit Site in Clonskeagh and in small residential developments. No new development should be allowed in these green areas unless they are water compatible. All existing embankments and walls should be evaluated for new developments behind them.

Residential development (mainly infill) with a small amount of commercial would be a natural extension of existing development in this area. However, any development could reasonably be accommodated within the extents of Flood Zone C and should not need to extend into Flood Zone A or B unless defended. Some development may require to await future flood defence works in this area.

Site: 11. Dodder: Donnybrook Bridge – Dundrum Road

Justification Test for Development Plans

1. Section 1 is covered elsewhere in this SFRA justifying all of Dublin City

2. The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:

(i) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement
Answer: Yes: This area is an established residential suburb of Dublin City. This stretch of the Dodder goes from Donnybrook (Anglesea) Bridge to Clonskeagh Bridge to Dundrum Road Bridge. To the southeast it includes Beaver Row and Beech Hill Road (in Dun Laoghaire Rathdown County Council). To the northwest it includes the rear of lower part of Eglington Road, Dunbar, Brookvale Road, two Smurfit Weirs, Ashton's Pub and the Smurfit Site. Upstream of Clonskeagh Bridge it includes the Clonskeagh House, Scully's field, Strand Terrace in Milltown. This area is essential to facilitate the expansion of the City.

(ii) Comprises significant previously developed and/or under-utilised lands
Answer: The River along this stretch primarily flows through built up established residential suburbs. Sites would generally consist of brownfield sites.

(iii) Is within or adjoining the core of an established or designated urban settlement
Answer: Yes: The lands form part of an established suburb of the City.

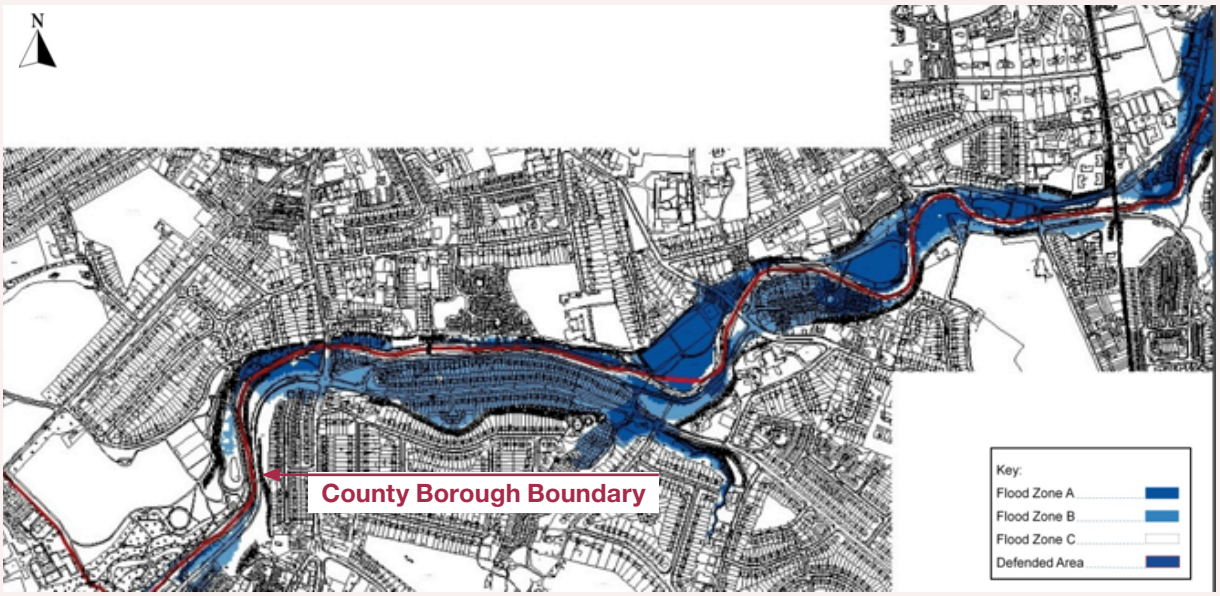
(iv) Will be essential in achieving compact and sustainable urban growth
Answer: Yes (see response to (iii) above)

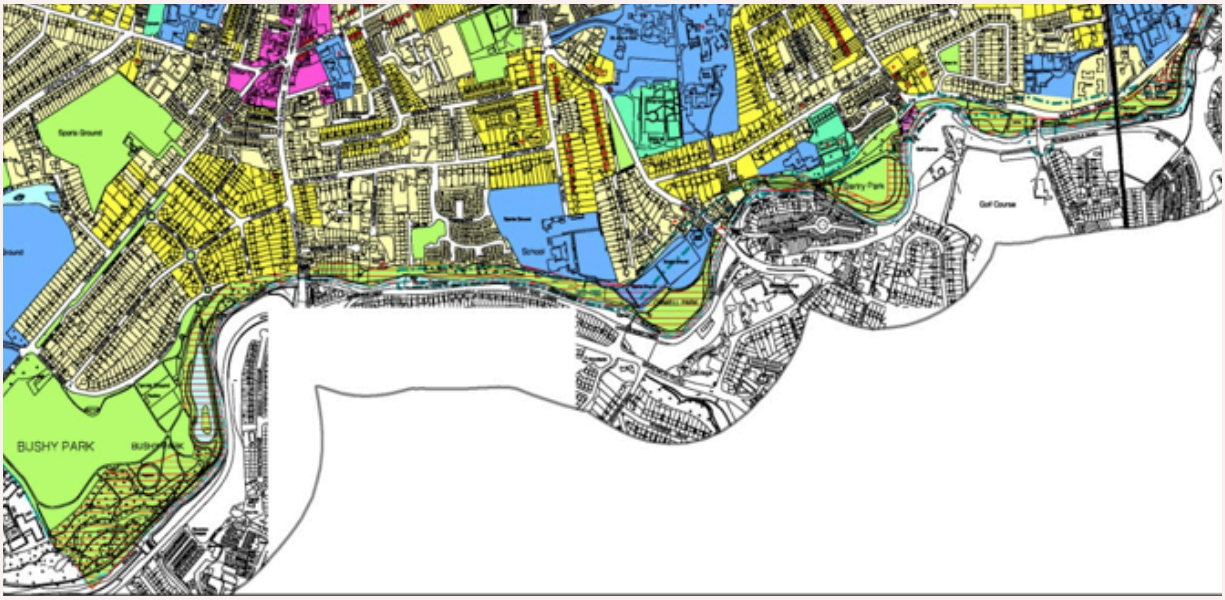
(v) There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement
Answer: There are no suitable alternative lands for the particular uses or development type in areas at lower risk of flooding, within or adjoining the urban settlement.

3. Strategic Flood Risk Assessment for Flood Zones A and B (for defended Flood Zones A and B see Section 4.8)

- Some areas within Flood Zone A and B are open space, providing a river corridor along the Dodder. These lands should be retained as they will provide moderation of flows to currently developed areas.
- Larger scale development or regeneration should be configured to avoid development within Flood Zone A and B, thus reconnecting the floodplain and minimising downstream flows.
- Storm (surface) water and overland flows have been identified as being important in this area, so should be assessed in any site flood risk assessment.
- Liaison with Dun Laoghaire / Rathdown County Council is required for any proposed development which may have cause a change in flood risk in their area.

Site: 12. Dodder: Dundrum Road – Bushy Park Boundary





Dublin City Council Development Plan 2016–2022 (zoning map key at back of tables)

Site: 12. Dodder: Dundrum Road – Bushy Park Boundary	
Site Description	This area on the Dodder river goes from Dundrum Road Bridge to the western end of Bushy Park on the north side of the river. This includes areas adjacent to Milltown Road, Shanagarry Apartments, the Dropping Well Pub, Classon's Bridge, Dartry Cottages, Dartry Park, Orwell Bridge, Rathfarnham Bridge and Bushy Park. The southern floodplains are in Dun Laoghaire/Rathdown County Council and South Dublin County Council and they should be consulted on any proposed development in this area. The area has only fluvial and pluvial rainfall influences. Development in this area is mainly parkland which has some frequently flooded areas. There is a mixture of low density Residential and Commercial with infill development of both.
Benefitting from Defences (flood relief scheme works)	Existing flood defences above ground level in this area generally have openings in them and therefore are not taken into consideration in the Zoned maps. New flood defences in this area will not be constructed for a number of years.
Sensitivity to Climate Change	Moderate to high.
Residual Risk	As no existing flood defences are in place this is not currently applicable, but will apply when new flood defences are constructed.
Historical Flooding	The flood maps attached are consistent with previous flooding of this section of the River Dodder in 1986 and 2011 and at other times of high river flows.
Storm (surface) water	All storm (surface) water in this area needs to be carefully managed and provision made for significant rainfall events during high river flows. Should development be permitted, best practice with regard to storm (surface) water management should be implemented across the development area, to limit storm (surface) water runoff to current values. Separation of surface and foul should be carried out where possible. All Developments shall have regard to the Pluvial Flood Maps in their Site Specific Flood Risk Assessment, see Flood ResilienCity Project, Volume 2 City Wide Pluvial Flood Risk Assessment at http://www.dublincity.ie/main-menu-services-water-waste-and-environment-drains-sewers-and-waste-water/flood-prevention-plans

Commentary on Flood Risk:
The flood extents indicate flow paths generally coming directly out of the river channel. These can be compounded with local pluvial flooding if heavy rainfall coincides with a high river flow. Backing up of the local combined and storm (surface) water network can occur when heavy rainfall coincides with high river flows. Some fluvial flood routes are modelled to leave upstream of the pedestrian bridge adjacent to Orwell Gardens and back into the river before Dartry Cottages. Any development to alter these flood routes needs to be carefully planned.

The flood maps were produced based on the OPW CFRAM Dodder Pilot Study and checked against historic flooding in the area.

Development Options:
The main flood cells in this area on the Dublin City Council side are located in parkland. No new development should be allowed in these green areas unless they are water compatible ones. All existing embankments and walls should be evaluated for new developments behind them.

Residential development (mainly infill) with a small amount of commercial would be a natural extension of existing development in this area. However, any development could reasonably be accommodated within the extents of Flood Zone C and should not need to extend into Flood Zone A or B unless defended. Some development may require to await future flood works in this area.

Site: 12. Dodder: Dundrum Road – Bushy Park Boundary

Justification Test for Development Plans

1. Section 1 is covered elsewhere in this SFRA justifying all of Dublin City

2. The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:

(i) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement
Answer: Yes: This area is an established residential suburb of Dublin City. This stretch of the Dodder runs along the boundary with Dun Laoghaire / Rathdown County Council and South Dublin County Council, and flows from Dundrum Road Bridge to the western end of Bushy Park on the north side of the river. This includes areas adjacent to Milltown Road, Shanagarry Apartments, Dropping Well Pub, Classon's Bridge, Dartry Cottages, Dartry Park, Orwell Bridge, Rathfarnham Bridge and Bushy Park. This area is an established residential suburb of Dublin City and is essential to facilitate the future expansion of the City.

(ii) Comprises significant previously developed and/or under-utilised lands
Answer: The River along this stretch primarily flows through parkland which is zoned Z9 in the Plan which is to protect provide and improve recreational amenity and open space and green networks. This land is unlikely to be redeveloped. Part of the River crosses over school grounds which appear to be in use as sports grounds for the schools, these lands are zoned Z15 in the current plan, which is to provide for institutional, educational, recreational community, green infrastructure and health uses. There would be limited large sites for redevelopment along this stretch. Primarily development is likely to be small infill commercial or residential

(iii) Is within or adjoining the core of an established or designated urban settlement
Answer: Yes: The lands form part of an established suburb of the City.

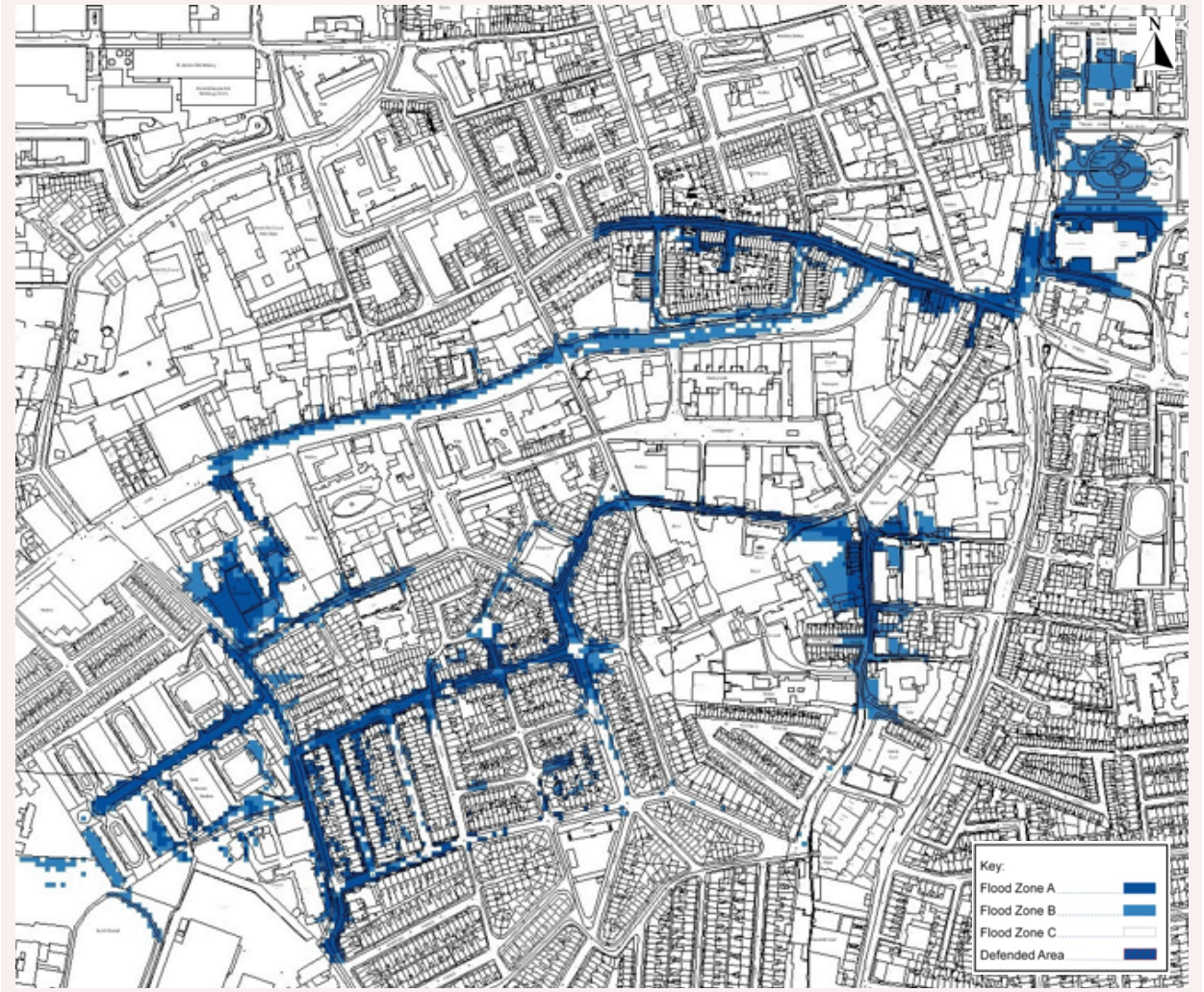
(**iv**) **Will be essential in achieving compact and sustainable urban growth**
Answer: Yes (see response to (iii) above)

(v) There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement
Answer: There are no suitable alternative lands for the particular uses or development type in areas at lower risk of flooding, within or adjoining the urban settlement.

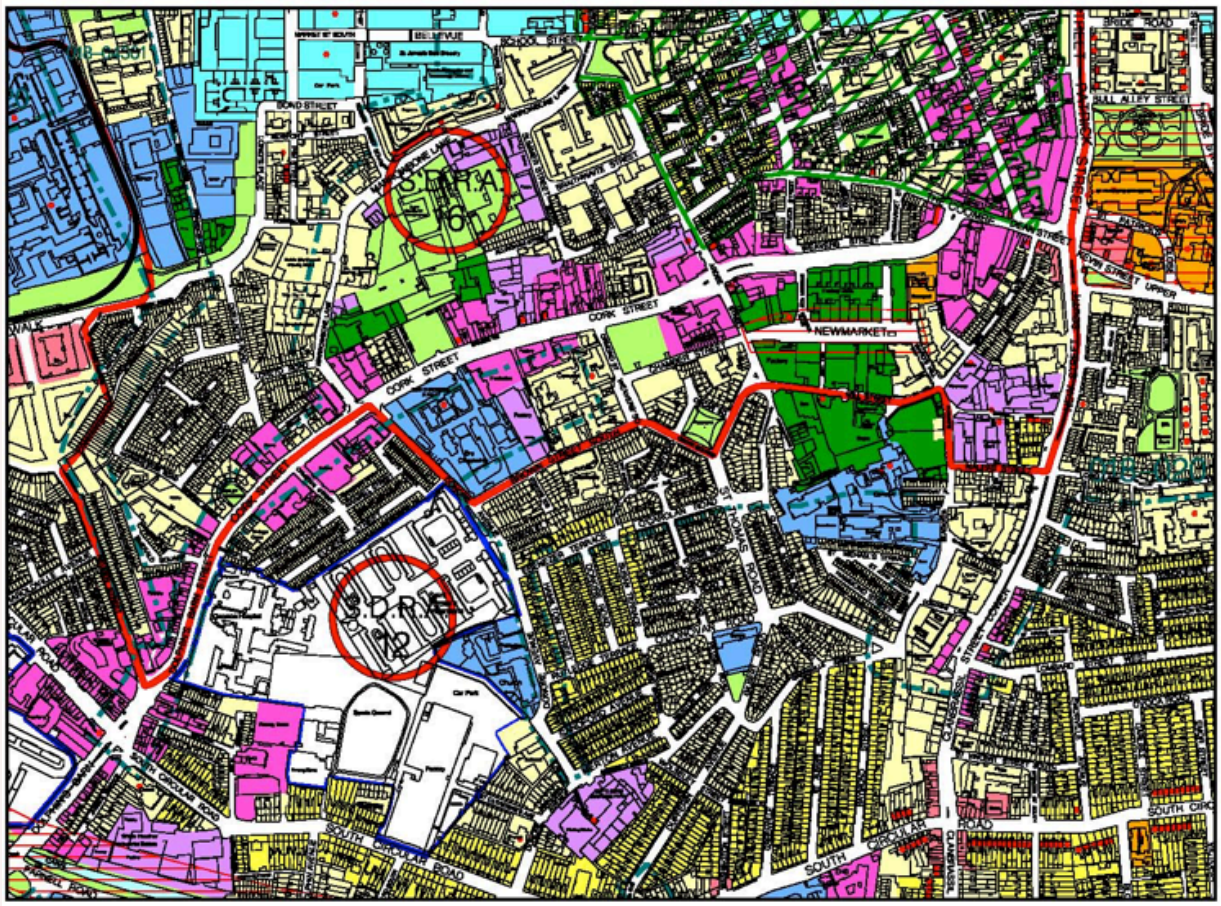
3. Strategic Flood Risk Assessment for Flood Zones A and B (for defended Flood Zones A and B see Section 4.8)

- Lands within Flood Zones A and B are zoned for water compatible uses, which are appropriate and provide greater benefits in retaining out of bank storage areas and facilitating the operation of downstream flood defences.
- Proposed new development will require a detailed flood risk assessment.

Site: 13. Poddle: Inside Canal



Site: 13. Poddle: Inside Canal



Dublin City Council Development Plan 2016–2022 (zoning map key at back of tables)

Site Description	The area on the Poddle River culvert goes from Donore Avenue, the Coombe, Cork Street and Patrick Street. It is mainly fluvial with some tidal influence at its lower end. Development in this area is a mixture of high density Residential and Commercial with infill development of both.
Benefitting from Defences (flood relief scheme works)	An overflow into the Grand Canal Sewer storm (surface) water section) reduces flow in the Poddle into the City Centre inside the Grand Canal.
Sensitivity to Climate Change	An increase of 20% for estimated climate change on top of the estimated 100 year river flow will cause extra flooding in this area. A 30% increase in river flow on top of the estimated 100-year river will cause significant extra flooding.
Residual Risk	Any proposed developments in the protected areas require residual risk for blockage of Grand Canal overflow or other cause to be mitigated against, which may be an assessment of flowpaths and setting of appropriate finished floor levels. A structural inspection of this overflow will be carried out each year.
Historical Flooding	The flood maps attached are consistent with previous flooding of this section of the River Poddle.

Site: 13. Poddle: Inside Canal	
Storm (surface) water	All storm (surface) water in this area needs to be carefully managed and provision made for significant rainfall events during high river flows. Should development be permitted, best practice with regard to storm (surface) water management should be implemented across the development area, to limit storm (surface) water runoff to current values. Separation of storm (surface) water and foul sewage flows should be carried out where possible. All Developments shall have regard to the Pluvial Flood Maps in their Site Specific Flood Risk Assessment, see Flood ResilienCity Project, Volume 2 City Wide Pluvial Flood Risk Assessment at http://www.dublincity.ie/main-menu-services-water-waste-and-environment-drains-sewers-and-waste-water/flood-prevention-plans

Commentary on Flood Risk:
The flood extents indicate flow paths generally coming directly out of the river culvert through manholes and gully grids. These can be compounded with local pluvial flooding if heavy rainfall coincides with high river culvert flows. The flood maps were produced based on the OPW CFRAM Study and they have been checked against historic flooding in the area.

Development Options:
The main flood cells in this area are located on roadways and in small residential, commercial and industrial developments. No new development should be allowed in these areas unless they are defended except for extensions and small infill provided the number of people at flood risk is not increased.

Residential development (mainly infill) with a small amount of commercial and industrial would be a natural extension of existing development in this area. However, any development could reasonably be accommodated within the extents of Flood Zone C and should not need to extend into Flood Zone A or B unless defended. Some development may require to await future flood defence works on the Poddle River.

Justification Test for Development Plans

1. Section 1 is covered elsewhere in this SFRA justifying all of Dublin City

2. The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:

(i) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement
Answer: Yes: This area is an established built up part of the inner City, In this stretch of the River the Poddle River flows from Donore Avenue, the Coombe, Cork Street and Patrick Street. Development in this area is a mixture of high density Residential and Commercial with infill development of both. This area would be essential for the future expansion of the urban settlement.

(ii) Comprises significant previously developed and/or under-utilised lands
Answer: Sites would predominately be brownfield sites. Development in this area is likely to be a mixture of Residential and Commercial/retail.

(iii) Is within or adjoining the core of an established or designated urban settlement
Answer: Yes: The lands form part of an established inner suburban part of the City.

Site: 13. Poddle: Inside Canal

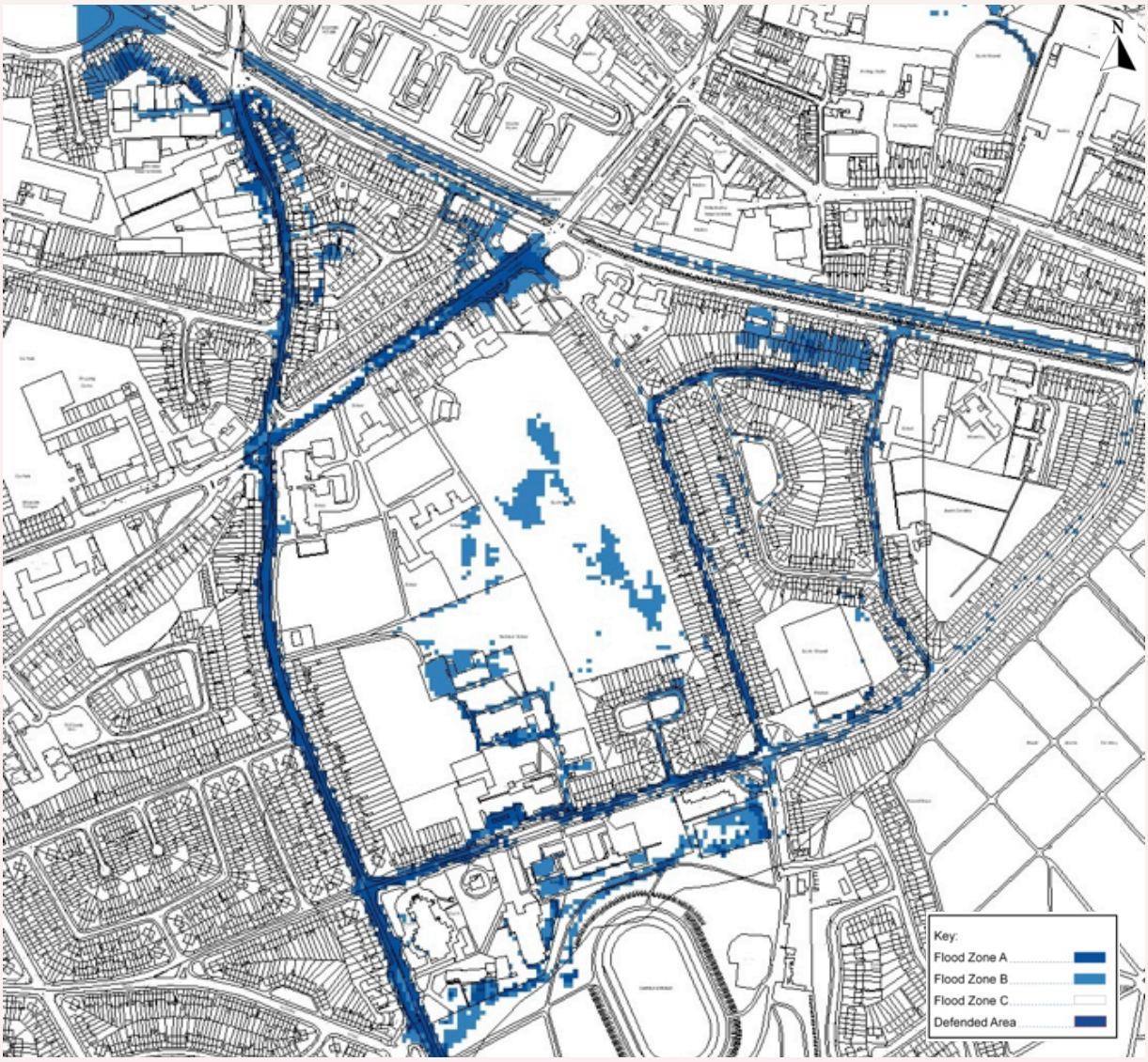
(iv) **Will be essential in achieving compact and sustainable urban growth**
Answer: Yes: (see response to (iii) above)

(v) **There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement**
Answer: There are no suitable alternative lands for the particular uses or development type in areas at lower risk of flooding, within or adjoining the urban settlement.

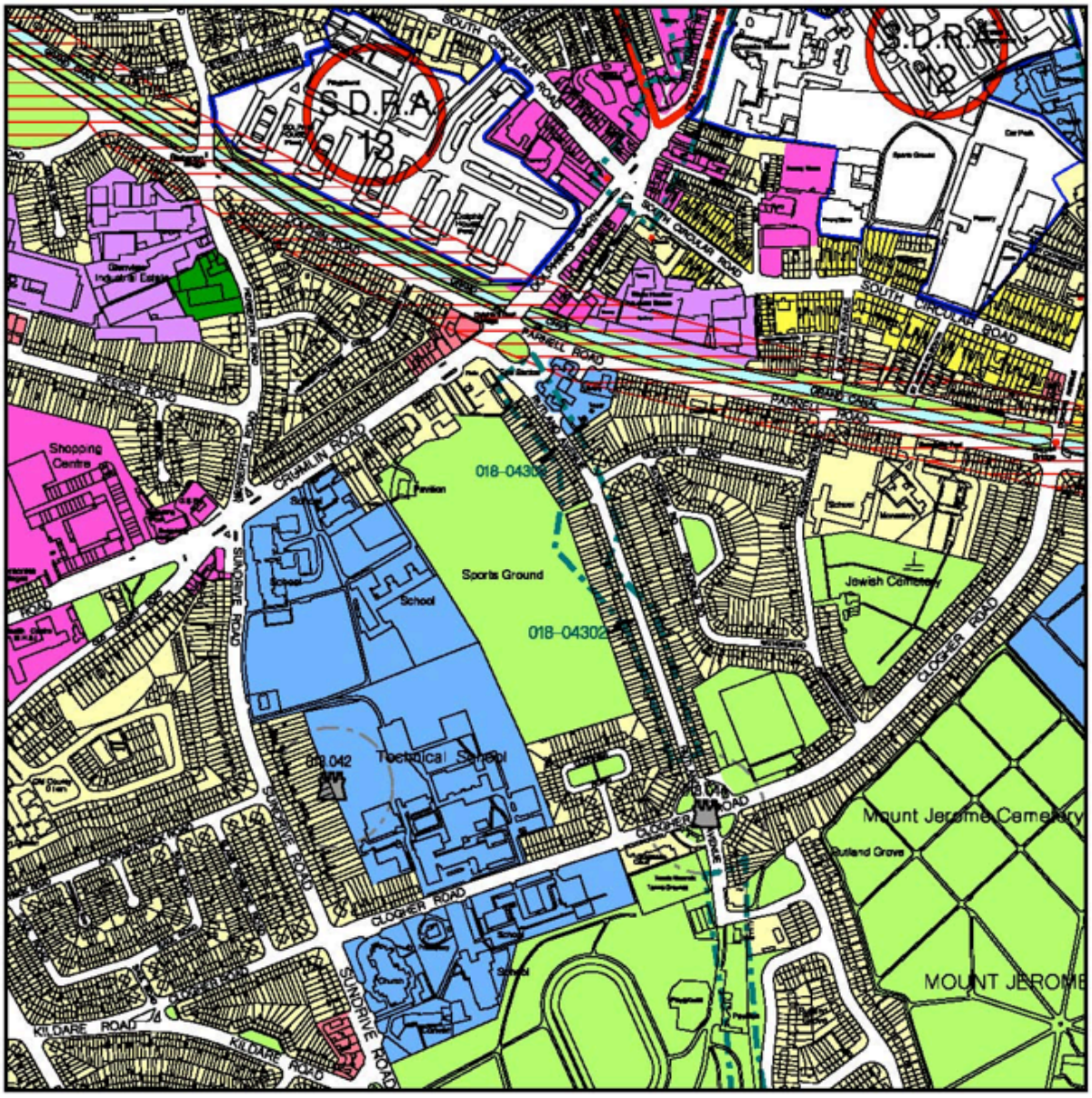
3. Strategic Flood Risk Assessment for Flood Zones A and B (for defended Flood Zones A and B see section 4.8)

- Modelling shows that risks are primarily linked to the development of overland flow paths which progress along roads. FRAs for developments should specifically address this risk, both to ensure flow paths do not become obstructed and to ensure an appropriate standard of flood resilient construction, which could include (where possible) raising finished floor levels.
- Particular attention to the design of any proposed basements should be carried out with full recognition of Dublin City Council Policies and Objectives and the detail in the SFRA, in this regard.

Site: 14. Poddle: Culverts outside Canal



Site: 14. Poddle: Culverts outside Canal



Dublin City Council Development Plan 2016–2022 (zoning map key at back of tables)

Site Description	This area on the Poddle River Flood Zone goes from Sundrive Road to Clogher Road, to Lower Crumlin Road, to Rutland Avenue. It has fluvial with pluvial rainfall influences. Development in this area is a mixture of high density Residential and Commercial with infill development of both.
Benefitting from Defences (flood relief scheme works)	No existing defences are present.
Sensitivity to Climate Change	An increase of 20% flow on top of the estimated 100-year culvert flow will cause more flooding in this area. A 30% increase in river flow on top of the estimated 100-year culvert flows will cause significant flooding.

Site: 14. Poddle: Culverts outside Canal	
Residual Risk	There are no defences, but residual risks arising from blockage of the culverts is possible and should be assessed to determine how flow paths and water depths may be changed.
Historical Flooding	The flood maps attached are consistent with previous flooding of this section of the River Poddle.
Storm (surface) water	All storm (surface) water in this area needs to be carefully managed and provision made for significant rainfall events during high river flows. Should development be permitted, best practice with regard to storm (surface) water management should be implemented across the development area, to limit storm (surface) water runoff to current values. Separation of storm (surface) water and foul sewage flows should be carried out where possible. All Developments shall have regard to the Pluvial Flood Maps in their Site Specific Flood Risk Assessment, see Flood ResilienCity Project, Volume 2 City Wide Pluvial Flood Risk Assessment at http://www.dublincity.ie/main-menu-services-water-waste-and-environment-drains-sewers-and-waste-water/flood-prevention-plans

Commentary on Flood Risk:
The flood extents indicate flow paths generally coming directly out of the river culvert through manholes and gully grids as well as some overland flows from the river itself upstream of its crossing on Sundrive Road. These can be compounded with local pluvial flooding if heavy rainfall coincides with high river culvert flows.

The flood maps were produced based on the OPW CFRAM Study and they have been checked against historic flooding in the area.

Development Options:
The main flood cells in this area are located on roadways and in small residential, commercial and industrial developments. No new development should be allowed in these areas unless they are defended except for extensions and small infill provided the number of people at flood risk is not increased.

Residential development (mainly infill) with a small amount of commercial and industrial would be a natural extension of existing development in this area. However, any development could reasonably be accommodated within the extents of Flood Zone C and should not need to extend into Flood Zone A or B unless defended. Some development may require to await future flood works on the Poddle River.

Justification Test for Development Plans

1. Section 1 is covered elsewhere in this SFRA justifying all of Dublin City

2. The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:

(i) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement
Answer: Yes: This area is an established residential suburb of Dublin City. In this stretch the Poddle River goes from Sundrive Road, to Clogher Road, to Lower Crumlin Road, to Rutland Avenue. Development in this area is a mixture of high to medium density Residential and Commercial with infill development of both. This area is essential for the future expansion of the City.

(ii) Comprises significant previously developed and/or under-utilised lands
Answer: Sites would predominately be brownfield sites. Development in this area is likely to be a mixture of mainly Residential and some Commercial.

Site: 14. Poddle: Culverts outside Canal

(iii) **Is within or adjoining the core of an established or designated urban settlement**
Answer: Yes: The lands form part of an established suburb of the City.

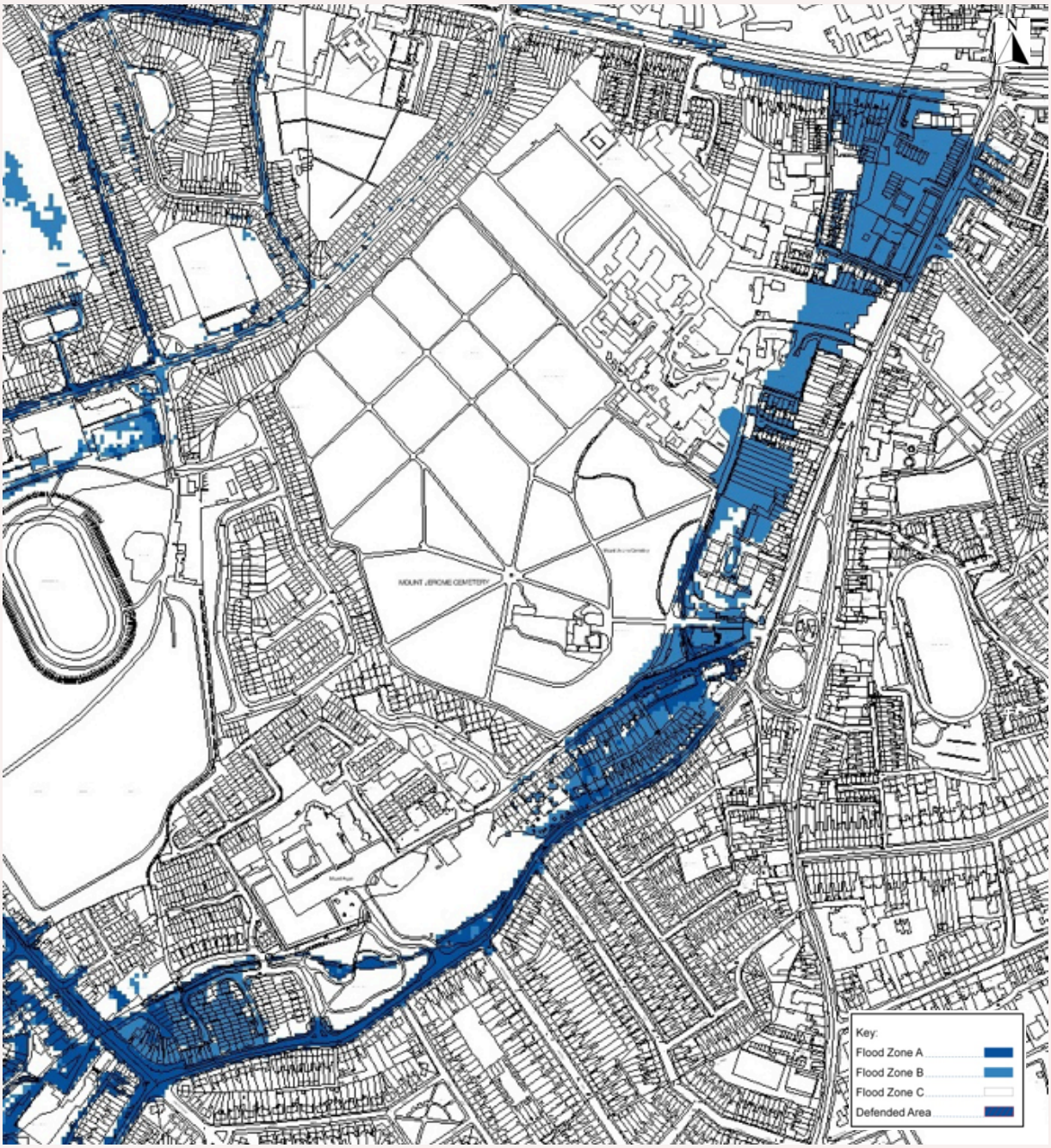
(iv) **Will be essential in achieving compact and sustainable urban growth**
Answer: Yes (see response to (iii) above)

(v) **There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement**
Answer: There are no suitable alternative lands for the particular uses or development type in areas at lower risk of flooding, within or adjoining the urban settlement.

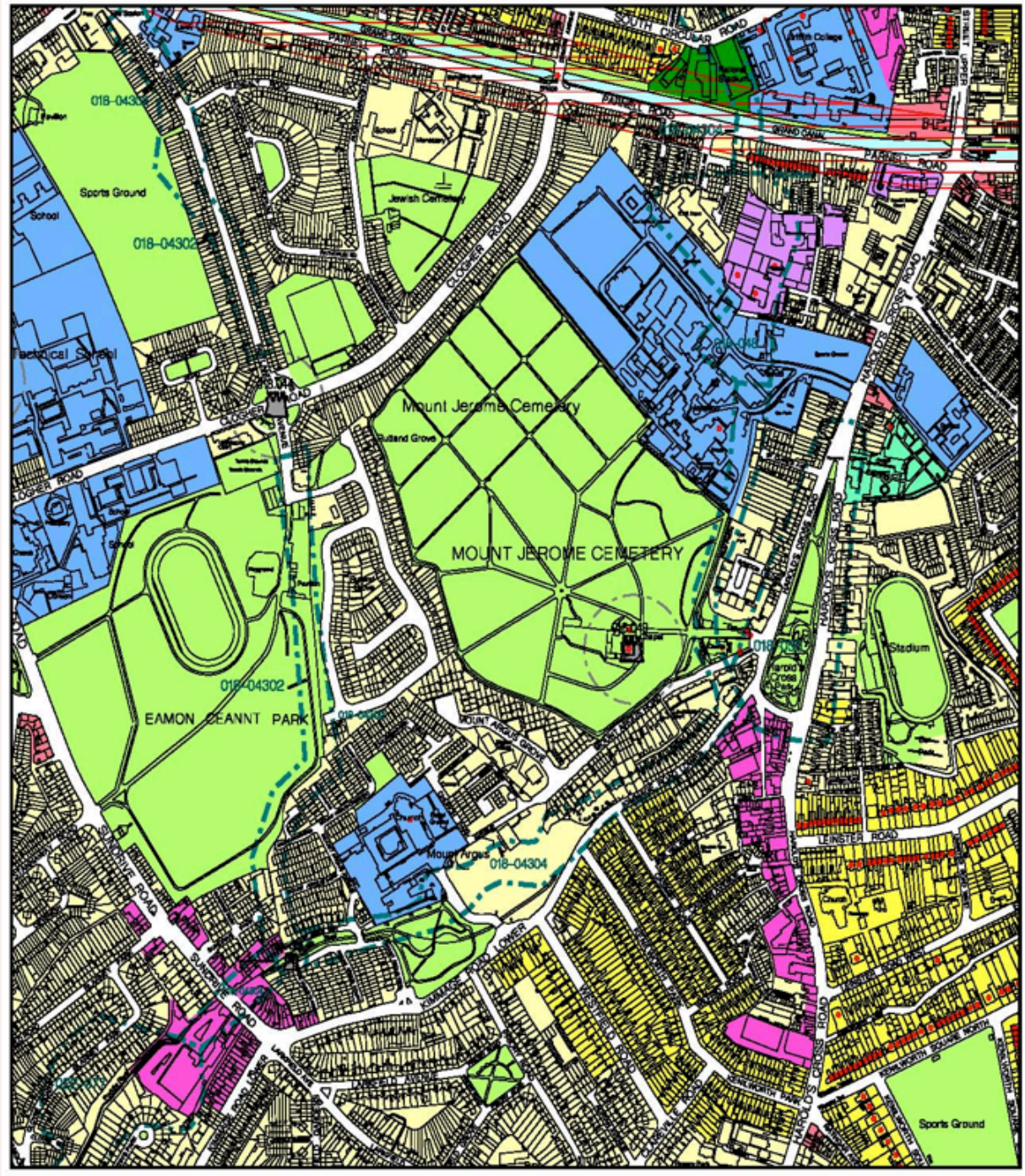
3. Strategic Flood Risk Assessment for Flood Zones A and B (for defended Flood Zones A and B see section 4.8)

- Modelling shows that risks are primarily linked to the development of overland flow paths which progress along roads. FRAs for developments should specifically address this risk, both to ensure flow paths do not become obstructed and to ensure an appropriate standard of flood resilient construction, which could include (where possible) raising finished floor levels.
- Particular attention to the design of any proposed basements should be carried out with full recognition of Dublin City Council Policies and Objectives, and the detail in the SFRA, in this regard.

Site: 15. Poddle: Grand Canal to Sundrive Road



Site: 15. Poddle: Grand Canal to Sundrive Road



Dublin City Council Development Plan 2016–2022 (zoning map key at back of tables)

Site: 15. Poddle: Grand Canal to Sundrive Road	
Site Description	This area on the Poddle River goes from Sundrive Road to Parnell Road beside the Grand Canal. It is fluvial. Development in this area is a mixture of mainly high density Residential and some Commercial with infill development of both.
Benefitting from Defences (flood relief scheme works)	No existing defences are present.
Sensitivity to Climate Change	An increase of 20% flow on top of the estimated 100-year river flow will cause more flooding in this area. A 30% increase in river flow on top of the estimated 100-year culvert flow will cause significant flooding.
Residual Risk	Not applicable
Historical Flooding	The flood maps attached are consistent with previous flooding of this section of the River Poddle.
Storm (surface) water	All storm (surface) water in this area needs to be carefully managed and provision made for significant rainfall events during high river flows. Should development be permitted, best practice with regard to storm (surface) water management should be implemented across the development area, to limit storm (surface) water runoff to current values. Separation of storm (surface) water and foul sewage flows should be carried out where possible. All Developments shall have regard to the Pluvial Flood Maps in their Site Specific Flood Risk Assessment, see Flood ResilienCity Project, Volume 2 City Wide Pluvial Flood Risk Assessment at http://www.dublincity.ie/main-menu-services-water-waste-and-environment-drains-sewers-and-waste-water/flood-prevention-plans

Commentary on Flood Risk:
The flood extents indicate flow paths generally coming directly out of the river at Gandon Close, Mount Argus Road and re-entering the river downstream either directly or through the drainage network. These can be compounded with local pluvial flooding if heavy rainfall coincides with high river flows.

The flood maps were produced based on the OPW CFRAM Study and they have been checked against historic flooding in the area.

Development Options:
The main flood cells in this area are located in residential, commercial and industrial developments. No new development should be allowed in these areas unless they are defended except for extensions and small infill provided the number of people at flood risk is not increased.

Residential development (mainly infill) with a small amount of commercial and industrial would be a natural extension of existing development in this area. However, any development could reasonably be accommodated within the extents of Flood Zone C and should not need to extend into Flood Zone A or B unless defended. Some development may require to await future flood defence works on the Poddle River.

Site: 15. Poddle: Grand Canal to Sundrive Road

Justification Test for Development Plans

1. Section 1 is covered elsewhere in this SFRA justifying all of Dublin City

2. The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:

(i) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement
Answer: Yes: This area is an established residential suburb of Dublin City. The River Poddle in this section flows from Sundrive Road to Parnell Road beside the Grand Canal Development in this area is a mixture of mainly Residential and some Commercial with infill development of both. This area is essential to the future expansion of the City.

(ii) Comprises significant previously developed and/or under-utilised lands
Answer: There would be limited large development sites. Any sites for redevelopment would predominately be brownfield sites. Development in this area is likely to be a mixture of mainly Residential and some Commercial.

(iii) Is within or adjoining the core of an established or designated urban settlement
Answer: Yes: The lands form part of an established suburb of the City.

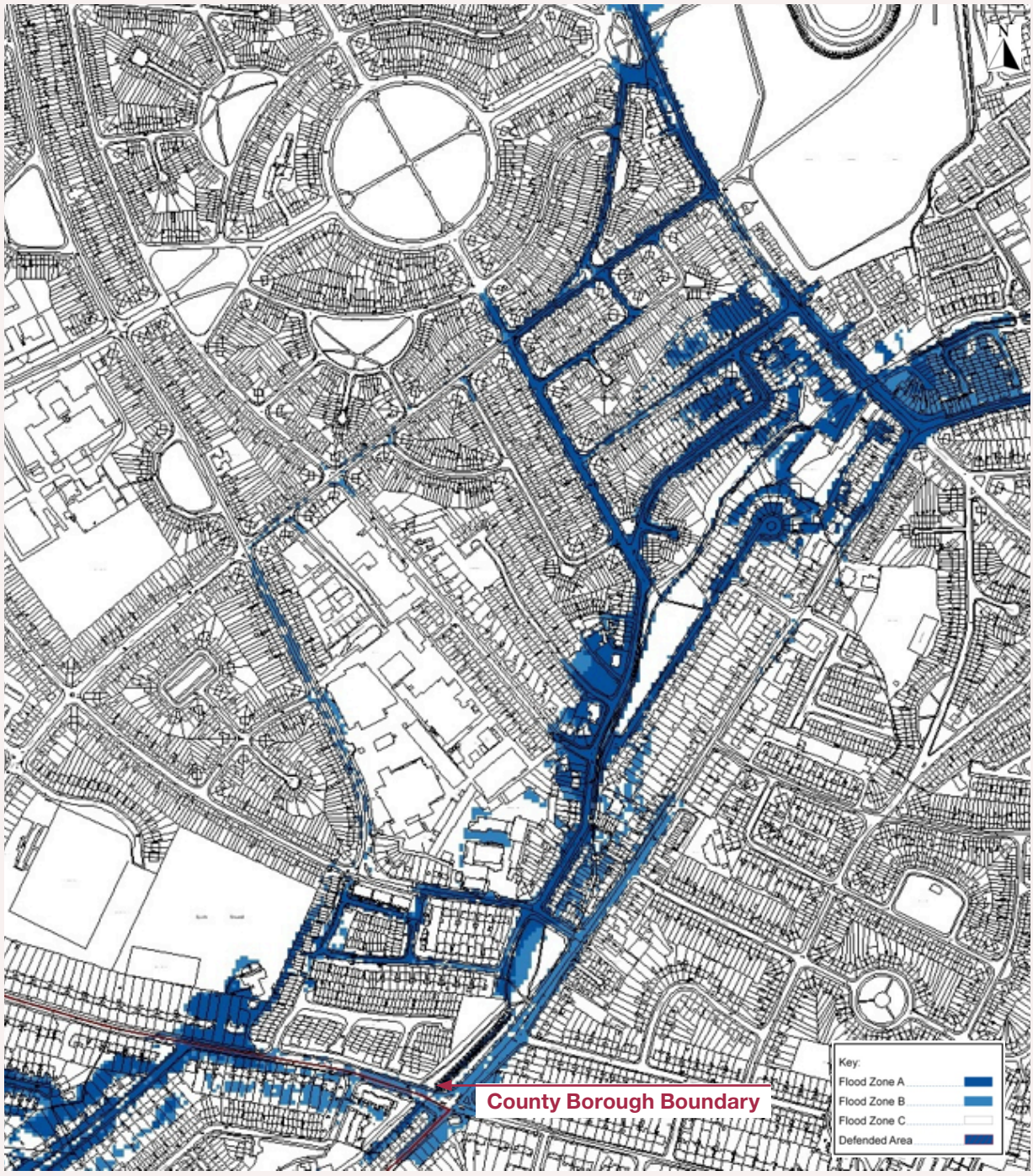
(iv) Will be essential in achieving compact and sustainable urban growth
Answer: Yes (see response to (iii) above)

(v) There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement
Answer: There are no suitable alternative lands for the particular uses or development type in areas at lower risk of flooding, within or adjoining the urban settlement.

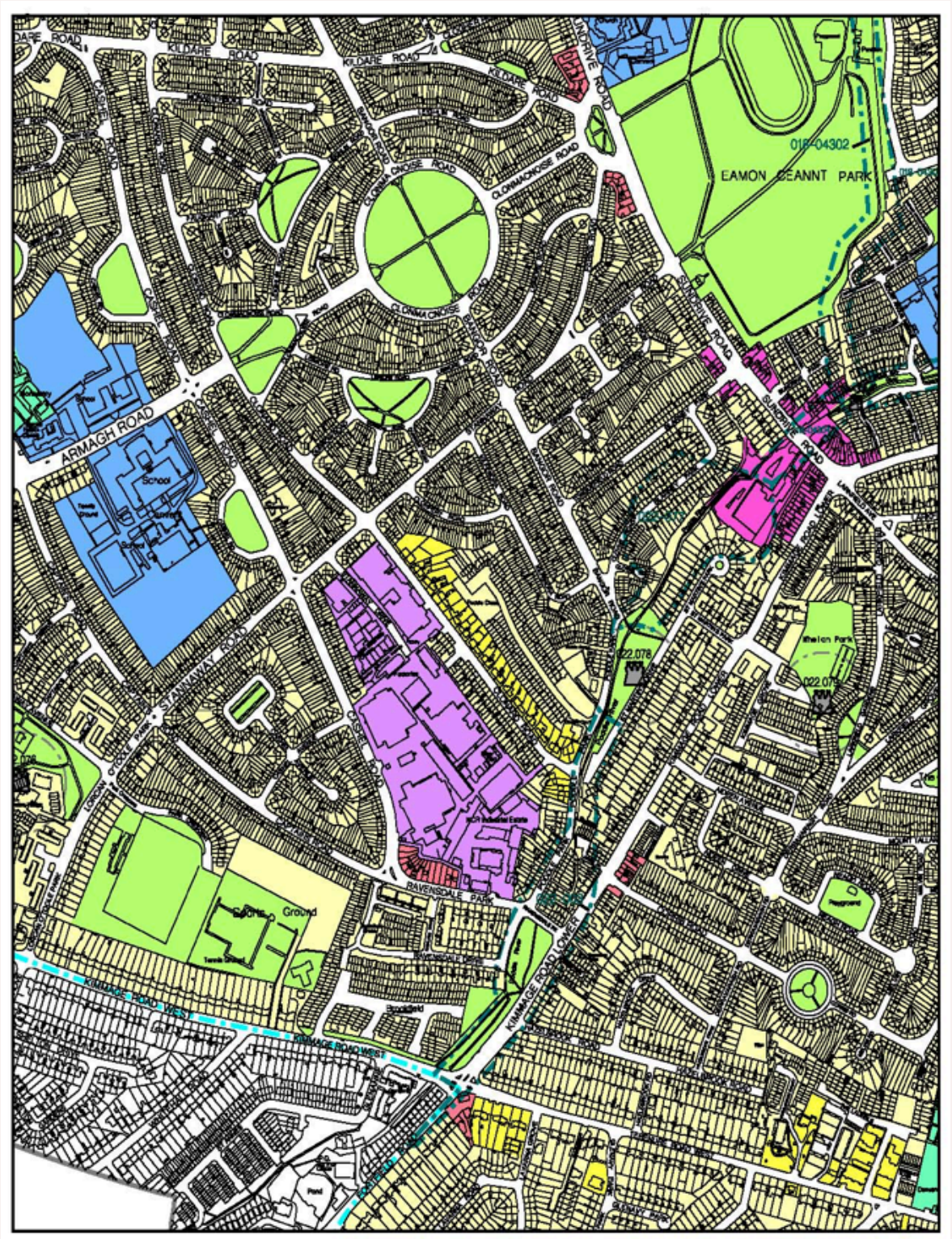
3. Strategic Flood Risk Assessment for Flood Zones A and B (for defended Flood Zones A and B see section 4.8)

- Flood risks in this area are through a combination of direct channel capacity exceedance and the resulting overland flows, both from a natural lack of capacity and through potential blockage of culverts.
- Modelling also shows that risks are primarily linked to the development of overland flow paths which progress along roads and pond in both undeveloped and developed sites. FRAs for developments should specifically address this risk, both to ensure flow paths do not become obstructed and to ensure an appropriate standard of flood resilient construction, which could include (where possible) raising finished floor levels. Given the importance of retaining overland flow paths and current storage areas within the existing developed lands, new highly or less vulnerable development within Flood Zones A or B cannot be justified and should be avoided. Water compatible development, such as parks and playing fields are permitted, provided there is no loss in storage capacity or obstruction of flow routes where development in Flood Zone C is proposed, overland flow routes arising from culvert blockage should also be assessed and any resulting flow paths (which may not be highlighted in the Flood Zone Maps) should also be protected.

Site: 16. Poddle: Sundrive Road – Kimmage Road West



Site: 16. Poddle: Sundrive Road – Kimmage Road West



Dublin City Council Development Plan 2016–2022 (zoning map key at back of tables)

Site: 16. Poddle: Sundrive Road – Kimmage Road West	
Site Description	This area on the Poddle River goes from Kimmage Road West to Sundrive Road. Development in this area is a mixture of mainly Residential and some Commercial with infill development of both.
Benefitting from Defences (flood relief scheme works)	There is a length of embankment and low flood wall within Poddle Park, but this is incomplete and does not function as a flood defence. It does influence flow paths, particularly in lower return period events, so has been retained in the model that produced the Flood Zone Maps.
Sensitivity to Climate Change	An increase of 20% flow on top of the estimated 100-year river flow will cause more flooding in this area. A 30% increase in river flow on top of the estimated 100-year culvert flow will cause significant flooding.
Residual Risk	Risks associated with culvert blockage should be investigated and appraised and this assessment should be used to inform site layout and building finished floor levels. It is important that overland flow routes are not blocked as a result of development.
Historical Flooding	The flood maps attached are consistent with previous flooding of this section of the River Poddle. There is a history of flooding at Harold's Cross and this has been reflected in the Flood Zones based on records of the events.
Storm (surface) water	All storm (surface) water in this area needs to be carefully managed and provision made for significant rainfall events during high river flows. Should development be permitted, best practice with regard to storm (surface) water management should be implemented across the development area, to limit storm (surface) water runoff to current values. Separation of storm (surface) water and foul sewage flows should be carried out where possible. All Developments shall have regard to the Pluvial Flood Maps in their Site Specific Flood Risk Assessment, see Flood ResilienCity Project, Volume 2 City Wide Pluvial Flood Risk Assessment at http://www.dublincity.ie/main-menu-services-water-waste-and-environment-drains-sewers-and-waste-water/flood-prevention-plans

Commentary on Flood Risk:
The flood extents indicate flow paths generally coming directly out of the river at Poddle Park and Ravensdale Park and re-entering the river downstream either directly or through the drainage network. Other flow routes stay out of the river and enter the drainage network elsewhere. Further fluvial flows are estimated to come down Whitehall Road, in South Dublin and into the Dublin City area. These can be compounded with local pluvial flooding if heavy rainfall coincides with high river culvert and river flows.

The flood maps were produced based on the OPW CFRAM Study and they have been checked against historic flooding in the area.

Development Options:
The main flood cells in this area are located in residential and small commercial and industrial developments. No new development should be allowed in these areas unless they are defended except for extensions and small infill provided the number of people at flood risk is not increased.

Residential development (mainly infill) with a small amount of commercial and industrial would be a natural extension of existing development in this area. However, any development could reasonably be accommodated within the extents of Flood Zone C and should not need to extend into Flood Zone A or B unless defended. Some development may require to await future flood defence works on the Poddle River.

Site: 16. Poddle: Sundrive Road – Kimmage Road West

Justification Test for Development Plans

1. Section 1 is covered elsewhere in this SFRA justifying all of Dublin City

2. The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:

(i) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement
Answer: Yes: This area is an established residential suburb of Dublin City. The Poddle River in this area flows through mainly residential areas from Kimmage Road West to Sundrive Road. Development in this area is a mixture of mainly Residential and some Commercial with infill development of both.

1. Comprises significant previously developed and/or under-utilised lands
Answer: Sites would predominately be brownfield sites. Development in this area is likely to be a mixture of mainly Residential and some Commercial.

(ii) Is within or adjoining the core of an established or designated urban settlement
Answer: Yes: The lands form part of an established suburb of the City.

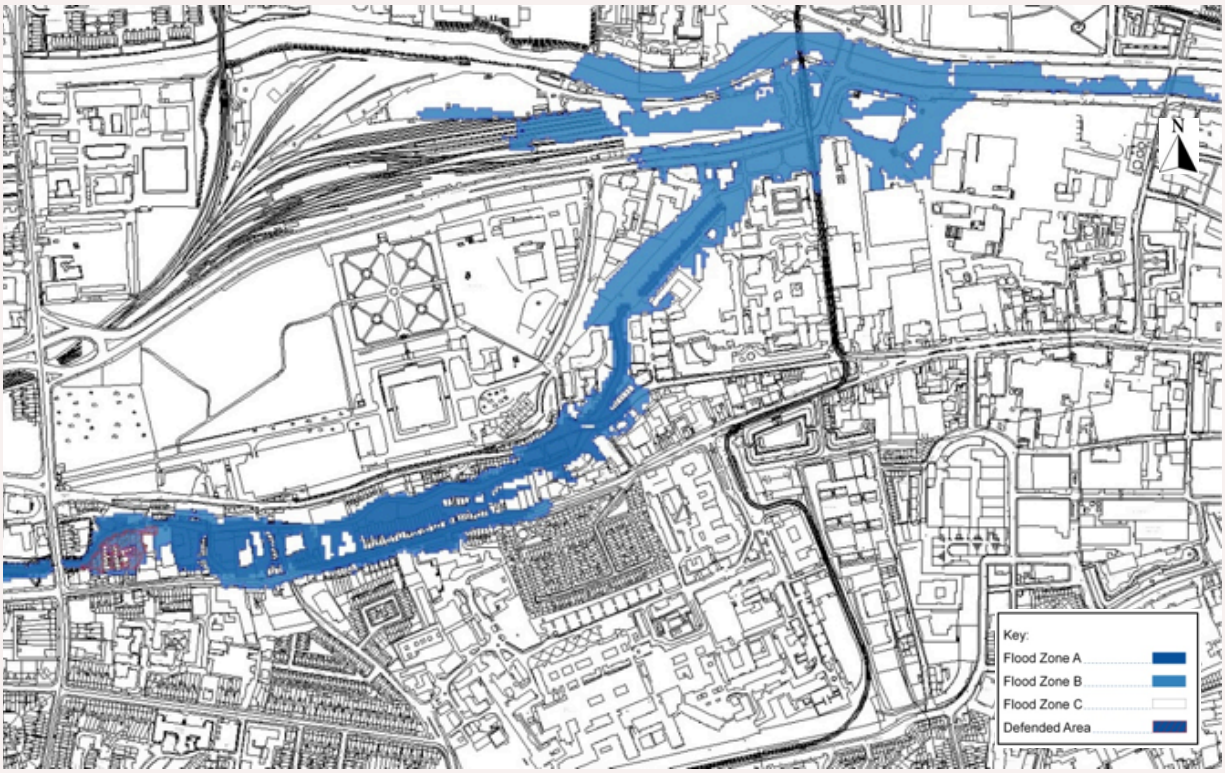
(iii) Will be essential in achieving compact and sustainable urban growth
Answer: Yes: (see response to (iii) above)

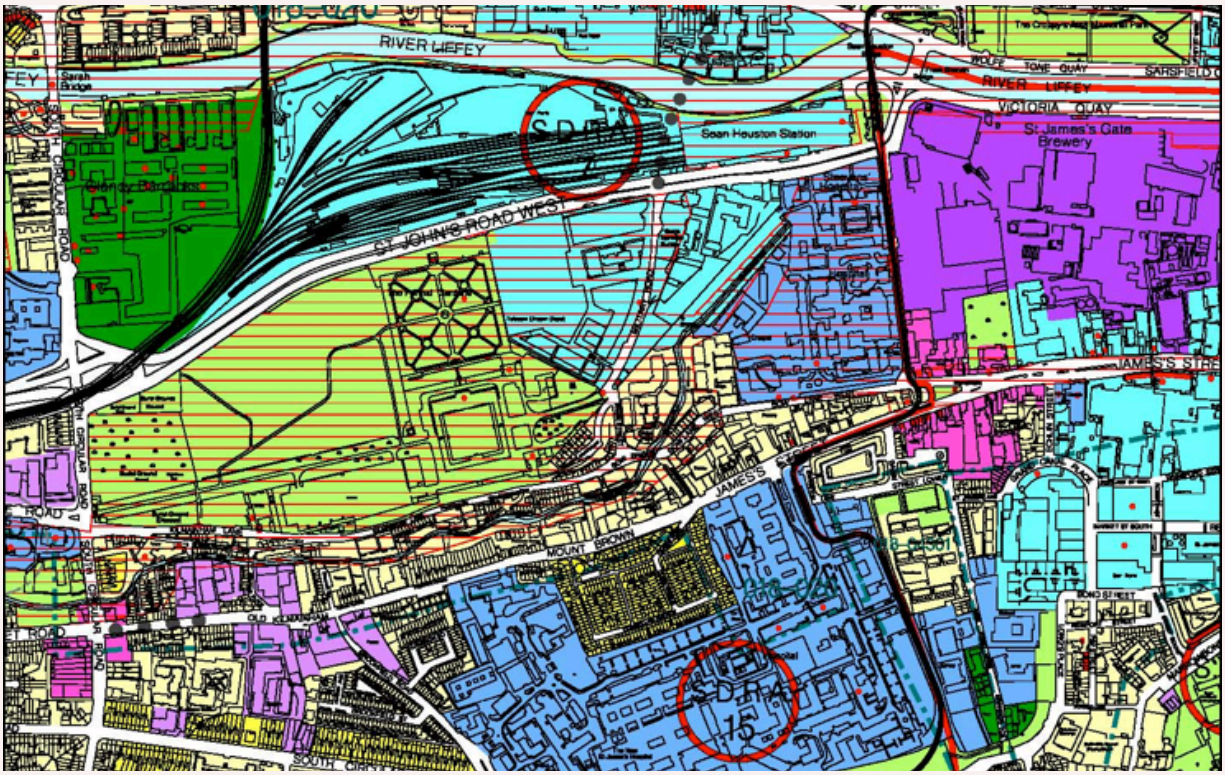
(iv) There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement
Answer: There are no suitable alternative lands for the particular uses or development type in areas at lower risk of flooding, within or adjoining the urban settlement.

3. Strategic Flood Risk Assessment for Flood Zones A and B (for Defended Flood Zones A and B see section 4.8)

- Flood risks in this area are through a combination of direct channel capacity exceedance and the resulting overland flows, both from culvert overtopping and through potential blockage of culverts.
- Modelling also shows that flood risks are primarily linked to the development of overland flow paths which progress along roads and pond in both undeveloped and developed sites. FRAs for developments should specifically address this risk, both to ensure flow paths do not become obstructed and to ensure an appropriate standard of flood resilient construction.
- Given the importance of retaining overland flow paths and current storage areas within the existing developed lands, new highly or less vulnerable development within Flood Zones A or B cannot be justified and should be avoided. Water compatible development, such as parks and playing fields are permitted, provided there is no loss in storage capacity or obstruction of flow routes.
- Where development in Flood Zone C is proposed, overland flow routes arising from culvert blockage should also be assessed and any resulting flow paths (which may not be highlighted in the Flood Zone Maps) should also be protected.
- In Harold's Cross, where it is known that culvert blockage is a significant risk, the outlines have been amended to take into account the possible impacts of a blocked culvert. In this area it will not be appropriate to refer to the CFRAM Study in relation to climate change extents. Instead, a combined culvert blockage and climate change run should be carried out as part of the Site Specific Flood Risk Assessment. A typical blockage factor of 50% should be used in the design assessment.

Site: 17. Lower Camac: South Circular Road to Liffey Estuary





Dublin City Council Development Plan 2016–2022 (zoning map key at back of tables)

Site: 17. Lower Camac: South Circular Road to Liffey Estuary	
Site Description	In this section the River Camac flows through residential areas in Kilmainham where it then runs behind the Jail Museum before entering the Liffey alongside Heuston Station. The areas primarily located in Flood Zone A lie between Kilmainham Lane and Old Kilmainham Road which are currently zoned Z1 (residential) in the Current Development Plan, and are heavily developed by residential and some industrial units. Some lands owned by the OPW north of the river is one of the few exceptions where Zone B encroaches on part of the site and climate change may affect more of it in the future. Most developments are likely to be infill or brownfield.
Benefitting from Defences (flood relief scheme works) and residual risk	Apart from the most westerly section at Lady's Lane and Castleforbes Terrace, shown hatched, the area does not benefit from defences. The protected areas at Lady's Lane and Castleforbes Terrace have residual risk for the 100-year fluvial event to the extent of the hashed lines, and will flood through overtopping during any event greater than the 1 in 100-year flood. The CFRAM Study for the Camac did not reveal any overall flood alleviation scheme for the catchment, except for flood awareness and flood warning systems; a further study on individual flood cells will be carried out in the future.
Sensitivity to Climate Change	Slight to moderate - there is little difference between the extents of Flood Zone A and B in most locations. Sea level rise is likely to have more of an impact on water levels at the downstream end. For large scale development within areas shown to be vulnerable to climate change a more detailed hydraulic study may be required to fully understand the risks. The standard of protection given by existing defences will also be reduced as climate change impacts are felt.
Historical Flooding	The flood maps attached are consistent with previous flooding of this section of the Camac.
Storm (surface) water	This portion of the Camac Catchments is susceptible to pluvial flooding from intense rainfall events, particularly the section along Old Kilmainham Road and Mount Brown from the South Circular road to Cromwell's Quarters. Should development be permitted, best practice with regards to storm (surface) water management should be implemented across the development area, to limit storm (surface) water runoff to current values. All Developments shall have regard to the Pluvial Flood Maps in their Site Specific Flood Risk Assessment, see Flood ResilienCity Project, Volume 2 City Wide Pluvial Flood Risk Assessment at http://www.dublincity.ie/main-menu-services-water-waste-and-environment-drains-sewers-and-waste-water/flood-prevention-plans

Commentary on Flood Risk:
The flood extents indicate flow paths generally coming directly out of the river channel. Pluvial flooding may increase flooding risk if it occurs during high river flows.

The flood maps were produced based on the OPW CFRAM Study and checked against historic flooding in the area. Public consultation was also carried out on these in 2014 to iron out any local inaccuracies.

Site: 17. Lower Camac: South Circular Road to Liffey Estuary

Development Options:
The main flood cells in this area are located in residential and small commercial and industrial developments. No new development should be allowed in these areas unless they are defended except for extensions and small infill provided the number of people at flood risk is not increased.

Residential development (mainly infill) with a small amount of commercial and industrial would be a natural extension of existing development in this area. However, any significant development could reasonably be accommodated within the extents of Flood Zone C and should not need to extend into Flood Zone A or B unless defended. Some development may require to await future flood defence works on the Camac River.

Justification Test for Development Plans

1. Section 1 is covered elsewhere in this SFRA justifying all of Dublin City

2. The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:

(i) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement
Answer: Yes: The areas located in Flood Zones A and B are primarily built up, especially around Kilmainham, where there the area is made of established built up residential area, with some industrial and commercial properties. There would be limited large development sites within this area, the possible development of these sites will be infill or extensions onto existing properties. This area is an established built up part of the city.

(ii) Comprises significant previously developed and/or under-utilised lands
Answer: Most of the lands within Flood Zone A and B are already built up or comprise of brownfield sites.

(iii) Is within or adjoining the core of an established or designated urban settlement
Answer: Yes: The lands form part of an established built up part of the City close to Strategic Rail Infrastructure. The area around Heuston is identified as a Key Developing Area (KDA) under the Core Strategy, which represents areas of the inner and outer city with substantial development capacity and the potential to deliver the residential, employment and recreational needs of the city. The Heuston Area will support the economic and cultural specialism's essential for growth and diversification of the City's economy. Within these KDAs there are a number of Strategic Development & Regeneration Areas (SDRA), which are important brownfield sites with the potential to deliver a significant quantum of mixed-uses and create synergies to regenerate their respective areas. Heuston & Environs is identified as an SDRA.

(iv) Will be essential in achieving compact and sustainable urban growth
Answer: Yes: The lands form part of an established built up part of the City close to Strategic Rail Infrastructure. The area around Heuston is identified as a Key Developing Area (KDA) under the Core Strategy, which represents areas of the inner and outer city with substantial development capacity and the potential to deliver the residential, employment and recreational needs of the city. The Heuston Area will support the economic and cultural specialism's essential for growth and diversification of the City's economy. Within these KDAs there are a number of Strategic Development & Regeneration Areas (SDRA), which are important brownfield sites with the potential to deliver a significant quantum of mixed-uses and create synergies to regenerate their respective areas. Heuston & Environs is identified as an SDRA

Site: 17. Lower Camac: South Circular Road to Liffey Estuary

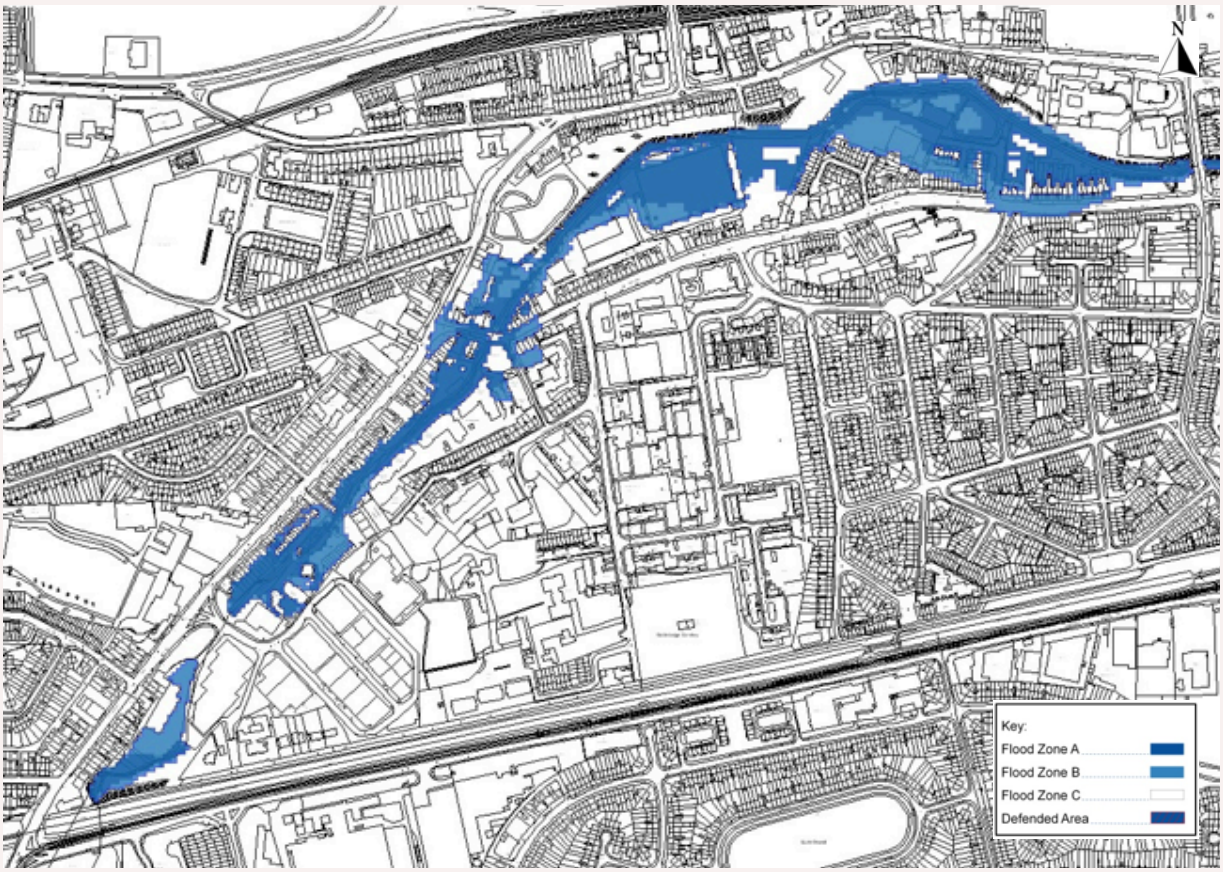
(v) **There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement**
Answer: There are no suitable alternative lands for the particular uses or development type in areas at lower risk of flooding, within or adjoining the urban settlement. Areas idenitifed as being in Flood Zones A and B are considered essential to achieving a consolidated urban centre and to comply with the NSS and RPG.

3. **Strategic Flood Risk Assessment for Flood Zones A and B (for Defended Flood Zones A and B see section 4.8)**

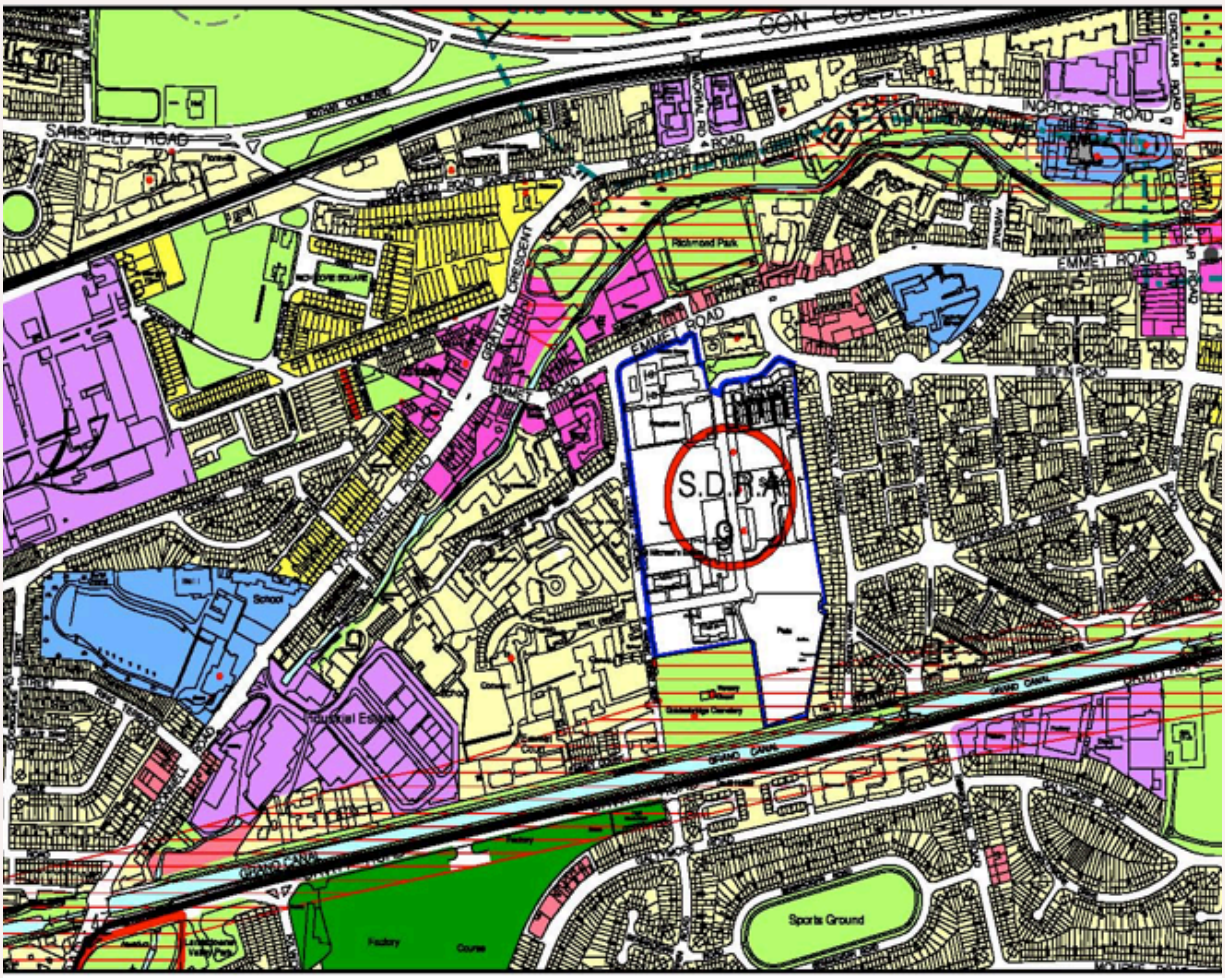
This text should be read in conjunction with the comments on the relevant reaches of the Liffey.

- Developments within Flood Zone A should be limited to extensions onto existing buildings, or some changes of use. There should be no increase in flood risk where changes of use or basement accommodation are proposed.
- Commercial development within previously developed parts of Flood Zone B may be justified, provided property resilient construction is carried out, and no increase in flood risk elsewhere can be developed.

Site: 18. Middle Camac: Davitt Road to South Circular Road



Site: 18. Middle Camac: Davitt Road to South Circular Road



Dublin City Council Development Plan 2016–2022 (zoning map key at back of tables)

Site Description	This section of the middle Camac flows from the Grand Canal at Blackhorse Bridge, through Goldenbridge industrial Estate to the south of Tyrconnell Road/Inchicore Road before flowing to the South Circular Road north of Emmet Road. The area is heavily developed with residential and some industrial units. Some land is owned by Dublin City Council and Richmond Park and elsewhere near the river is required for flood storage. Developments are likely to be infill or brownfield sites.
Benefitting from Defences (flood relief scheme works) and residual Risk	The area does not benefit from formal flood defences.
Sensitivity to Climate Change	Slight-moderate - there is significant difference between the extents of Flood Zone A and B in a number of locations which indicates an increase in flood risk as river flows increase.
Historical Flooding	The flood maps attached are consistent with previous flooding of this section of the Camac.

Site: 18. Middle Camac: Davitt Road to South Circular Road	
Storm (surface) water	As this portion of the Camac Catchment is susceptible to pluvial flooding from intense rainfall events, particularly the section around Turvey Avenue, should development be permitted, best practice with regards to storm (surface) water management should be implemented across the development area, to limit storm (surface) water runoff to current values. Underground developments such as car parks should be designed to mitigate against flood risk. All Developments shall have regard to the Pluvial Flood Maps in their Site Specific Flood Risk Assessment, see Flood ResilienCity Project, Volume 2 City Wide Pluvial Flood Risk Assessment at http://www.dublincity.ie/main-menu-services-water-waste-and-environment-drains-sewers-and-waste-water/flood-prevention-plans

Commentary on Flood Risk:
The flood extents indicate flow paths generally coming directly out of the river channel.
The flood maps were produced based on the OPW CFRAM Study and checked against historic flooding in the area. Public consultation was also carried out on these in 2014 to iron out any local inaccuracies. Many areas remain at significant flood risk pending further studies.

Development Options:
The main flood cells in this area are located in residential, commercial and industrial developments. No new development should be allowed in these areas unless they are defended, except for extensions and small infill provided the number of people at flood risk is not increased.

Residential development (mainly infill) with a small amount of commercial and industrial would be a natural extension of existing development in this area. However, any development could reasonably be accommodated within the extents of Flood Zone C and should not need to extend into Flood Zone A or B unless defended. Some development may require to await future flood defence works on the Camac River.

Justification Test for Development Plans

1. Section 1 is covered elsewhere in this SFRA justifying all of Dublin City

2. The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:

(i) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement
Answer: Yes: The areas located in Flood Zones A and B are primarily built up. The area is considered essential to facilitate the regeneration and expansion of the urban settlement. Some of Flood Zones A and B are located within Z9 zoning lands (open space) including Richmond Park, which is open space, and water compatible uses would be acceptable within this zoning. The Camac River as it flows between Davitt Road and Tyrconnell Road passes though Goldenbridge Industrial Estate, and is largely built up. The river then flows through a relatively built up area to the south of Tyrconnell Road in Inchicore, with mainly residential and some commercial units. There would be limited large development sites within this area.

(ii) Comprises significant previously developed and/or under-utilised lands
Answer: Most of the lands within Flood Zone A and B are already built up or comprise of brownfield sites.

(iii) Is within or adjoining the core of an established or designated urban settlement
Answer: Yes: The lands form part of an established built up part of the City.

Site: 18. Middle Camac: Davitt Road to South Circular Road

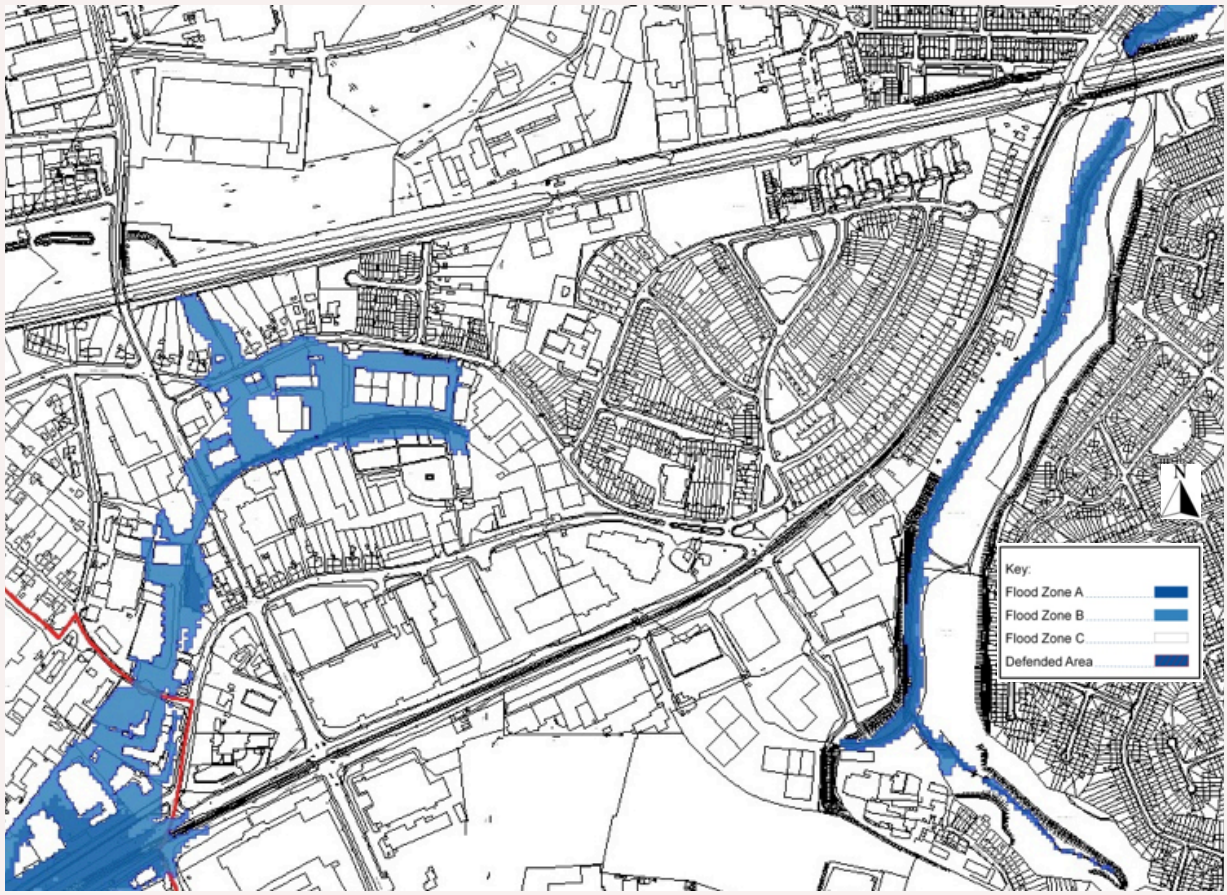
(iv) **Will be essential in achieving compact and sustainable urban growth**
Answer: Yes: The lands form part of an established built up part of the City.

(v) **There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement**
Answer: There are no suitable alternative lands for the particular uses or development type in areas at lower risk of flooding, within or adjoining the urban settlement. Areas idenitifed as being in Flood Zones A and B are considered essential to achieving a consolidated urban centre and to comply with the NSS and RPG.

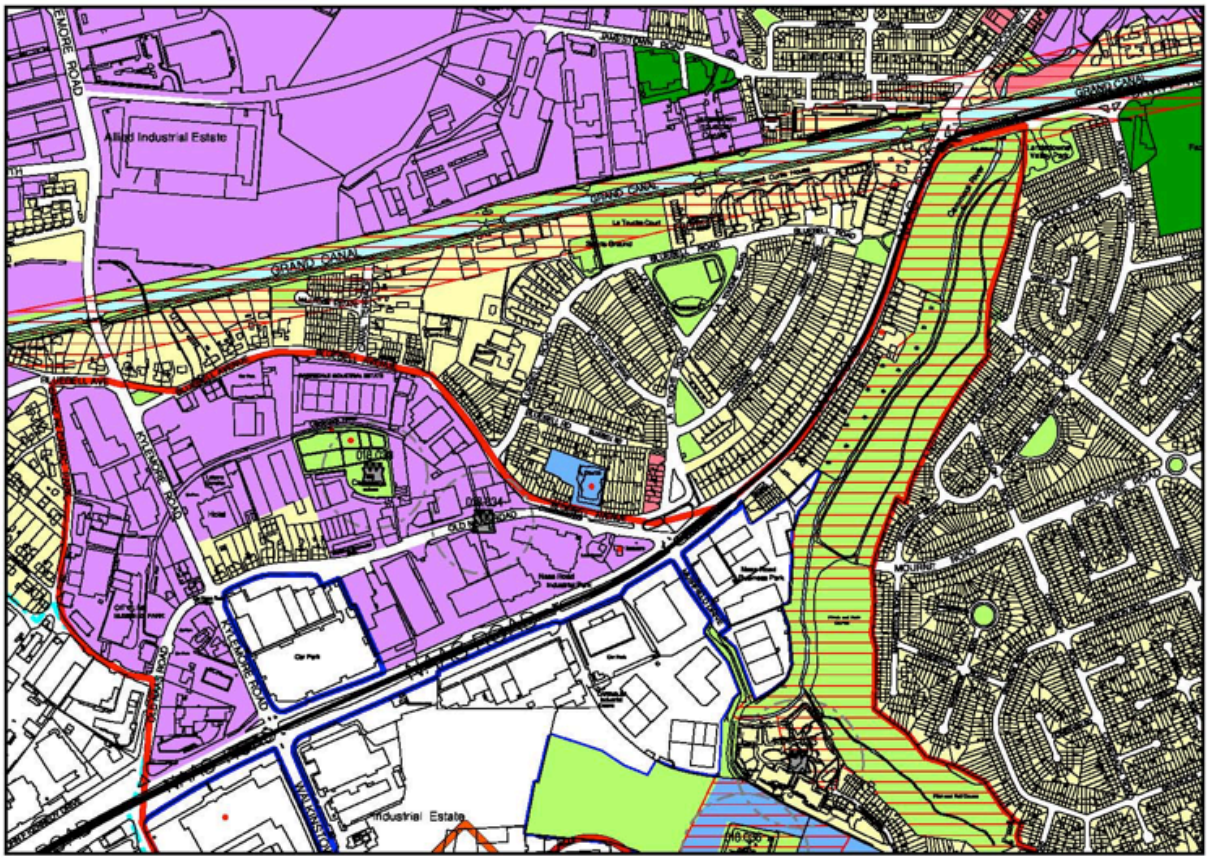
3. **Strategic Flood Risk Assessment For Flood Zones A and B (for defended Flood Zones A and B see section 4.8)**

- Lands which are within Flood A and B that are currently open space should be retained as such.
- Developments within Flood Zone A should be limited to extensions onto existing buildings, or some changes of use. There should be no increase in flood risk where changes of use or basement accommodation are proposed.
- Commercial development within previously developed parts of Flood Zone B may be justified, provided property resilient construction is carried out, and no increase in flood risk elsewhere can be developed.

Site: 19. Upper Camac: Old Naas Road Boundary to Davitt Road



Site: 19. Upper Camac: Old Naas Road Boundary to Davitt Road



Dublin City Council Development Plan 2016–2022 (zoning map key at back of tables)

Site Description	The River Camac in this section flows from South Dublin County Council at the Old Naas Road. There are four stretches where the river channel is open and natural but these are so short and far apart that the river is essentially a heavily modified water body and has been designated as such in the River Basin Management Plan. The river passes through a number of industrial estates and then flows through Landsdowne Valley Park. The Robinhood Stream, the Gallblack River (including the Blackditch and Gallanstown streams) and the Walkinstown Stream all discharge to the River Camac. An extensive storm (surface) water drainage network discharges to the River Camac and a significant number of combined sewer overflows also discharge to the river and its tributaries. The area is heavily developed by mainly industrial units. Some land is owned by Dublin City Council and others near the river and is required for flood storage. Developments are likely to be infill or green/brownfield sites. A significant portion of the river is culverted under the Old and new Naas Roads as well as under Davitt road and the Grand Canal.
Benefitting from Defences (flood relief scheme works) and residual risk	The site does not benefit from formal defences and all informal defences have been omitted in the flood mapping. The CFRAM Study for the Camac did not reveal any overall flood alleviation scheme for the catchment, except for flood awareness and flood warning systems. A further study of individual flood cells may produce flood alleviation schemes to reduce flood risk.

Site: 19. Upper Camac: Old Naas Road Boundary to Davitt Road	
Sensitivity to Climate Change	Moderate to high. There are extensive parts of the upstream commercial areas within Flood Zone B, indicating climate change is likely to give a significant increase in risk.
Historical Flooding	The flood maps attached are consistent with previous flooding of this section of the Camac.
Storm (surface) water	As this portion of the Camac Catchment is susceptible to pluvial flooding from intense rainfall events, particularly the low section on the Old Naas Road, should development be permitted, best practice with regards to storm (surface) water management should be implemented across the development area, to limit storm (surface) water runoff to current values. All Developments shall have regard to the Pluvial Flood Maps in their Site Specific Flood Risk Assessment, see Flood ResilienCity Project, Volume 2 City Wide Pluvial Flood Risk Assessment at http://www.dublincity.ie/main-menu-services-water-waste-and-environment-drains-sewers-and-waste-water/flood-prevention-plans

Commentary on Flood Risk:
The flood extents indicate flow paths generally coming directly out of the river channel.
The flood maps were produced based on the OPW CFRAM Study and checked against historic flooding in the area. Public consultation was also carried out on these in 2014 to iron out any local inaccuracies.

Development Options:
The main flood cells in this portion of the Camac catchment are located in green areas in residential, commercial and industrial developments. No new development should be allowed in these green areas. No development should be allowed in the other flood cells unless they are defended, except for extensions and small infill provided the number of people at flood risk is not increased.

Residential development (mainly infill) with some commercial and industrial would be a natural extension of existing development in this area. However, any development could reasonably be accommodated within the extents of Flood Zone C and should not need to extend into Flood Zone A or B unless defended. Some development may require to await future flood defence works on the Camac River.

Justification Test for Development Plans

1. Section 1 is covered elsewhere in this SFRA justifying all of Dublin City

2. The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:

(i) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement
Answer: Yes: The areas located in Flood Zones A and B are primarily built up. The areas identified as being mainly within Flood Zone A and B are primarily located in Z6 zoned lands which is to provide for the creation and protection of enterprise and facilitate opportunities for employment creation. The area indicated in the Flood Cell above forms part of the Naas Road Local Area Plan. This Plan was adopted in 2013, and as part of this a Strategic Flood Risk Assessment was included. This is one of the Areas identified to deliver the Core Strategy.

(ii) Comprises significant previously developed and/or under-utilised lands
Answer: Most of the lands within Flood Zone A and B are already built up or comprise of brownfield sites.

Site: 19. Upper Camac: Old Naas Road Boundary to Davitt Road

(iii) **Is within or adjoining the core of an established or designated urban settlement**
Answer: Yes: The area indicated in the Flood Cell above forms part of the Naas Road Local Area Plan. This Plan was adopted in 2013, and as part of this a Strategic Flood Risk Assessment was included. This is one of the Areas identified to deliver the Core Strategy.

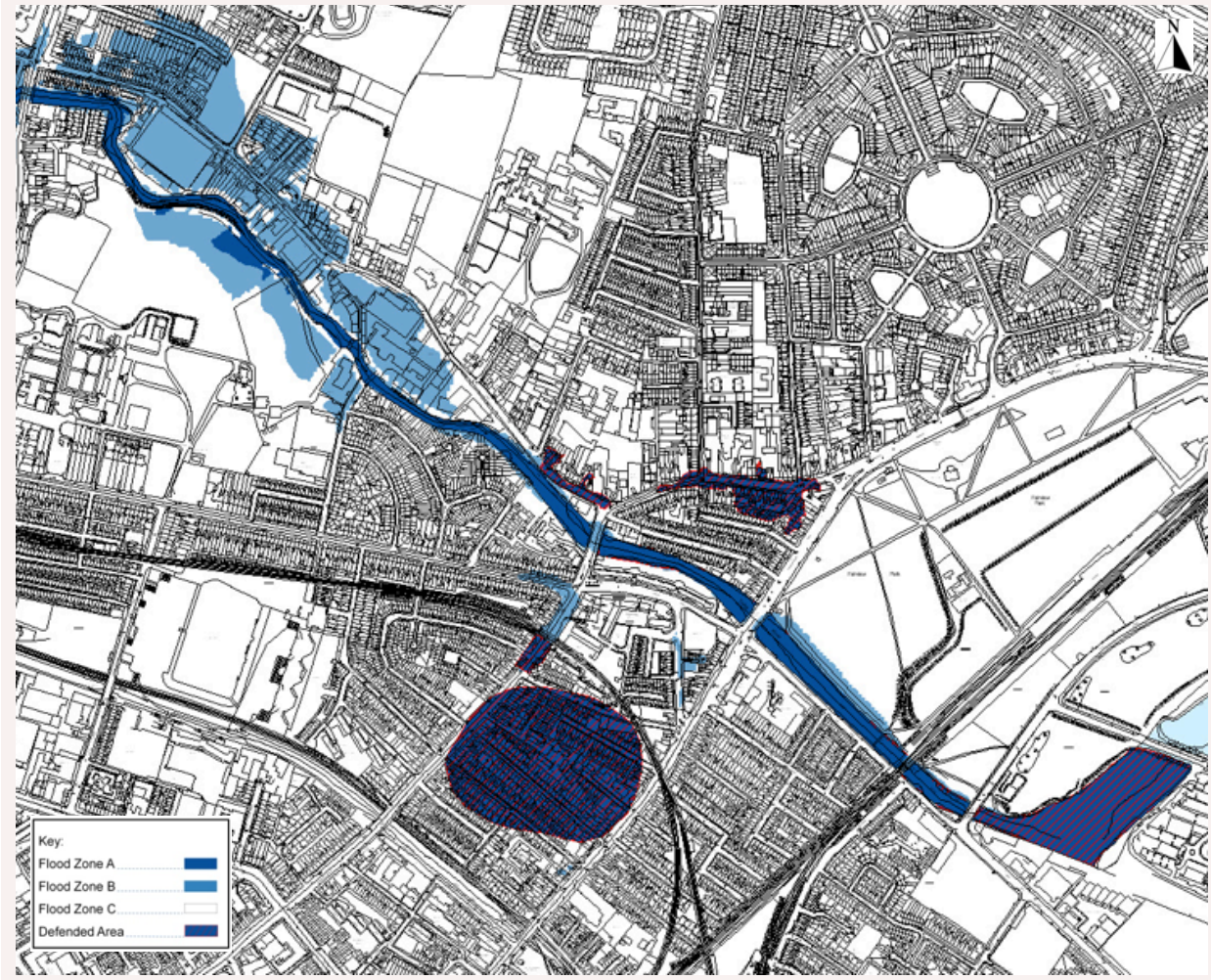
(iv) **Will be essential in achieving compact and sustainable urban growth**
Answer: Yes: This area is essential in achieving the compact and sustainable growth of the City. The area indicated in the Flood Cell above forms part of the Naas Road Local Area Plan. This Plan was adopted in 2013, and as part of this a Strategic Flood Risk Assessment was included. This is one of the Areas identified to deliver the Core Strategy.

(v) **There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement**
Answer: There are no suitable alternative lands for the particular uses or development type in areas at lower risk of flooding, within or adjoining the urban settlement. Areas idenitifed as being in Flood Zones A and B are considered essential to achieving a consolidated urban centre and to comply with the NSS and RPG.

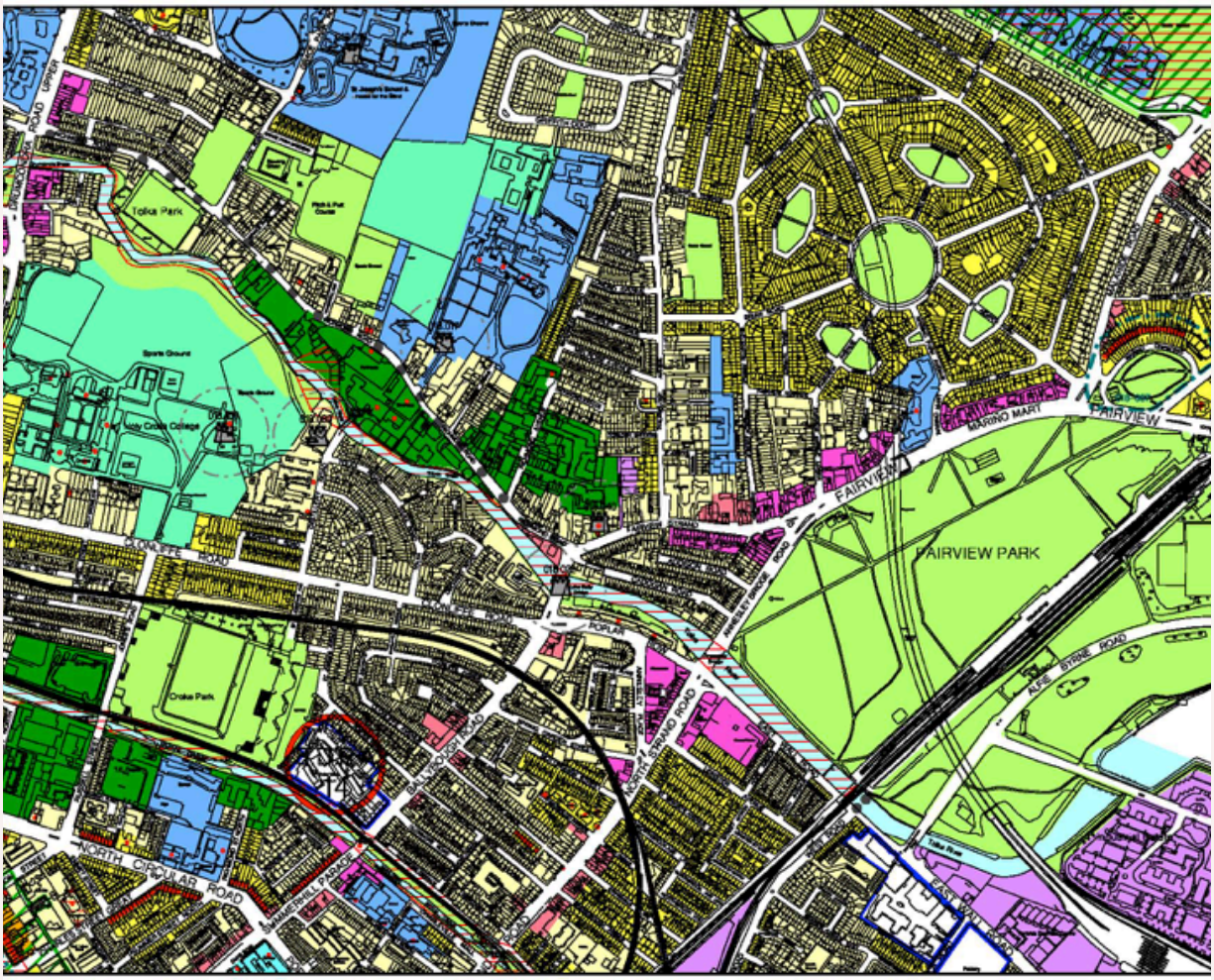
3. **Strategic Flood Risk Assessment For Flood Zones A and B (for defended Flood Zones A and B see section 4.8)**

- Lands which are within Flood Zones A and B and are currently open space should be retained as such and development should not be permitted on greenfield lands.
- Developments within Flood Zone A should be limited to extensions onto existing buildings, or some changes of use. There should be no increase in flood risk where changes of use or basement accommodation are proposed.
- Commercial development within previously developed parts of Flood Zone B may be justified, provided property resilient construction is carried out, and no increase in flood risk elsewhere can be developed.
- Development arising within the Naas Road Local Area Plan should include a detailed flood risk assessment which must demonstrate that risks through the catchment will not be increased. The sequential approach should be applied through site master planning and should avoid encroachment onto, or loss of, the flood plain.

Site: 20 Tolka: Dublin Port to Drumcondra Bridge



Site: 20 Tolka: Dublin Port to Drumcondra Bridge



Dublin City Council Development Plan 2016–2022 (zoning map key at back of tables)

Site Description	The area on the Tolka Estuary goes from the Dublin Port to Drumcondra Bridge. It crosses under Alfie Byrne Road, the Dublin – Belfast Railway line and Annesley Bridge. It is adjacent to East Wall Road from Alfie Byrne Road, the western end of Fairview park, Poplar Row, Cadogan Road, Luke Kelly Bridge, Orchard Road, Tolka Road, Distillery Road and Bridge. It is also adjacent to Richmond Road, Tolka Park, the Arch Bishop's House and Cian Park. It is currently tidal to approximately 100m below Drumcondra bridge. Development in this area is a mixture of high and low density commercial and residential with infill development of both. There are a number of parks beside the Tolka River which are natural flood plains.
Benefitting from Defences (flood relief scheme works)	Flood defences incorporating 200-year tide level, plus 300mm freeboard, plus allowance for fluvial surcharge at high tide have been constructed from East Wall Road to Drumcondra Bridge. The old Distillery Bridge was removed and a new one was put in at a higher level. These defences incorporate the latest design and together with a flood gate at the pedestrian bridge on East Wall Road to Fairview Park provide the statutory level of protection.
Sensitivity to Climate Change	Significant, particularly where likely sea level rise exceeds the height of existing defences.

Site: 20 Tolka: Dublin Port to Drumcondra Bridge	
Residual Risk	An appropriate assessment of residual risk of defence failure should be carried out. A structural inspection of all new defences is carried out each year.
Historical Flooding	The flood maps attached are consistent with previous flooding of this section of the River Tolka in 1954 and 2002. The highest recorded tide (3rd January 2014) was contained by the new flood defences.
Storm (surface) water	All storm (surface) water in this area needs to be carefully managed and provision made for significant rainfall events during high tides. A five year high tide event should be assumed during a 100-year rainfall event. Should development be permitted, best practice with regard to storm (surface) water management should be implemented across the development area, to limit storm (surface) water runoff to current values. Separation of storm (surface) water and foul sewage flows should be carried out where possible. All Developments shall have regard to the Pluvial Flood Maps in their Site Specific Flood Risk Assessment, see Flood ResilienCity Project, Volume 2 City Wide Pluvial Flood Risk Assessment at http://www.dublincity.ie/main-menu-services-water-waste-and-environment-drains-sewers-and-waste-water/flood-prevention-plans

Commentary on Flood Risk:
The flood extents indicate flow paths generally coming directly out of the tidal region. These can be compounded with local pluvial flooding if heavy rainfall coincides with a high tide. Wave action is not deemed significant in this section of the Tolka Estuary.

The flood maps were produced based on the OPW CFRAM Study and checked against historic flooding in the area.

Development Options:
High density Commercial and Residential development (some infill) would be a natural extension of existing development.

Justification Test for Development Plans

1. Section 1 is covered elsewhere in this SFRA Justifying all of Dublin City

2. The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:

(i) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement
Answer: Yes: This area is an established residential part of Dublin City. The River flows from Drumcondra Bridge through the Tolka Estuary to Dublin Port. It crosses under Alfie Byrne Road, Dublin – Belfast Railway Line and Annesley Bridge. It flows adjacent to East Wall Road from Alfie Byrne Road, the western end of Fairview Park, Poplar Row, Cadogan Road, Luke Kelly Bridge, Orchard Road, Tolka Road, Distillery Road and Bridge. It is also adjacent to Richmond Road, Tolka Park, the Arch Bishop's House and Cian Park. The area is essential for the expansion of Dublin City and comprises a mixture of high and low density Commercial and Residential with infill development of both. There are a number of parks which are natural flood plains also in this area.

Site: 20 Tolka: Dublin Port to Drumcondra Bridge

(ii) **Comprises significant previously developed and/or under-utilised lands**
Answer: Most of the lands within Flood Zone A and B are already built up or comprise of brownfield sites. The River also flows through a number of parks which act as natural flood plains.

(iii) **Is within or adjoining the core of an established or designated urban settlement**
Answer: Yes: The lands form part of an established suburb of the City.

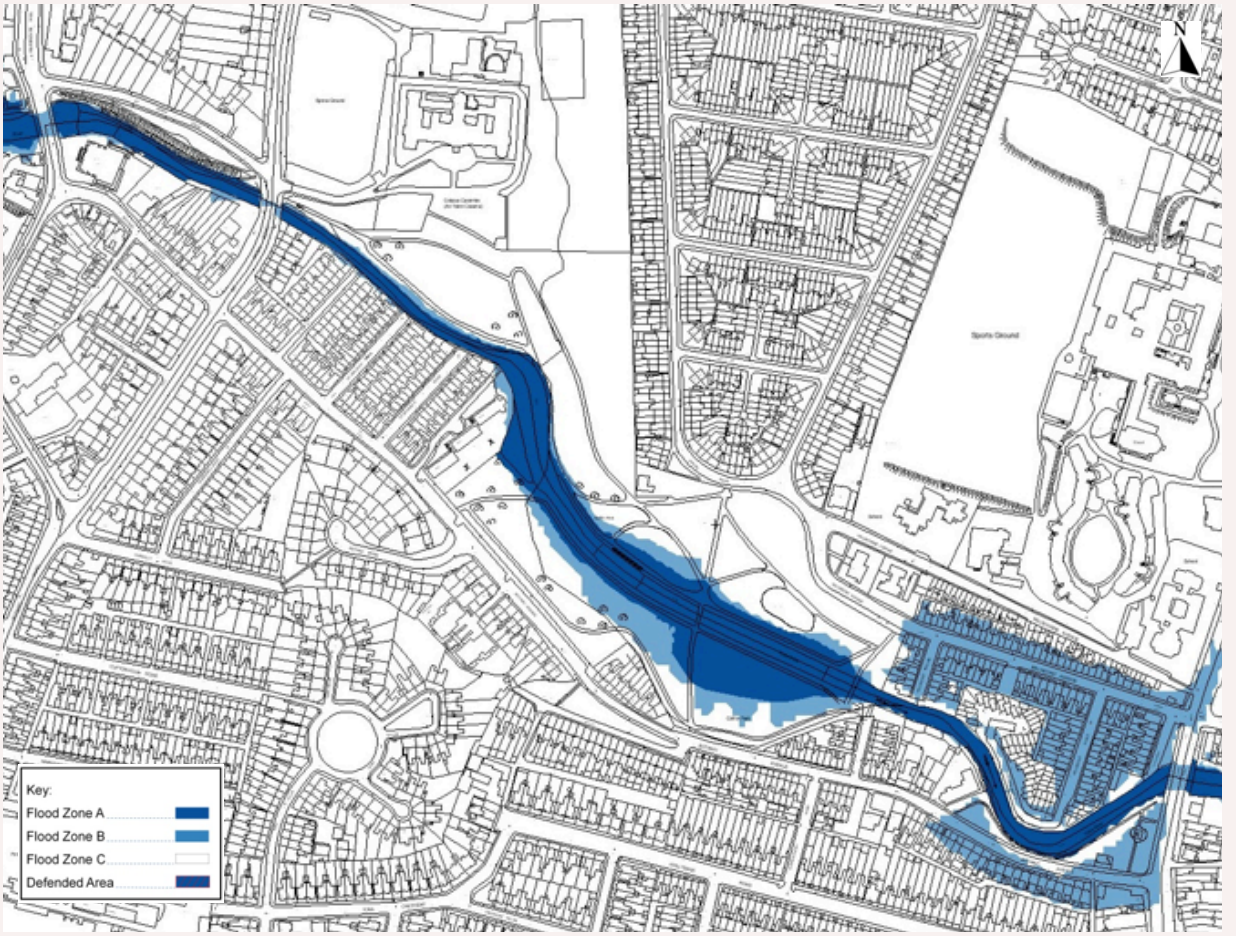
(iv) **Will be essential in achieving compact and sustainable urban growth**
Answer: Yes: (see response to (iii) above)

(v) **There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement.**
Answer: There are no suitable alternative lands for the particular uses or development type in areas at lower risk of flooding, within or adjoining the urban settlement. Areas idenitifed as being in Flood Zones A and B are considered essential to achieving a consolidated urban centre and to comply with the NSS and RPG.

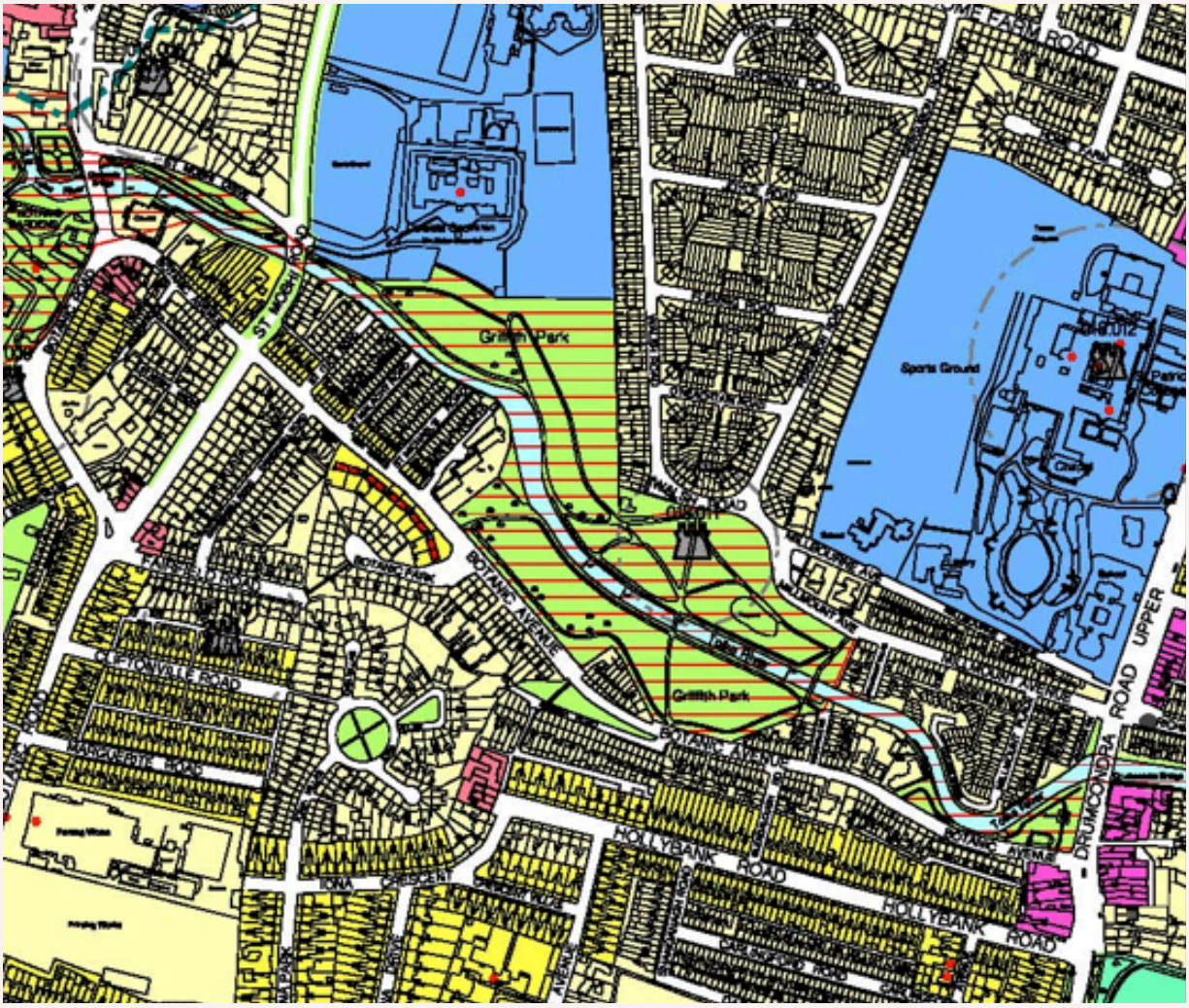
3. **Strategic Flood Risk Assessment for Flood Zones A and B (for defended Flood Zones A and B see section 4.8)**

- Areas of open space within Flood Zones A and B must be preserved as they supplement the flood defences to provide protection.
- Development behind flood defences should proceed in line with the general recommendations flood assessment and management in this SFRA with particular reference to section 4.8.

Site: 21. Tolka: Drumcondra Bridge to St. Mobhi Road



Site: 21. Tolka: Drumcondra Bridge to St. Mobhi Road



Dublin City Council Development Plan 2016–2022 (zoning map key at back of tables)

Site Description	This area on the Tolka River catchment goes from Drumcondra Bridge to St. Mobhi Road. It runs adjacent to Botanic Avenue, Millmount Avenue, Terrace & Place, St. Ita's Road, St. Michael's Road, St. Malachi's Road and Griffith Park. There is no tidal influence on this length of the river. Development in this area is a mixture of low density Residential and Commercial with infill development of both. Griffith Park is a natural flood plain.
Benefitting from Defences (flood relief scheme works)	Flood defences incorporating 100-year river level, plus 300mm freeboard (500mm for embankments), have been constructed over this section from 2003 to 2006. The lower bridge in Griffith Park was removed and a new one was put in at a higher level. These defences incorporate the latest design and provide the statutory level of protection. A new pumping station has been constructed near the junction of Drumcondra Road and Botanic Avenue to mitigate against pluvial flooding behind the new embankment during high river flows.
Sensitivity to Climate Change	Significant - Particularly where likely sea level rise exceeds the height of the defences.

Site: 21. Tolka: Drumcondra Bridge to St. Mobhi Road	
Residual Risk	An appropriate assessment of residual risk of defence failure should be carried out. A structural inspection of all new defences is carried out each year.
Historical Flooding	The flood maps attached are consistent with previous flooding of this section of the River Tolka in 1954 and 2002. Large fluvial floods since new flood defence construction in 2003–2006 have passed without significant incident.
Storm (surface) water	All storm (surface) water in this area needs to be carefully managed and provision made for significant rainfall events during high river flows. Should development be permitted, best practice with regard to storm (surface) water management should be implemented across the development area, to limit storm (surface) water runoff to current values. Separation of storm (surface) water and foul sewage flows should be carried out where possible. All Developments shall have regard to the Pluvial Flood Maps in their Site Specific Flood Risk Assessment, see Flood ResilienCity Project, Volume 2 City Wide Pluvial Flood Risk Assessment at http://www.dublincity.ie/main-menu-services-water-waste-and-environment-drains-sewers-and-waste-water/flood-prevention-plans

Commentary on Flood Risk:
The flood extents indicate flow paths generally coming directly out of the river channel travelling down Botanic Avenue and Millmount Avenue before finding their way back into the river channel. These can be compounded with local pluvial flooding if heavy rainfall coincides with high river flows. This risk has been moderated by the presence of the flood defences.

The flood maps were produced based on the Greater Dublin Strategic Drainage Study and have been verified by the OPW CFRAM Study team as being largely consistent with current methodologies and they have been checked against historic flooding in the area.

Development Options:
Commercial and Residential development (some infill) would be a natural extension of existing development.

Justification Test for Development Plans

1. Section 1 is covered elsewhere in this SFRA justifying all of Dublin City

2. The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:

(i) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement
Answer: Yes: This area is an established residential suburb of Dublin City. In this stretch the Tolka River flows from Drumcondra Bridge to St. Mobhi Road. It runs adjacent to Botanic Avenue, Millmount Avenue, Terrace & Place, St. Ita's, St. Michael's, St. Malachi's Road and Griffith Park. Development in this area is a mixture of low density Residential and Commercial.

(ii) Comprises significant previously developed and/or under-utilised lands
Answer: Most of the lands within Flood Zone A and B are already built up or comprise of brownfield sites. The River also flows through Griffith Park which is a natural flood plain.

(iii) Is within or adjoining the core of an established or designated urban settlement
Answer: Yes: The lands form part of an established suburb of the City.

Site: 21. Tolka: Drumcondra Bridge to St. Mobhi Road

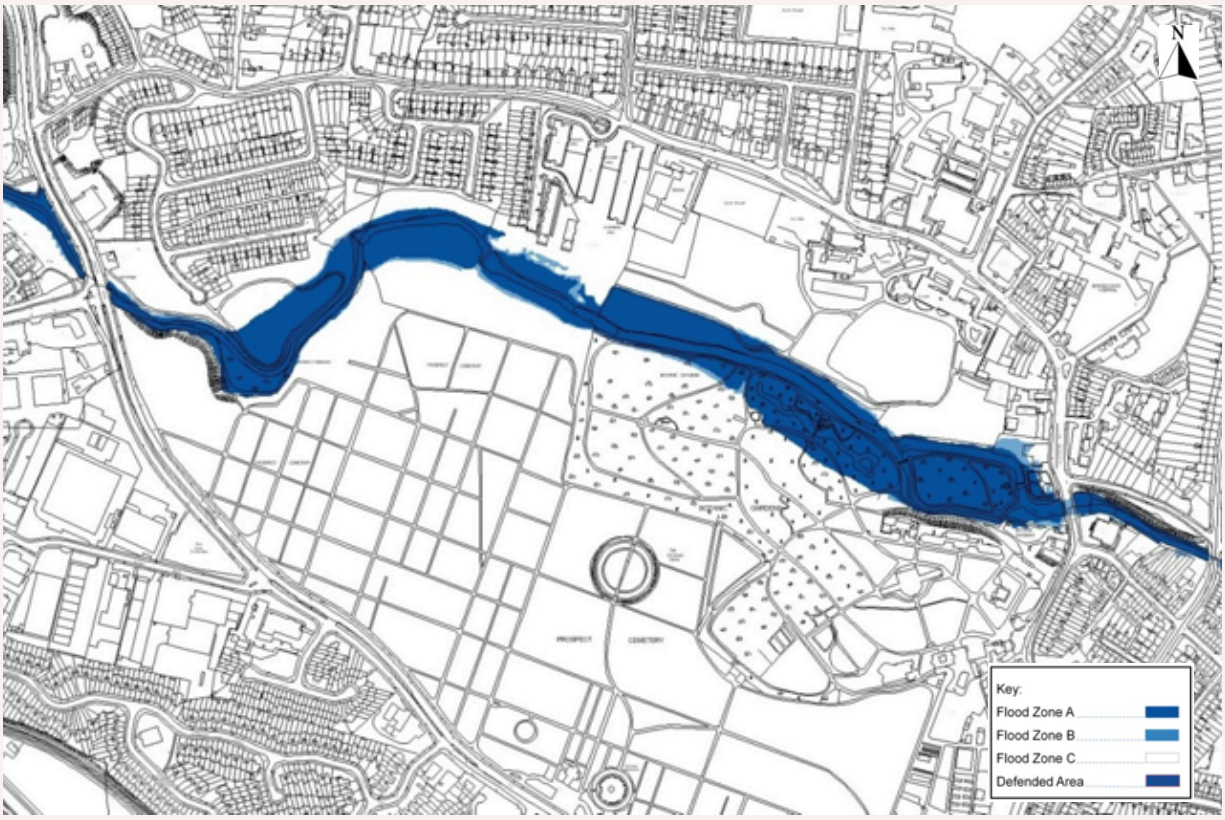
(iv) **Will be essential in achieving compact and sustainable urban growth**
Answer: Yes: (see response to (iii) above)

(v) **There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement**
Answer: There are no suitable alternative lands for the particular uses or development type in areas at lower risk of flooding, within or adjoining the urban settlement. Areas idenitifed as being in Flood Zones A and B are considered essential to achieving a consolidated urban centre and to comply with the NSS and RPG.

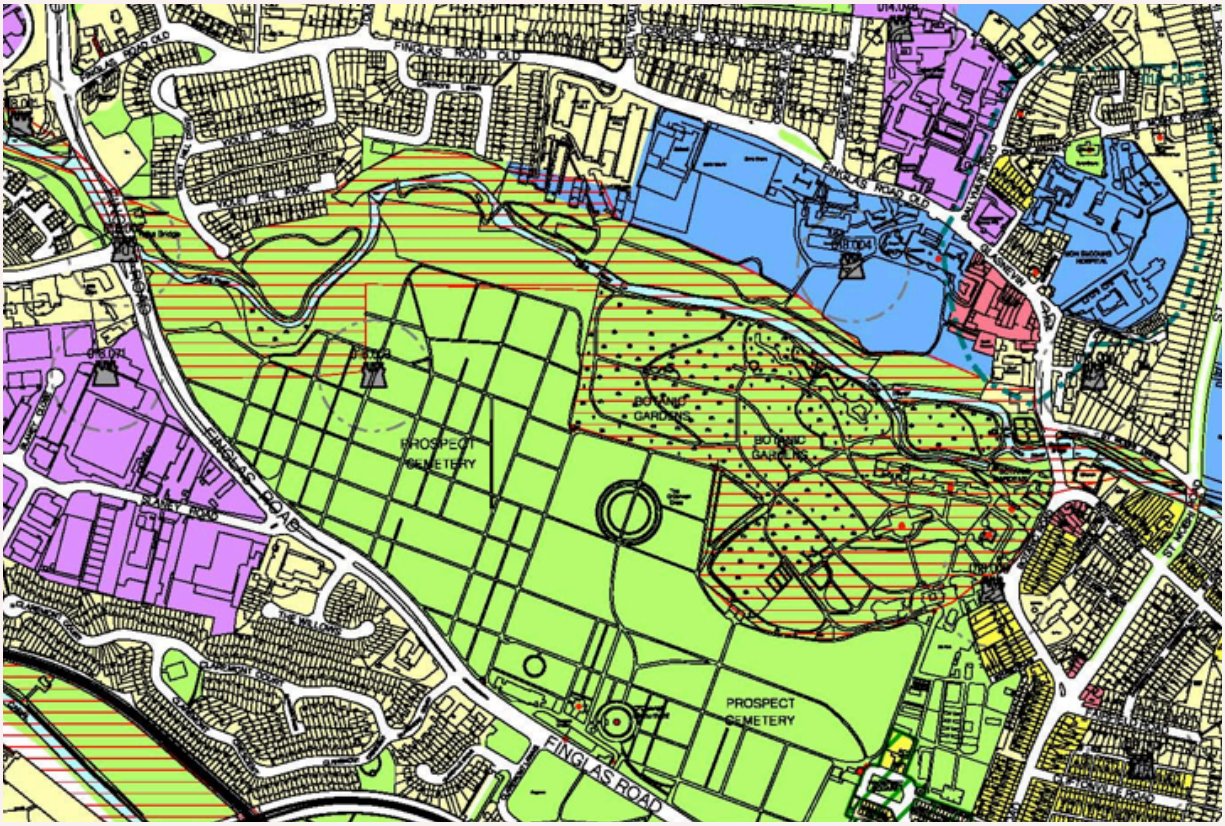
3. Strategic Flood Risk Assessment for Flood Zones A and B (for defended Flood Zones A and B see section 4.8)

- Areas of open space within Flood Zones A and B must be preserved as they supplement the flood defences to provide protection.
- In this area, the development is likely to take the form of extensions to existing development.
- Development behind defences should proceed in line with the general recommendations for flood assessment and management in this SFRA with reference to section 4.8.

Site: 22. Tolka: St. Mobhi Road – Finglas Road



Site: 22. Tolka: St. Mobhi Road – Finglas Road



Dublin City Council Development Plan 2016–2022 (zoning map key at back of tables)

Site Description	The area on the Tolka River goes from St. Mobhi Road Bridge to Glasnevin Road Bridge to Finglas Road Bridge. It runs adjacent to Botanic Avenue, St. Mobhi Drive, through the Botanic Gardens and Prospect Cemetery. Development in this area is a mixture of low density Residential and Commercial with infill development of both. It includes a church and a school. The Botanic Gardens is a natural flood plain.
Benefitting from Defences (flood relief scheme works)	The open space through the Botanic Gardens provides a natural flood plain upstream of the man-made defences.
Sensitivity to Climate Change	Low – there is little difference between Flood Zone A and B, and is within areas of open space.
Residual Risk	Not applicable
Historical Flooding	The flood maps attached are consistent with previous flooding of this section of the River Tolka in 1954 and 2002.
Storm (surface) water	Run off from the parkland is natural and should be retained as such. All Developments shall have regard to the Pluvial Flood Maps in their Site Specific Flood Risk Assessment, see Flood ResilienCity Project, Volume 2 City Wide Pluvial Flood Risk Assessment at http://www.dublincity.ie/main-menu-services-water-waste-and-environment-drains-sewers-and-waste-water/flood-prevention-plans

Site: 22. Tolka: St. Mobhi Road – Finglas Road

Commentary on Flood Risk:

The flood extents indicate flow paths generally coming directly out of the river channel travelling down Botanic Avenue before finding their way back into the river channel at its lower end. These can be compounded with local pluvial flooding if heavy rainfall coincides with high river flows.

The flood maps were produced based on the Greater Dublin Strategic Drainage Study and have been verified by the OPW CFRAM Study team as being largely consistent with current methodologies and they have been checked against historic flooding in the area.

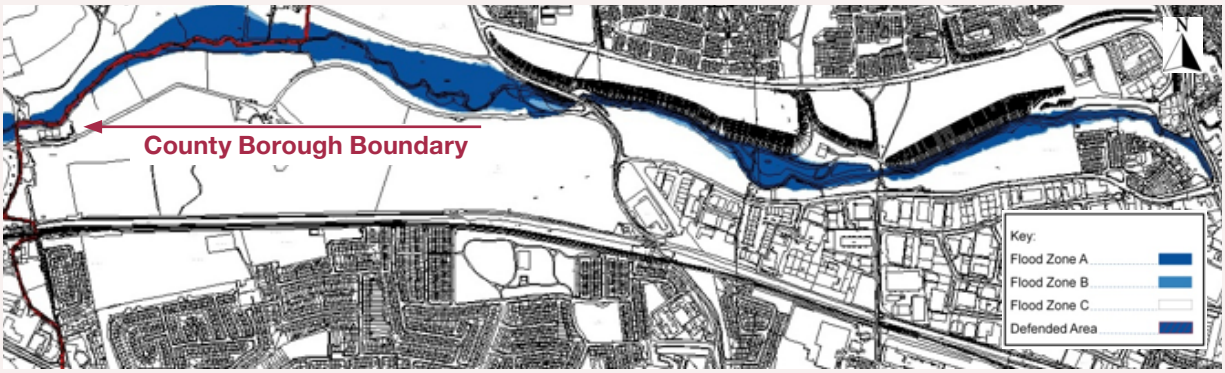
Development Options:

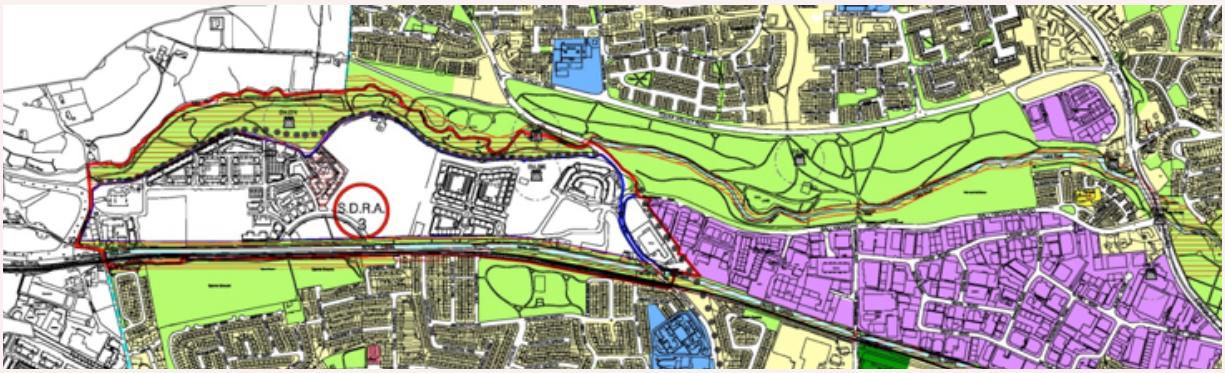
The flood cells in this area are all in green spaces which must be retained to maintain reduced flood risk elsewhere. Only water compatible developments will be allowed.

Justification Test for Development Plans

- This area is an established residential suburb of Dublin City. The River Tolka in this section flows from St. Mobhi Road Bridge to Glasnevin Road Bridge to Finglas Road Bridge. It runs adjacent to Botanic Avenue, St. Mobhi Drive, through the Botanic Gardens and Prospect Cemetery. Development in this area is a mixture of low density Residential and Commercial with infill development of both. The area includes a church and a school. However, the area within Flood Zones A and B is within the Botanic Gardens (water compatible) so the Justification Test is not applicable.
- The floodplain lands should be retained as their current water compatible uses.

Site: 23. Tolka: Finglas Road – County Borough Boundary





Dublin City Council Development Plan 2016–2022 (zoning map key at back of tables)

Site Description	This area on the Tolka River goes from Finglas Road Bridge through parkland to the boundary. It runs adjacent to Ballyboggan Road and Rivermount. Development in this area is parkland with some residential to the south. The park is a natural flood plain.
Benefitting from Defences (flood relief scheme works)	None. The park provides a natural flood plain.
Sensitivity to Climate Change	Low – there is little difference between Flood Zones A and B, and is within areas of open space.
Residual Risk	Not applicable
Historical Flooding	The flood maps attached are consistent with previous flooding of this section of the River Tolka in 1954 and 2002.
Storm (surface) water	Run off from the parkland is natural and should be retained as such. All Developments shall have regard to the Pluvial Flood Maps in their Site Specific Flood Risk Assessment, see Flood ResilienCity Project, Volume 2 City Wide Pluvial Flood Risk Assessment at http://www.dublincity.ie/main-menu-services-water-waste-and-environment-drains-sewers-and-waste-water/flood-prevention-plans

Site: 23. Tolka: Finglas Road – County Borough Boundary

Commentary on Flood Risk:

The flood extents indicate flow paths generally coming directly out of the river channel and finding their way back into the river channel slightly downstream. The Finglas Stream flows into the Tolka River near Finglas Road.

The flood maps were produced based on the Greater Dublin Strategic Drainage Study and have been verified by the OPW CFRAM Study team as being largely consistent with current methodologies and they have been checked against historic flooding in the area.

Development Options:

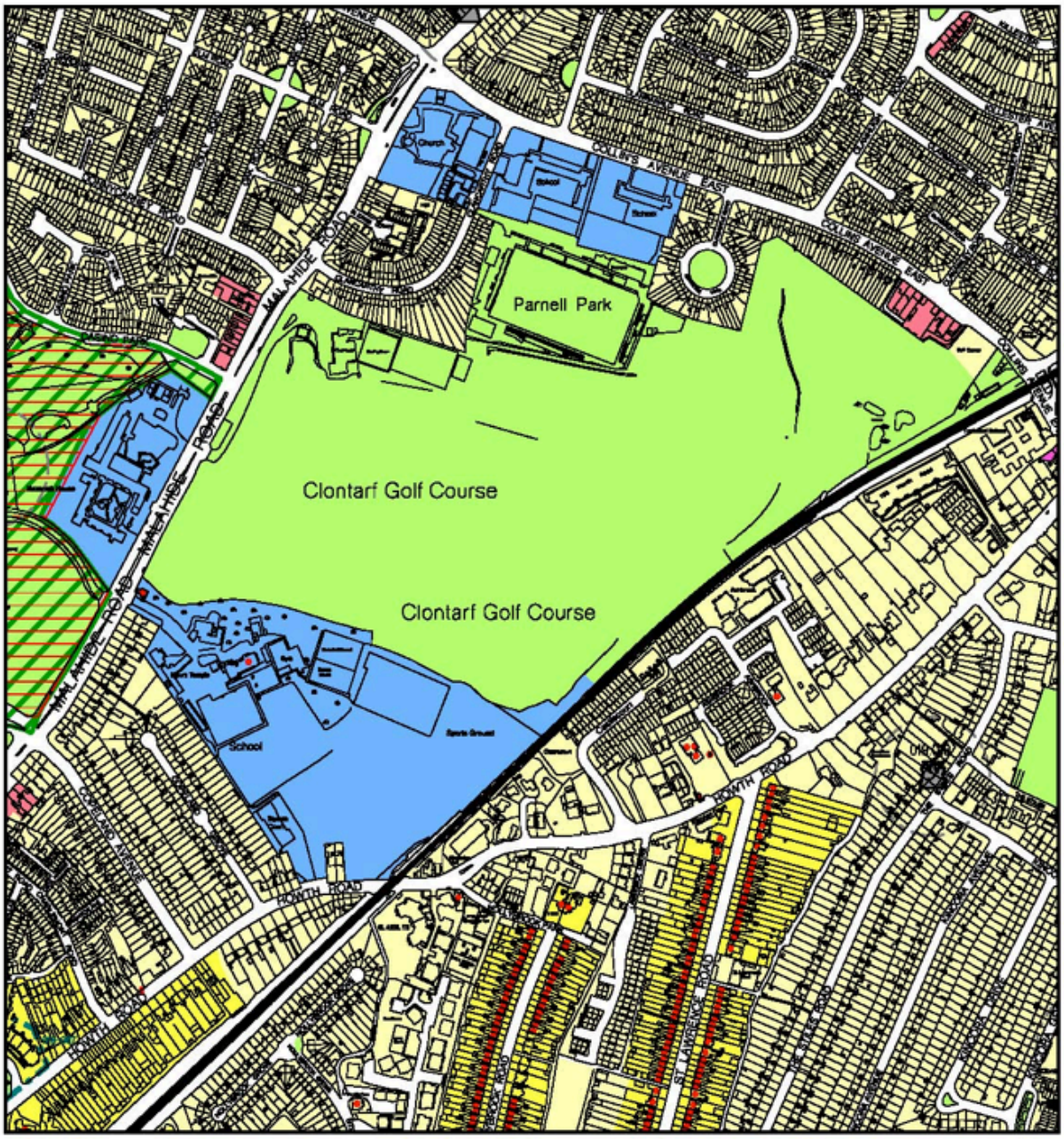
Most of the flood cells are in parkland flood plains which must be retained, only water compatible development should be allowed here. Commercial and Residential development (some infill) would be a natural extension of existing development just upstream of Finglas Road.

Justification Test for Development Plans

- Part of the lands to the south of the River Tolka form part of the Ashtown-Pelletstown Local Area Plan, 2014. Pelletstown has also been designated as a Strategic Development and Regeneration Area (See Section Chapter 15 of the Written Statement section 15.1.1.3 SDRA 3). To the east of the LAP lands is the Dublin Industrial estate. This area is considered essential for the future expansion of the City. However, the area within Flood Zones A and B is within park land (water compatible) so the Justification Test is not applicable.
- The floodplain lands should be retained as their current water compatible uses.

Site: 24. Wad: Clontarf Road to Collins Avenue East

Site: 24. Wad: Clontarf Road to Collins Avenue East



Dublin City Council Development Plan 2016–2022 (zoning map key at back of tables)

Site Description	The area on the culverted Wad River goes from Collins Avenue East through the grounds of a primary school, across Clanmoyle Road, into Clontarf Golf Club, under the Howth Road, Glaslyn, Brooklawn, across the Clontarf Road and into the Port Area 200m east of Alfie Byrne Road. There is a Garda Station close to the line of the Wad south of Brooklawn. Development in this area is a mixture of high density Residential with some Commercial and infill development of both.
Benefitting from Defences (flood relief scheme works)	New flood defences have been installed in the form of a storage pond in Clontarf Golf Club. These come into operation even if penstocks fail to operate.

Site: 24. Wad: Clontarf Road to Collins Avenue East	
Sensitivity to Climate Change	Slight to moderate - new flood defences will take a 20% increase in river flows.
Residual Risk	Failure of the new drainage system (including the new flood defences) is unlikely as it is in the form of a pond rather than walls or embankment. Climate change causing an increase in flows greater than 20% will cause further flooding. A structural inspection of the overflow from Clanmoyle Road to the storage pond in the Clontarf Golf Club will be carried out each year. Protected areas are shown hatched, which is all of Zone A from Clanmoyle downstream.
Historical Flooding	The flood maps attached are consistent with previous flooding of this section of the River Wad.
Storm (surface) water	All storm (surface) water in this area needs to be carefully managed and provision made for significant rainfall events during high river flows. Should development be permitted, best practice with regard to storm (surface) water management should be implemented across the development area, to limit storm (surface) water runoff to current values. Separation of storm (surface) water and foul sewage flows should be carried out where possible. All Developments shall have regard to the Pluvial Flood Maps in their Site Specific Flood Risk Assessment, see Flood ResilienCity Project, Volume 2 City Wide Pluvial Flood Risk Assessment at http://www.dublincity.ie/main-menu-services-water-waste-and-environment-drains-sewers-and-waste-water/flood-prevention-plans

Commentary on Flood Risk:
The flood extents indicate flow paths generally coming directly out of the river culvert through manholes and gully grids. These can be compounded with local pluvial flooding if heavy rainfall coincides with high river culvert flows. The flood maps were produced based on the Wad Catchment Flood Study and they have been checked against historic flooding in the area.

It should be noted that information in relation to the extent of Flood Zone B is not available for this river reach. Whilst flood risk is generally limited, it is important that the impact of a more extreme event is investigated through a Site Specific Flood Risk Assessment.

Development Options:
Residential and small scale commercial/retail development in the form of infill would be a natural extension of existing development.

Justification Test for Development Plans

1. Section 1 is covered elsewhere in this SFRA justifying all of Dublin City

2. The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:

(i) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement
Answer: Yes: This area is an established residential suburb of Dublin City. The Wad River in this section which is culverted goes from Collins Avenue East through the grounds of a primary school, across Clanmoyle Road, into Clontarf Golf Club, under the Howth Road, Glaslyn, Brooklawn, across the Clontarf Road and into the Port Area 200m east of Alfie Byrne Road. This area is essential for the future expansion of the north east of the City.

Site: 24. Wad: Clontarf Road to Collins Avenue East

(ii) **Comprises significant previously developed and/or under-utilised lands**
Answer: Most of the lands within Flood Zones A and B are already built up or comprise of brownfield sites. Some of the lands comprise the Clontarf Golf Club, and school lands.

(iii) **Is within or adjoining the core of an established or designated urban settlement**
Answer: Yes: The lands form part of an established suburb of the City.

(iv) **Will be essential in achieving compact and sustainable urban growth**
Answer: Yes: (see response to (iii) above)

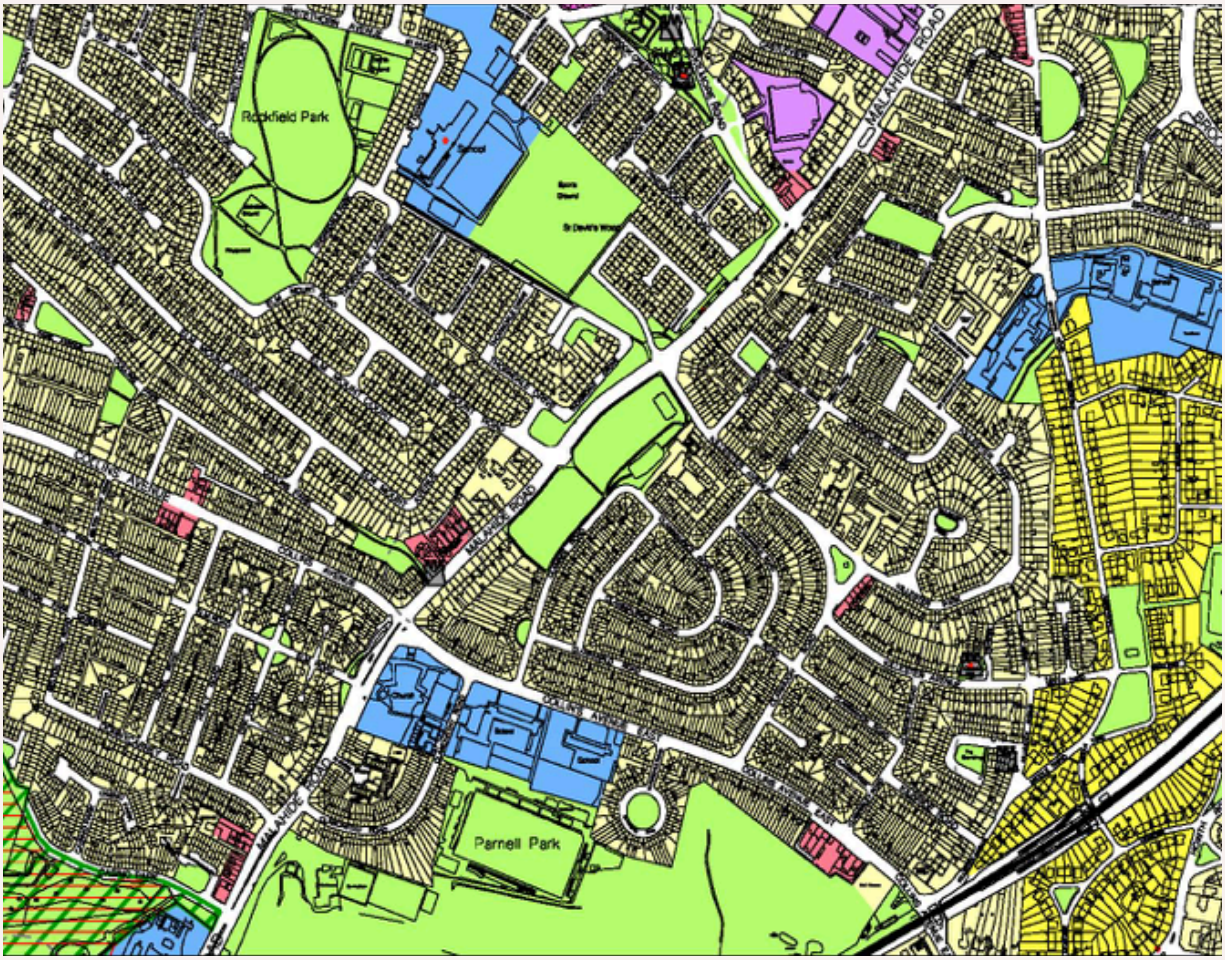
(v) **There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement**
Answer: There are no suitable alternative lands for the particular uses or development type in areas at lower risk of flooding, within or adjoining the urban settlement. Areas idenitifed as being in Flood Zones A and B are considered essential to achieving a consolidated urban centre and to comply with the NSS and RPG.

3. **Strategic Flood Risk Assessment for Flood Zones A and B (for defended Flood Zones A and B see section 4.8)**

- Area of open space in floodplains and storage areas must be retained.
- Flood risk is generally limited in this area, and development opportunities are likely to involve redevelopment and small extensions which should follow the requirements for flood risk assessment detailed in this SFRA with particular reference to section 4.8.

Site: 25. Wad: Collins Avenue East to Collins Park

Site: 25. Wad: Collins Avenue East to Collins Park



Dublin City Council Development Plan 2016–2022 (zoning map key at back of tables)

Site Description	The area on the culverted Wad River goes from Collins Park, crosses the Malahide Road near the TOPAZ garage and onto Collins Avenue East. Development in this area is a mixture of Residential with some Commercial with infill development of both.
Benefitting from Defences (flood relief scheme works)	There are no flood defences installed in this area, but there is a downstream storage area in Clontarf Golf Club.
Sensitivity to Climate Change	High, particularly if the capacity of the culvert is exceeded more frequently.
Residual Risk	There are no flood defences to overtop, but blockage of the culvert could lead to increased flood risk, and new risk to areas shown within Flood Zone C currently.
Historical Flooding	The flood maps attached are consistent with previous flooding of this section of the River Wad.

Site: 25. Wad: Collins Avenue East to Collins Park	
Storm (surface) water	All storm (surface) water in this area needs to be carefully managed and provision made for significant rainfall events during high river flows. Should development be permitted, best practice with regard to storm (surface) water management should be implemented across the development area, to limit storm (surface) water runoff to current values. Separation of and foul sewage flows should be carried out where possible. All Developments shall have regard to the pluvial Flood Maps in their Site Specific Flood Risk Assessment, see Flood ResilienCity Project, Volume 2 City Wide Pluvial Flood Risk Assessment at http://www.dublincity.ie/main-menu-services-water-waste-and-environment-drains-sewers-and-waste-water/flood-prevention-plans

Storm (surface) Water Commentary on Flood Risk:
The flood extents indicate flow paths generally coming directly out of the river culvert through manholes and gully grids. These can be compounded with local pluvial flooding if heavy rainfall coincides with high river culvert flows. The flood maps were produced based on the Wad Catchment Flood Study and they have been checked against historic flooding in the area.

It should be noted that information in relation to the extent of Flood Zone B is not available for this river reach. Whilst flood risk is generally limited, it is important that the impact of a more extreme event is investigated through a Site Specific Flood Risk Assessment.

Development Options:
Residential with some commercial development (some infill) would be a natural extension of existing development.

Justification Test for Development Plans

1. Section 1 is covered elsewhere in this SFRA Justifying all of Dublin City

2. The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:

(i) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement
Answer: Yes: This area is an established residential suburb of Dublin City. This stretch of the culverted Wad River goes from Collins Park, crosses the Malahide Road near the TOPAZ garage and onto Collins Avenue East. Development in this area is a mixture of Residential with some Commercial with infill development of both. This area is essential to facilitate the expansion of the City.

(ii) Comprises significant previously developed and/or under-utilised lands
Answer: Most of the lands within Flood Zones A and B are already built up or comprise of brownfield sites.

(iii) Is within or adjoining the core of an established or designated urban settlement
Answer: Yes: The lands form part of an established suburb of the City.

(iv) Will be essential in achieving compact and sustainable urban growth
Answer: Yes: (see response to (iii) above)

Site: 25. Wad: Collins Avenue East to Collins Park

(v) **There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement**
Answer: There are no suitable alternative lands for the particular uses or development type in areas at lower risk of flooding, within or adjoining the urban settlement. Areas idenitifed as being in Flood Zones A and B are considered essential to achieving a consolidated urban centre and to comply with the NSS and RPG.

3. **Strategic Flood Risk Assessment for Flood Zones A and B (for defended Flood Zones A and B see section 4.8)**

- Modelling shows that risks are primarily linked to the development of overland flow paths which progress along roads. FRAs for developments should specifically address this risk, both to ensure flow paths do not become obstructed and to ensure an appropriate standard of flood resilient construction, which could include (where possible) raising finished floor levels.
- Particular attention to the design of any proposed basements should be carried out with full recognition of Dublin City Council Policies and Objectives, and the detail in this SFRA, in this regard.
- Whilst flood risk is generally limited, it is important that the impact of a more extreme event is investigated through a Site Specific Flood Risk Assessment as climate change and Food Zone B have not been modelled as part of the Wad Flood Relief Scheme.

Site: Coastal: 26. Clontarf Alfie Byrne Road to Wooden Bridge

Dublin City Council Development Plan 2016–2022 (zoning map key at back of tables)

Site Description	This area includes the eastern end of Fairview and Clontarf Road from the Malahide Road to the Wooden Bridge. Inland flood risk areas include the culverted Wad River 200m east of Alfie Byrne Road, lower ends of Strandville Road, Hollybrook Road, St. Laurence Road and Seaview Road North as well as the junctions with Oulton road, Belgrove Road and Vernon Avenue, Conquer Hill Road and Kincora Court as per above map. Development in this area is mainly low to medium density residential with some commercial and sports areas.
Benefitting from Defences (flood relief scheme works)	This area is protected by the existing sea wall to a level of 3.1m to 3.2m Malin Head except for the last 250m east of Alfie Byrne Road which apart from rock armour offers no additional protection to the promenade. Some flood defence options are being considered, however if feasible it will be a number of years before they can be implemented. Wave action is a significant element in any flooding of this area.
Sensitivity to Climate Change	Extreme, both for direct tidal inundation and overtopping of sea walls, and through increased and more severe wave action.
Residual Risk	Any proposed developments in the protected areas require residual flood risk from overtopping or other cause to be assessed and mitigated against.
Historical Flooding	The defended flood maps attached are consistent with previous flooding of this section of Clontarf.

Site: Coastal: 26. Clontarf Alfie Byrne Road to Wooden Bridge	
Storm (surface) water	All storm (surface) water in this area needs to be carefully managed and provision made for significant rainfall events during high tides. A one year high tide event should be assumed during a 100-year rainfall event. Should development be permitted, best practice with regard to storm (surface) water management should be implemented across the development area, to limit storm (surface) water runoff to current values. All Developments shall have regard to the Pluvial Flood Maps in their Site Specific Flood Risk Assessment, see Flood ResilienCity Project, Volume 2 City Wide Pluvial Flood Risk Assessment at http://www.dublincity.ie/main-menu-services-water-waste-and-environment-drains-sewers-and-waste-water/flood-prevention-plans

Commentary on Flood Risk:
The flood extents indicate flow paths generally coming directly out of the tidal region by over ground routes. Pluvial rainfall during a high tide can increase flood risk.

The flood maps were produced based on the OPW CFRAM Study and checked against historic flooding in the area.

Development Options:
Residential with some Commercial development (some infill) would be a natural extension of existing development. Existing green areas in floodplains should only be developed with water compatible ventures.

Justification Test for Development Plans

1. Section 1 is covered elsewhere in this SFRA justifying all of Dublin City

2. The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:

(i) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement
Answer: Yes: This area comprises of an established residential suburb of Clontarf. The area includes the eastern end of Fairview and Clontarf Road from the Malahide Road to the Wooden Bridge. This area is essential for the future expansion of the urban settlement as a residential suburb.

(ii) Comprises significant previously developed and/or under-utilised lands
Answer: The area shown in the flood zone is mainly built out; there may be small infill sites or brownfield sites to be redeveloped.

(iii) Is within or adjoining the core of an established or designated urban settlement
Answer: Yes: The area is an established residential area to the north east of Dublin City.

(iv) Will be essential in achieving compact and sustainable urban growth
Answer: Yes: This area is essential in achieving compact and sustainable urban growth.

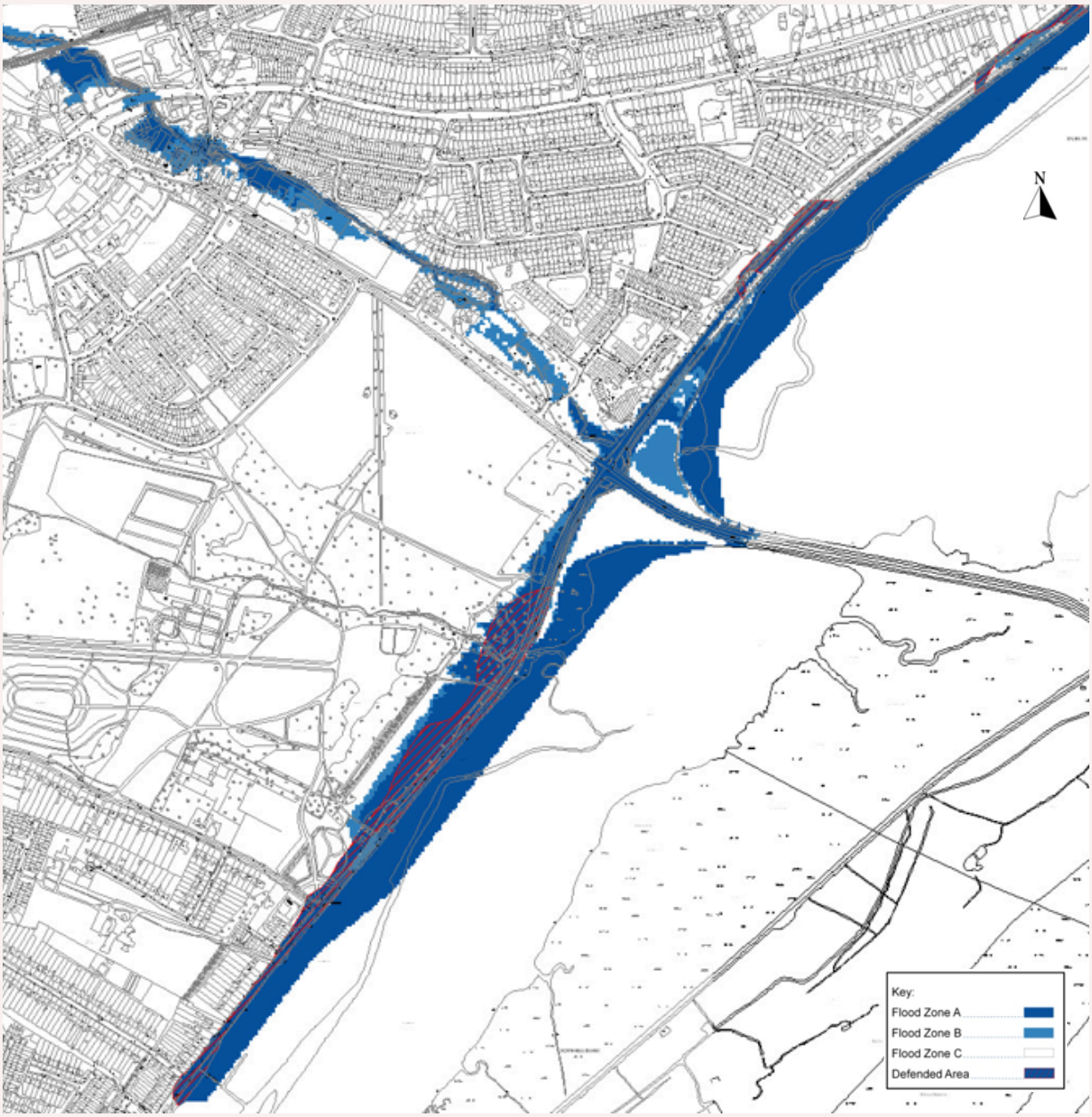
(v) There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement
Answer: There are no suitable alternative lands for the particular uses or development type in areas at lower risk of flooding, within or adjoining the urban settlement. This area is essential for the future expansion of Dublin City.

Site: Coastal: 26. Clontarf Alfie Byrne Road to Wooden Bridge

3. Strategic Flood Risk Assessment for Flood Zones A and B (for defended Flood Zones A and B see section 4.8)

- Residential and small scale commercial/retail development in the form of infill would be a natural extension of existing development.
- Small scale extensions / change of use may be Justified provided:
  - there is no increase in flood risk, which includes no increase in vulnerability of development and no increase in numbers of people within the Flood Zone A or B extent.
  - The residual risk of sea wall overtopping should be assessed, and it should be assumed that direct inundation to the height of the tide will occur.
  - Emergency procedures, both during and for the recovery phase of a tidal event, should be detailed.
- New development (infill) should progress following the guidance in this SFRA, with finished floor levels set at a level which takes into account climate change.
- Large scale new development should either incorporate flood management within the design (through landscaping and ground rising).
- There is no requirement to provide compensatory storage for land raising within the tidal flood risk zone.

Site: 27. Santry River: James Larkin Road to DART Railway and Dollymount Wooden Bridge to Clontarf Road Coastal Zone



Site: 27. Santry River: James Larkin Road to DART Railway and Dollymount Wooden Bridge to Clontarf Road Coastal Zone

Dublin City Council Development Plan 2016–2022 (zoning map key at back of tables)

Site Description	The area is adjacent to Watermill Road, includes Bedford Lodge, Manor House Girls Secondary School, Raheny Village both sides of low point on Main Street, Watermill Court, rear of 407–419 Howth Road, rear of River House, Raheny Shopping Centre. Flood risk areas include green areas adjacent to river and sea which act as flood plains. The Naniken in St. Anne's Park can flood due to fluvial or fluvial plus high tides. The Santry River can have additional flooding during high tides. Development in this area is mainly low to medium density Residential with some Commercial areas close to the river.

Site: 27. Santry River: James Larkin Road to DART Railway and Dollymount Wooden Bridge to Clontarf Road Coastal Zone	
Benefitting from Defences (flood relief scheme works)	There are no formal defences on the Santry River. There is a sea wall and embankment in the green area either side of the Causeway which defends from coastal flooding. Construction of a new sea flood wall to a level of 4.25m Malin Head from the Wooden bridge to the Causeway is currently under construction, with embankment height 4.45m Malin Head in green areas. This should be completed in 2016.
Sensitivity to Climate Change	Significant, particularly along the sea front and on the tidally influenced parts of the Santry River.
Residual Risk	Blockage of existing structures should be reduced by good river maintenance, however the residual risk of this should be considered in developments downstream of Harmonstown Road. There is also a risk of overtopping of the sea wall and embankment, which can be simulated by direct propagation of sea levels inland.
Historical Flooding	The defended flood maps attached are consistent with previous flooding of this section of the Santry River, pre and post new defence works.
Storm (surface) water	All storm (surface) water in this area needs to be carefully managed and provision made for significant rainfall events during high tides. A one year high tide event should be assumed during a 100-year rainfall event. Should development be permitted, best practice with regard to storm (surface) water management should be implemented across the development area and in the catchments of the Naniken and Santry Rivers, to limit storm (surface) water runoff to current values. All Developments shall have regard to the Pluvial Flood Maps in their Site Specific Flood Risk Assessment, see Flood ResilienCity Project, Volume 2 City Wide Pluvial Flood Risk Assessment at http://www.dublincity.ie/main-menu-services-water-waste-and-environment-drains-sewers-and-waste-water/flood-prevention-plans

Commentary on Flood Risk:
The flood extents indicate flow paths generally coming directly out of the river channel by over ground routes and then returning to the river the same way or via the existing drainage network. Tidal inundation occurs through over ground routes or up the Naniken and Santry culverts under James Larkin Road and then out of the rivers. Coastal flooding is directly from the sea flooding parts of James Larkin and Clontarf Roads.

The flood maps were produced based on the OPW CFRAM Study and checked against historic flooding in the area.

Development Options:
Small scale residential/infill development would be the natural extension of existing development. Existing green areas in flood plains should only be developed with water compatible uses consistent with the Z9 zoning.

Site: 27. Santry River: James Larkin Road to DART Railway and Dollymount Wooden Bridge to Clontarf Road Coastal Zone

Justification Test for Development Plans

1. Section 1 is covered elsewhere in this SFRA Justifying all of Dublin City

2. The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:

(i) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement
Answer: Yes: This area is an established built up residential area of the City. Along the Coast to the south there is St. Anne's Park and Bull Island. Along James Larkin Road, there are mainly built up residential sites. Development along the coastal road and lower Santry River is likely to be small infill residential and or extensions onto existing properties. This area is essential to facilitate the expansion of the urban settlement. However, the areas located in coastal Flood Zones A and B are primarily parkland and roadways.

(ii) Comprises significant previously developed and/or under-utilised lands
Answer: The area shown in the fluvial flood zone is mainly built out; there may be small infill sites or brownfield sites to be redeveloped.

(iii) Is within or adjoining the core of an established or designated urban settlement
Answer: Yes: The area is an established residential area to the north east of Dublin City.

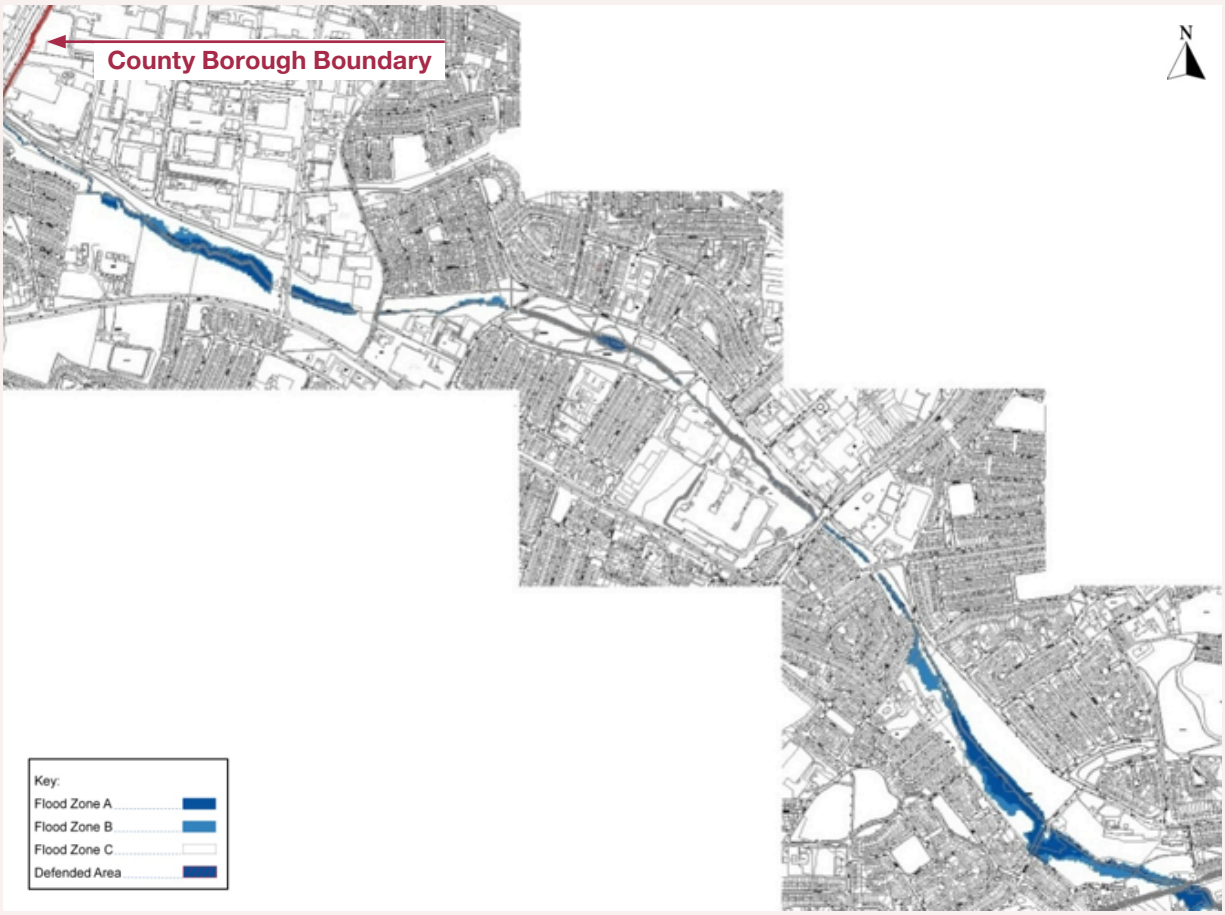
(iv) Will be essential in achieving compact and sustainable urban growth
Answer: Yes: This area is essential in achieving compact and sustainable urban growth.

(v) There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement
Answer: There are no suitable alternative lands for the particular uses or development type in areas at lower risk of flooding, within or adjoining the urban settlement. This area is essential for the future expansion of Dublin City.

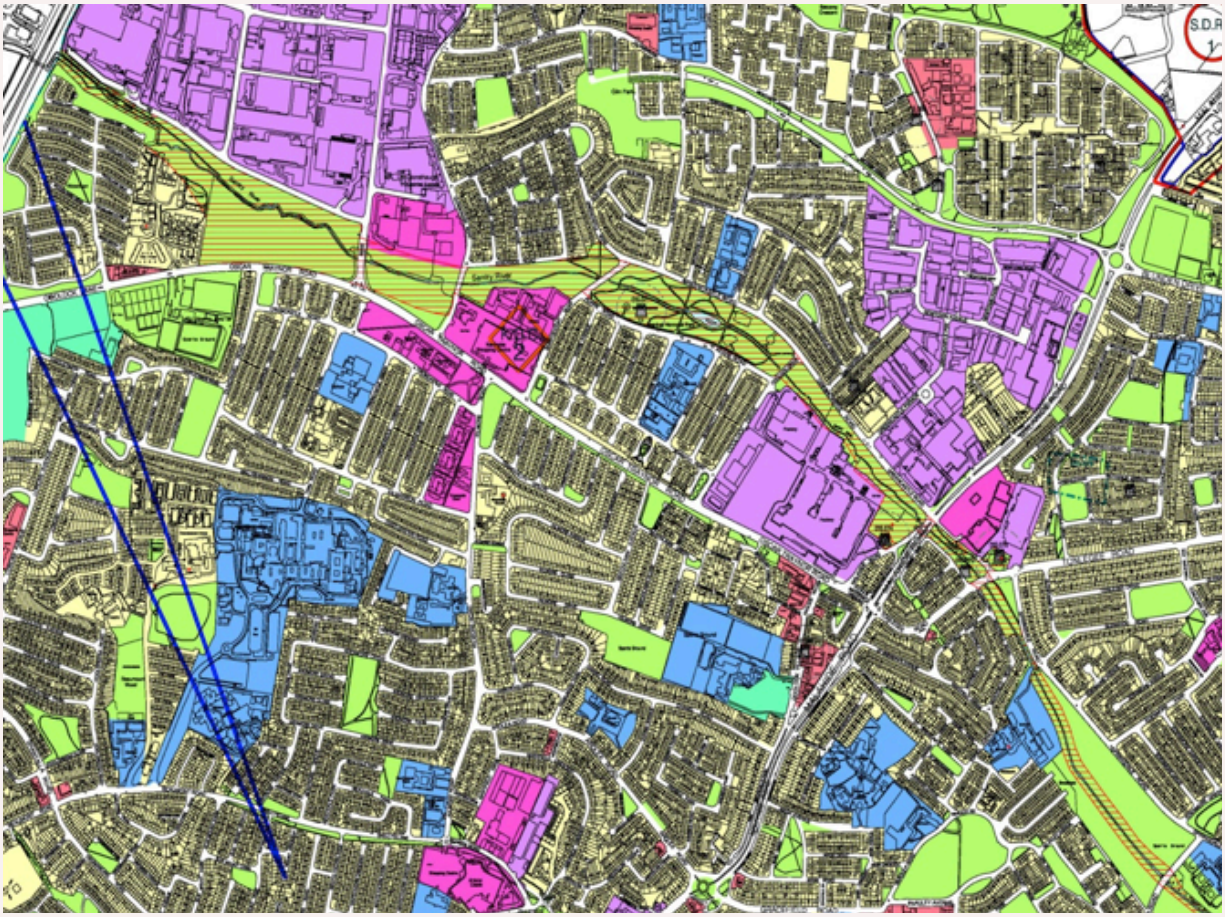
3. Strategic Flood Risk Assessment for Flood Zones A and B (for defended Flood Zones A and B see section 4.8)

- There is no development within the tidal extents currently and existing water compatible uses should be retained, both along the coast and up the Santry River.
- Along the River Santry, development may be progressed according to the guidance in this SFRA. Particular attention should be given to joint probability events, where a high tide coincides with high river flows.
- The impact of sea level rise on development currently within Flood Zone C should be assessed and mitigated.

Site: 28. Santry River: DART Railway - Boundary



Site: 28. Santry River: DART Railway - Boundary



Dublin City Council Development Plan 2016–2022 (zoning map key at back of tables)

Site Description	This area is upstream of the DART line and includes a park with small pedestrian bridge, which is a flood plain to Harmonstown Road which has a flood defence incorporated in it. It runs to the rear of Moatfield Road to Tonlegee Road to the Malahide Road, to Barryscourt Road, Clonshaugh Road and south of Clonshaugh Industrial Estate to M50 boundary. Flood risk areas include green areas adjacent to river which act as flood plains. Development in this area is mainly low to medium density Residential with some Commercial areas close to the river but current flood risk appears to be outside of existing development areas.
Benefitting from Defences (flood relief scheme works)	This area of parkland downstream of Harmonstown Road to the DART line benefits from new flood defences up to the 100-year flood level. The rest of this area apart from bridge restrictions does not benefit from flood defences.
Sensitivity to Climate Change	Generally low – Flood Zones A and B show some difference in extent, but this is largely within open space and parkland so will not impact on existing development.
Residual Risk	There are no defences.
Historical Flooding	The flood maps attached are consistent with previous flooding of this section of the Santry River, pre and post new defence works.

Site: 28. Santry River: DART Railway - Boundary	
Storm (surface) water	At low portions of Moatfield Road high river flows combined with heavy rainfall have caused some backing up of the drainage network and largely pluvial flooding. All storm (surface) water in this area needs to be carefully managed and provision made for significant rainfall events during high river flows. Should development be permitted, best practice with regard to storm (surface) water management should be implemented across the development area and in the catchments of the Naniken and Santry Rivers which have some interlinkage, to limit storm (surface) water runoff at least to current values. All Developments shall have regard to the Pluvial Flood Maps in their Site Specific Flood Risk Assessment, see Flood ResilienCity Project, Volume 2 City Wide Pluvial Flood Risk Assessment at http://www.dublincity.ie/main-menu-services-water-waste-and-environment-drains-sewers-and-waste-water/flood-prevention-plans

Commentary on Flood Risk:

The flood extents indicate flow paths generally coming directly out of the river channel by over ground routes and then returning to the river the same way or via the existing drainage network.
The flood maps were produced based on the OPW CFRAM Study and checked against historic flooding in the area.

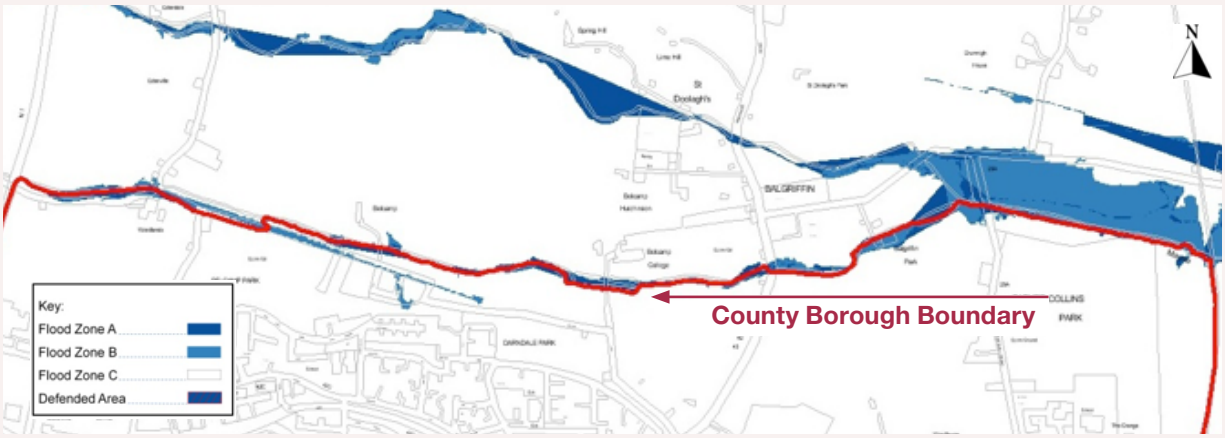
Development Options:

Most of the Flood Zones in this portion of the Santry Catchments are in green areas which should be maintained. Residential with some Commercial development (some infill) would be a natural extension of existing development in this portion of the Santry River.

Justification Test for Development Plans

- The areas located in Flood Zones A and B are primarily parkland, which is water compatible and should be retained. The Justification Test confirms that development in most of these areas is not justified.

Site: 29. Mayne: Dublin Belfast Railway Line – M50



Dublin City Council Development Plan 2016–2022 (zoning map key at back of tables)

Site Description	This area on the Mayne River which forms some of the boundary between Fingal County Council and Dublin City Council goes from the Dublin-Belfast Railway line in Snugborough through Balgriffin Park, south of Belcamp College adjacent to the N32 to Junction 3 on the M50. It has tidal influence roughly to the Malahide Road and fluvial and pluvial west of this. Development in this area is a mixture of mainly Residential and some Commercial with infill development of both. Parkland and sports development also features.
Benefitting from Defences (flood relief scheme works)	There are no formal defences in this area.
Sensitivity to Climate Change	Low – there is little difference in flood extents of Flood Zones A and B.
Residual Risk	Not applicable.
Historical Flooding	The flood maps attached are consistent with previous flooding of this section of the River Mayne.

Site: 29. Mayne: Dublin Belfast Railway Line – M50	
Storm (surface) water	All storm (surface) water in this area needs to be carefully managed and provision made for significant rainfall events during high river flows. Should development be permitted, best practice with regards to storm (surface) water management should be implemented across the development area, to limit storm (surface) water runoff to current values. Separation of storm (surface) water and foul sewage flows should be carried out where possible. All Developments shall have regard to the Pluvial Flood Maps in their Site Specific Flood Risk Assessment, see Flood ResilienCity Project, Volume 2 City Wide Pluvial Flood Risk Assessment at http://www.dublincity.ie/main-menu-services-water-waste-and-environment-drains-sewers-and-waste-water/flood-prevention-plans

Commentary on Flood Risk:

The flood extents indicate flow paths generally coming directly out of the river and re-entering the river downstream either directly or through the drainage network. These can be compounded with local pluvial flooding if heavy rainfall coincides with high river flows and high tides.

The flood maps were produced based on the OPW CFRAM Study for Fingal East Meath Catchments and they have been checked against historic flooding in the area.

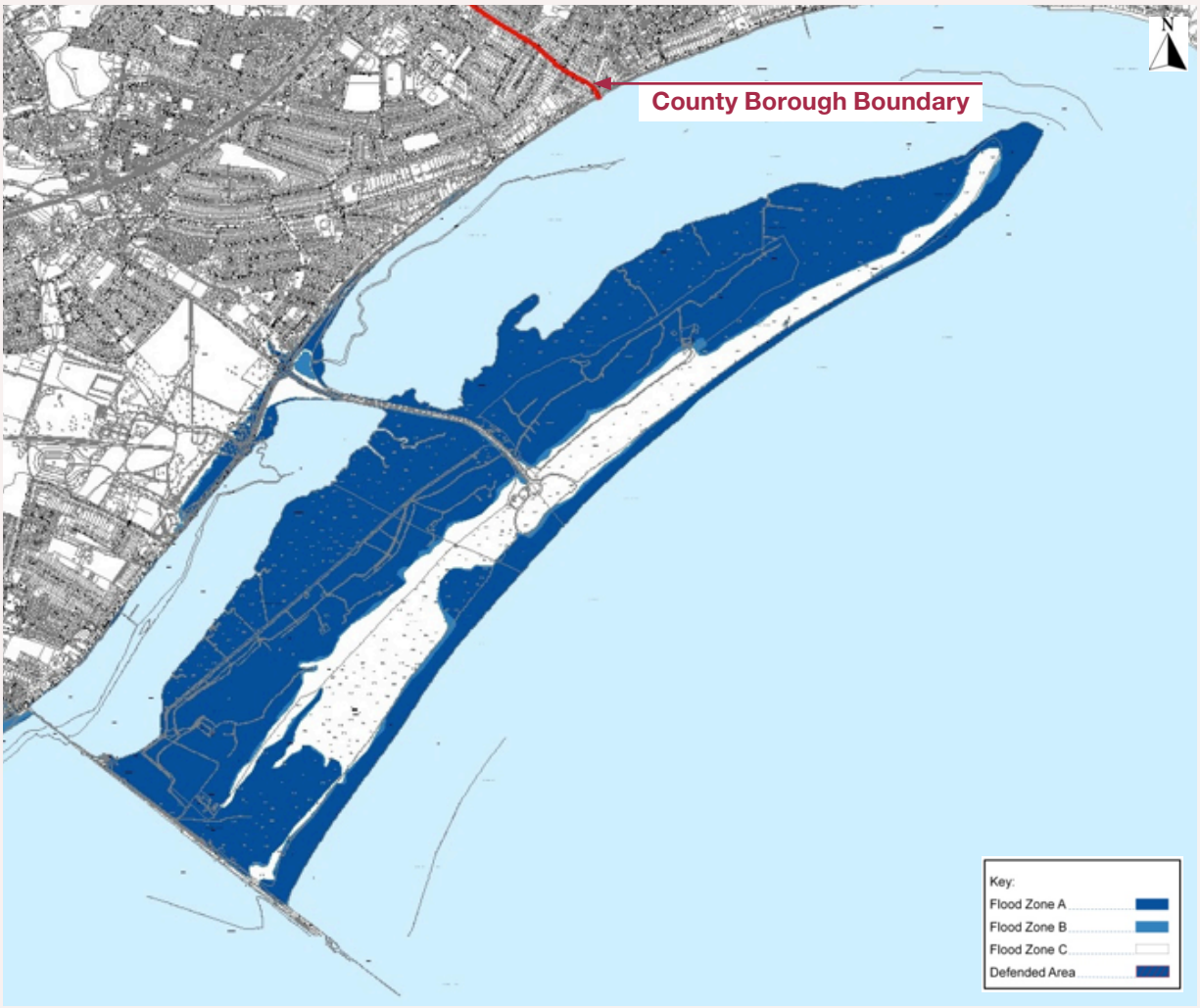
Development Options:

The River Mayne flows along the boundary with Dublin City Council and Fingal County Council. Most of the Flood Risk Areas would be located outside of the DCC boundary. Part of the River that would be within DCC's boundary would be covered by the Clongriffin - Belymayne (North Fringe) LAP 2012. Please refer to this for Development Options.

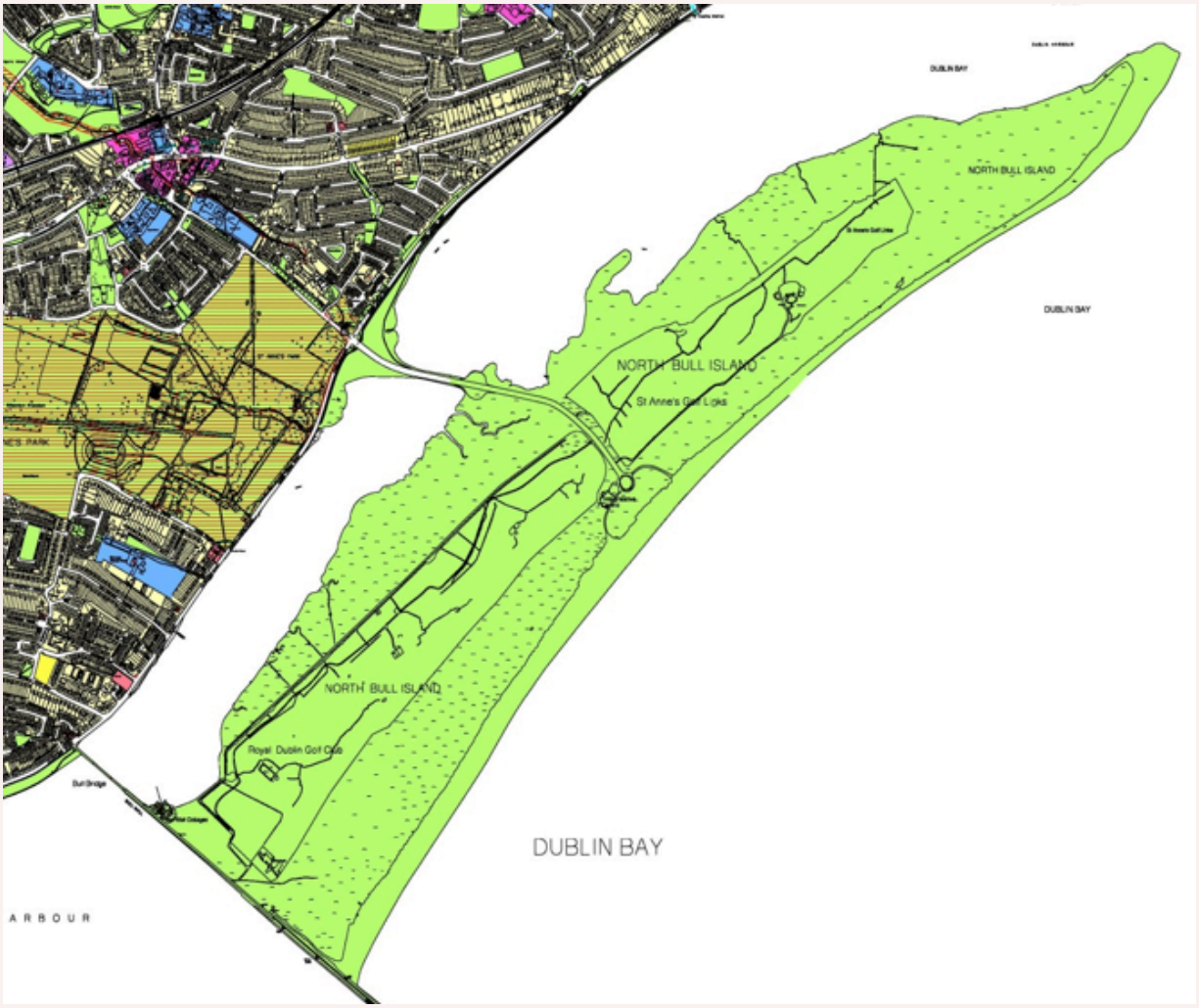
Justification Test for Development Plans

- The land to the south of the River Mayne which forms the boundary with Fingal County Council is one of the areas identified as a Key Development Areas in the current plan. These represent significant areas of the inner and outer city with substantial development capacity and the potential to deliver the residential, employment and recreational needs of the city. The River Mayne runs along the boundary of Dublin City Council and Fingal County Council. Part of the area to the south of the River is covered by the Clongriffin- Belmayne Local Area Plan, 2012.
- The areas located in Flood Zones A and B are primarily open space, which is water compatible and should be retained. The Justification Test confirms that development in most of these areas is not justified. This should be consolidated through future revisions to the local area plans.
- Fingal County Council Planning should be consulted of any development close to its border which might have current or future flooding implications in Fingal.

Site: 30. Coastal:- North Bull Island



Site: 30. Coastal:- North Bull Island



Dublin City Council Development Plan 2016–2022 (zoning map key at back of tables)

Site Description	North Bull Island is an important tourist attraction that incorporates two golf courses, Dollymount Beach and the North Bull Island Nature Reserve. The island was declared a Bird Sanctuary in the 1930s and, following the construction of the Causeway Road in 1962, a UNESCO Biosphere Reserve was established here in 1981 to be followed by a Nature Reserve in 1988. A Visitor and Interpretative Centre was built here in 1986. There are a small number of dwellings on the island, located near the bridge at Bull Wall Cottages.
Benefitting from Defences (flood relief scheme works)	There are no designed flood defences on the North Bull Island.
Sensitivity to Climate Change	High – with sea level rise of 0.5m the majority of the island will be below water.
Residual Risk	N/A
Historical Flooding	High tides frequently inundate the margins of the island.
Storm (surface) water	As no development is planned, management of storm (surface) water is not an issue.

Site: 30. Coastal:- North Bull Island

Commentary on Flood Risk:
The whole island is vulnerable to inundation from the sea.

Development Options:
There is a specific objective in the development plan "GIO22 -To promote and upgrade visitor facilities at North Bull Island to raise awareness of biodiversity and promote nature conservation and manage recreation sustainably, having regards to Article (6) of the Habitats Directive"
All development should be water compatible. Evacuation plans for high tides with large wave action should be included with any proposed development.

Justification Test for Development Plans

- Nearly the whole island is within Flood Zone A, but as it is a nature reserve, with no new development proposed, other than a visitor facility, without residential accommodation, and as such meets the criteria under the Justification Test as per paragraph 1.10.2.
- Refurbishment of existing less vulnerable buildings, such as the visitors centre, may be accommodated, but flood risk management, through setting finished floor levels should be given due regard, particularly in relation to the potential impacts of climate change. Visitor safety should also be considered, particularly when storm surges and high tides are forecast.

USE ZONING OBJECTIVES

Zone Z1 To protect, provide and Improve residential amenities

Zone Z2 To protect and/or improve the amenities of residential conservation areas

Zone Z3 To provide for and Improve neighbourhood facilities

Zone Z4 To provide for and improve mixed–services facilities

Zone Z5 To consolidate and facilitate the development of the central area, and to identify, reinforce, strengthen and protect its civic design character and dignity

Zone Z6 To provide for the creation and protection of enterprise and facilitate opportunities for employment creation

Zone Z7 To provide for the protection and creation of industrial uses and facilitate opportunities for employment creation

Zone Z8 To protect the existing architectural and civic design character, and to allow only for limited expansion consistent with the conservation objective

Zone Z9 To preserve, provide and improve recreational amenity and open space and green networks

Zone Z10 To consolidate and facilitate the development of inner city and inner suburban sites for mixed–uses, with residential the predominant use in suburban locations, and office/retail/residential the predominant uses in inner city areas

Zone Z11 To protect and improve canal, coastal and river amenities

Zone Z12 To ensure that existing environmental amenities are protected in the predominantly residential future use of these lands

Zone Z14 To seek the social, economic and physical development and/or rejuvenation of an area with mixed use of which residential and "Z6" would be the predominant uses

Zone Z15 To protect and provide for institutional and community uses

SPECIFIC OBJECTIVES

Conservation Areas

Architectural Conservation Areas

Protected Structures. [RPS takes precedence] * * *

Sites of Archaeological Interest

Zones of Archaeological Interest

Key District Centres K.D.C. 1

SEVESO II establishments

Strategic Development & Regeneration Areas S.D.R.A. 1

LAP (Local Area Plan) & SDZ (Special Development Zone)

Dublin Airport Outer Public Safety Zone

ROADS

Road Schemes and Bridges

1. Map to be read in conjunction with the written statement
2. Roads objectives are shown diagrammatically

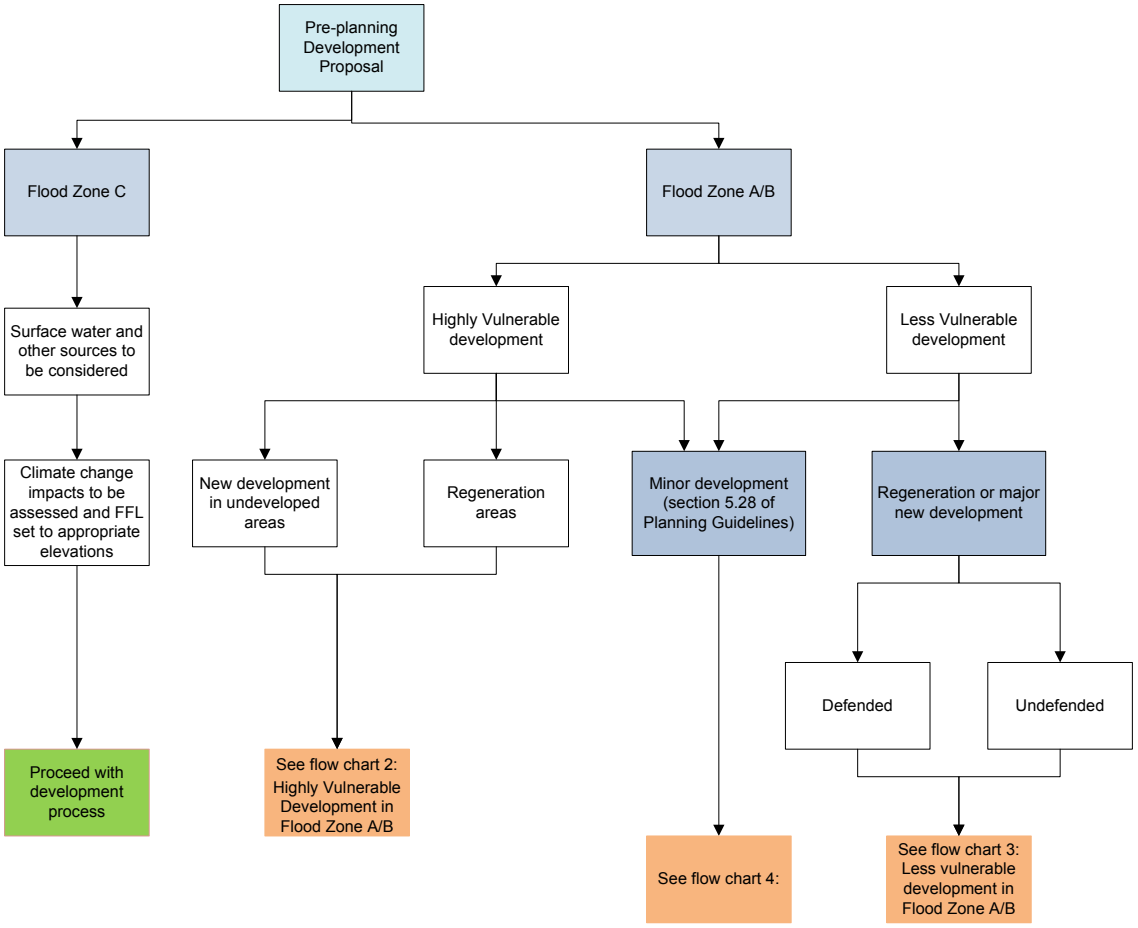
City Boundary

Appendix

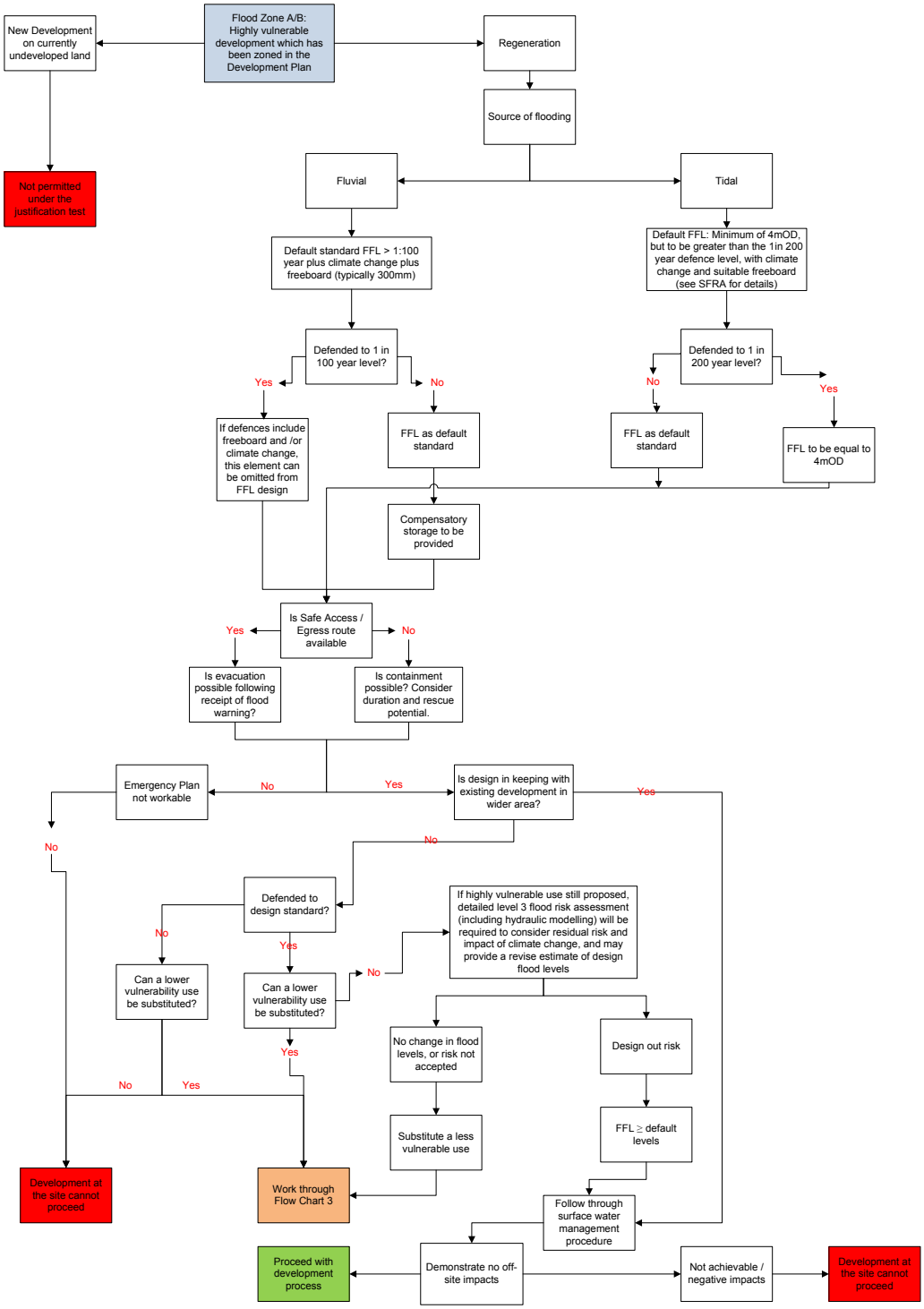
4

Flow Charts

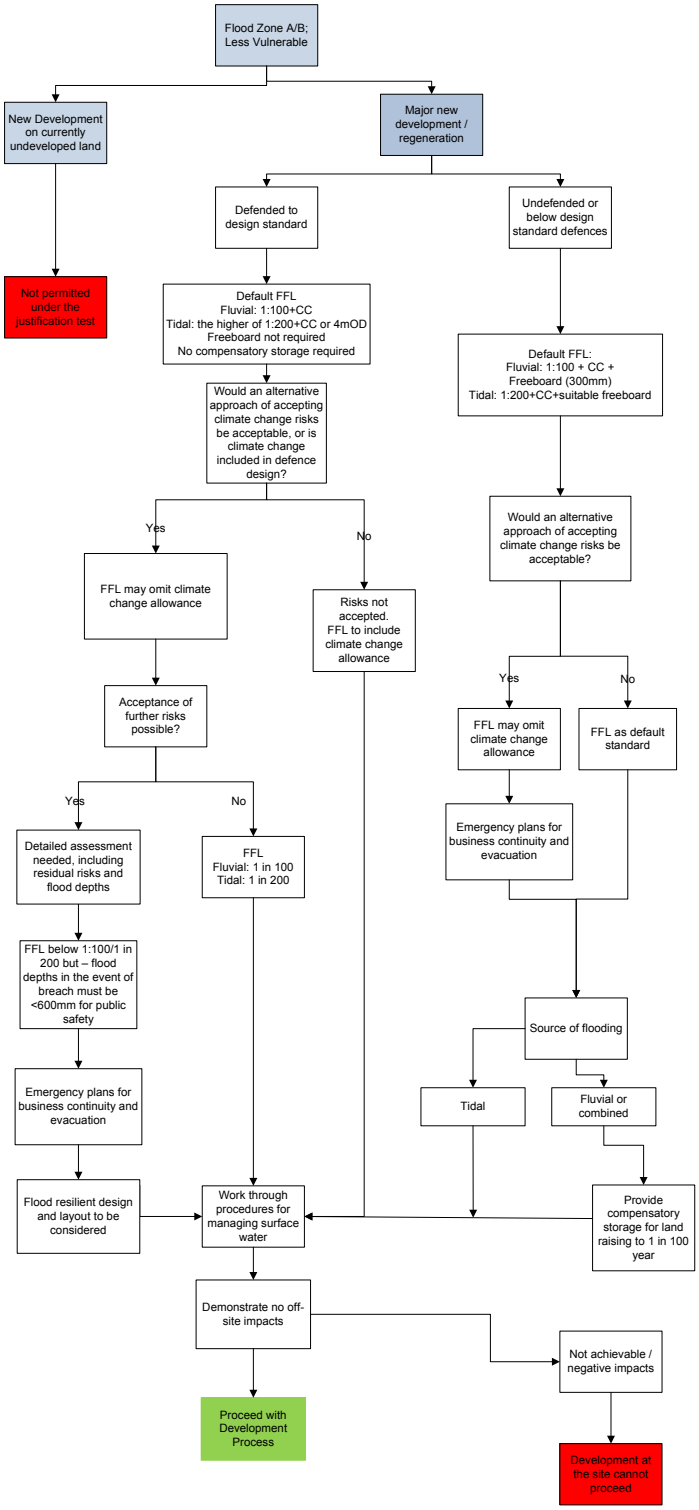
Flow Chart 1: Development Management Process



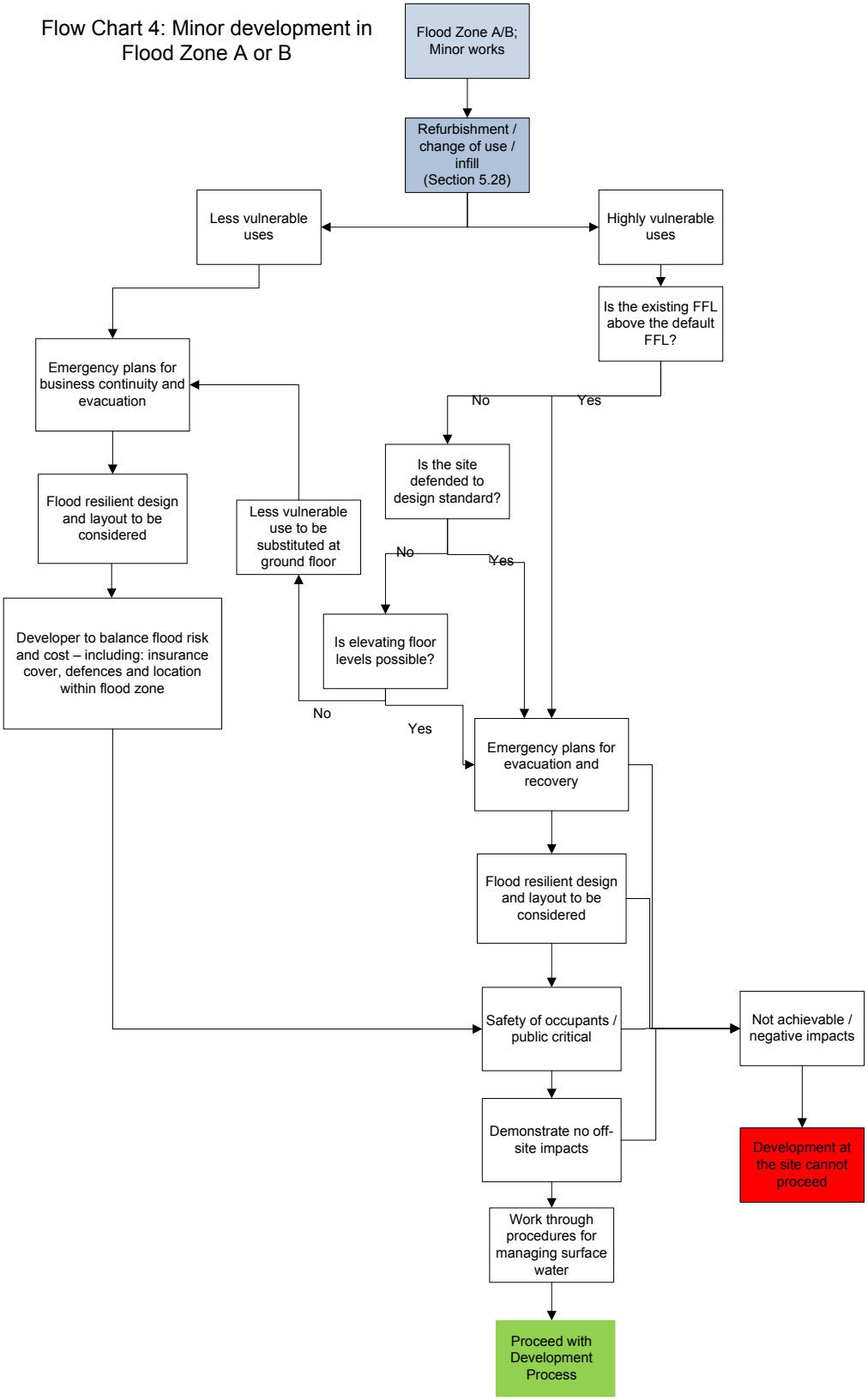
Flow Chart 2: Highly Vulnerable Development in Flood Zone A/B



Flow Chart 3: Less Vulnerable Development in Flood Zone A or B

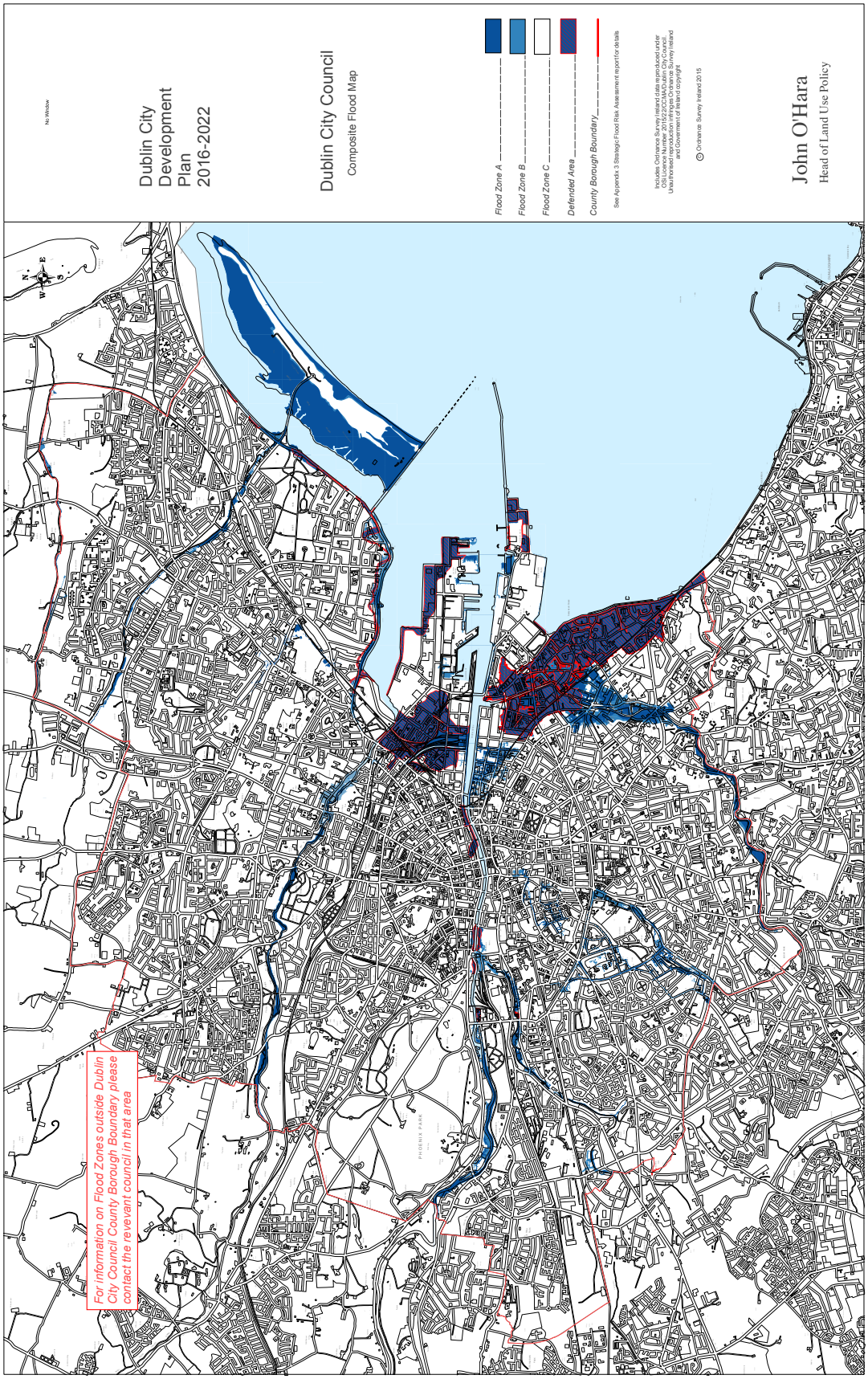


Flow Chart 4: Minor development in Flood Zone A or B



Appendix 5

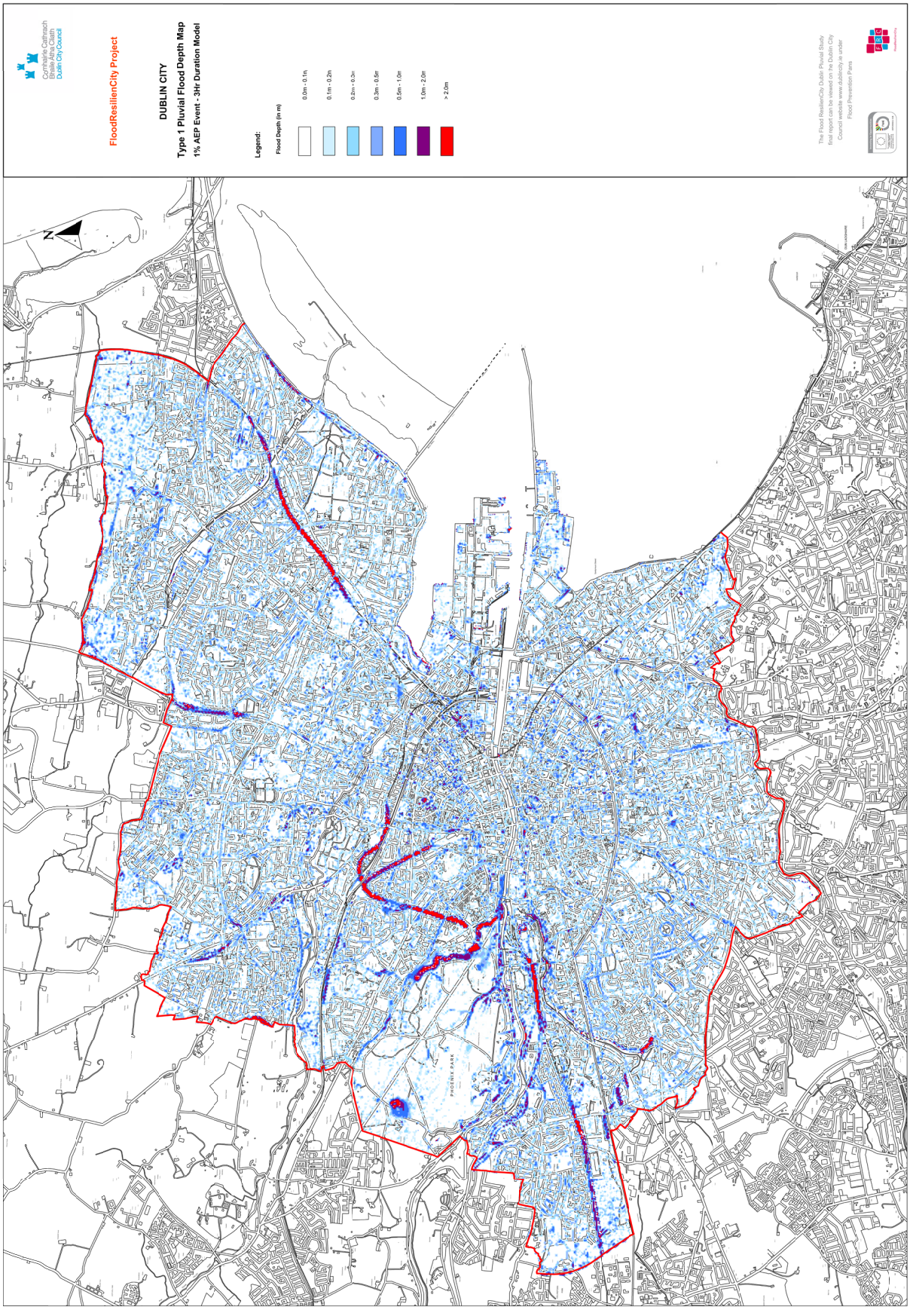
Composite Flood Zone Map


Dublin City Development Plan 2016-2022
Dublin City Council
Composite Flood Map
Flood Zone A
Flood Zone B
Flood Zone C
Defended Area
County Borough Boundary
See Appendix 3 Strategic Flood Risk Assessment report for details
Includes Ordnance Survey Ireland data reproduced under OSi Licence number 2007/06/CCMA/Dublin City Council Unauthorised reproduction infringes Ordnance Survey Ireland and Government of Ireland copyright
© Ordnance Survey Ireland 2015
John O'Hara
Head of Land Use Policy
No Window
For information on Flood Zones outside Dublin City Council County Borough Boundary please contact the revevant council in that area

Appendix

6

Pluvial Flood Maps (FRC Maps)


Comhairle Cathrach Bhaile Átha Cliath
Dublin City Council
FloodResilienCity Project
DUBLIN CITY
Type 1 Pluvial Flood Depth Map
1% AEP Event - 3Hr Duration Model
Legend:
Flood Depth (in m)
0.0m - 0.1m
0.1m - 0.2m
0.2m - 0.3m
0.3m - 0.5m
0.5m - 1.0m
1.0m - 2.0m
> 2.0m
N
The Flood ResilienCity Dublin Pluvial Study final report can be viewed on the Dublin City Council website www.dublincity.ie under Flood Prevention Plans
PHOENIX PARK


Comhairle Cathrach Bhaile Átha Cliath
Dublin City Council
FloodResilienCity Project
DUBLIN CITY
Type 1 Pluvial Flood Hazard Map
1% AEP Event - 3Hr Duration Model
Legend:
Flood Hazard
Low (0.0m - 0.75)
Moderate (0.75 - 1.25)
Significant (1.25 - 2.00)
Extreme (> 2.00)
Notes
Description
Degree of Flood Hazard
Low
Moderate
Significant
Extreme
Debris Factor
Low - Flood zone with shallow flowing water or deep standing water
Moderate - For some people - Flood zone with deep or fast flowing water
Significant - For most people - Flood zone with deep and fast flowing water.
Extreme - For all - Extreme danger to all - Flood zone with deep and fast flowing water.
The Flood ResilienCity Dublin Pluvial Study final report can be viewed on the Dublin City Council website www.dublincity.ie under Flood Prevention Plans
PHOENIX PARK

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Comhairle Cathrach
Bhaile Átha Cliath
Dublin City Council

21 October 2016