



Dublin Port Masterplan 2040

Reviewed 2018

Strategic Flood Risk Assessment

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1 INTRODUCTION

Dublin Port Company is undertaking a review of their Masterplan for the redevelopment of Dublin Port covering the period 2017-2040.

RPS was commissioned by Dublin Port to carry out a Strategic Flood Risk Assessment (SFRA) in relation to the Masterplan 2040, for redevelopment of the port. The SFRA is an assessment of flood risk to the site, and has been prepared in accordance with 'Planning System and Flood Risk Management Guidelines for Planning Authorities' published by the Department of the Environment, Heritage and Local Government and the OPW in November 2009, referred to hereafter as 'The Guidelines'.

The main purpose of this SFRA report is to appraise the adequacy of existing information, prepare flood zone maps, and to highlight potential development areas that require more detailed assessment on a site specific level. The SFRA also provides guidance for development within areas of potential risk of flooding.

2 STUDY AREA

2.1 SITE LOCATION

The majority of the site pertaining to the Masterplan 2040 is located within the existing port area which is known as the Northern Port lands. There are also two other areas- the Southern Port Land which is located on the opposite side of the River Liffey from the existing port; and Dublin Inland Port which is located close to Dublin Airport. The locations of the areas are shown in Figure 2.1, and in detail in Figures 2.2 and 2.3.

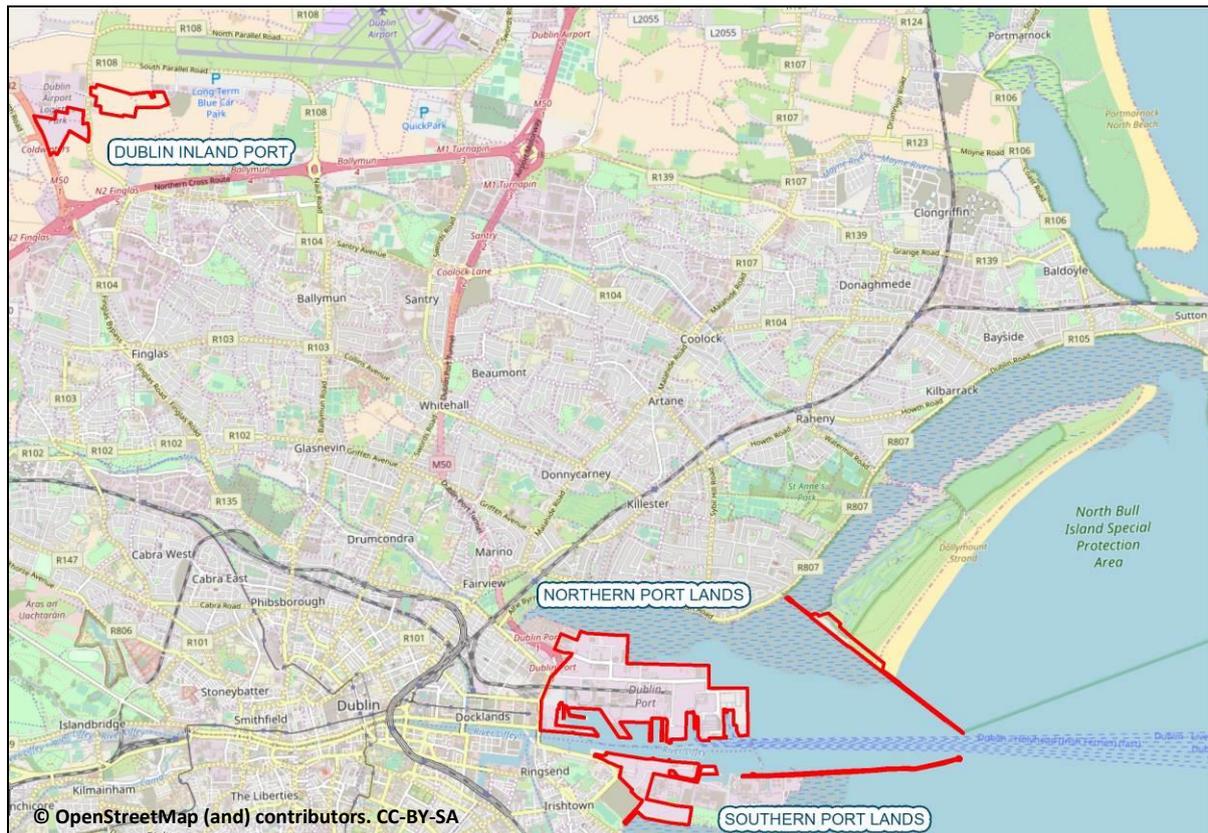


Figure 2.1 Location overview map

2.2 SITE DESCRIPTION

2.2.1 Northern Port Lands

The Northern Port Lands is a highly industrialised area located in a prominent coastal position in Dublin. It contains both passenger and goods port facilities.

2.2.2 Southern Port Lands

The Southern Port Lands is currently used for storage associated with port operations and load-on/load-off operations.

2.2.3 Dublin Inland Port

The land parcel of the Dublin Inland Port on the left is an old golf course (sport and leisure facilities land use) and the land parcel on the right is a field (agricultural land use).

2.3 WATERCOURSES

The River Liffey flows adjacent to both the Northern and Southern Port Lands. The River Tolka flows to the north of the Northern Port Lands. The locations of these watercourses in relation to the Masterplan areas are shown in Figure 2.4.



Figure 2.4 Locations of watercourses- Northern and Southern Port Lands

There are no identified watercourses within the areas identified for the Inland Port. The Santry River flows to the north east of the site as shown in Figure 2.5.

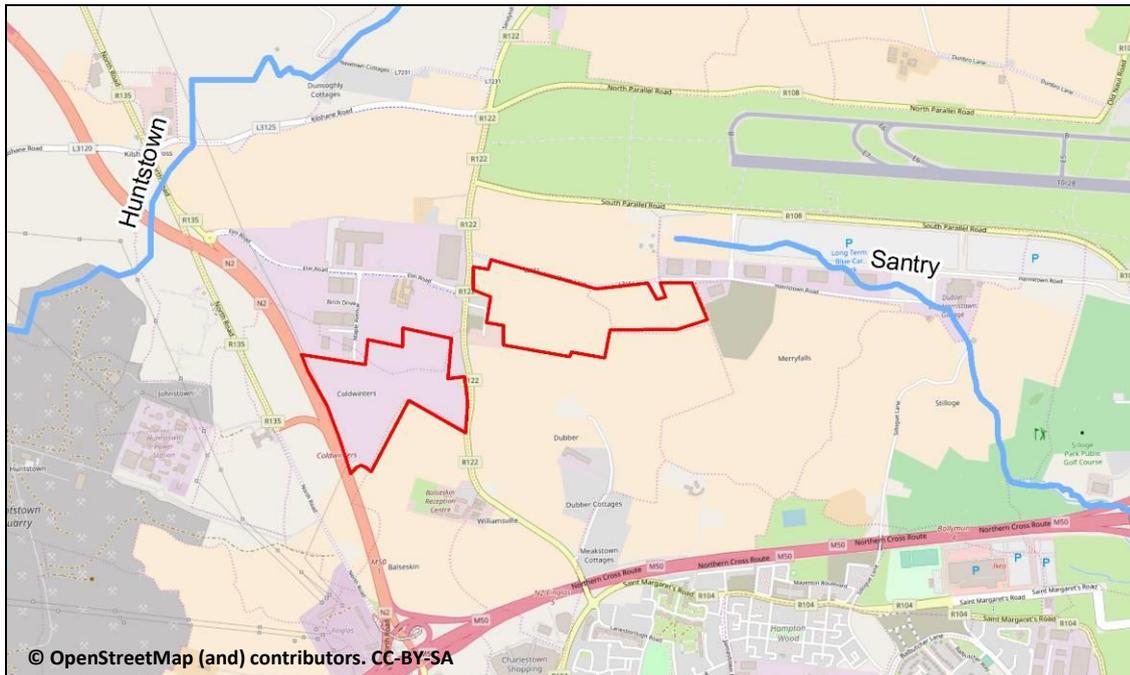


Figure 2.5 Locations of watercourses- Dublin Inland Port

2.4 EXISTING FLOOD DEFENCES

There are no formal flood defences provided within any of the sites.

Along the northern boundary of the port area there are areas consisting of raised planted areas but these are deemed to be neither defences nor hydraulically significant structures within the analysis.

3 THE PLANNING SYSTEM AND FLOOD RISK MANAGEMENT GUIDELINES

3.1 INTRODUCTION

'The Planning System and Flood Risk Management: Guidelines for Planning Authorities' was published in 2009 by the Department of Environment, Heritage and Local Government in conjunction with the Office of Public Works (OPW). The purpose of the guidelines is to ensure that flood risk is a key consideration in preparing development plans and local area plans and in the assessment of planning applications. The Guidelines will also assist regional authorities in preparing regional planning guidelines and should be used by developers and the wider public in addressing flood risk in preparing development proposals.

The core objectives of the Guidelines are to:

- Avoid inappropriate development in areas at risk of flooding;
- Avoid new developments increasing flood risk elsewhere, including that which may arise from surface water runoff;
- Ensure effective management of residual risks for development permitted in floodplains;
- Avoid unnecessary restriction of national, regional or local economic and social growth;
- Improve the understanding of flood risk among relevant stakeholders; and
- Ensure that the requirements of EU and national law in relation to the natural environment and nature conservation are complied with at all stages of flood risk management.

Under the Guidelines, FRAs are required at different scales by different organisations for many different purposes. A hierarchy of assessments is necessary to ensure a proportionate response to the needs of organisations by avoiding the need for detailed and costly assessments prior to making strategic decisions. This hierarchy is summarised in Table A2 of the Guidelines, which has been produced as Figure 3.1.

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

Table A2: Hierarchy of flood risk assessment

Figure 3.1 Extract from Planning Guidelines- Hierarchy of flood risk assessment

3.2 DEFINITION OF FLOOD RISK

Flood risk is a combination of the likelihood of flooding and the potential consequences arising.

Likelihood of flooding is normally defined as the percentage probability of a flood of a given magnitude or severity occurring or being exceeded in any given year.

Consequences of flooding depend on the hazards associated with the flooding (e.g. depth of water, speed of flow, duration), and the vulnerability of people, property and the environment potentially affected by a flood (e.g. the age profile of population, type of development, presence of mitigation measures).

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

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

3.3 FLOOD ZONES

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

- **Flood Zone A** - where the probability of flooding from rivers and the sea is highest (greater than 1% for river flooding, or 0.5% for coastal flooding);
- **Flood Zone B** - where the probability of flooding from rivers and the sea is moderate (between 0.1% and 1% for river flooding, or between 0.1% and 0.5% for coastal flooding);
- **Flood Zone C** - where the probability of flooding from rivers and the sea is low (less than 0.1% for both river and coastal flooding).

The flood zones are based on the current assessment of the fluvial and tidal events without the inclusion of climate change factors. The presence of flood protection structures should be ignored in determining flood zones. This is because areas protected by flood defences still carry a residual risk of flooding from overtopping or breach of defences and the fact that there may be no guarantee that the defences will be maintained in perpetuity. The flood zones described above are indicative of river and coastal flooding only. They should not be used to suggest that any areas are free from flood risk, since they do not include the effects of other forms of flooding such as groundwater or artificial drainage systems.

3.4 SEQUENTIAL APPROACH

A sequential approach to planning is a key tool in ensuring that development, particularly new development, is first and foremost directed towards land that is at low risk of flooding. The sequential approach described in Figure 3.1 of the Guidelines (reproduced below as Figure 3.2) should be applied to all stages of the planning and development management process. It is of particular importance at the plan-making stage but is also applicable in the layout and design of development within a specific site at the development management stage.

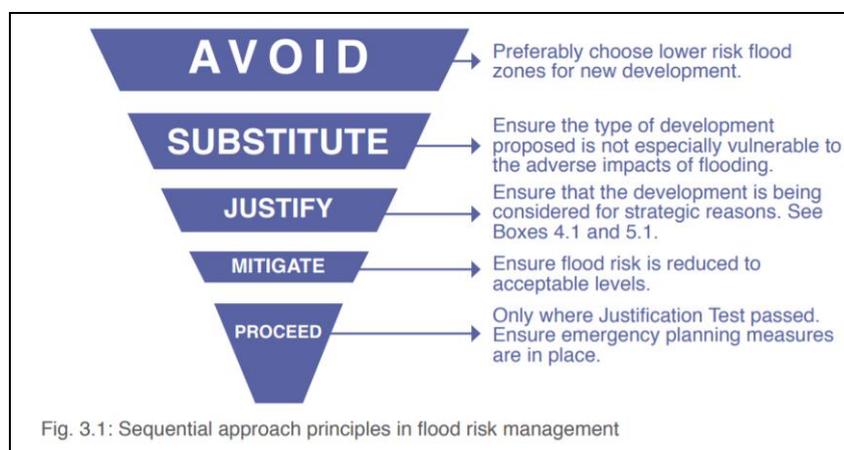


Figure 3.2 Extract from Planning Guidelines- Sequential approach principles

The sequential approach makes use of flood risk assessment and of prior identification of flood zones for river and coastal flooding and classification of the vulnerability to flooding of different types of development.

3.5 CLASSIFICATION OF VULNERABILITY

The Guidelines classify different types of development in terms of their vulnerability class (Table 3.1 of the guidelines). This table has been reproduced as Figure 3.3.

Vulnerability class	Land uses and types of development which include*:
Highly vulnerable development (including essential infrastructure)	<p>Garda, ambulance and fire stations and command centres required to be operational during flooding;</p> <p>Hospitals;</p> <p>Emergency access and egress points;</p> <p>Schools;</p> <p>Dwelling houses, student halls of residence and hostels;</p> <p>Residential institutions such as residential care homes, children's homes and social services homes;</p> <p>Caravans and mobile home parks;</p> <p>Dwelling houses designed, constructed or adapted for the elderly or, other people with impaired mobility; and</p> <p>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.</p>
Less vulnerable development	<p>Buildings used for: retail, leisure, warehousing, commercial, industrial and non-residential institutions;</p> <p>Land and buildings used for holiday or short-let caravans and camping, subject to specific warning and evacuation plans;</p> <p>Land and buildings used for agriculture and forestry;</p> <p>Waste treatment (except landfill and hazardous waste);</p> <p>Mineral working and processing; and</p> <p>Local transport infrastructure.</p>
Water-compatible development	<p>Flood control infrastructure;</p> <p>Docks, marinas and wharves;</p> <p>Navigation facilities;</p> <p>Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location;</p> <p>Water-based recreation and tourism (excluding sleeping accommodation);</p> <p>Lifeguard and coastguard stations;</p> <p>Amenity open space, outdoor sports and recreation and essential facilities such as changing rooms; and</p> <p>Essential ancillary sleeping or residential accommodation for staff required by uses in this category (subject to a specific warning and evacuation plan).</p>
*Uses not listed here should be considered on their own merits	

Table 3.1 Classification of vulnerability of different types of development

Figure 3.3 Extract from Planning Guidelines- Classification of vulnerability of development

Table 3.2 of the Guidelines (reproduced as Figure 3.4) illustrates 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.

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	Justification Test	Justification Test	Appropriate
Less vulnerable development	Justification Test	Appropriate	Appropriate
Water-compatible development	Appropriate	Appropriate	Appropriate

Table 3.2: Matrix of vulnerability versus flood zone to illustrate appropriate development and that required to meet the Justification Test.

Figure 3.4 Extract from Planning Guidelines- Vulnerability versus flood zones

3.6 JUSTIFICATION TEST

The Justification Test has been designed to rigorously assess the appropriateness, or otherwise, of particular developments that are being considered in areas of moderate or high flood risk. The test is comprised of two processes:

- The first is the **Plan-making Justification Test** described in chapter 4 of the Guidelines and used at the plan preparation and adoption stage where it is intended to zone or otherwise designate land which is at moderate or high risk of flooding;
- The second is the **Development Management Justification Test** described in chapter 5 of the Guidelines and used at the planning application stage where it is intended to develop land at moderate or high risk of flooding for uses or development vulnerable to flooding that would generally be inappropriate for that land.

3.7 STRATEGIC FLOOD RISK ASSESSMENT

A Strategic Environmental Assessment needs to be supported by appropriate analysis of flood risk. A staged approach should be adopted, carrying out only such assessment as is needed for the purpose of decision-making. All stages may not be needed to complete a flood risk assessment. This will depend on the level of risk and the potential conflict with proposed development and the scale of mitigation measures being proposed. A Strategic Flood Risk Assessment (SFRA) can therefore encompass all levels of flood risk. Each SFRA is designed individually to match the availability of data,

scale and nature of flood risk issues, the type of development planned, and any focus on regeneration.

The key outputs from an SFRA and the key steps in its delivery are outlined in detail in Appendix A of the Guidelines. The objectives of an SFRA are summarised below:

- To provide for an improved understanding of flood risk issues within the development plan and development management process, and to communicate this to a wide range of stakeholders;
- To produce an assessment of existing flood defence infrastructure and the consequences of failure of that infrastructure and also identification of areas of natural floodplain to be safeguarded;
- To produce a suitably detailed flood risk assessment, drawing on and extending existing data and information, leading to a suite of flood risk maps that support the application of the sequential approach, in key areas where there may be tension between development pressures and avoidance of flood risk;
- To inform, where necessary, the application of the Justification Test;
- To conclude whether measures to deal with flood risks to the area proposed for development can satisfactorily reduce the risks to an acceptable level while not increasing flood risk elsewhere; and
- To produce guidance on mitigation measures, how surface water should be managed and appropriate criteria to be used in the review of site specific flood risk assessments.

4 POTENTIAL SOURCES OF FLOOD RISK

4.1 AVAILABLE INFORMATION

The Office of Public Works, as lead agency for flood risk management in Ireland, is producing Flood Risk Management Plans (FRMPs) in line with National Flood Policy and the requirements of the EU Floods Directive. Draft FRMPs are currently being produced by the OPW and its partners under the Catchment-based Flood Risk Assessment and Management (CFRAM) Programme. Draft mapping prepared under the CFRAM programme have been used to define the flood risk in this SFRA.

The assessment is based on flood maps available in February 2018 including information from the Eastern CFRAM Study and the Preliminary Flood Risk Assessment (PFRA). This is the most comprehensive flood zone mapping available for the area and is considered appropriate for use as a strategic overview of flood risk.

4.2 HISTORICAL FLOODING

The OPW National Flood Hazard Mapping website shows no historical flooding events within the Masterplan areas. There are a number of historic flood events recorded in the vicinity of the Northern and Southern Port Lands. The locations of these are shown in Figure 4.1 which is an extract from the OPW website.

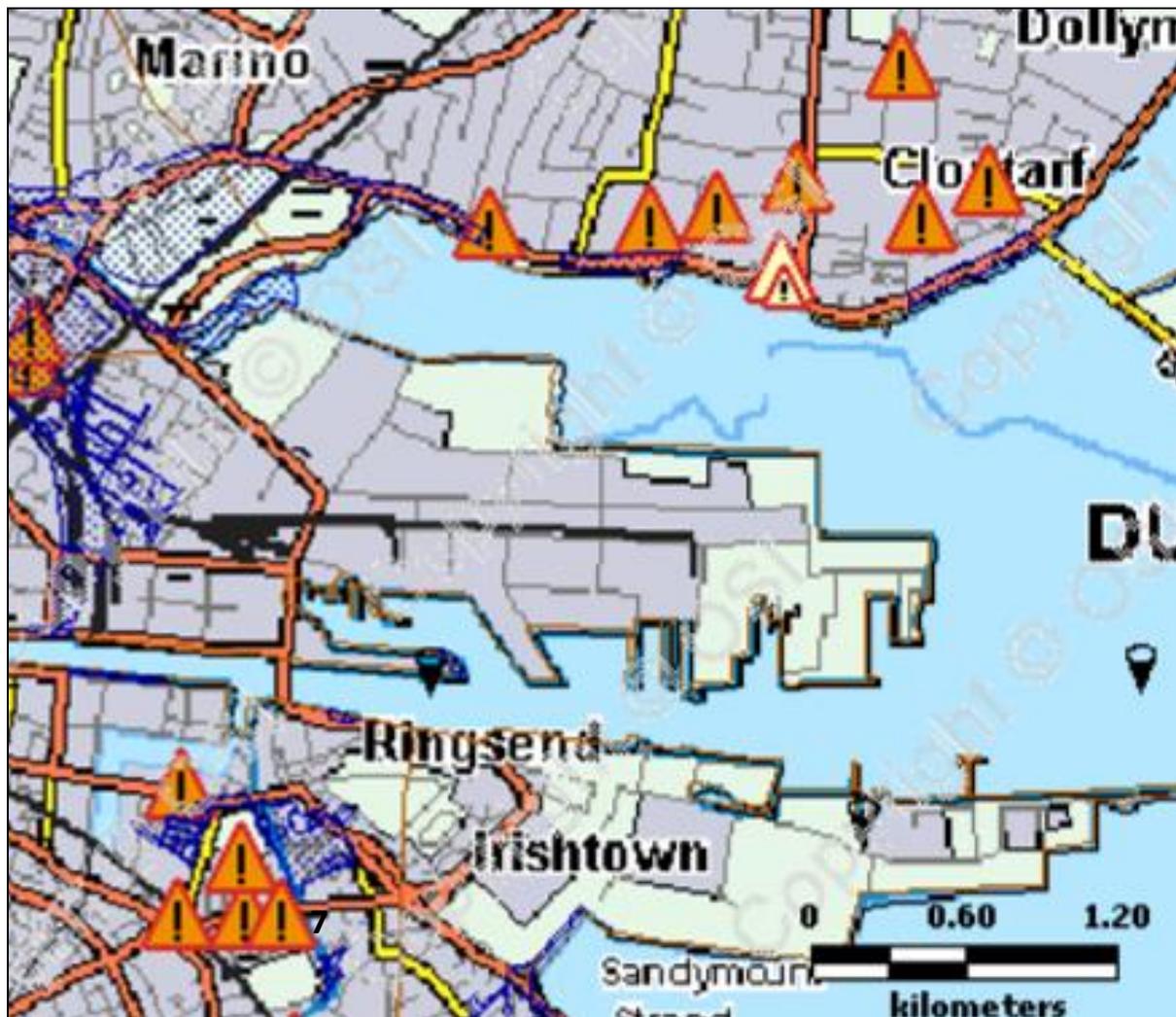


Figure 4.1 Historical flood events from OPW website (February 2018)

4.3 FLUVIAL FLOOD RISK

4.3.1 Northern and Southern Port Lands

These areas were included in the Eastern CFRAMS study, and therefore fluvial flood extents are available. Figures 4.2-4.4 show extracts from the fluvial flood maps and the maps are presented in full in Appendix A. The maps show that the sites are not at risk of fluvial flooding. This source of flooding will therefore not be considered further in this SFRA.

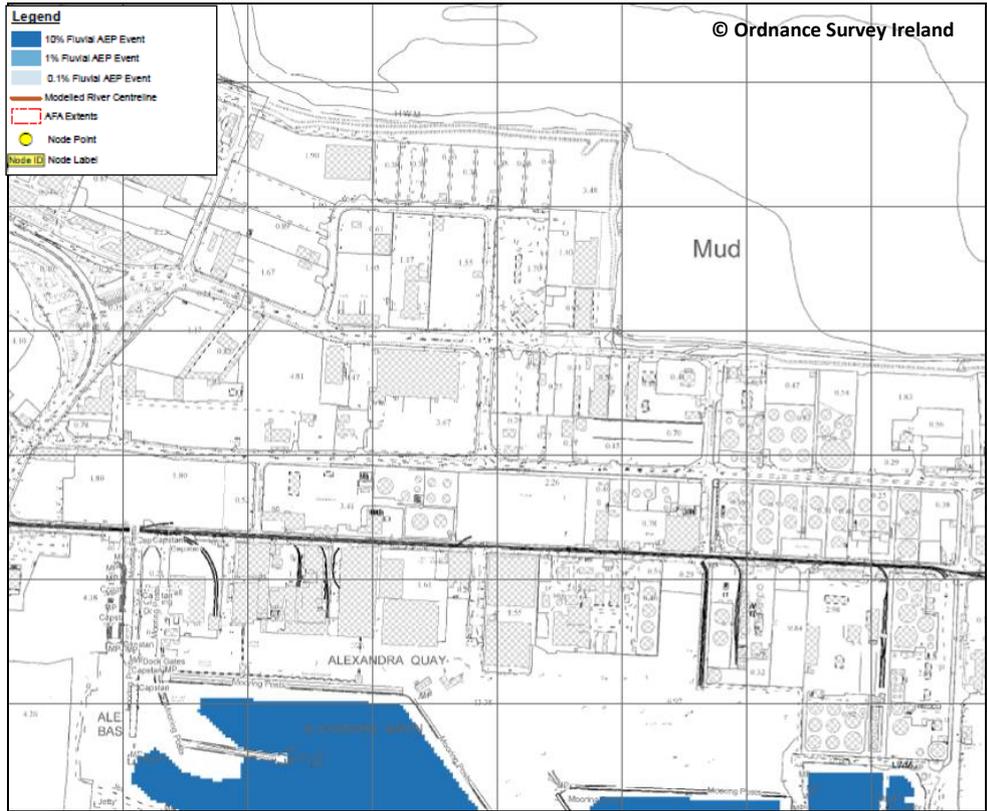


Figure 4.2 Extract from Eastern CFRAMS Fluvial Flood Maps (Map 7) - Northern Port Lands

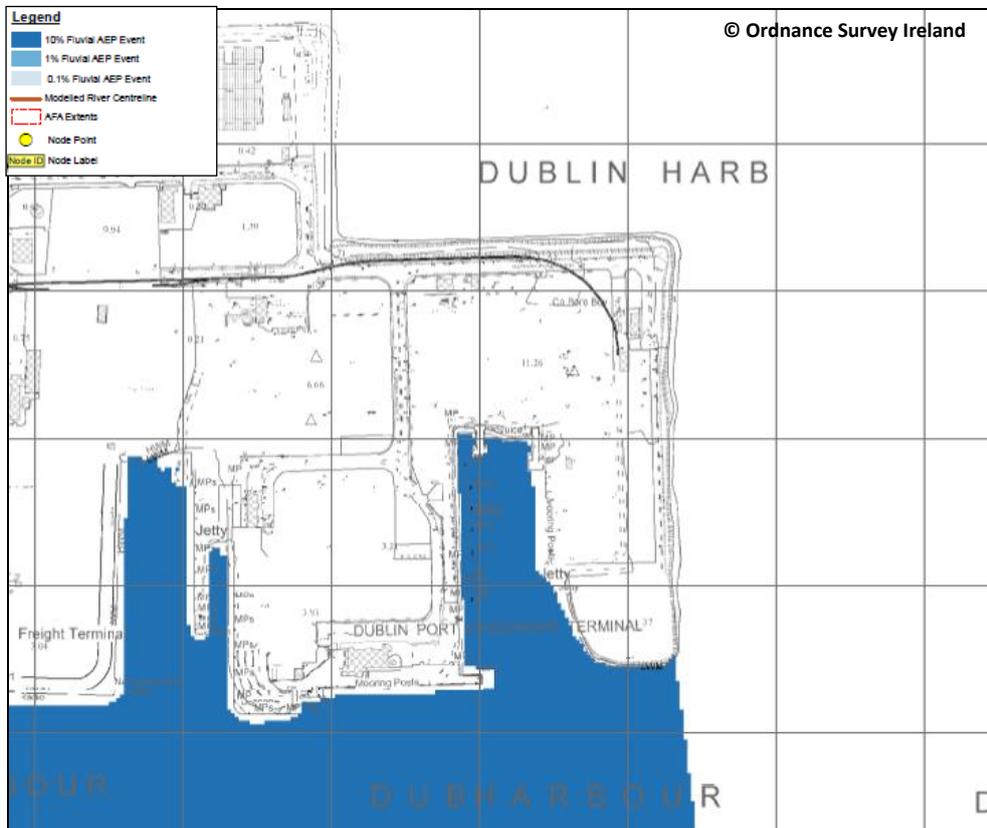


Figure 4.3 Extract from Eastern CFRAMS Fluvial Flood Maps (Map 8) - Northern Port Lands

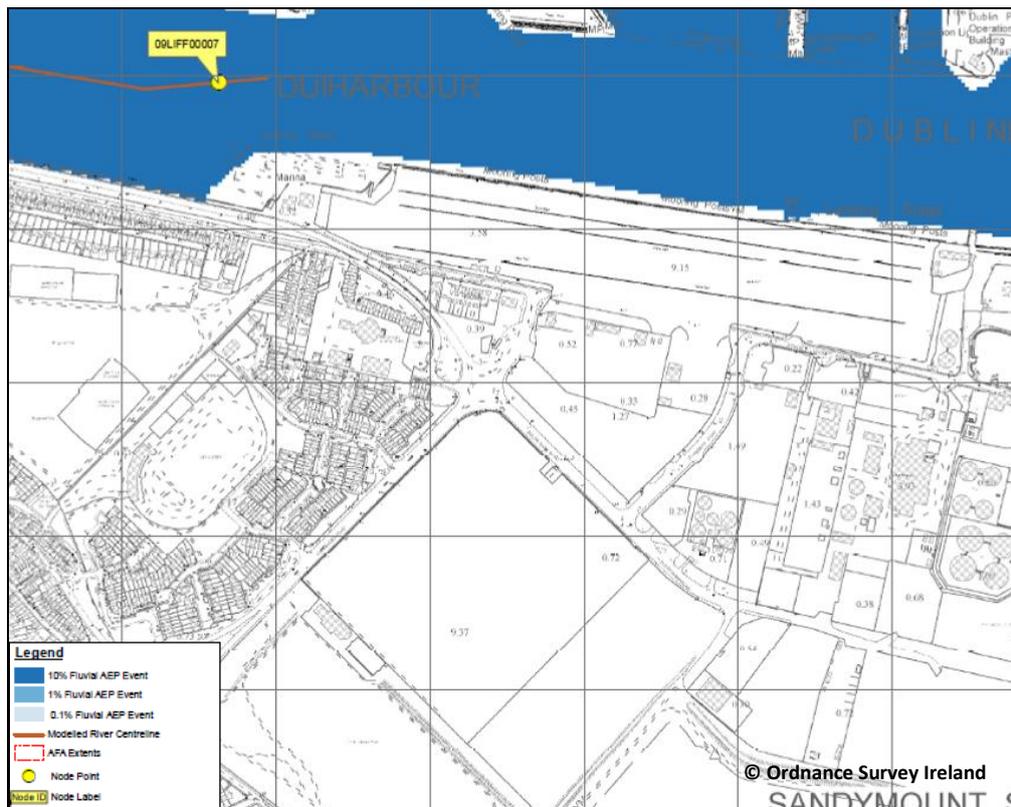


Figure 4.4 Extract from Eastern CFRAMS Fluvial Flood Maps (Map 5) - Southern Port Lands

4.3.2 Dublin Inland Port

The Eastern CFRAM Fluvial Flood Maps show that there is no identified fluvial flood risk at this site (see Appendix A). This is also confirmed in the OPW PFRA map for the area which is shown in Appendix B.

4.4 COASTAL FLOOD RISK

4.4.1 Northern and Southern Port Lands

The Rivers Liffey and Tolka can be considered tidal at this location. Both of these watercourses flow into Dublin Bay. This area was included in the Eastern CFRAMS study, and therefore coastal flood extents are available. Figure 4.4 shows extracts from the coastal flood maps and the maps are presented in full in Appendix C.

The maps show that areas of the sites are at risk of coastal flooding. This source of flooding will be considered further in this SFRA.

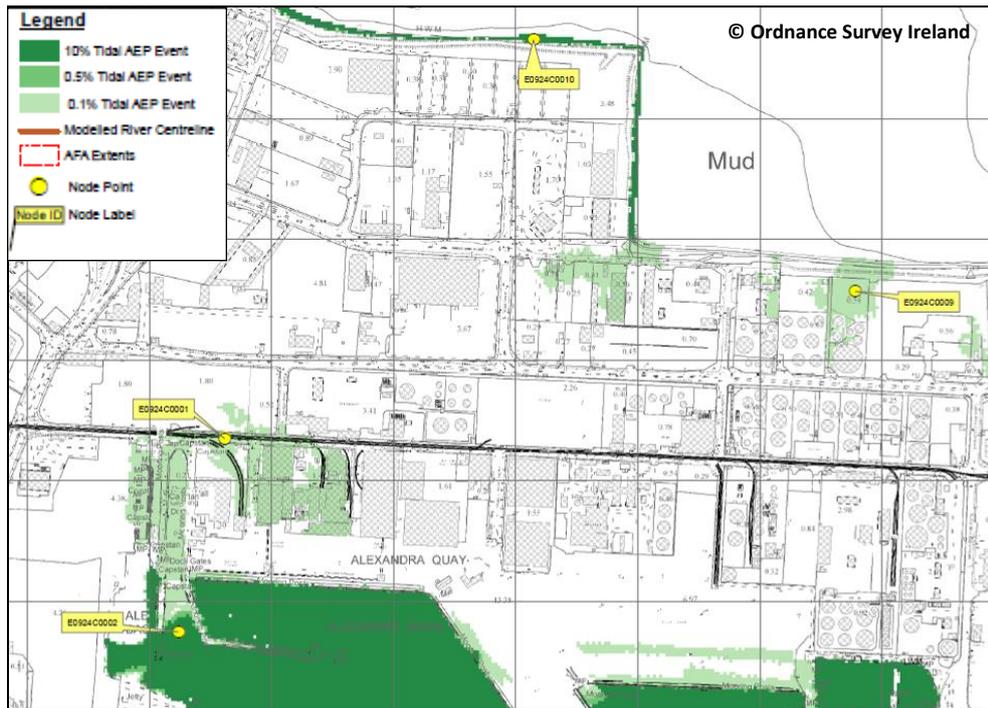


Figure 4.5 Extract from Eastern CFRAMS Coastal Flood Maps (Map 7) - Northern Port Lands

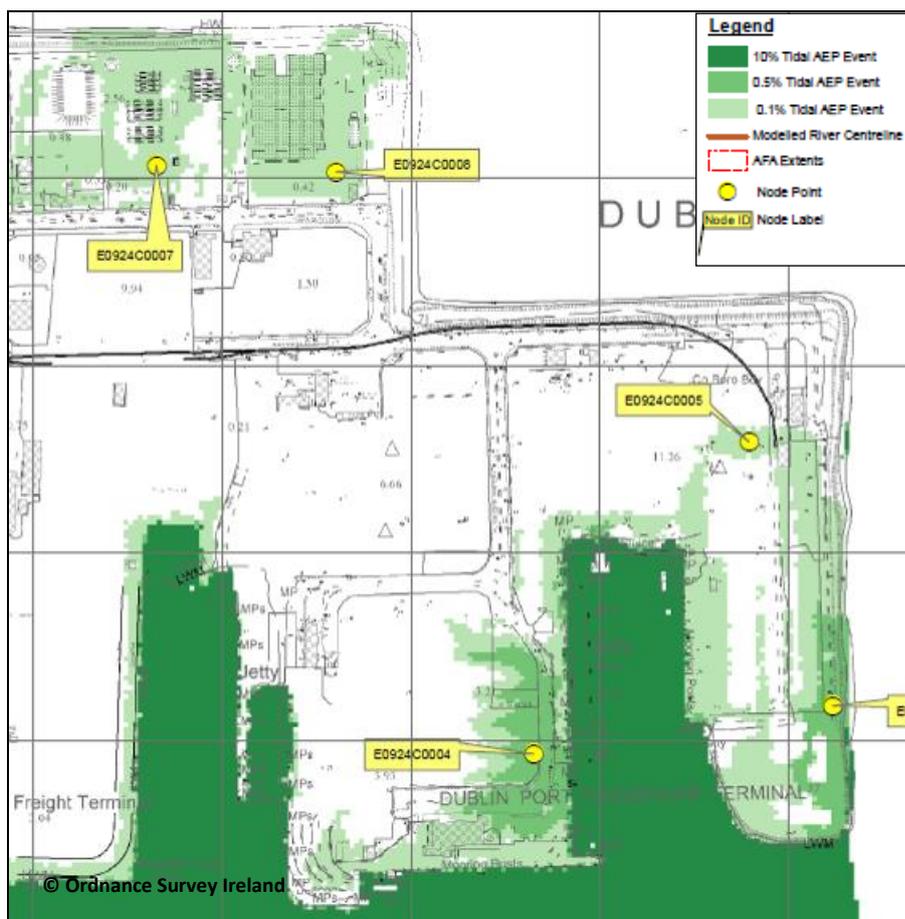


Figure 4.6 Extract from Eastern CFRAMS Coastal Flood Maps (Map 8) - Northern Port Lands

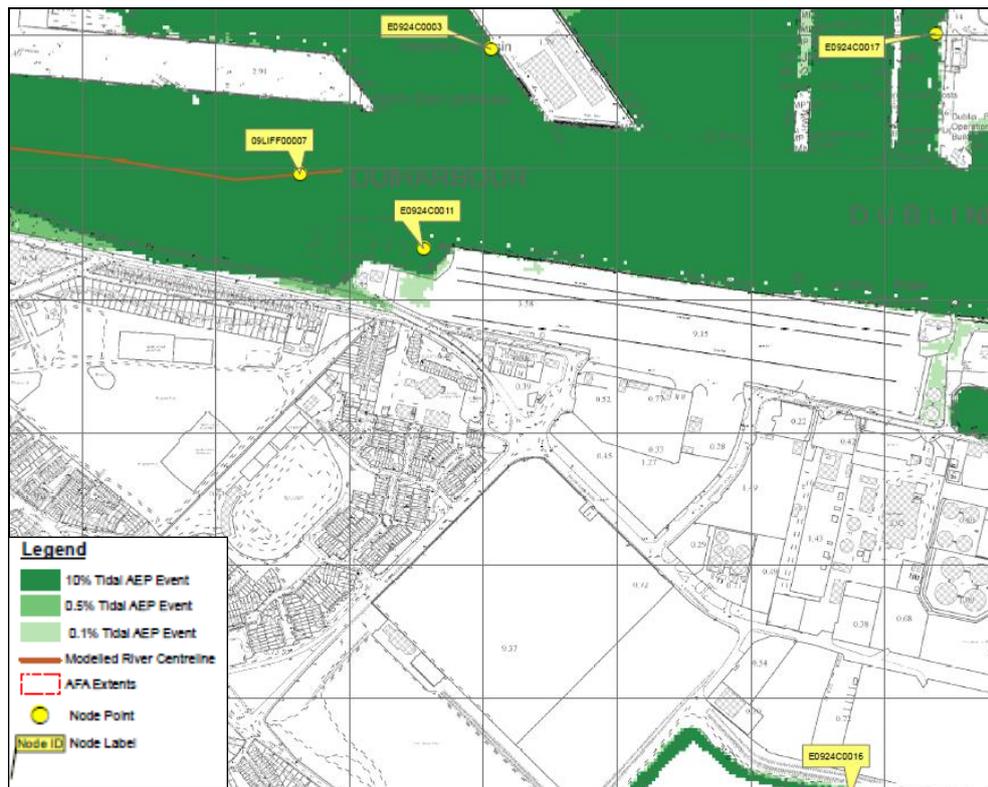


Figure 4.7 Extract from Eastern CFRAMS Coastal Flood Maps (Map 5)- Southern Port Lands

4.4.2 Dublin Inland Port

Due to its inland location, there is no coastal flood risk at the Dublin Inland Port site.

4.5 OTHER SOURCES OF FLOODING

The flood zones only account for fluvial and coastal flooding. They should not be used to suggest that any areas are free from flood risk as they do not account for potential flooding from other sources. Hence a review of other sources of flooding was carried out to identify potential areas of risk.

4.5.1 Pluvial flooding

4.5.1.1 Northern and Southern Port Lands

Generally, in order for a site to be considered at risk from surface water flow it characteristically has steep gradients either within or above the site and a reasonably large contributing catchment area. In this case the application site and the surrounding land are low lying and flat and therefore the risk of significant flooding from overland flow would be considered low.

Pluvial flooding maps were included in the Eastern CFRAMS study. Figure 4.8 shows extracts from the pluvial flood map and the map is presented in full in Appendix D. This shows that there are areas of the sites at risk from pluvial flooding.

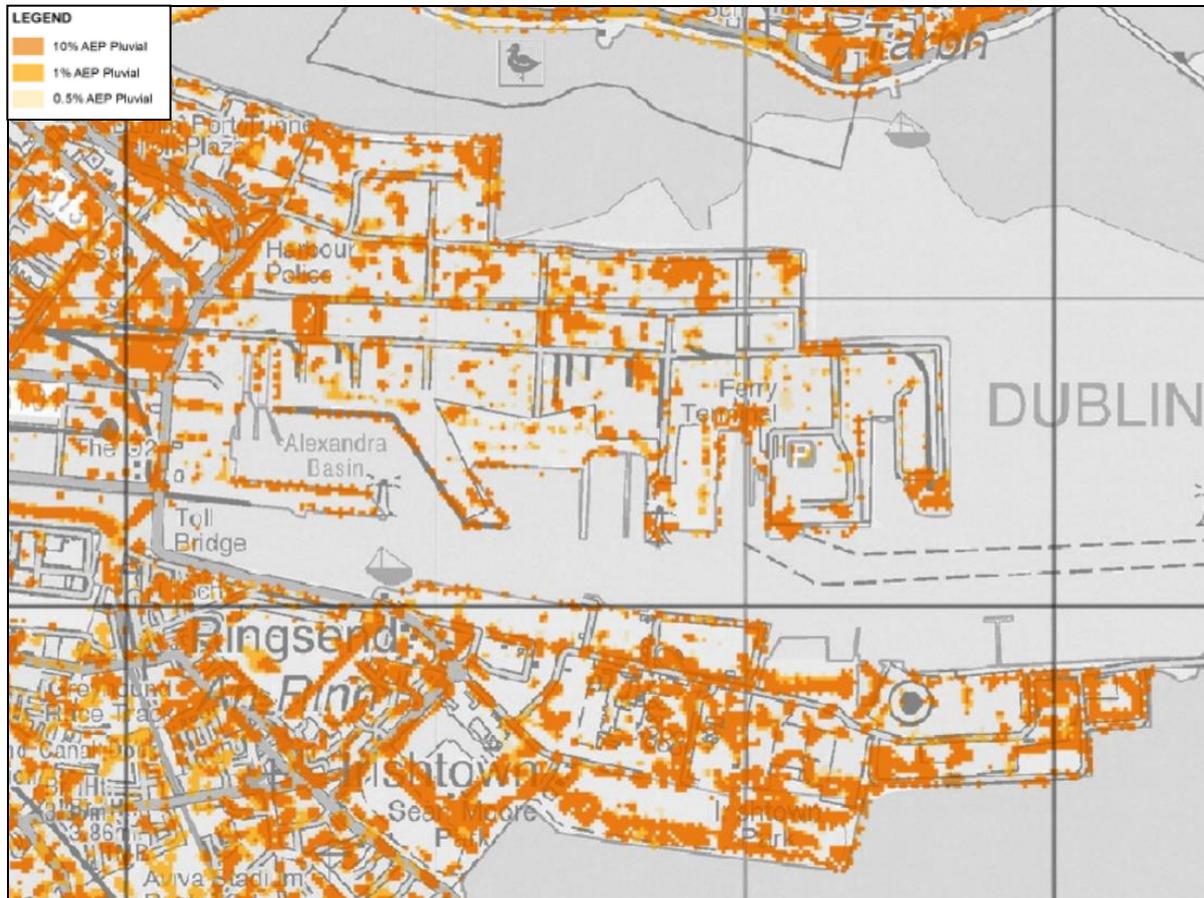


Figure 4.8 Extract from Eastern CFRAMS Pluvial Flood Map (Map 1) - Northern & Southern Port Lands

4.5.1.2 Dublin Inland Port

Generally, in order for a site to be considered at risk from surface water flow it characteristically has steep gradients either within or above the site and a reasonably large contributing catchment area. In this case the application site and the surrounding land are low lying and flat and therefore the risk of significant flooding from overland flow would be considered low.

Figure 4.9 shows an extract from the OPW PFRA map which shows pluvial flood map and the map is presented in full in Appendix B. This shows that the sites are not at risk from pluvial flooding.

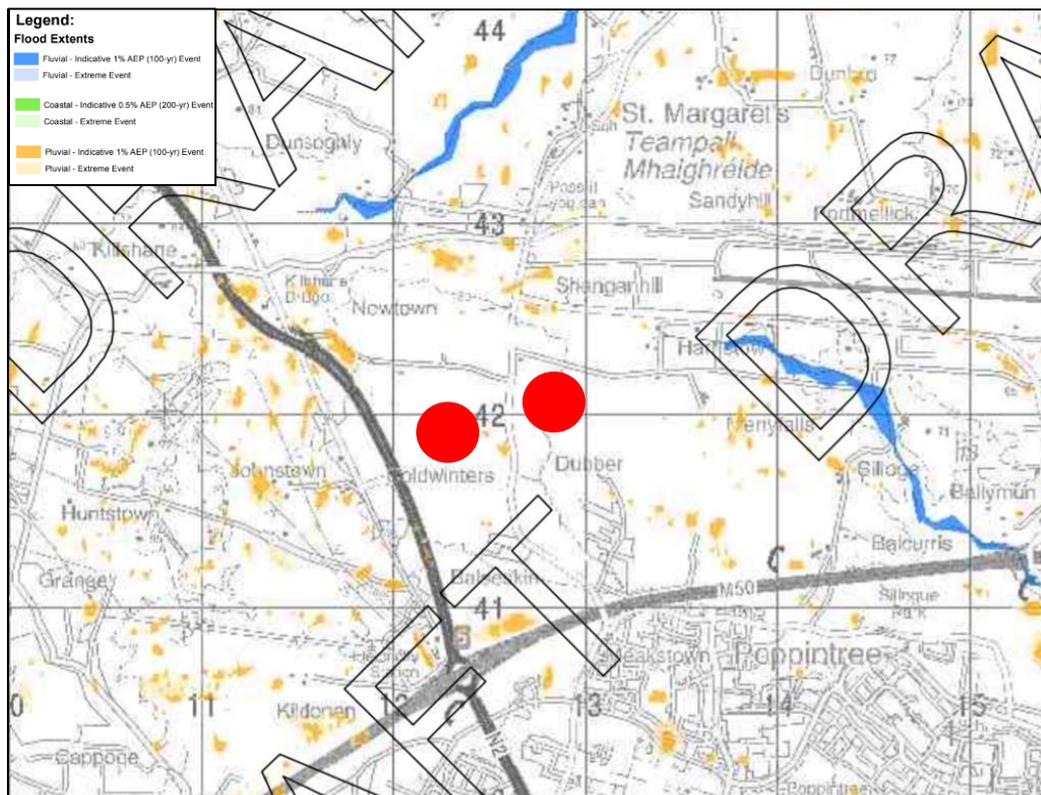


Figure 4.9 Extract from OPW PFRA Map - Dublin Inland Port

4.5.2 Flooding from Drainage Systems

4.5.2.1 Northern and Southern Port Lands

Surface water originating from DPC lands and port estate roads is discharged to the surface water drainage system. The majority of run-off from the surface water system within the port estate is passed through interceptors prior to discharging to Dublin Bay at a number of locations. There is no history of flooding from the existing storm drainage system.

4.5.2.2 Dublin Inland Port

The sites are greenfield so no formal drainage systems are currently in place.

4.6 FLOOD ZONE MAPS

The Dublin Inland Port sites are located in Flood Zone C, so no mapping has been completed.

The flood zones for the Northern and Southern Port Lands have been derived from the Eastern CFRAM Study mapping. These maps are the most comprehensive flood maps produced for the area since the introduction of the Guidelines and the Floods Directive, and are the best currently available data. The flood zones only account for coastal flooding. The flood zone map is shown in Figure 4.10. Note that the Flood Zones are based on present day flood levels.

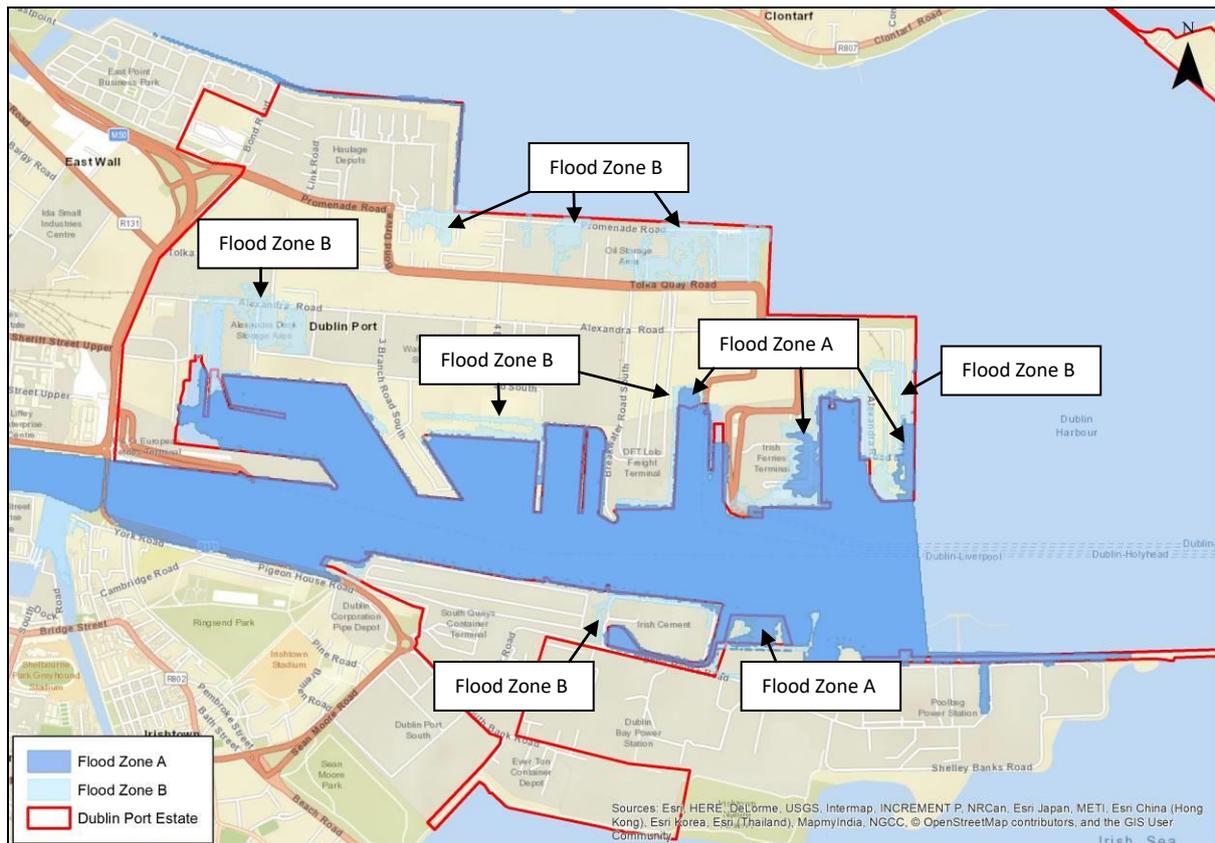


Figure 4.6 Flood Zones for Northern and Southern Port Lands (Present Day)

The flood zone map shows that the majority of the Northern Port Lands is in Flood Zone C, however there are limited areas within Flood Zone A and some areas within Flood Zone B. The areas in Flood Zone A are in the south-eastern corner, around Terminal Road South and Alexandra Road Extension. These areas are also in Flood Zone B, with the addition of areas to the north of Tolka Quay Road and to the north of Alexandra Basin.

The flood zone map shows that the majority of the Southern Port Lands is in Flood Zone C, however there are limited areas within Flood Zone A and Flood Zone B. These areas are adjacent to the River Liffey.

5 CLIMATE CHANGE

The flood zones are generated without the inclusion of climate change factors. Due to the uncertainty surrounding the potential effects of climate change a precautionary approach is recommended by the Guidelines. Examples of the precautionary approach include:

- 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;
- 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.

Current guidance for the application of climate change in terms of sea level rise is provided in 'Assessment of Future Scenarios for Flood Risk Management' (OPW 2009). This recommends that two potential future scenarios are considered: Mid-Range Future Scenario (MRFS) which represents a 'likely' future scenario; and High End Future Scenario (HEFS) which represents a more extreme potential future scenario. Based on these two scenarios the OPW recommends allowances for climate change in relation to river flows and sea level as shown in Table 5.1.

Table 5.1 Allowances for future scenarios

Criteria	Mid-Range Future Scenario	High End Future Scenario
Extreme rainfall depths	+20%	+30%
Flood flows	+20%	+30%
Mean sea level rise	+500mm	+1000mm

It is proposed that the developments in the port will take place in the short term (2017-2021), medium term (2012-2013) and long term (2031-2040). Whilst the allowances for future scenarios have not been included in the flood zone mapping, they should be taken account of in any proposed mitigation measures proposed, particularly for the medium to long term.

For most developments, a 0.5m increase in sea levels is appropriate. Where the risk associated with inundation of a development is low and the design life is short (typically less than 30 years) the allowance provided for climate change may be less than the 0.5m level. 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 locate, and those which represent a high economic and long term investment. In such situations it would be reasonable to expect the high-end future scenario

(1m increase in sea level) to be designed to. As climate projections are further developed, it may be prudent to demonstrate adaptability to even higher sea levels.

The Eastern CFRAM study produced flood maps for the Mid-Range Future Scenario. These maps have been used to produce flood zones for the Northern and Southern Port Lands. The flood zone map is shown in Figure 5.1.

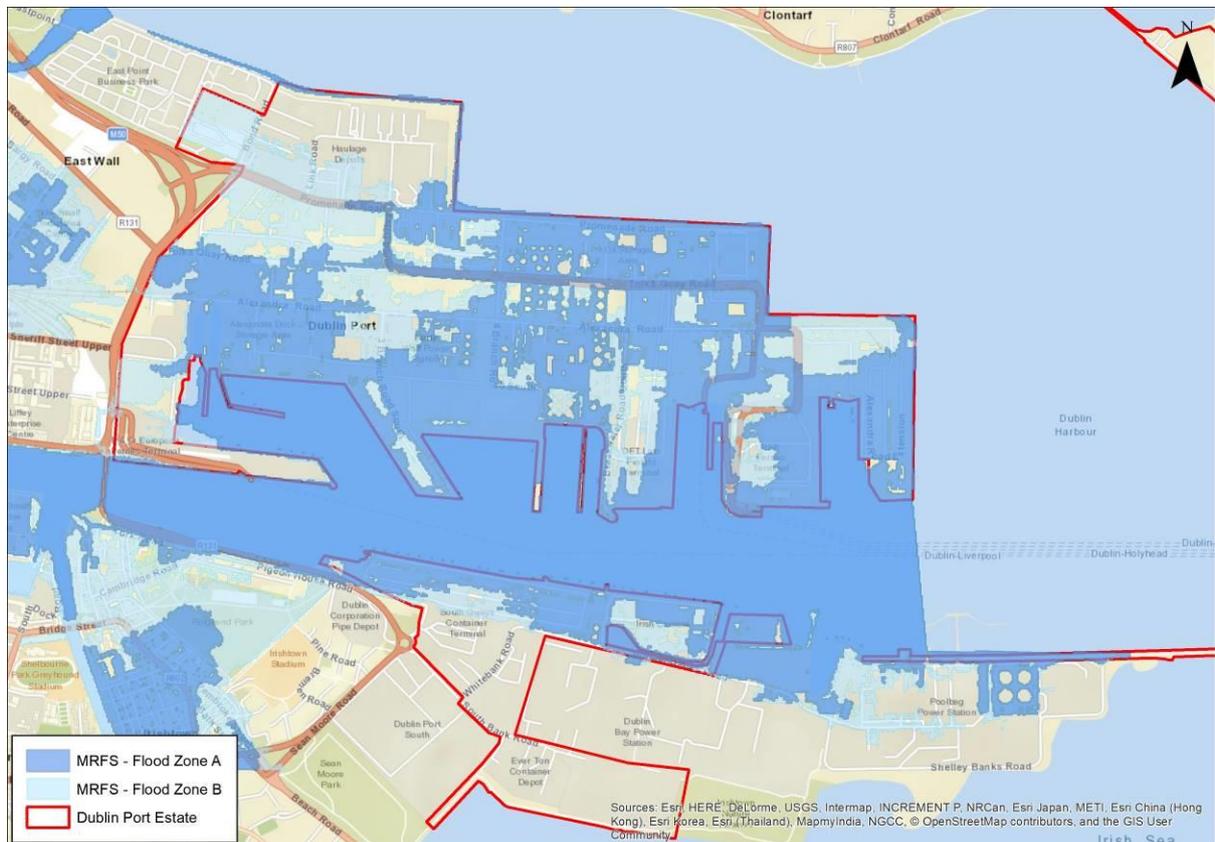


Figure 5.1 Flood Zones for Northern and Southern Port Lands (Mid-Range Future Scenario)

Figure 5.1 shows that there will be significantly more areas located within Flood Zones A and B in the future.

6 DEVELOPMENT ZONING AND THE JUSTIFICATION TEST

The purpose of zoning the Masterplan area is to indicate the types of development which would be considered most appropriate in each land use category. The zoning objectives can be related to the vulnerability classifications in the 'Planning System and Flood Risk Management Guidelines'- highly vulnerable, less vulnerable and water compatible. The vulnerability of the land use, coupled with the Flood Zone in which it is located, guides the need for the Justification Test for individual applications within the Masterplan area.

The individual proposals for the Masterplan area have been considered based on the present day flood zones derived from the Eastern CFRAM study mapping. Figure 6.1 identifies plots that will be affected by either Flood Zone A or B.

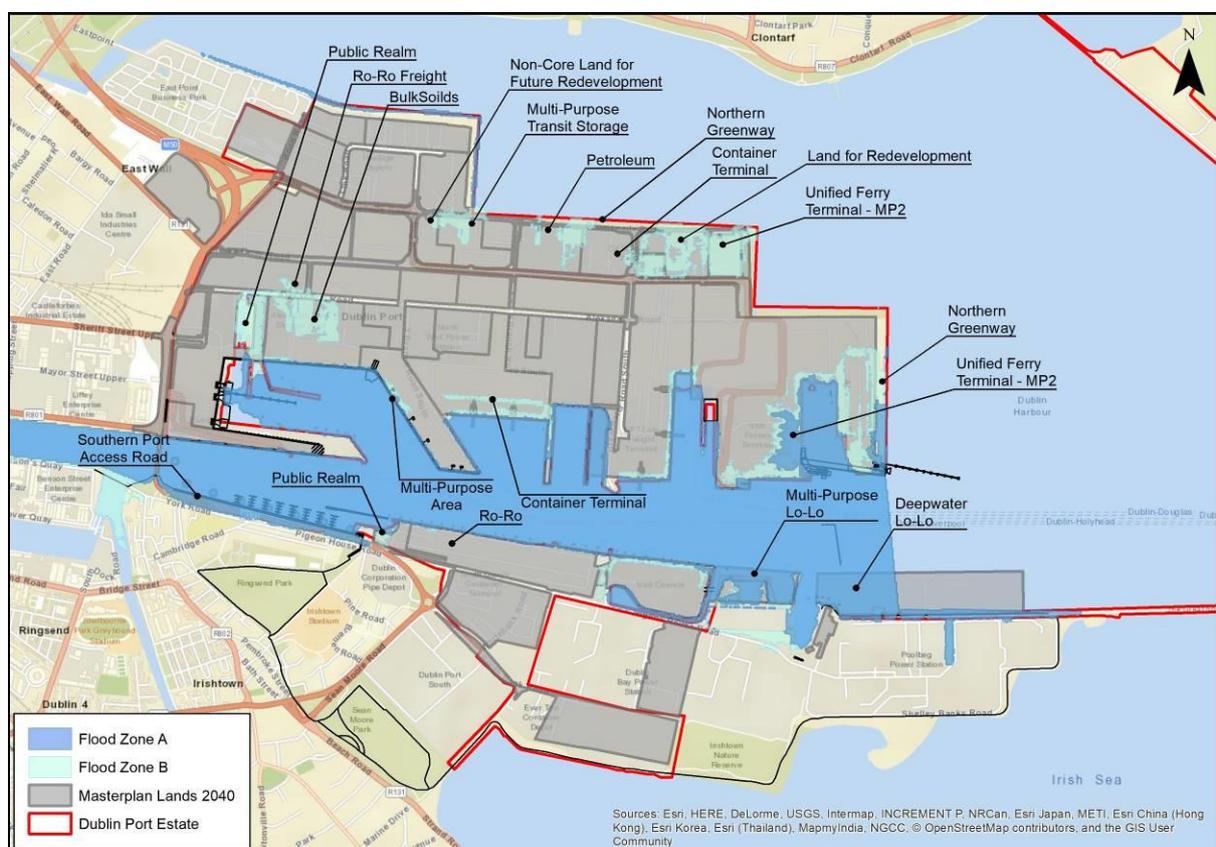


Figure 6.1 Flood Zones for Northern and Southern Port Lands Masterplan Areas (Present Day)

6.1 REQUIREMENTS FOR A FLOOD RISK ASSESSMENT

An appropriately detailed site-specific FRA will be required in support of any planning application for individual developments within the Masterplan area. The level of detail will vary depending on the risks identified and the proposed land use. As a minimum, all proposed development, including that in Flood Zone C, must consider the impact of surface water flood risks on drainage design and demonstrate compliance with the minimum required finished floor levels. In addition, flood risk

from sources other than fluvial and tidal should be reviewed, as should the impacts of climate change.

For sites within Flood Zone A or B, a site-specific 'Stage 2- Initial FRA' will be required, which may need to be developed into a 'Stage 3- Detailed FRA'. The extents of Flood Zone A and B have been delineated in this SFRA based on the Eastern CFRAM study maps. However, future studies may refine the extents so a comprehensive review of available data should be undertaken for any FRA. A more detailed, site-specific Flood Risk Assessment may produce locally varying flood outlines.

Any proposal must demonstrate the use of the sequential approach in terms of site layout and design and must satisfy the Justification Test (if required). The proposal will have to demonstrate appropriate mitigation and management measures are put in place.

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

6.2 DEVELOPMENT IN FLOOD ZONE C

The majority of the sites within the Masterplan area are located 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 climate change. This is particularly relevant at the Port site. Risk from sources other than fluvial and coastal must also be addressed. As a minimum, an FRA should be undertaken which will screen out possible indirect sources of flood risk and where they cannot be screened out it should present mitigation measures.

6.3 APPLICATIONS FOR MINOR DEVELOPMENT IN AREAS AT RISK OF FLOODING

Section 5.28 of the Guidelines identifies certain types of development as being 'minor works' and therefore exempt from the Justification Test. Such development relates to changes of use of existing buildings or extensions and additions to existing commercial and industrial enterprises. Despite the 'Sequential Approach' and 'Justification Test' not applying, 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. Where possible, the design of built elements of these application should demonstrate flood resilient design.

6.4 HIGHLY VULNERABLE DEVELOPMENT IN FLOOD ZONE A OR B

Most of the types of highly vulnerable developments listed in Figure 3.2 will not be proposed as part of the Masterplan. However, there may be some uses that could cause a source of pollution which would be considered as highly vulnerable. If possible, these uses should be sited in Flood Zone C. If a highly vulnerable development is proposed in either Flood Zone A or B, it will require a particularly rigorous consideration of flood risks and robust flood management measures through any site-specific FRA. A Justification Test will be required for all highly vulnerable developments in Flood Zone A or B.

6.5 LESS VULNERABLE DEVELOPMENT IN FLOOD ZONE A OR B

Less vulnerable development includes buildings used for warehousing, commercial and industrial uses so this is likely to apply to the proposals for the Port (see Figure 3.2 for list). Figure 6.1 shows the proposed uses within Flood Zones A and B. Where possible, less vulnerable developments should not be located in Flood Zone A. If a less vulnerable development is to be located in Flood Zone A then a Justification Test must be included in the site-specific FRA. A Justification Test is not required for this type of development in Flood Zone B.

6.6 WATER-COMPATIBLE DEVELOPMENT

These types of developments are likely to be required for the Port (see Figure 3.2 for list). A number of the uses within the Masterplan that are shown to be located in Flood Zone A, such as the proposed Ro-Ro and Lo-Lo facilities, can be considered as water compatible'. Despite the 'Sequential Approach' and 'Justification Test' not applying, an assessment of the risks of flooding should accompany such applications.

6.7 FLOOD MITIGATION MEASURES

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.

In all cases, the design and assessment of development should be the present day 0.5% tidal event, with a suitable allowance for climate change and a suitable freeboard included in the setting of minimum finished floor levels and development levels (roads and pavements). Typical freeboard should be at least 300-500mm, but in tidal areas could be higher due to wave action. A comprehensive review of the most up to date available data should be undertaken for any FRA to confirm the levels.

As the flood risks are tidal, mitigation through land raising will have no impact on neighbouring development, so compensatory storage is not required.

For some developments the minimum levels may not be achievable and alternative mitigation measures will be required to be considered and justified. The proposal should demonstrate the use of flood-resistant construction measures that are aimed at preventing water from entering a building and that mitigate the damage to 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.

The FRA should consider the safety and long-term operability of the development and the safety of operatives. Evacuation routes in the event of inundation of surrounding land should also be detailed.

7 RECOMMENDATIONS

In order to comply with ‘The Planning System and Flood Risk Management Guidelines’ and contribute towards flood risk management within the Dublin Port Masterplan, the recommendations below were made by the SFRA process.

Title	Recommendation
All proposed developments	All proposed individual developments within the Northern and Southern Port lands is required to carry out a site-specific Flood Risk Assessment to comply with the Guidelines.
Land uses	The Flood Zones identified by the SFRA should be used in the identification of land uses for in line with the provisions contained in the Guidelines. This will determine the need for a Justification Test for individual sites within the Masterplan area. Future studies may refine the flood zones so a comprehensive review of the most to date available data should be undertaken for any site-specific FRA.
Mitigation measures	<p>Minimum floor levels should be set at the present day 0.5% AEP tidal event with a suitable allowance for climate change and a suitable freeboard, taking account of the site specific wave climate. A comprehensive review of the most up to date available data should be undertaken for any FRA to confirm the levels.</p> <p>For developments where these levels may not be achievable, alternative mitigation measures will be required to be considered and justified in the site-specific FRA. This can include flood-resistant and flood-resilient construction.</p> <p>The proposed mitigation measures are subject to the findings of any site-specific FRA that is required to be undertaken.</p>
Minimum levels of site protection during construction	Minimum levels of site protection during construction would not need to account for climate change and should be set at the present day 0.5% AEP tidal level.
Storm drainage	All new developments to include SUDS design as part of the scheme

8 CONCLUSION

A Strategic Flood Risk Assessment (SFRA) has been undertaken for the Dublin Port Masterplan 2040. The SFRA is produced in accordance with 'The Planning System and Flood Risk Management Guidelines for Planning Authorities (DEHLG, 2009).

The SFRA concluded that the Dublin Inland Port is not at risk of flooding from any source. However, parts of the Northern and Southern Port Lands are at risk of coastal flooding and the respective flood zoning has been appropriately determined. The purpose of zoning the Masterplan area is to indicate the types of development which would be considered most appropriate in each land use category. The zoning objectives can be related to the vulnerability classifications in the 'Planning System and Flood Risk Management Guidelines'- highly vulnerable, less vulnerable and water compatible. The vulnerability of the land use, coupled with the Flood Zone in which it is located, guides the need for the Justification Test for individual applications within the Masterplan area.

An appropriately detailed FRA will be required in support of any planning application for individual developments within the Masterplan area. The level of detail will vary depending on the risks identified and the proposed land use. As a minimum, all proposed development, including that in Flood Zone C, must consider the impact of surface water flood risks on drainage design and demonstrate compliance with the minimum required finished floor levels. In addition, flood risk from sources other than fluvial and tidal should be reviewed, as should the impacts of climate change.

For sites within Flood Zone A or B, a site-specific 'Stage 2- Initial FRA' will be required, which may need to be developed into a 'Stage 3- Detailed FRA'. The extents of Flood Zone A and B have been delineated in this SFRA. However, future studies may refine the flood levels and extents so a comprehensive review of available data should be undertaken for any FRA.

Any proposal must demonstrate the use of the sequential approach in terms of site layout and design and must satisfy the Justification Test (if required). The proposal will have to demonstrate appropriate mitigation and management measures are put in place.

9 REFERENCES

DEHLG & OPW (2009). The Planning System and Flood Risk Management: Guidelines for Planning Authorities.

DEHLG & OPW (2009). The Planning System and Flood Risk Management: Guidelines for Planning Authorities Technical Appendices.

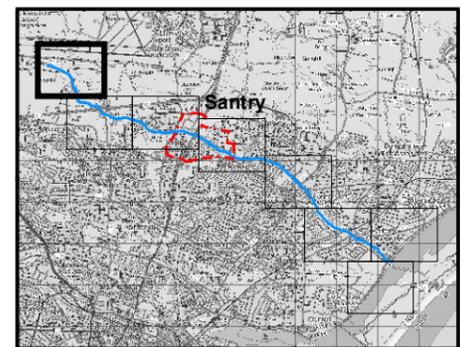
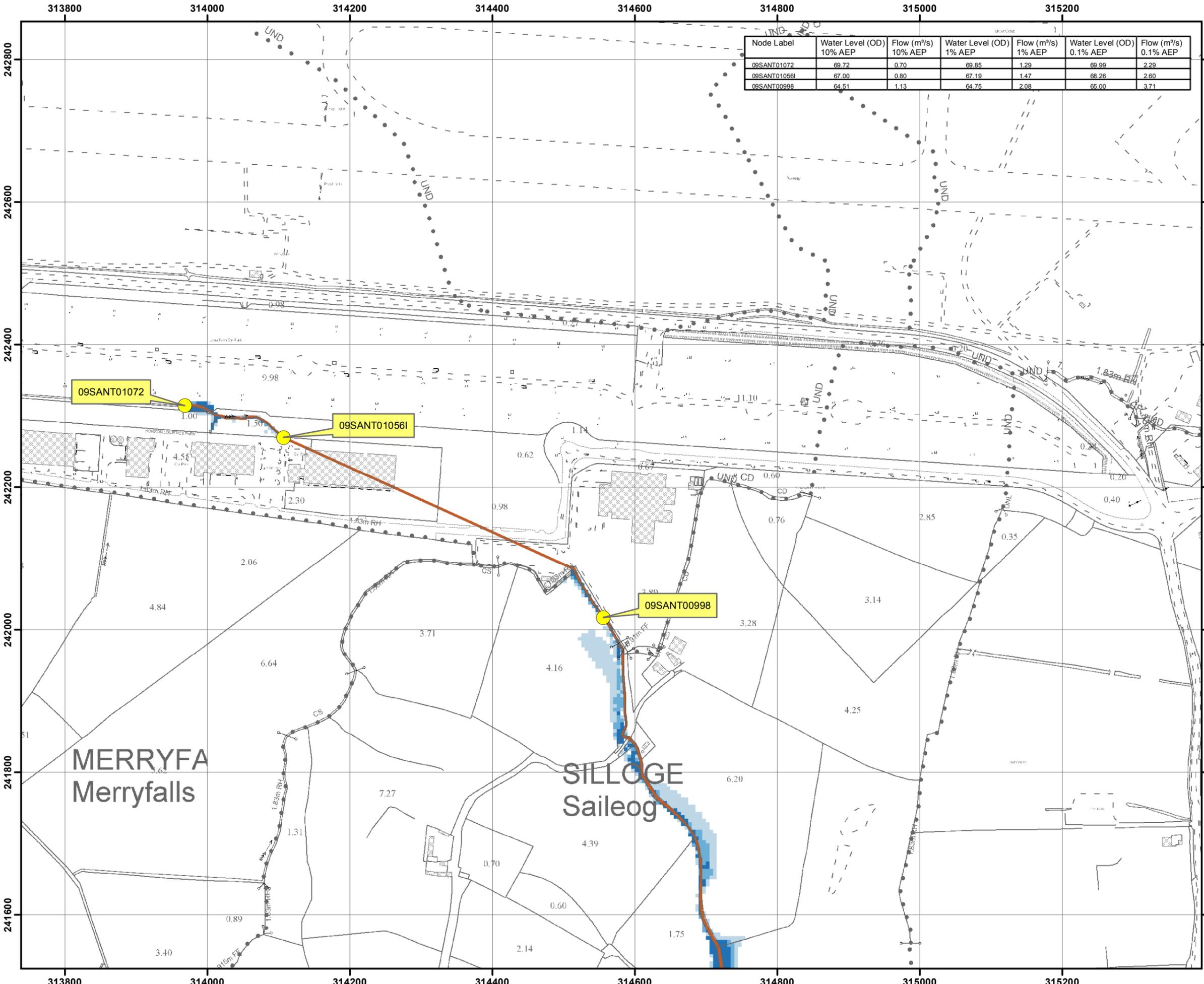
OPW (2009). Assessment of Potential Future Scenarios. Flood Risk Management Draft Guidance.

OPW. Eastern CFRAMS Study Flood Maps. Available at <http://maps.opw.ie/floodplans/>

OPW National Flood Hazard Mapping. Available at <http://www.floodmaps.ie/>

APPENDIX A

FLUVIAL FLOOD MAPS FROM EASTERN CFRAM STUDY



IMPORTANT USER NOTE:
 THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.

- Legend**
- 10% Fluvial AEP Event
 - 1% Fluvial AEP Event
 - 0.1% Fluvial AEP Event
 - Modelled River Centreline
 - AFA Extents
 - Node Point
 - Node ID

FINAL

REV:	NOTE:	DATE:
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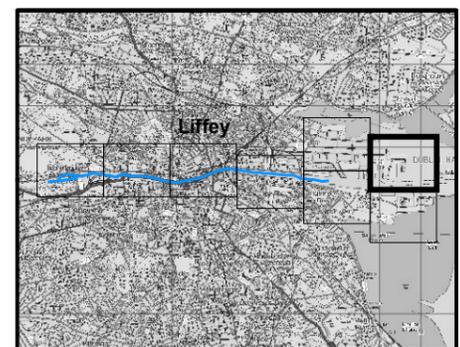
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 74 Boucher Road
 BT12 6RZ
 Eireland@rpsgroup.com

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 F +44(0) 28 90 668286
 W www.rpsgroup.com

Map:	
Santry Fluvial Flood Extents	
Map Type: EXTENT	
Source: FLUVIAL	
Map Area: HPW	
Scenario: CURRENT	
Drawn By: C.C.	Date: 27 July 2016
Checked By: A.S.	Date: 27 July 2016
Approved By: S.P.	Date: 27 July 2016
Drawing No.: E09SAY_EXFCD_F0_01	
Map Series: Page 1 of 8	
Drawing Scale: 1:5,000 @ A3	





IMPORTANT USER NOTE:
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- Legend**
- 10% Fluvial AEP Event
 - 1% Fluvial AEP Event
 - 0.1% Fluvial AEP Event
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 - Node Label

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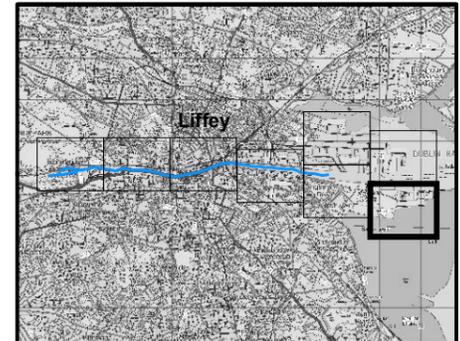
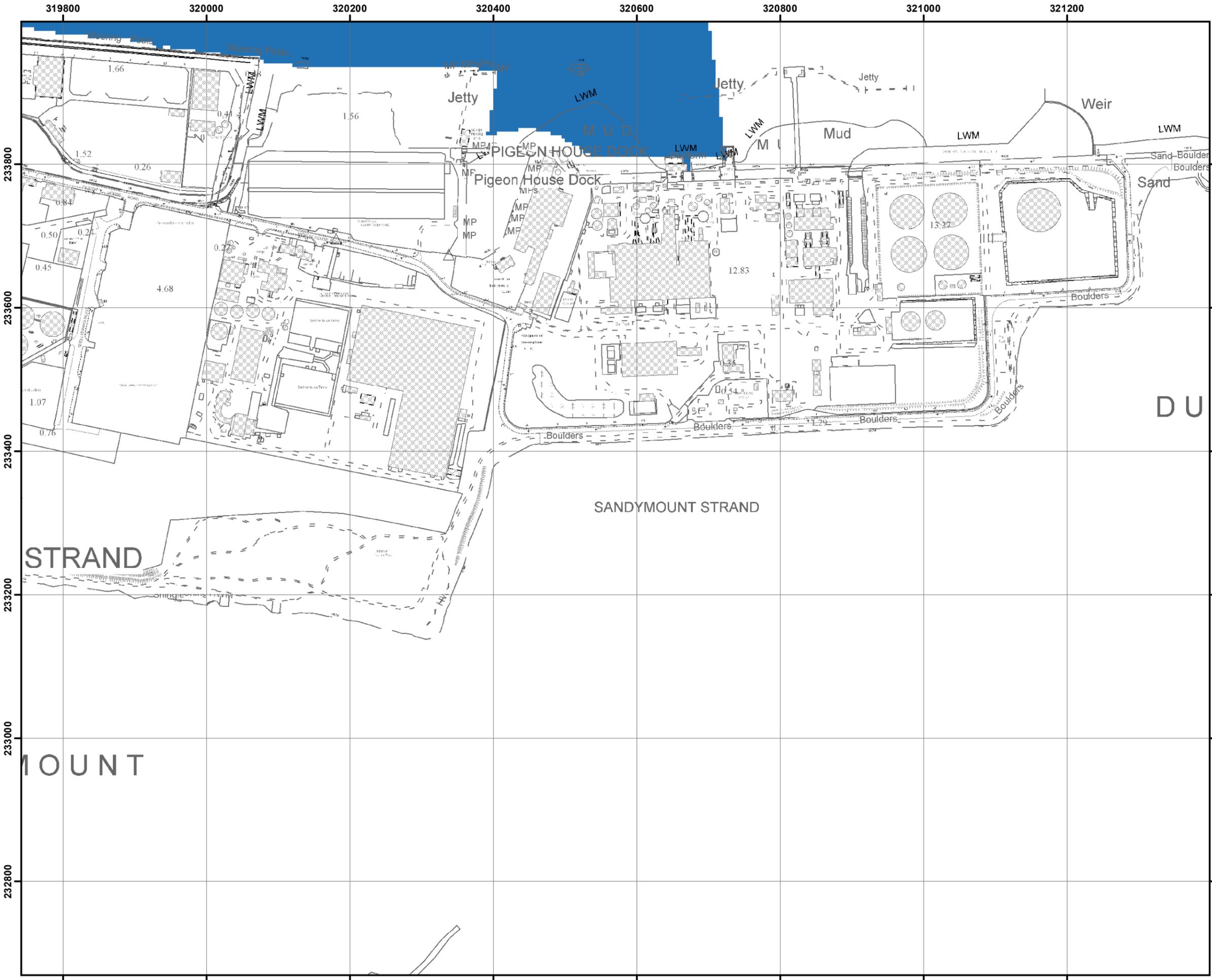
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F +44(0) 28 90 668286
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Map:	
Liffey Fluvial Flood Extents	
Map Type: EXTENT	
Source: FLUVIAL	
Map Area: HPW	
Scenario: CURRENT	
Drawn By : C.C.	Date : 28 July 2016
Checked By : A.S.	Date : 28 July 2016
Approved By : S.P.	Date : 28 July 2016
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Map Series : Page 8 of 8	
Drawing Scale : 1:5,000 @ A3	





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- Legend**
- 10% Fluvial AEP Event
 - 1% Fluvial AEP Event
 - 0.1% Fluvial AEP Event
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 - AFA Extents
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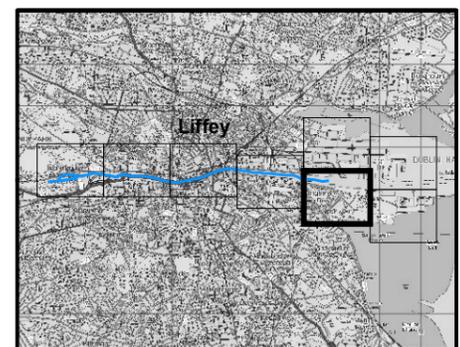
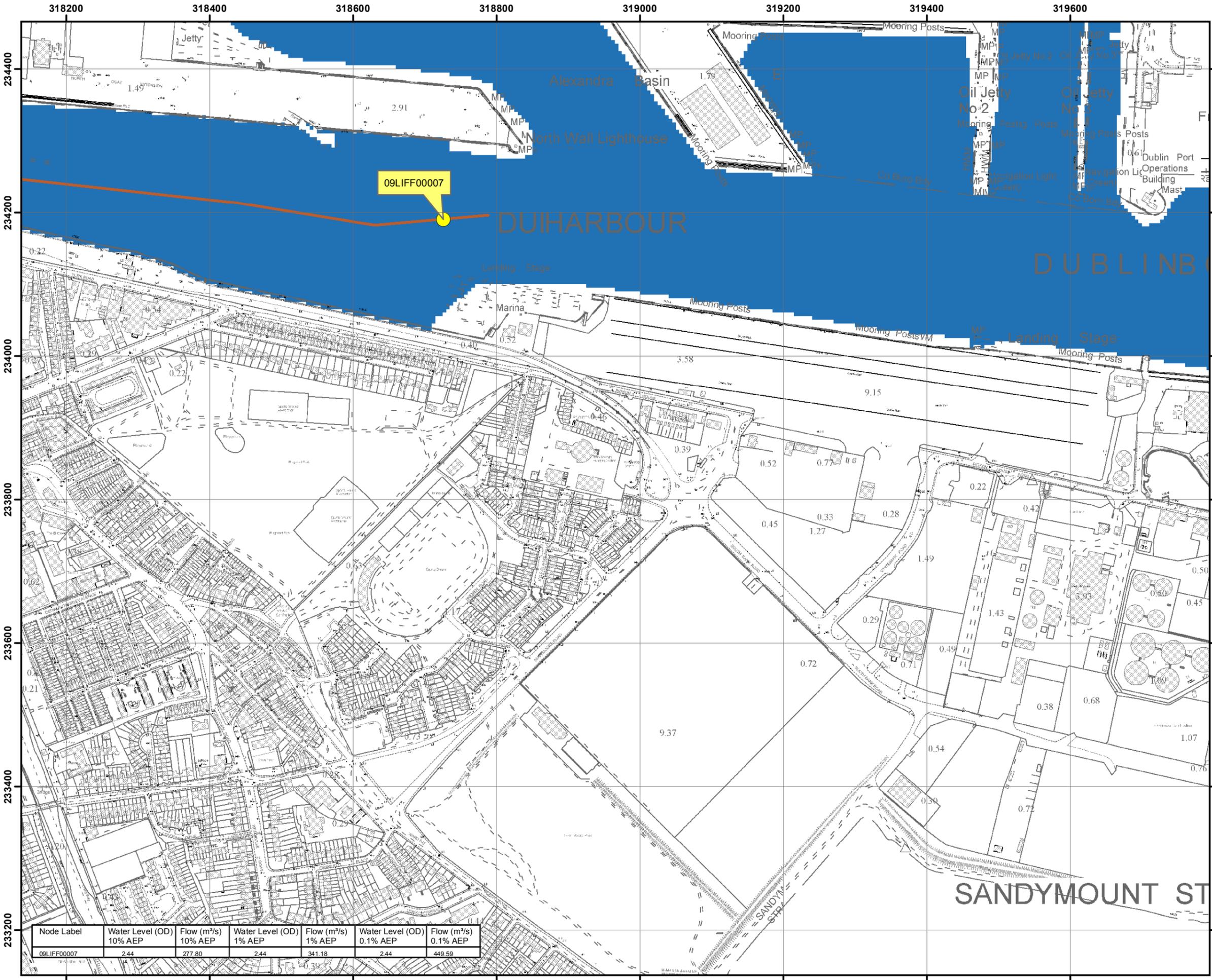
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Map:	
Liffey Fluvial Flood Extents	
Map Type: EXTENT	
Source: FLUVIAL	
Map Area: HPW	
Scenario: CURRENT	
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Checked By : A.S.	Date : 28 July 2016
Approved By : S.P.	Date : 28 July 2016
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- Legend**
- 10% Fluvial AEP Event
 - 1% Fluvial AEP Event
 - 0.1% Fluvial AEP Event
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 - AFA Extents
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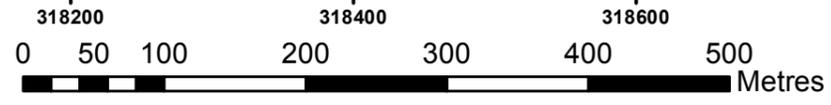
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Map Area: HPW	
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Drawn By : C.C.	Date : 28 July 2016
Checked By : A.S.	Date : 28 July 2016
Approved By : S.P.	Date : 28 July 2016
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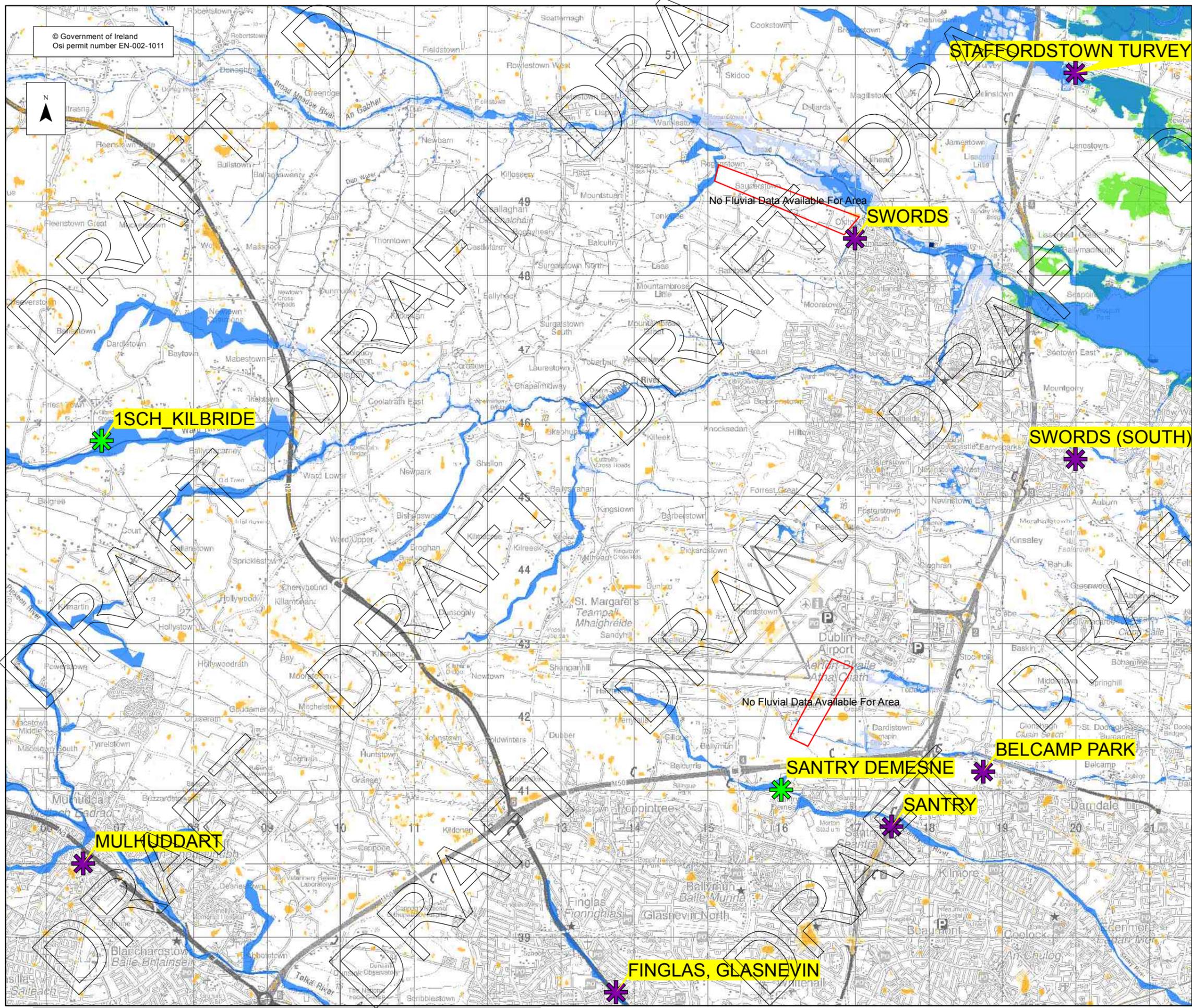
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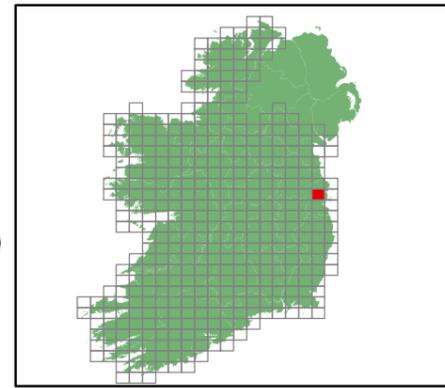
APPENDIX B

PFRA INDICATIVE EXTENTS AND OUTCOMES MAP

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Osi permit number EN-002-1011



Location Plan :



Legend:

- Flood Extents**
- Fluvial - Indicative 1% AEP (100-yr) Event
 - Fluvial - Extreme Event
 - Coastal - Indicative 0.5% AEP (200-yr) Event
 - Coastal - Extreme Event
 - Pluvial - Indicative 1% AEP (100-yr) Event
 - Pluvial - Extreme Event
 - Groundwater Flood Extents
 - Lakes / Turloughs
- PFRA Outcomes**
- ✳ Probable Area for Further Assesment
 - ✳ Possible Area for Further Assesment

Important User Note:
The flood extents shown on these maps are based on broad-scale simple analysis and may not be accurate for a specific location. Information on the purpose, development and limitations of these maps is available in the relevant reports (see www.cfram.ie). Users should seek professional advice if they intend to rely on the maps in any way.

If you believe that the maps are inaccurate in some way please forward full details by contacting the OPW (refer to PFRA Information leaflets or 'Have Your Say' on www.cfram.ie).

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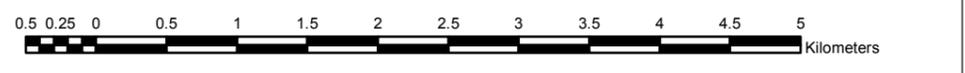
Project :
PRELIMINARY FLOOD RISK ASSESMENT (PFRA)

Map :
PFRA Indicative extents and outcomes
- Draft for Consultation

Figure By : PJW Date : July 2011
Checked By : MA Date : July 2011

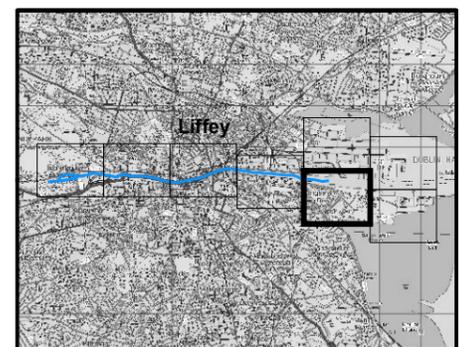
Figure No. :
2019 / MAP / 256 / A Revision
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APPENDIX C

COASTAL FLOOD MAPS FROM EASTERN CFRAM STUDY



IMPORTANT USER NOTE:
THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.

- Legend**
- 10% Tidal AEP Event
 - 0.5% Tidal AEP Event
 - 0.1% Tidal AEP Event
 - Modelled River Centreline
 - AFA Extents
 - Node Point
 - Node ID
 - Node Label

FINAL

REV:	NOTE:	DATE:
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Node Label	Water Level (OD) 10% AEP	Flow (m ³ /s) 10% AEP	Water Level (OD) 0.5% AEP	Flow (m ³ /s) 0.5% AEP	Water Level (OD) 0.1% AEP	Flow (m ³ /s) 0.1% AEP
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E0924C0011	2.67	N/A	3.11	N/A	3.34	N/A
E0924C0016	2.67	N/A	3.11	N/A	3.34	N/A
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Map:
Liffey Tidal Flood Extents

Map Type: EXTENT

Source: TIDAL

Map Area: COASTAL

Scenario: CURRENT

Drawn By: C.C. **Date:** 28 July 2016

Checked By: A.S. **Date:** 28 July 2016

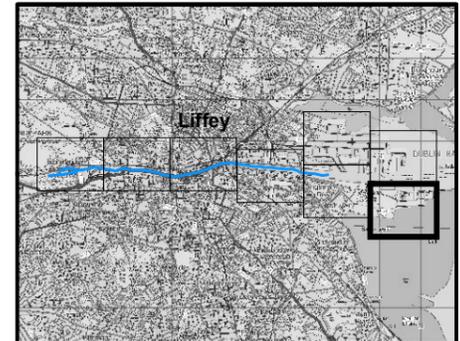
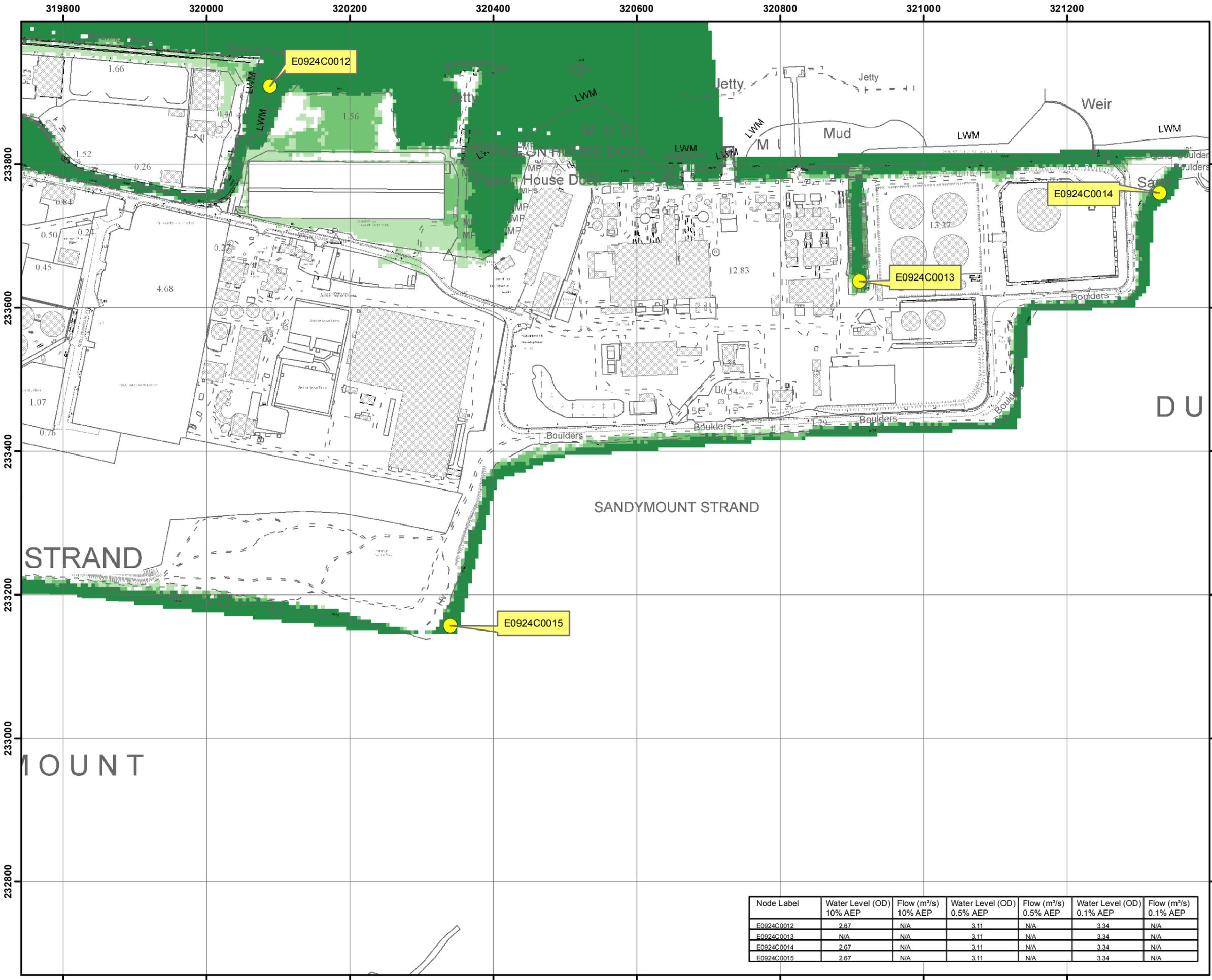
Approved By: S.P. **Date:** 28 July 2016

Drawing No.:
E09LIF_EXCCD_F0_05

Map Series: Page 5 of 8

Drawing Scale: 1:5,000 @ A3





IMPORTANT USER NOTE:
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- Legend**
- 10% Tidal AEP Event
 - 0.5% Tidal AEP Event
 - 0.1% Tidal AEP Event
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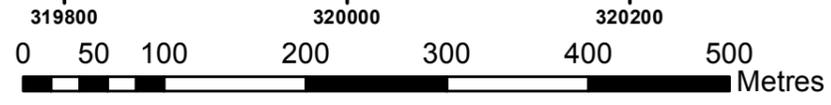
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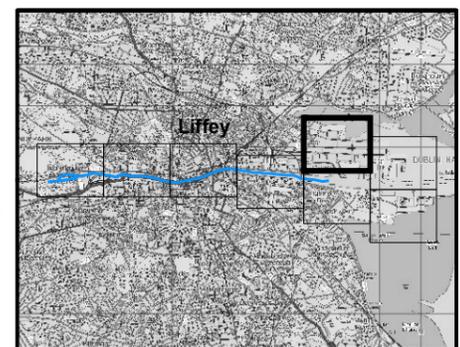
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Drawn By : C.C.	Date : 28 July 2016
Checked By : A.S.	Date : 28 July 2016
Approved By : S.P.	Date : 28 July 2016
Drawing No. :	
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Node Label	Water Level (OD) 10% AEP	Flow (m ³ /s) 10% AEP	Water Level (OD) 0.5% AEP	Flow (m ³ /s) 0.5% AEP	Water Level (OD) 0.1% AEP	Flow (m ³ /s) 0.1% AEP
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Node Label	Water Level (OD)		Flow (m³/s)		Water Level (OD)		Flow (m³/s)	
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E0924C0009	N/A	N/A	N/A	N/A	3.34	N/A		
E0924C0010	2.67	N/A	3.11	N/A	3.34	N/A		



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- Legend**
- 10% Tidal AEP Event
 - 0.5% Tidal AEP Event
 - 0.1% Tidal AEP Event
 - Modelled River Centreline
 - AFA Extents
 - Node Point
 - Node ID
 - Node Label

FINAL

REV:	NOTE:	DATE:
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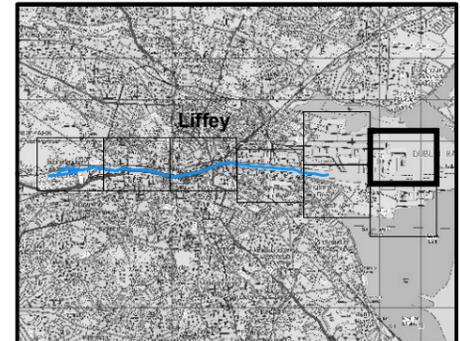
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Map:	
Liffey Tidal Flood Extents	
Map Type: EXTENT	
Source: TIDAL	
Map Area: COASTAL	
Scenario: CURRENT	
Drawn By : C.C.	Date : 28 July 2016
Checked By : A.S.	Date : 28 July 2016
Approved By : S.P.	Date : 28 July 2016
Drawing No. : E09LIF_EXCCD_F0_07	
Map Series : Page 7 of 8	
Drawing Scale : 1:5,000 @ A3	



Node Label	Water Level (OD) 10% AEP	Flow (m³/s) 10% AEP	Water Level (OD) 0.5% AEP	Flow (m³/s) 0.5% AEP	Water Level (OD) 0.1% AEP	Flow (m³/s) 0.1% AEP
E0924C0004	N/A	N/A	3.11	N/A	3.34	N/A
E0924C0005	N/A	N/A	N/A	N/A	3.31	N/A
E0924C0006	N/A	N/A	3.11	N/A	3.34	N/A
E0924C0007	N/A	N/A	N/A	N/A	3.31	N/A
E0924C0008	N/A	N/A	N/A	N/A	3.32	N/A



IMPORTANT USER NOTE:
THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.

- Legend**
- 10% Tidal AEP Event
 - 0.5% Tidal AEP Event
 - 0.1% Tidal AEP Event
 - Modelled River Centreline
 - AFA Extents
 - Node Point
 - Node ID

FINAL

REV:	NOTE:	DATE:
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Map:	
Liffey Tidal Flood Extents	
Map Type: EXTENT	
Source: TIDAL	
Map Area: COASTAL	
Scenario: CURRENT	
Drawn By : C.C.	Date : 28 July 2016
Checked By : A.S.	Date : 28 July 2016
Approved By : S.P.	Date : 28 July 2016
Drawing No. : E09LIF_EXCCD_F0_08	
Map Series : Page 8 of 8	
Drawing Scale : 1:5,000 @ A3	



APPENDIX D

PLUVIAL FLOOD MAPS FROM EASTERN CFRAM STUDY

309000

312000

315000

318000

321000

234000

234000

231000

231000

228000

228000

225000

225000

309000

312000

315000

318000

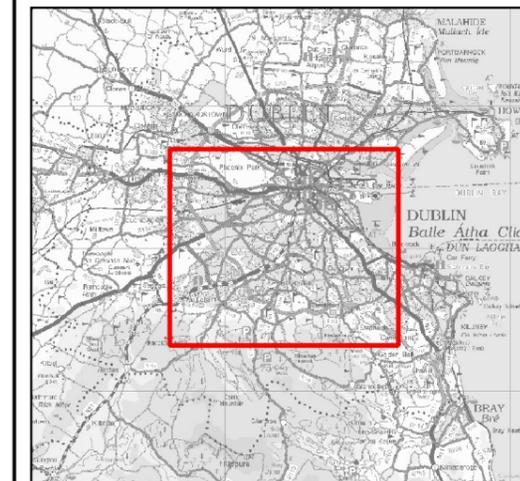
321000

1000 0 1000 2000 3000 4000 Meters



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Location Plan:



LEGEND

-  10% AEP Pluvial
-  1% AEP Pluvial
-  0.5% AEP Pluvial

IMPORTANT USER NOTE:
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The Office of Public Works
Jonathan Swift Street
Trim
Co. Meath



Dublin City Council
Civic Offices
Wood Quay
Dublin 8

Project:
DUBLIN PLUVIAL STUDY (FloodResilienCity)

Map: **DUBLIN CITY - PLUVIAL FLOOD EXTENT MAP**

Map Type:	EXTENT - 180min Rainfall
Source:	PLUVIAL
Map Area:	URBAN
Scenario:	CURRENT

Drawn by:	IH	Date:	Aug - 2016
Checked by:	MC	Date:	Aug - 2016
Approved by:	JM	Date:	Aug - 2016

Map No.: **E09DCC_EXPDC_F0_03**

Revision: F0

Map Scale: 1:50,000 Plot Scale: 1:1 @ A3

