Beach Road Apartments, Sandymount, Dublin 4

Site-Specific Flood Risk Assessment

September 2024

Document Control

Document Number: 222207-PUNCH-XX-XX-RP-C-0010

Status	Rev	Description	Date	Prepared	Checked	Approved
A0	C01	Planning Amendment Issue	26/09/2024	C. Dempsey	M Richardson	C Shannon

Table of Contents

Table of Contents ii
1.0 Introduction 1
1.1 Background 1
1.2 Nature of the Proposed Development 1
1.2.1 Proposed Additional Flood Mitigation Measures 2
2.0 Relevant Guidance 3
2.1 The Planning System and Flood Risk Management Guidelines 3
2.2 Dublin City Development Plan 2022-2028 SFRA 4
2.3 Land Zoning 4
3.0 Flood Risk Identification 5
3.1 Existing Hydrological Environment 5
3.2 Topographical & Walkover Surveys 5
3.3 Site Geology 6
3.4 History of Flooding 6
3.5 Review of Existing Surface Water Infrastructure 8
3.6 Existing Flood Defences 8
3.7 Review of Historic Mapping 9
4.0 Flood Zone Assessment 10
4.1 Strategic Flood Risk Assessment (SFRA) Mapping 10
4.2 CFRAMS Mapping 11
4.2.1 CFRAMS Coastal Flood Mapping 11
4.2.1 CFRAMS Fluvial Flood Mapping 12
4.2.1 CFRAMS Pluvial Flood Mapping 13
4.3 Estimate of Flood Zone 14
4.4 Modelled Flood Levels 14
4.5 Flood Risk to Adjacent Sites 14

5.0 Flood Risk Assessment 17
5.1 Sources of Flooding 17
5.2 Climate Change 17
5.2.1 Fluvial Flooding 18
5.2.2 Coastal Flooding 19
5.3 Site Vulnerability 20
5.4 Flood Mitigation Measures 20
5.5 Flood Risk Management 21
6.0 Conclusion 23

Appendix A. Existing Utilities Drawing ..... B
Appendix B. Site Topographical Survey C
Appendix C. Site Visit Images ..... D
Appendix D. OPW Historic Flood Events Record ..... D
Appendix E. Sandymount Observed 2011 Flood Extent ..... E
Appendix F. CFRAMS Mapping ..... F
Appendix G. SFRA Justification Tests (Area: 8. Coastal: Sandymount) ..... G

1.0 Introduction

1.1 Background

This report is provided in support of a planning amendment, planning retention application as part of an LRD application for a development previously approved under SHD ABP-310299-21. The Flood Risk Assessment is carried out in full compliance with the requirements of "The Planning System & Flood Risk Management Guidelines" published by the Department of the Environment, Heritage and Local Government in November 2009 and the DCC Development Plan 2022-2028.

Note that a previous planning application (reference no. 2001/18) was submitted for the subject site for 90 no. dwellings and was granted planning (decision order no. P2857) on 19 June 2018.

The layout of the proposed scheme is detailed in a series of planning drawings by Plus Architecture accompanying this planning amendment.

1.2 Nature of the Proposed Development

The proposed development is located on lands to the south-west of Beach Road in Sandymount, in the east of Dublin City. The site is bordered to the north-east by the R111/Church Avenue, to the south-west by St. Matthew's school and to the east by the R802/Beach Road. There are a number of private residential properties in the area.

The development is substantially equivalent to the original application and the development description should be taken from architectural documentation. The development includes a multi storey apartment development with basement parking, ancillary internal uses, and external substation. Vehicular and pedestrian access to the site will be from Beach Road with additional pedestrian access via Church Avenue.

The development will also include the provision of: private open space in the form of balconies and terraces (on the Beach Road, Church Avenue frontages and to the rear of the building on the northwestern, southeastern and southwestern facades), and semi-private and public open space at ground level; all hard and soft landscaping including boundary treatments; changes in levels; plant; PV panels; SuDS' measures including a green roof; waste collection area; and all other associated site excavation and site development works above and below ground.

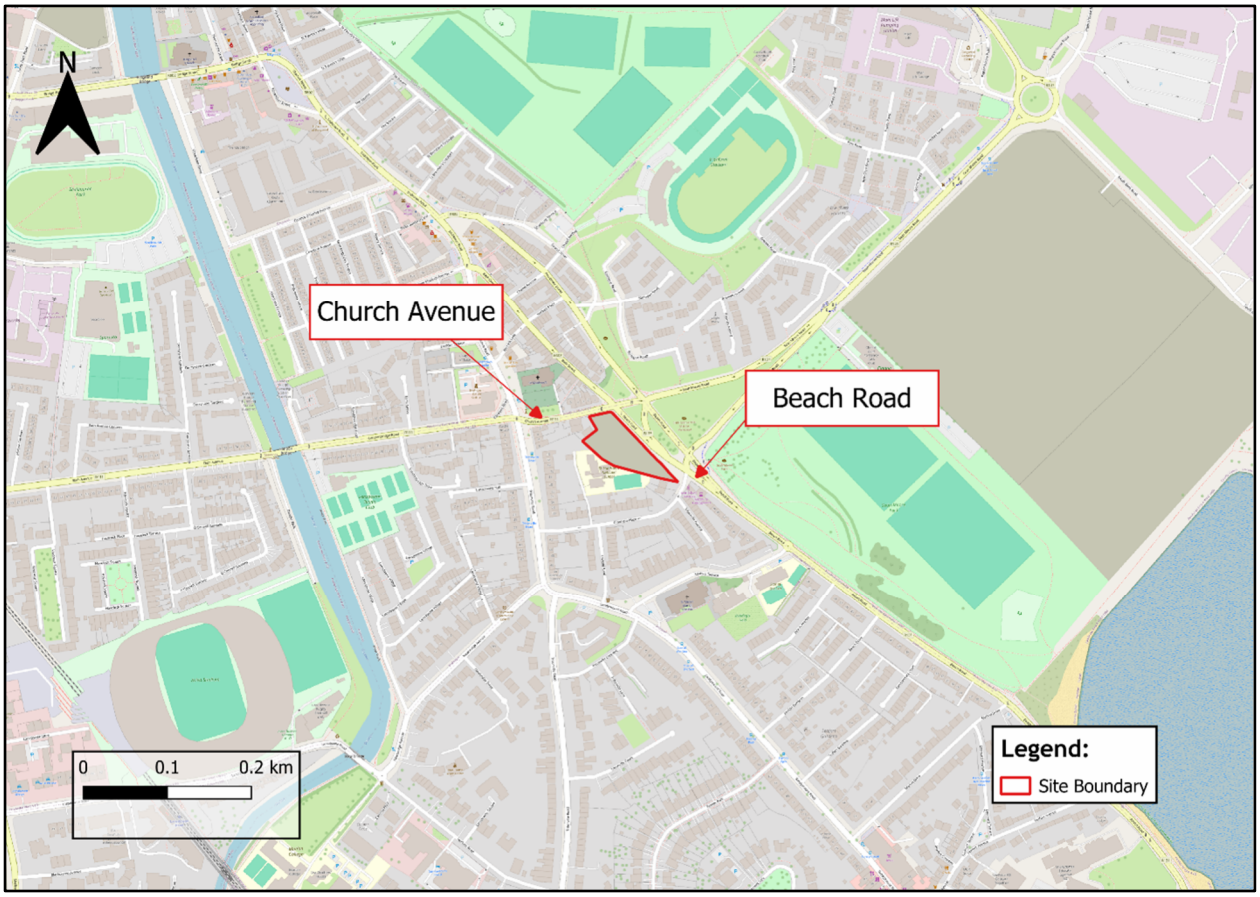


Figure 1-1: Location of Proposed Development (Site Boundary indicated in red).

1.2.1 Proposed Additional Flood Mitigation Measures

The new flood mitigation measures proposed in this planning amendment are:

- Drainage that services low level areas below flood level is managed by a penstock to be closed in the event of a flood.
- Demountable flood barriers are proposed adjacent to the substation to prevent the substation and adjacent landscape areas from flooding.

The layout of these additional mitigation measures is shown in BRA-PUN-PA-00DR-C-D2-0100 “Proposed Ground Floor Drainage Layout” and BRA-PUN-PA-00DR-C-D2-0800 “Demountable Flood Barriers”.

2.0 Relevant Guidance

2.1 The Planning System and Flood Risk Management Guidelines

In September 2008, "The Planning System and Flood Risk Management" Guidelines were published by the Department of the Environment, Heritage and Local Government in Draft format. In November 2009, the adopted version of the document was published.

The Flood Risk Management Guidelines give guidance on flood risk and development. The guidelines recommend a precautionary approach when considering flood risk management in the planning system. The core principle of the guidelines is to adopt a risk based sequential approach to managing flood risk and to avoid development in areas that are at risk. The sequential approach is based on the identification of flood zones for river and coastal flooding. The guidelines include definitions of Flood Zones A, B and C as noted below. It should be noted that these do not take into account the presence of flood defences, as there remain risks of overtopping and breach of the defences.

Table 2-1: Flood Zone Designations

Flood Zone	Type of Flooding	Annual Exceedance Probability (AEP)
Flood Zone A	Coastal	Less than a 1:200 (0.5% AEP) year event
	Fluvial	Less than a 1:100 (1% AEP) year event
Flood Zone B	Coastal	Greater than a 1:200 (0.5% AEP) and less than a 1:1000 (0.1% AEP) year event
	Fluvial	Greater than a 1:100 (1% AEP) and less than a 1:1000 (0.1% AEP) year event
Flood Zone C	Coastal	Greater than a 1:1000 (0.1% AEP) year event
	Fluvial	Greater than a 1:1000 (0.1% AEP) year event

Once a flood zone has been identified, the guidelines set out the different types of development appropriate to each zone. Exceptions to the restriction of development due to potential flood risks are provided for through the use of the Justification Test, where the planning need and the sustainable management of flood risk to an acceptable level must be demonstrated. This recognises that there will be a need for future development in existing towns and urban centres that lie within flood risk zones, and that the avoidance of all future development in these areas would be unsustainable.

A three staged approach to undertaking an FRA is recommended:

Stage 1: Flood Risk Identification – Identification of any issues relating to the site that will require further investigation through a Flood Risk Assessment;

Stage 2: Initial Flood Risk Assessment – Involves establishment of the sources of flooding, the extent of the flood risk, potential impacts of the development and possible mitigation measures;

Stage 3: Detailed Flood Risk Assessment – Assess flood risk issues in sufficient detail to provide quantitative appraisal of potential flood risk of the development, impacts of the flooding elsewhere and the effectiveness of any proposed mitigation measures.

This report addresses the requirements for Stage 2.

2.2 Dublin City Development Plan 2022-2028 SFRA

A Strategic Flood Risk Assessment (SFRA) was prepared to accompany the DCC Development Plan 2022-2028. Sandymount falls within Area 8 in Appendix B (Area Assessment and Justification Test Tables) of this document. The SFRA states the following in relation to SSFRAs for Area 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 being completed. Small scale development, such as extensions, is acceptable, but larger scale development is premature. Once completed, new flood defences may alter restrictions on such developments and a reappraisal of flood risk would be appropriate as per this SFRA and the main Development Plan.*
- *Climate change risks are significant and need to be assessed under the site-specific FRA with guidance on finished floor levels applied as detailed in the SFRA.*
- *Groundwater flooding particularly during high tide, should be considered in all development flood risk assessments in this site area.*

2.3 Land Zoning

The land on which the development is proposed is currently zoned as "Z1" in the Dublin City Development Plan 2022-2028. This designation refers to lands that are "Sustainable Residential Neighbourhoods".

3.0 Flood Risk Identification

3.1 Existing Hydrological Environment

The existing hydrological environment is characterised primarily by the coast and the tidal changes. The site is located approximately 600m northwest of Sandymount Strand. The area to the east of the site is generally reclaimed land.

The development is located approximately 350m to the east of the River Dodder. Existing flood defences are in place on the banks of the River Dodder in this location.

The hydrological environment around the site is shown in Figure 3-1 below. Runoff from the area is drained via the River Dodder and a number of existing combined sewers.

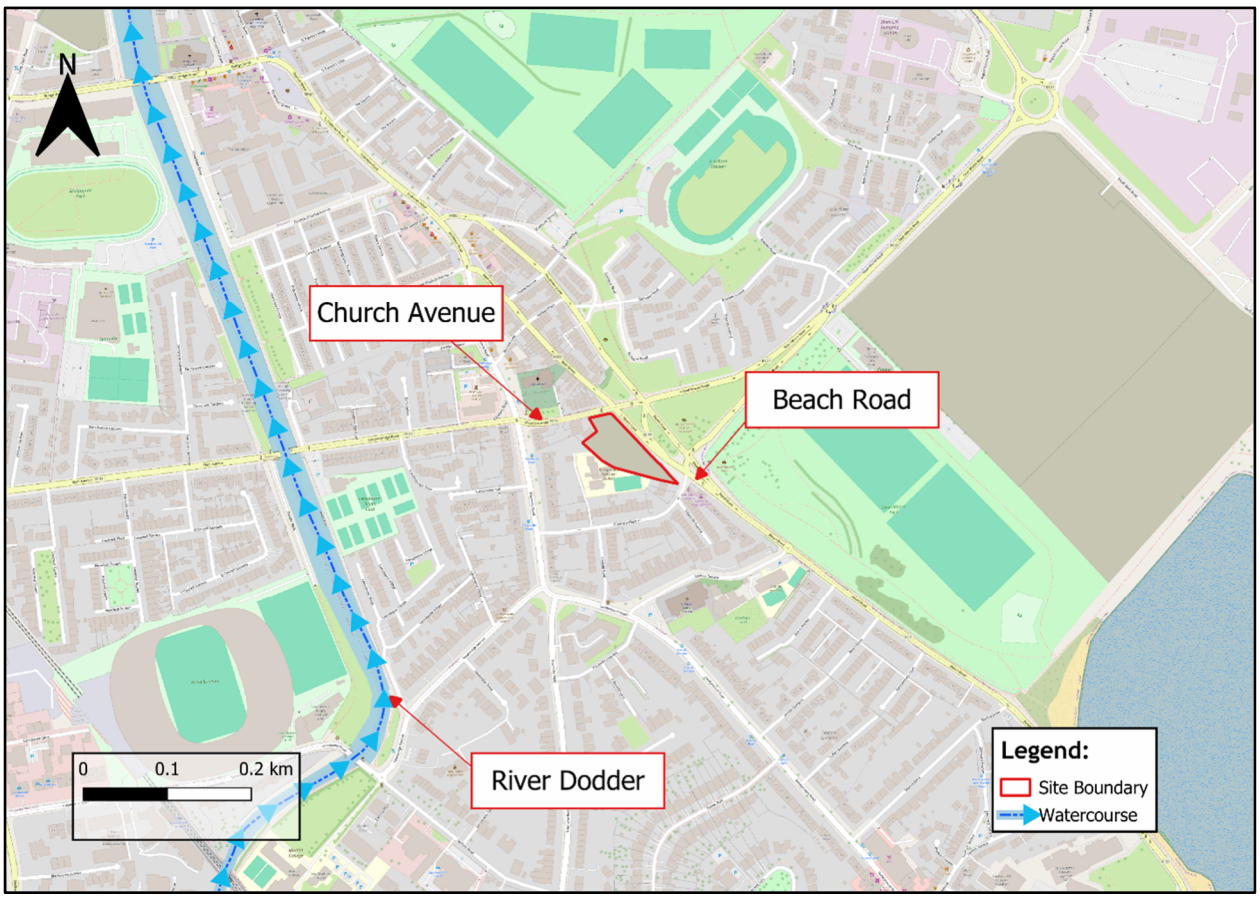


Figure 3-1: Hydrological environment around the site.

3.2 Topographical & Walkover Surveys

A topographical survey of the site and its environs was carried out by Murphy Surveys Limited and provided to PUNCH Consulting Engineers to assist in the design and preparation of this Flood Risk Assessment. This survey was carried out in November 2017. A copy of this survey is included in Appendix B.

PUNCH Consulting Engineers visited the site on 2 November 2017 in order to identify the key features of the site, to establish any potential sources of flooding and to identify the likely routes of flood waters. Appendix C contains a selection of key images taken during this site visit.

The following was established from the site visit and review of the topographical survey:

- The site generally falls from the south-east to the north-west;
- The existing levels of the site are lower than the surrounding roads, and the site contains a localised low point relative to the roads to the north and east. This low point currently drains via an existing gulley and connects to a drain on Church Avenue;
- The site is presently 100% impermeable due to the presence of hard surfaces and the existing buildings;
- The grounds around the existing car dealership structure contain a low point of approximately 2.0m AOD to the west of the structure.

3.3 Site Geology

The geology of the site was reviewed using data from the Geological Survey of Ireland (available at www.gsi.ie). The Quaternary geology mapping of the area shows that the area has a history of flooding due to its proximity to the coastline and the River Dodder. While Figure 3-2 below describes the quaternary geology as 'urban', evidence of Beach Sands to the south and west of the site suggest that the lands were (geologically) historically natural beach lands which were subject to coastal flooding.

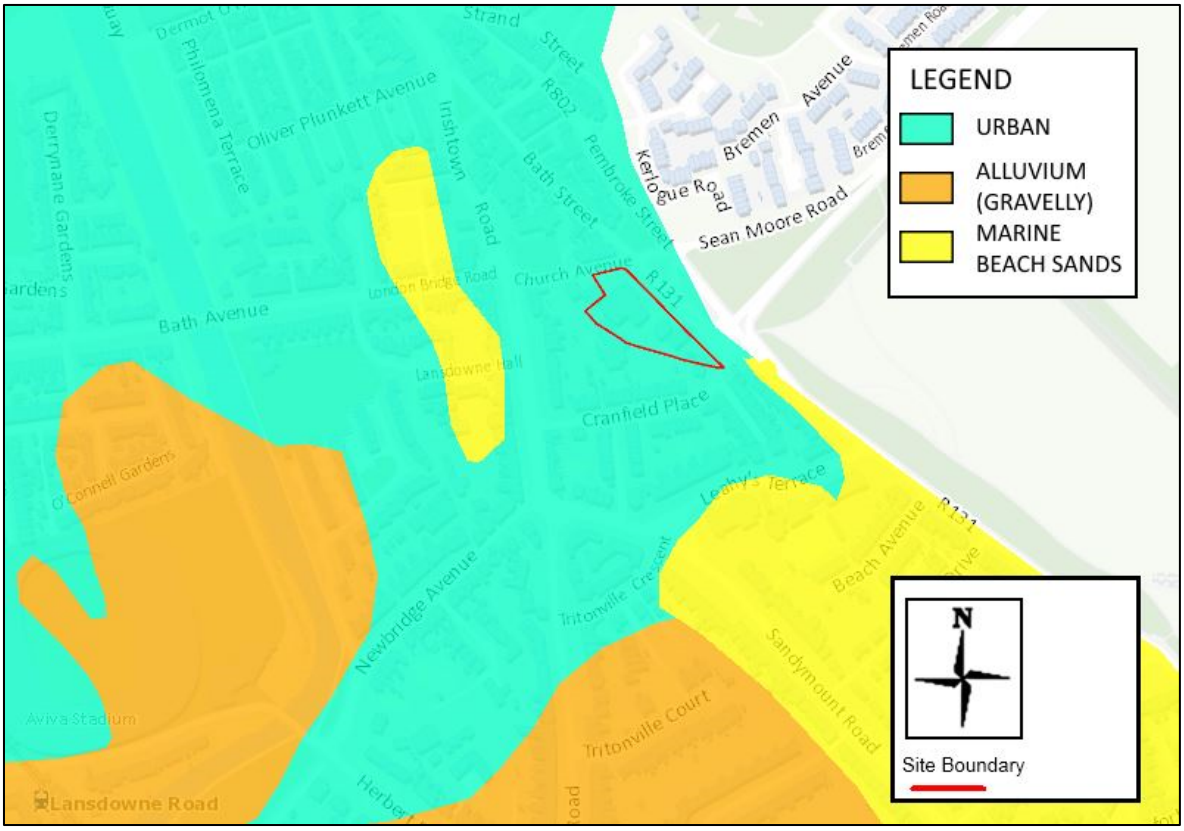


Figure 3-2: *Quaternary Geology (source Geological Survey of Ireland (www.gsi.ie))*

The surface geology of the site overlies a bedrock of Marine Basinal Facies, and groundwater vulnerability in the area is classified as Low.

3.4 History of Flooding

The area has a history of flooding which is detailed in a number of sources, particularly the OPW Flood Hazard Mapping website, floodmaps.ie, which holds a record of historic flood events. A review of this

database indicated that, while there have been reported incidences of flooding in the local area (see Appendix D), none of these records report a flooding incident at the site of the proposed development.

Additional information relating to flooding in the Sandymount area was obtained from Dublin City Council as part of the consultation in advance of the preparation of this SSFRA. Significant coastal flooding occurred in the area in both 2002 and 2014. In February 2002 the flood level was measured at 2.95m AOD at Alexander Basin at Dublin Port. During this event, 1,250 buildings in Dublin experienced flooding. Dublin City Council have compiled mapping of the observed flood extents from this event and the relevant Sandymount map is presented in Appendix E.

During flooding in January 2014, a maximum coastal flood level of 3.02m AOD was recorded. During this event, the number of buildings flooded was reduced to 4 as coastal flood defences had been installed. The subject site of this SSFRA was not impacted during either of these flooding events.

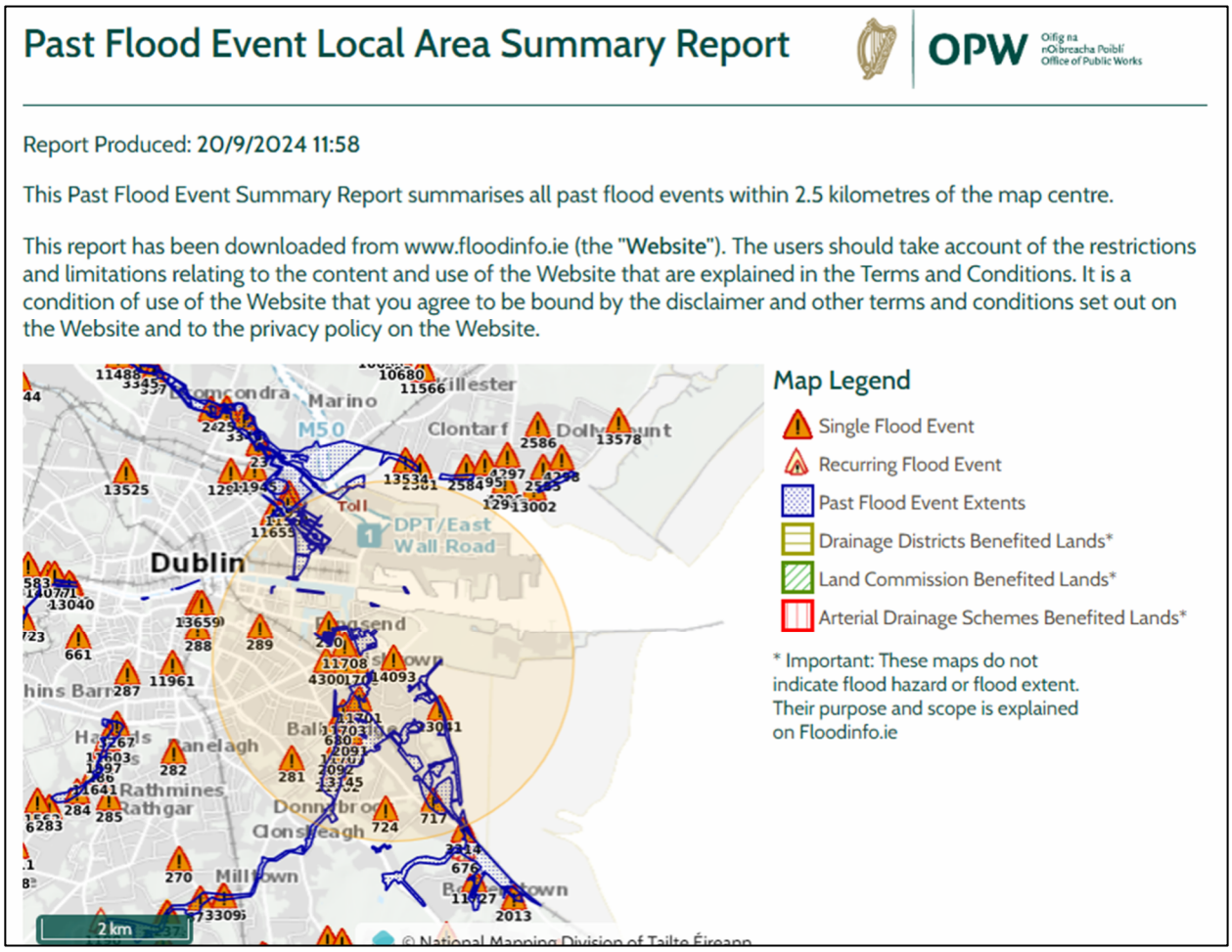


Figure 3-3: Extract from OPW Floodmaps Database Report (see Appendix D for full report).

3.5 Review of Existing Surface Water Infrastructure

A review of the surface water drainage network in the area was undertaken based on the Irish Water GIS database

The surrounding environment has extensive man-made drainage features. These include stormwater and combined sewers along Beach Road and Church Avenue. Utilities drawings provided by Irish Water show that a surface water sewer and a combined sewer exist to the north of the site, and fall to the west, along Church Avenue. In general, the drainage in the area falls to the north-east along Beach Road and then to the west along Church Avenue. A copy of the utilities drawing, showing watermains and drainage, is presented in 0 of this document.

3.6 Existing Flood Defences

Flood defences exist both along the River Dodder and along the Dublin coast. These defences ensure that the study site lies within the defended zone. The following extracts from Appendix A of "The Planning System and Flood Risk Management Guidelines for Planning Authorities" describe how such sites should be assessed:

> *It is also important that an assessment of flood risk should consider both the actual and the residual risks.*
>
> *Actual flood risk is the risk posed to an area, whether it is behind defences or undefended, at the time of the study. [...]*
>
> *Residual risks are the risks remaining after all risk avoidance, substitution and mitigation measures have been taken. Examples of residual flood risk include:*
>
> - *The failure of flood management infrastructure such as a breach of a raised flood defence, blockage of a surface water channel or drainage system, failure of a flap valve, overtopping of an upstream storage area, or failure of a pumped drainage system;*

The Strategic Flood Risk Assessment (SFRA) for the Dublin City Development Plan 2022-2028 details in Appendix 1 the existing flood defenses along the River Dodder, as follows:

> ***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.*
>
> ***London Bridge**: Parapets have been raised to cater for estimated two-hundred-year tidal event and global warming to the year 2100. Flood defences include upstream glass and metal panels.*
>
> ***London Bridge to Newbridge**: Both sides of the river are defended to the estimated two-hundred-year level plus estimated global warming to the year 2100 by embankments and retaining walls. All outlets are tidal flapped. A number of flood gates are closed in extreme flood events.*

As such the site is defended against the 0.5%AEP or 0.5%AEP tidal event with an allowance for climate change, and there remains at the site a residual risk following the potential failure of a flood defense at the River Dodder. The site is in this way assessed for the scenario of a failure in flood defenses occurring which places the site at risk.

The SFRA prepared as part of the Dublin City Development Plan 2022-2028 specifically addresses defended sites in Section 4.6 and the requirements for sites proposed in the defended areas.

Appendix 1 of the SFRA outlines the nature of the defenses along the River Dodder, which concludes that the River Dodder in the vicinity of the site is protected up to the 0.5%AEP event with an allowance for climate change.

3.7 Review of Historic Mapping

A review of the OSI 25-inch historical maps was completed, see Figure 3-4 below.

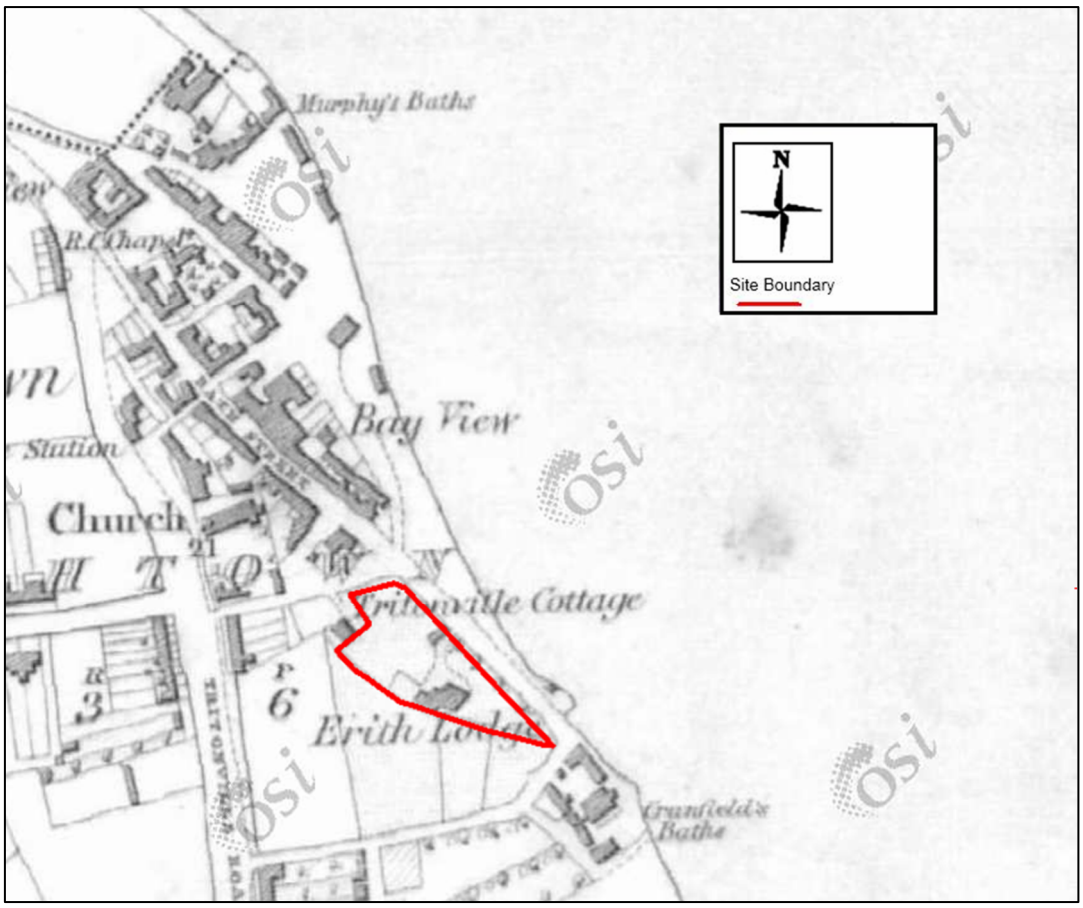


Figure 3-4*: OSI Historical 25-inch map (1897-1913)*[1]

Historic mapping shows that the site previously contained a dwelling/small building known as Erith Lodge. In the last 100 years the surrounding area has become significantly more urbanised, potentially leading to greater pluvial and fluvial flooding because of increased runoff from hardstand areas.

It is further noted that historical mapping shows that the lands to the east of the site have since this time been reclaimed from the ocean. Prior to this land reclamation, the site was located adjacent to the natural Sandymount tidal coastline.

[1] Sourced online at http://maps.osi.ie/publicviewer/#V2,635397,694487,12,9

4.0 Flood Zone Assessment

4.1 Strategic Flood Risk Assessment (SFRA) Mapping

The Dublin City Development Plan 2022-2028 SFRA Appendix E contains a composite flood map showing the location of the proposed development to be within Flood Zone B as seen in Figure 4-1.

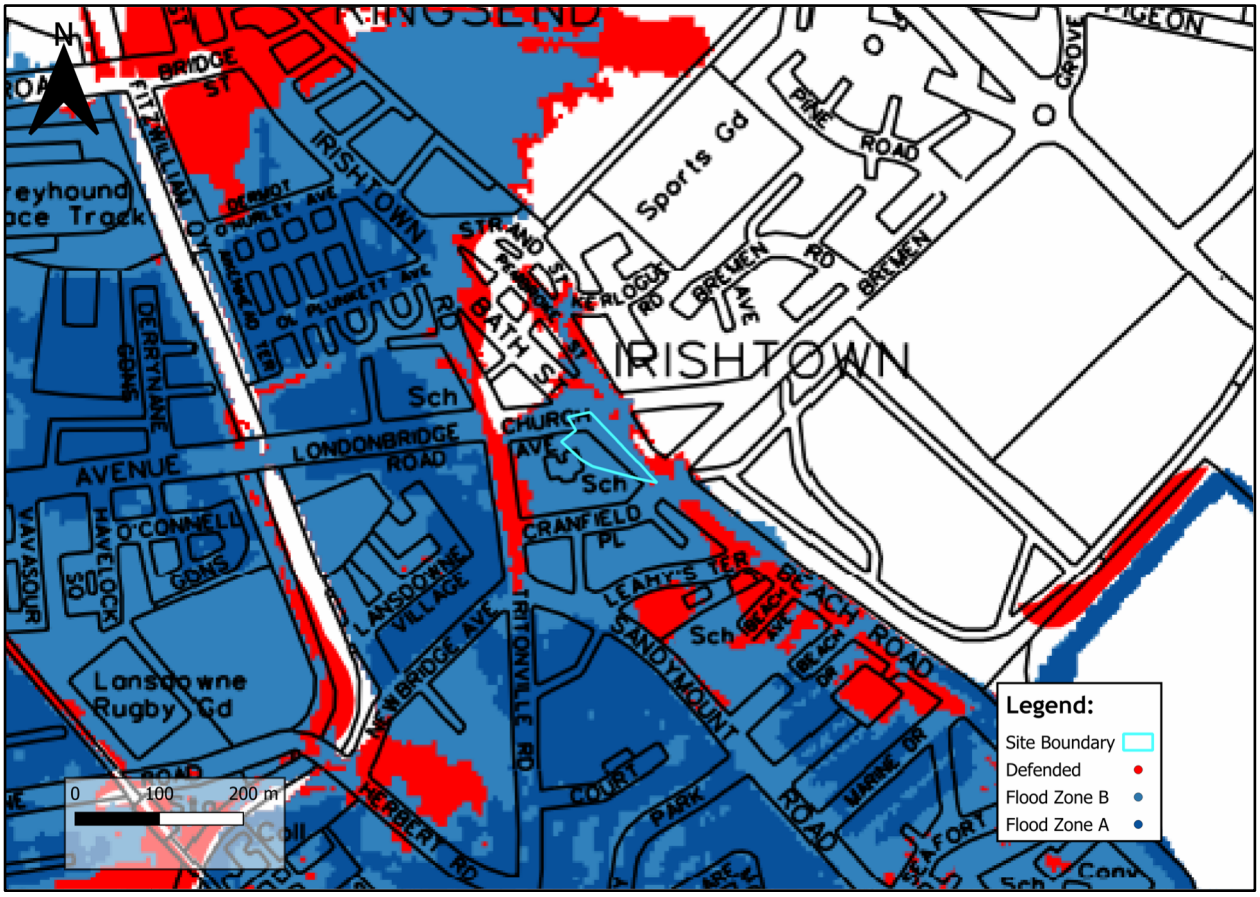


Figure 4-1: SFRA Composite Flood Map.

4.2 CFRAMS Mapping

The CFRAMS is an OPW led national programme which seeks to identify and map potential existing and future flood hazard in areas at significant risk from flooding. It also aims to identify flood relief measures and prepare Flood Risk Management Plans for these areas.

As part of the CFRAMS programme, mapping is available online for public viewing[2], and the local area has been assessed both as part of the River Dodder CFRAMS study and the Dublin pluvial study. The OPW has published detailed flood hazard mapping for the Dublin southern environs based on the results of the Eastern CFRAM study. This includes flood extent mapping for a number of return period events and flood depth mapping for each of the potential flood events.

4.2.1 CFRAMS Coastal Flood Mapping

As part of the Eastern CFRAMS, coastal flood extents were assessed. Figure 4-2 below is an extract of the River Dodder CFRAMS map for Beach Road Area (from CFRAMS drawing DR/EXT/UA/TIDAL/101). The CFRAMS assessment is based on hydraulic modelling of the River Dodder. Full CFRAMS mapping for the area is presented in Appendix F.

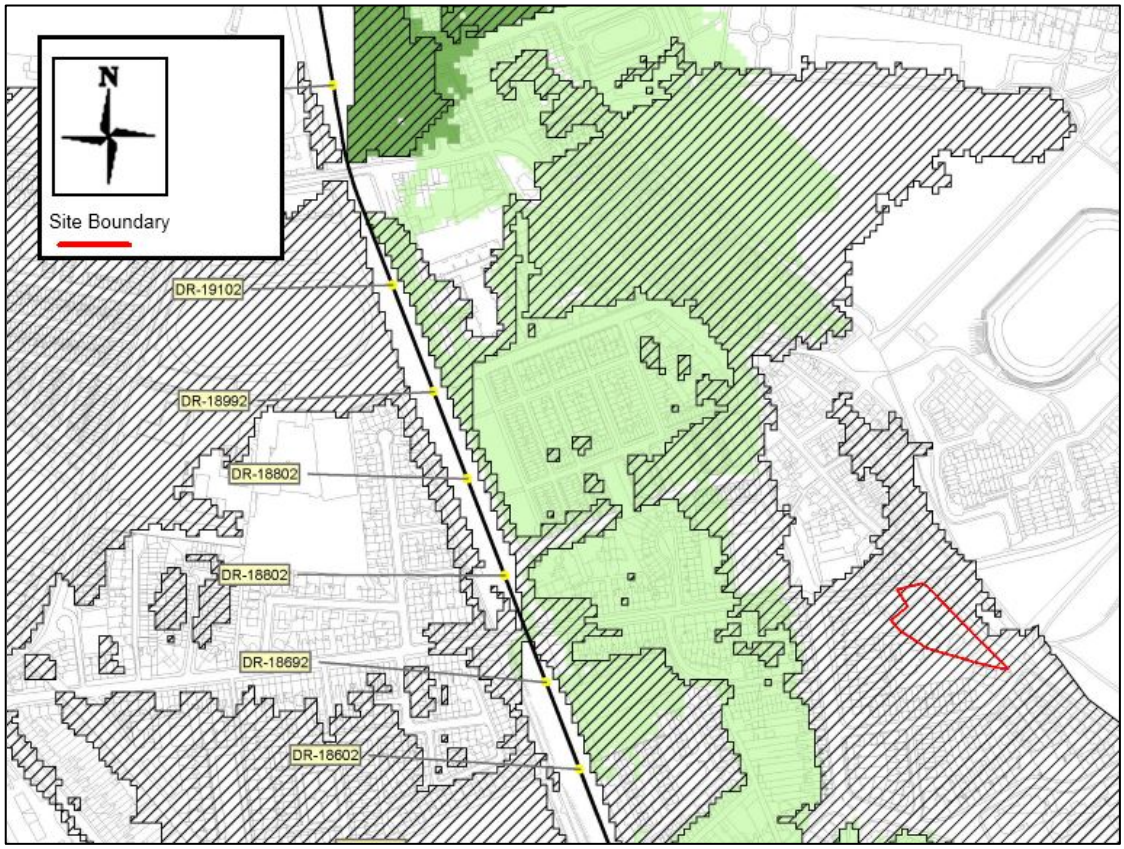
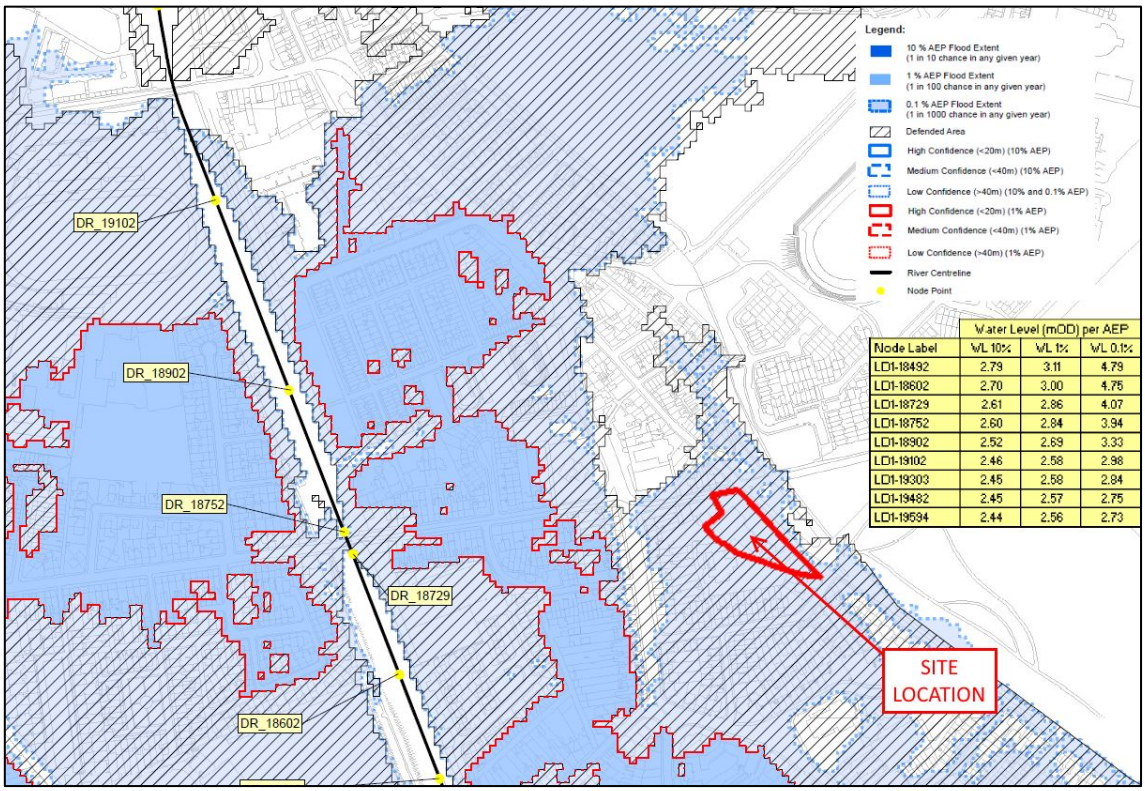


Figure 4-2: ***Extract from River Dodder CFRAMS Coastal Flood Maps***

[2] See http://maps.opw.ie/floodplans/offer_disclaimer/?next=/floodplans/fhr_map/en/

4.2.1 CFRAMS Fluvial Flood Mapping

Figure 4-5 below is an extract from the relevant Eastern CFRAMS fluvial flood extent map which shows that the site of the proposed development is located in defended Flood Zone B for fluvial flooding.



Node Label	Water Level (mOD) per AEP		
	WL 10%	WL 1%	WL 0.1%
LD1-18492	2.79	3.11	4.79
LD1-18602	2.70	3.00	4.75
LD1-18729	2.61	2.86	4.07
LD1-18752	2.60	2.84	3.94
LD1-18902	2.52	2.69	3.33
LD1-19102	2.46	2.58	2.98
LD1-19303	2.45	2.58	2.84
LD1-19482	2.45	2.57	2.75
LD1-19594	2.44	2.56	2.73

Figure 4-3: ***Extract from CFRAMS fluvial flood map for Beach Road area.***

An extract from the flood depth mapping for Flood Zone B is included in Figure 4-4: below (an extract from CFRAMS drawing DR/EXT/UA/DEP/1000/101A).

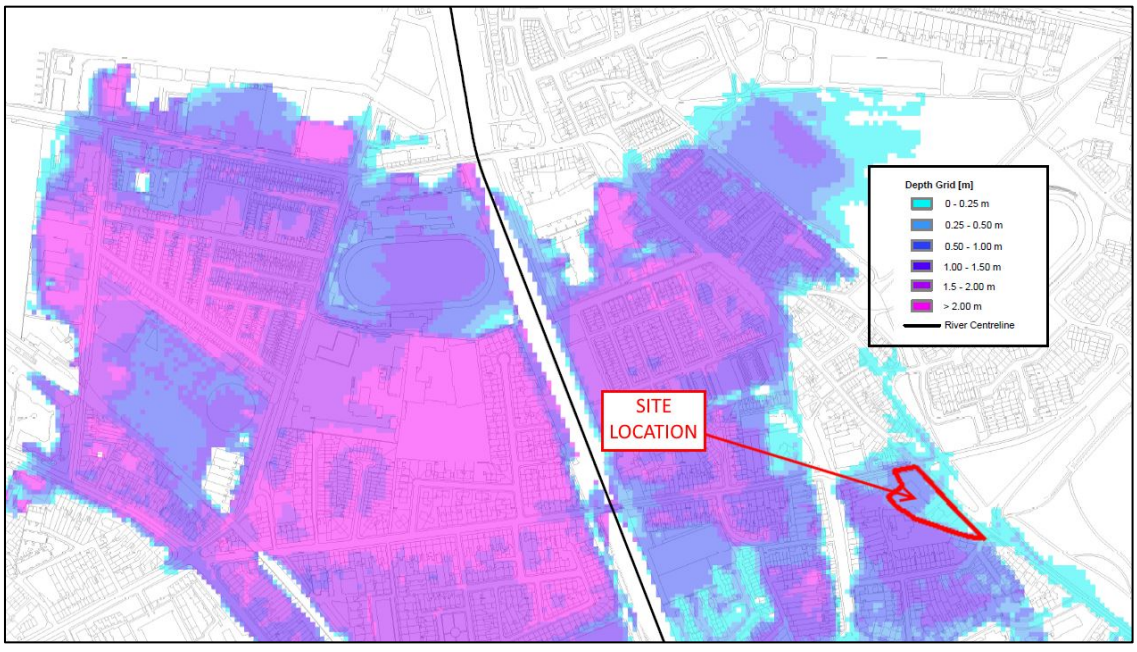


Figure 4-4: ***Extract from CFRAMS fluvial flood depth mapping for Beach Road area.***

The River Dodder CFRAMS flood depth mapping shows that the flood depth during the 0.1%AEP fluvial event at the site is between 0.5m and 1.0m. A more detailed modelled flood level at the site was obtained from RPS who carried out the modelling. The various flooding events modelled as part of the CFRAM Study are summarised in Table 4-1 below.

Table 4-1*: Nature of flooding for various return periods adjacent to the site*

Flood Event	Nature of Flooding
10% AEP	No flooding on site
1% AEP	No flooding on site
0.1% AEP	Flooding on site and road (maximum flood level of **2.967mAOD** on site)

4.2.1 CFRAMS Pluvial Flood Mapping

The CFRAMS Dublin Pluvial study shows that the site is subject to pluvial flooding at the north-west end, as shown in Figure 4-5: (an extract from CFRAMS drawing E09DCC_EXPCD_F0_03).



Figure 4-5: ***Extract from CFRAMS Dublin pluvial study***

4.3 Estimate of Flood Zone

The CFRAMS maps indicate that the site of the proposed development currently lies within Flood Zone B (outside the extents of a 1%AEP fluvial or 0.5%AEP coastal event but inside the extents of a 0.1%AEP fluvial or coastal event).

Under the Planning System and Flood Risk Management Guidelines published by the Department of the Environment in November 2009, an area where there is moderate probability of flooding from rivers and the sea (less than 0.1%AEP for both river and coastal flooding) is categorised as Flood Zone B. It is concluded that, according to CFRAMS mapping, the site lies within the defended Flood Zone B (See Figure 4-1).

4.4 Modelled Flood Levels

Modelled flood levels at the site were obtained from RPS who initially carried out the CFRAMS modelling. It was confirmed that the maximum depth of floodwaters on the site (for the 0.1%AEP flood event) was 0.94m and that the flood reached a level of 2.967m AOD in the model in this scenario. The modelled flood occurs as a result of fluvial/coastal flooding from the River Dodder causing waters to spill out. This causes floodwaters to flow along roads in the area and finally pond on the site and in residential buildings in the area.

Following advice from Dublin City Council, a freeboard of 400mm was added to the 0.1%AEP flood level in order to ascertain the minimum ground floor Finished Floor Level (FFL). This freeboard includes an allowance for climate change. This is discussed further in sections 5.2 and 5.3 below.

4.5 Flood Risk to Adjacent Sites

This section of the SSFRA deals with any changes in flood risk to adjacent sites as a result of the proposed development. This section demonstrates that there will be no increase in flood risk to adjacent sites. As part of a Site-Specific Flood Risk Assessment, it is normally necessary to quantify the displacement of floodwaters during a 1%AEP event but not during a 0.1%AEP event. The site is not subject to any flooding during a 1%AEP event.

It is reiterated that, under normal conditions, the site is not subject to fluvial flooding in the 1%AEP or 1%AEP events, as this is a defended area. Therefore, the introduction of the development will **not** result in an increase in flood risk to any adjacent properties. Flooding patterns elsewhere will not be impacted by the site.

The site is only subject to flooding in the event of a breach in the River Dodder flood defences coupled with a 0.1%AEP flow rate in the river. The likelihood of this occurring is very low, however the increase in flood level elsewhere during such an occurrence is quantified in the paragraphs below.

Flood volume displaced in event of defence failure

It is understood, as noted in Section 1.1 above, that during a breach in the River Dodder flood defences, coupled with a 0.1%AEP fluvial flood event, flood levels at the site would reach a level of 2.967m AOD. It follows that the site in its current configuration stores floodwaters during a 0.1%AEP breach if Dodder defences were to fail, which would be displaced by the proposed development.

The volume of floodwaters stored on the site has been calculated as 2,014m^3 during such a defence breach event. This volume was calculated using the Vertical Mapper add-on of MapInfo GIS software. This calculation was based on the topographical survey referred to in Section 3.2 and using the flood level of

2.967m AOD. Following the redevelopment of this site, these floodwaters would clearly be displaced elsewhere in the event of a breach in flood defences.

It is outside of the scope of this study to carry out hydraulic modelling to assess where such floodwaters would be displaced to. Instead, a conservative calculation has been carried out based on the portion of the floodplain assumed to be associated with flooding on the study site to assess what the overall increase in flood level would be as a result of the proposed scenario.

It is reiterated that there is no flooding at the site during 1%AEP events (i.e. the site is not in Flood Zone A) and that the site is in the defended Flood Zone B. As such, assuming the defences operate correctly, there will be no flooding at the site during either Flood Zone A or Flood Zone B events. Under normal circumstances, there will be no increase in flood risk as a result of the proposed development.

Based on an overall floodplain area of 146,800m^2, of which 3,700m^2 will be removed by the site, the average rise in flood level over the remaining 143,100m^2 (shown in Figure 4-6 below) is calculated as

$$\frac{Flood\ Volume\ (m^3)}{Flood\ Area\ (m^2)} = \frac{2014}{143100} = 0.0141m = 14.1mm$$

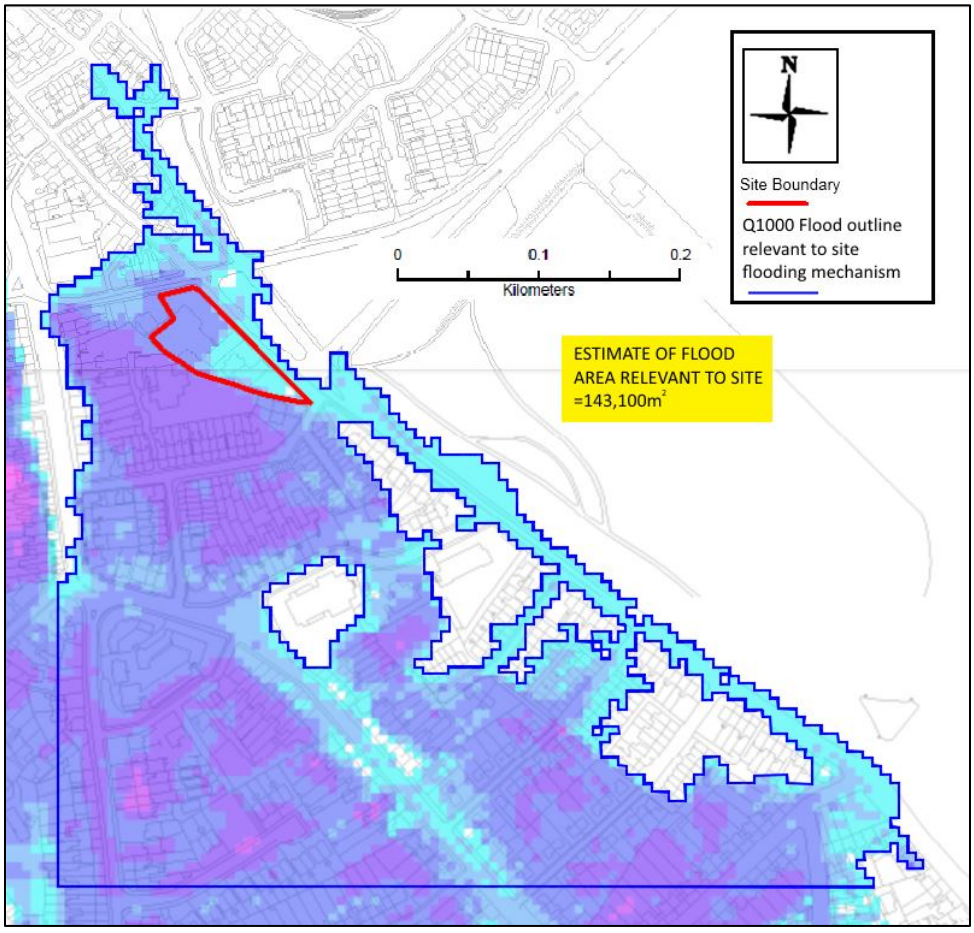


Figure 4-6: ***Area of floodplain used for assessment of flood level increase (flood defence breach)***

In light of this flood level increase during a defence breach, it is reiterated that the development of this site will, given normal operation of the flood defences on the River Dodder, not increase flood risk elsewhere. It will only be in the unlikely event of a flood defence breach and a 0.1%AEP event occurring at the same time that flood levels in the vicinity may increase.

Surface water flows from the site are to be managed via a stormwater drainage system which will ensure that the flow rate from the site to the existing sewer will not exceed 2 litres/second. This will be achieved through means of an attenuation tank and hydrobrake limiting the outflow. This will ensure that runoff from the site will not increase the risk of flooding to properties or public areas in the vicinity of the development.

DCC representatives have been engaged regarding the flood risks to adjacent sites and our rationale/justification that compensatory storage is not required as a result of our development.

5.0 Flood Risk Assessment

5.1 Sources of Flooding

When carrying out a flood risk assessment, one should consider all the potential flood risks and sources of flood water at the site. In general the relevant flood sources are:

- Fluvial Flooding

  Fluvial flooding is the result of a river exceeding its capacity and excess water spilling out onto the adjacent floodplain. The study area is at risk of fluvial flooding from the River Dodder. However, as noted above, the site lies within the defended zone. For the 0.1%AEP flood event, flooding may occur in the area should flood defences be overtopped. In the event of such an occurrence, FFLs at the site are set above the 0.1%AEP flood level with a suitable level of freeboard to account for climate change.

- Pluvial Flooding

  Pluvial flooding is the result of rainfall-generated overland flows which arise before run-off can enter any watercourse or sewer. It is usually associated with high intensity rainfall. There are no locations on the site which are noted in PFRA mapping as being at risk of pluvial flooding. The CFRAMS Dublin pluvial study shows that there is an area of pluvial flooding identified in the low point of the site. As part of the proposed development this 'low point' will be removed, and the land will be developed upon. The proposed storm network (as part of this development) has been designed to ensure there is no flood risk to the development from extreme precipitation events, and that the redevelopment of the site does not adversely affect flooding levels or extents in the area.

- Coastal Flooding

  Coastal flooding is the result of sea levels which are higher than normal and result in sea water overflowing onto the land during high tides or storm surges. CFRAMS mapping shows that the study area is not at risk of coastal flooding. However, as noted above, the site lies within the defended zone and as such is not susceptible to flooding unless a breach in flood defences occurs.

- Groundwater Flooding

  Groundwater flooding occurs when the level of the water stored in the ground rises as a result of prolonged rainfall. The study area is not at risk of groundwater flooding.

  It has been highlighted by Dublin City Council that groundwater in the area can be impacted by tidal fluctuations due to the unknown nature of the ground conditions and the permeability. In particular this can impact upon basements in the area. Mitigation against this is discussed in Section 5.4 below.

5.2 Climate Change

Advice on the expected impacts of climate change and the allowances to provide for future flood risk management in Ireland is given in the "OPW Assessment of Potential Future Scenarios, Flood Risk Management Draft Guidance", 2009. 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 "conservative" future scenario at the upper boundaries of future projections. Based on these two scenarios the OPW recommended allowances for climate change are given in Table 5-1.

Table 5-1: Recommended allowances for climate change (Taken from OPW – Assessment of Potential Future Scenarios for Flood Risk Management)

Parameter	MRFS	HEFS
Extreme Rainfall Depths	+20%	+30%
Flood Flows	+20%	+30%
Mean Sea Level Rise	+500 mm	+1000 mm
Land Movement	-0.5 mm/year*	-0.5 mm/year*
Urbanisation	No general allowance – Review on Case by Case Basis	No General allowance – Review on Case by Case Basis
Forestation	-1/6Tp**	-1/3Tp** +10% SPR***
Notes: * Applicable to the southern part of the country (Dublin – Galway and south of this) ** Reduce the time to peak (Tp) by a third; this allows for potential accelerated runoff that may arise as a result of drainage of afforested land *** Add 10% to the Standard Percentage Runoff (SPR) rate; this allows for increased runoff rates that may arise flowing felling of forestry		

The Strategic Flood Risk Assessment (SFRA) prepared for the DCC Development Plan 2022-2028 also provides a table of climate change allowance requirements, reproduced here as Table 5-2.

Table 5-2: Recommended allowances for climate change (DCC Development Plan 2022-2028 SFRA)

Development Vulnerability	Fluvial Climate Change Allowance (increase in flows)	Tidal Climate Change Allowance (increase in sea level)	Storm Water / Surface Water
Less Vulnerable	20%	0.5m (MRFS)	20% increase in rainfall
Highly Vulnerable	20%	0.5m (MRFS)	20% increase in rainfall
Critical or Extremely Vulnerable (e.g. hospitals, major sub-stations, blue light services)	30%	1.0m (HEFS)	30% increase in rainfall

5.2.1 Fluvial Flooding

The site lies within the defended zone of the 0.1%AEP fluvial flood event from the River Dodder.As noted in Section 3.6 above, the defences along the River Dodder are to a 0.5%AEP standard with allowance for climate change. The Ground floor FFLs are 383mm above the 0.1%AEP event (in the event of a breach in flood defences).

Under the CFRAMS, the River Dodder has been modelled for a 'future' HEFS scenario which shows the site as being within the fluvial 1%AEP and 0.1%AEP extents, as shown in Figure 5-1. The modelling undertaken to produce this mapping does not take into account the defences along the River Dodder. Following discussions with Dublin City Council, minimum FFLs were set at 3.37mAOD to take account of climate change on fluvial flood risk from the River Dodder.

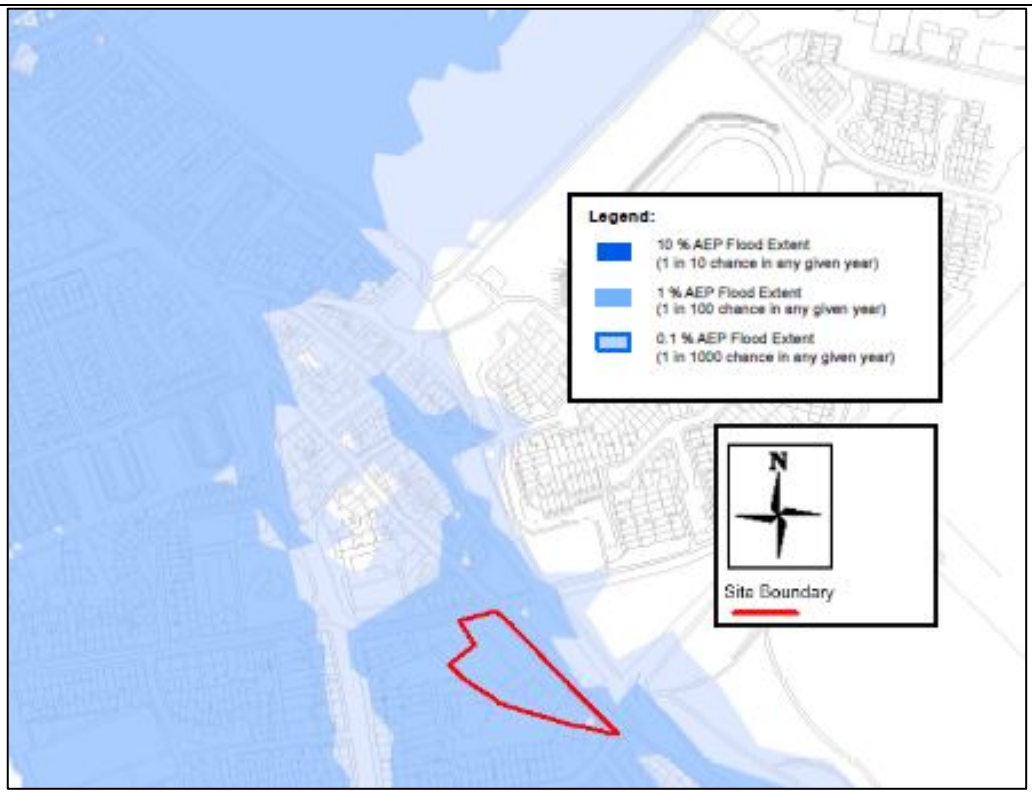


Figure 5-1: ***Extract from CFRAMS future (climate change) scenario flood depth mapping for Beach Road area.***

5.2.2 Coastal Flooding

The SFRA for Dublin City Council Development Plan 2022-2028 notes that to the effects of climate change on flooding in Sandymount are "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."

The effects of sea level rise have been assessed in relation to climate change. As per Table 5-2 above, it is appropriate to assess the effect of adding 0.5m to predicted extreme coastal flood levels. Currently the predicted extents of coastal flooding do not reach the vicinity of the site due to higher ground between Sandymount beach and the location of the proposed development. Current modelled coastal flood levels are 3.11mAOD for the 0.5%AEP coastal event and 3.34mAOD for the 0.1%AEP coastal event. These levels are taken from the Irish Coastal Protection Strategy Study (IPSCC) which fed into the CFRAM Study for the Dublin coastal area. Adding 500mm to these levels gives 3.61mAOD and 3.84mAOD respectively. While a flood to these levels would impact upon the proposed development and hundreds of other buildings in the local area, it is noted that the area is defended against coastal flooding. In the event of a breach in defences a coastal flood/surge to this level would not cause a full inundation in the Sandymount area. It appears that ground levels between the coastline and the proposed development provide a natural barrier against coastal floods/surges from reaching the site. In this way the development is protected against the effects of climate change in relation to sea level rise. The risk of the site being impacted during a coastal flood event with climate change accounted for is as such very low.

In the event of a forecasted coastal flood event likely to cause widespread flooding to the entire Sandymount area, it is proposed that the building management provide temporary barriers to protect the ground floor and the basement from floodwater damage.

5.3 Site Vulnerability

The proposed development is residential in nature, which is classified as a "Highly Vulnerable Development" in the guidelines. It has been demonstrated in this report that the site lies within the defended zone, and within the fluvial Flood Zone B. As such, for this development it is necessary to apply the Justification Test as demonstrated in Table 5-3 below.

Table 5-3: Matrix of Vulnerability versus Flood Zone to indicate Justification Requirement.

	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

As demonstrated in Table 5-3 above, sites located in Zone B which are residential in nature are subject to the Justification Test. The Dublin City SFRA has addressed the Sandymount area as part of "Area: 8. Coastal: Sandymount" and the Justification Test for this area is included in Appendix H. The Justification Tests undertaken as part of the SFRA notes the following:

Area: 8. Coastal: Sandymount

> *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 identified as being in Flood Zones A and B are considered essential to achieving a consolidated urban centre and to comply with the NPF and RSES.*

Site 9 (Dodder: Liffey to Ballsbridge) was also consulted as part of this however the description of the area indicates conclusively that the site of the proposed development does not fall into this site for Justification Test purposes.

No site-specific Justification Test is included in this SSFRA as the test is passed at a strategic area level in the SFRA.

5.4 Flood Mitigation Measures

With reference to Section 5.2 above, a review of flood maps produced as part of the CFRAMS indicate that the site of the development falls inside the extents of Flood Zone B for fluvial and coastal events.

The proposed residential development is classified in the guidelines as 'Highly Vulnerable Development'. The development is as such permitted in Flood Zone B only if the Justification Test is passed. The following measures will be required in order to mitigate against any flooding in Flood Zone B:

- The Finished Floor Levels (FFL) of the ground floor of the proposed building on the site will be set at 3.37m AOD. This is greater than the minimum of freeboard of 300mm above the 0.1%AEP flood level as required by Dublin City Council for development in the defended zone within Flood Zone B;

- The proposed basement will be isolated from the flood zone area through the use of demountable, temporary barriers at the entrance. This will be necessary to ensure that in the event of a breach in flood defences on the River Dodder during a 0.1%AEP event, basements are not subject to flooding from overland flood flows.
- All ventilation shafts, ducts, and other access/utilities entering the basement development will do so at a height greater than 3.37m AOD in order to remove potential flowpaths of surface water to the proposed basement;
- The proposed basement walls and floor will be sealed using suitable materials/treatments to prevent flooding via ingress from groundwater. The proposed basement will be Grade 2 based on the grades of waterproofing protection from BS 8102:2009 'Code of practice for the protection of below ground structures against water from the ground'. This performance level allows some seepage and damp areas. A combination of Type A (barrier), Type B (structurally integral), and Type C (drained) waterproofing protection is proposed. The secant piled wall will be faced internally with a waterproofing membrane and the RC liner wall will form the primary waterproofing protection. Any water seepage will be collected in a sump and pumped up to a high level where it will drain under gravity into the main drainage system. The waterproofing membrane from the wall will continue to the underside of the RC basement slab;
- Surface water flows shall be attenuated on site and the runoff rate from the site will not be greater than the runoff rate agreed with Dublin City Council, in order to reduce the risk of flooding elsewhere as a result of the development;
- A flood warning alarm, which may be by means of a float in an outlet drainage pipe, which will warn the operators of the development if water levels start to rise in the basement.
- Drainage that services low level areas below flood level is managed by a penstock to be closed in the event of a flood.
- Demountable flood barriers are proposed adjacent to the substation to prevent the substation and adjacent landscape areas from flooding.

Emergency access to the proposed development will be maintained during an extreme flood event. During extreme modelled events, Beach Road does not become fully impassable and access to the R131 (East Link toll road) remains possible in the north-eastern direction from the proposed site entrance.

It is considered that any residual flood risks can be managed through the use of emergency plans and evacuation procedures. The proprietor of the development shall monitor flood warnings as issued by Met Eireann and Dublin City Council, and emergency plans shall be developed to be implemented in advance of a forecasted flood event. This emergency plan will note the designated access and egress routes to the site in the event that flooding impacts the local road infrastructure.

It is noted that the proposed development has no impact on the flood risk outside the site of the proposed development, as there will be no increase in surface water runoff from the site following the implementation of SuDS options on the site to allow for the runoff rate to match that of the greenfield runoff rate of the site.

5.5 Flood Risk Management

Flood risk management under the EU Floods Directive aims to minimise the risks arising from flooding to people, property and the environment. Minimising risk can be achieved through structural measures that block or restrict the pathways of floodwaters, such as river defences or non-structural measures that are often aimed at reducing the vulnerability of people and communities such as flood warning, effective flood emergency response, or resilience measures for communities or individual properties.

Given that the site of the proposed development is located inside the defended Flood Zone B, successful mitigation measures must be implemented to ensure that the proposed development is not at risk of flooding. Following the implementation of the mitigation measures outlined in Section 5.4 above, the flooding risk to the properties or to people will be minimised during an extreme flood event.

Emergency access can be maintained to the site via the R131 road to the north-east in the event of a 0.1%AEP flood event and a breach in flood defences.

6.0 Conclusion

PUNCH Consulting Engineers were appointed to carry out a Site-Specific Flood Risk Assessment (SSFRA) study in support of a planning amendment, planning retention application as part of an LRD application for a development previously approved under SHD ABP-310299-21, for a proposed residential development consisting of 112 no. residential apartment dwellings in Sandymount, Dublin 4. A review of flooding and flood risk in the area was carried out and it was ascertained that the development lies within the defended zone of a 0.1%AEP flood. As such there is a residual risk of coastal/fluvial flooding to the site of the proposed development.

Flood maps produced as part of the Eastern CFRAM Study and flood maps produced as part of the SFRA from the relevant City Development Plan were consulted to establish the outline Flood Zone. A precise flood level at the site of 2.967m AOD was obtained from the CFRAMS modellers. Advice from Dublin City Council suggested that the Finished Floor Level (FFL) should be set at 400mm above the current 0.1%AEP flood level in the defended zone. The ground floor FFL was set at 3.37m AOD which is 403mm above the 0.1%AEP flood level. Additional mitigation measures have been prescribed to prevent flooding of the basement and to ensure that the proposed development does not worsen flooding elsewhere.

Appropriate measures have been taken to ensure that the proposed development will not be at risk of flooding, as described in Section 5.4, and also to ensure that impacts related to flooding elsewhere will not worsen as a result of the development. The mitigation measures proposed will ensure that the development is in compliance with the relevant sections of the Dublin City Development Plan as outlined in Section 2.2 as well as in full compliance with The Planning System & Flood Risk Management Guidelines. The new mitigations proposed in this planning amendment are:

- Drainage that services low level areas below flood level is managed by a penstock to be closed in the event of a flood.
- Demountable flood barriers are proposed adjacent to the substation to prevent the substation and adjacent landscape areas from flooding.

Appendix A. Existing Utilities Drawing



UISCE ÉIREANN : IRISH WATER

Ⓜ Boundary Meter
Ⓜ Unknown Meter ; Other Meter
Sluice Valve Open
Sluice Valve Closed

Water Hydrants

Hydrant Function

Fire Hydrant
Telemetry Kiosk
Cap
Other Fittings

Water Distribution Mains

Owned By

Irish Water
Irish Water
Irish Water
Water Abandoned Lines
Gravity - Combined
Gravity - Foul

Storm Manholes

Manhole Type

Standard
Surface Gravity Mains

1:1,000 at A3

Last edited: 06/10/2017

Metres
0 7.5 15 30

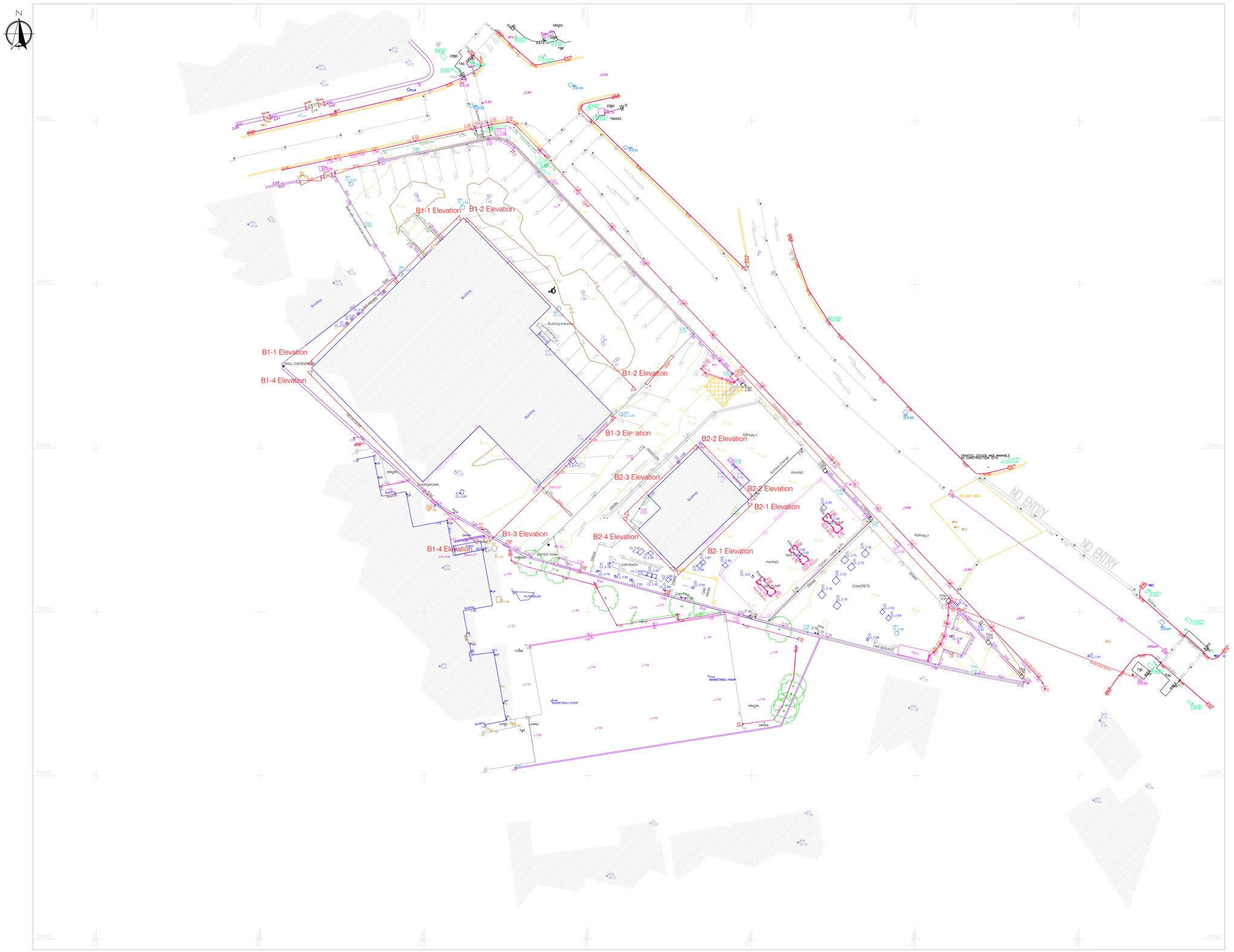
1. No part of this drawing may be reproduced or transmitted in any form or stored in any retrieval system of any nature without the written permission of Irish Water as copyright holder except as agreed for use on the project for which the document was originally issued.

2. Whilst every care has been taken in its compilation, Irish Water gives this information as to the position of its underground network as a general guide only on the strict understanding that it is based on the best available information provided by each Local Authority in Ireland to Irish Water. Irish Water can assume no responsibility for and give no guarantees, undertakings or warranties concerning the accuracy, completeness or up to date nature of the information provided and does not accept any liability whatsoever arising from any errors or omissions.This information should not be relied upon in the event of excavations or any other works being carried out in the vicinity of the Irish Water underground network. The onus is on the parties carrying out excavations or any other works to ensure the exact location of the Irish Water underground network is identified prior to excavations or any other works being carried out.
Service connection pipes are not generally shown but their presence should be anticipated.

© Copyright Irish Water

Reproduced from the Ordnance Survey Of Ireland by Permission of the Government. License No. 3-3-34

Appendix B. Site Topographical Survey



Notes

* This Survey was produced for original clients specification at time of instruction.
* If the survey is to be used by any other parties, or for purposes other than those originally considered, further details or higher accuracies may be required - Please contact PUM
* PUM take no responsability for additions made by third parties to survey.
* Accuracy and amount of detail is based on scale of mapping.
* Drainage pipe sizes (where shown) have been gauged from the surface for safety reasons and should be regarded the surface for safety reasons and should be regarded as approximate only.



LEGEND

Fence
Road
Path
Bim of kerb
Building
Hedge
Wall
Surface
Furniture
Top of bank
Bim of bank
Track
Steps
Ditch
Water edge
Rail
Gate
Top of kerb
Bim of kerb
Road marking solid
Road marking solid
Road marking dashed
Road marking dashed
Arrow
Contours
Inspection chamber
Eircom
Gully
Hydrant
Stop valve
Gas valve
Armstrong junction
Cable
Circular manhole
Square manhole
Electricity pole
Telegraph pole
Road sign
Lamp post
Traffic light
Service marker
Pole stay
Circular bollard
Square bollard
Station
Building ridge height
Building eave height
Top of wall
Top of fence
Top of tree

Rev	Date	Drawn	Description	Chkd	Appd
02	16/11/22	K.S.	TOPO UPDATED	K.S.	J.M.
01	24/10/22	L.M.	TOPO COMPLETED	K.S.	J.M.

PRECISION UTILITY MAPPING
Rathmale
Mungret
Limerick
Ireland
www.Precision-UM.ie

Client

Punch Consulting Engineers

Title

Beach Rd

Topographical Survey
Sheet 1 of 1

Surveyor	F. Malppan	F.M.	Eng check	--	--
Drawn	L. Moreira	L.M.	Coordination	Malin ITM	K.S.
Dwg check	K. Sheehan	K.S.	Approved	J. Markham	J.M.
Scale at A0	1:200	Status	Complete	Rev	02

Drawing Number

PUM-11109-T-DR-0001-02

Appendix C. Site Visit Images



Image C1 – View looking north from south-east corner of site



Image C2 – View of existing Maxol forecourt from the south-east of the site



Image C3 –View north along Beach Road, showing level difference between Beach Road & Forecourt



Image C4 – View west along Church Road, from north of site

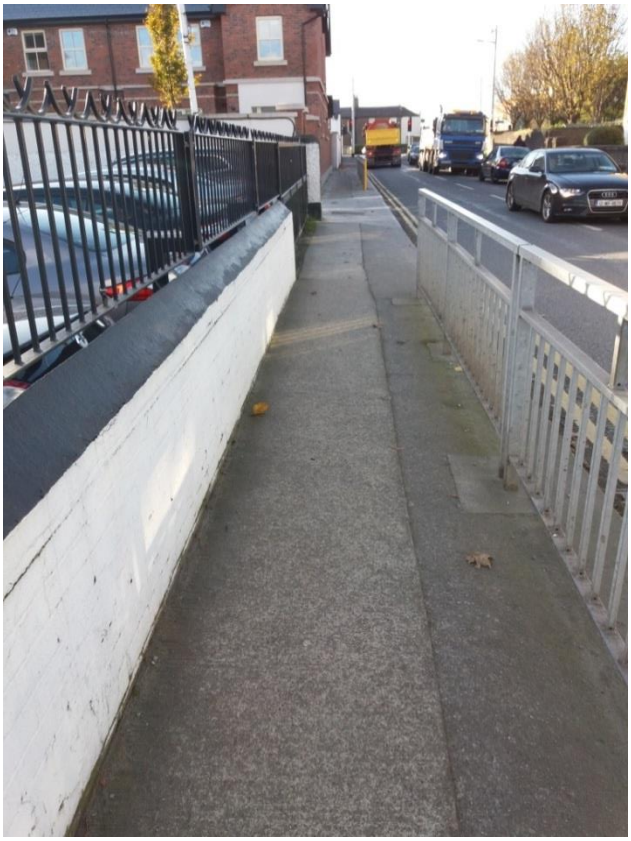


Image C6 – View along Church Road from site boundary, looking west



Image C7 – View within site forecourt, showing houses along south-western boundary

Appendix D. OPW Historic Flood Events Record

OPW National Flood Hazard Mapping

Summary Local Area Report

This Flood Report summarises all flood events within 2.5 kilometres of the map centre.

The map centre is in:

County: Dublin

NGR: O 187 332

This Flood Report has been downloaded from the Web site www.floodmaps.ie. The users should take account of the restrictions and limitations relating to the content and use of this Web site that are explained in the Disclaimer box when entering the site. It is a condition of use of the Web site that you accept the User Declaration and the Disclaimer.



Map Scale 1:11,766

Map Legend	
	Flood Points
	Multiple / Recurring Flood Points
	Areas Flooded
	Hydrometric Stations
	Rivers
	Lakes
	River Catchment Areas
	Land Commission *
	Drainage Districts *
	Benefiting Lands *

* Important: These maps do not indicate flood hazard or flood extent. Thier purpose and scope is explained in the Glossary.

22 Results

1. Tolka December 1954 — Start Date: 08/Dec/1954
County: Dublin — Flood Quality Code:1
Additional Information: Photos (2) Reports (13) Press Archive (9) More Mapped Information

2. Tolka November 2002 — Start Date: 13/Nov/2002
County: Meath, Dublin — Flood Quality Code:1
Additional Information: Photos (126) Reports (9) Videos (3) Press Archive (13) More Mapped Information

3. Dublin City Tidal Feb 2002 — Start Date: 01/Feb/2002
County: Dublin — Flood Quality Code:1
Additional Information: Photos (32) Reports (10) Press Archive (27) More Mapped Information

4. Dodder Ballsbridge Sept 1931 — Start Date: 03/Sep/1931
County: Dublin — Flood Quality Code:3
Additional Information: Reports (7) Press Archive (7) More Mapped Information

5. Dodder Anglesea Road Nov 1965 — Start Date: 17/Nov/1965
County: Dublin — Flood Quality Code:2

Additional Information: Photos (3) Reports (7) Press Archive (10) More Mapped Information

---

6. Dodder Anglesea Road Dec 1958 — Start Date: 18/Dec/1958
County: Dublin — Flood Quality Code:3

Additional Information: Reports (7) More Mapped Information

---

7. Nutley Elm Park Streams June 1963 — Start Date: 11/Jun/1963
County: Dublin — Flood Quality Code:2

Additional Information: Photos (7) Reports (6) Press Archive (20) More Mapped Information

---

8. Fenian Street June 1963 — Start Date: 11/Jun/1963
County: Dublin — Flood Quality Code:3

Additional Information: Reports (3) Press Archive (2) More Mapped Information

---

9. Ringsend June 1963 — Start Date: 11/Jun/1963
County: Dublin — Flood Quality Code:3

Additional Information: Reports (3) Press Archive (2) More Mapped Information

---

10. Dodder Donnybrook June 1963 — Start Date: 11/Jun/1963
County: Dublin — Flood Quality Code:3

Additional Information: Reports (3) Press Archive (3) More Mapped Information

---

11. Flooding at Anglesea Road, Ballsbridge, Dublin 4 on 24th Oct 2011 — Start Date: 24/Oct/2011
County: Dublin — Flood Quality Code:2

Additional Information: Reports (1) More Mapped Information

---

12. Flooding at ESB Sportsco, Ringsend, Dublin 4 on 24th Oct 2011 — Start Date: 24/Oct/2011
County: Dublin — Flood Quality Code:2

Additional Information: Reports (1) More Mapped Information

---

13. Flooding at Bath Avenue, Sandymount, Dublin 4 on 24th Oct 2011 — Start Date: 24/Oct/2011
County: Dublin — Flood Quality Code:2

Additional Information: Reports (1) More Mapped Information

---

14. Flooding at Havelock Square, Sandymount, Dublin 4 on 24th Oct 2011 — Start Date: 24/Oct/2011
County: Dublin — Flood Quality Code:2

Additional Information: Reports (1) More Mapped Information

---

15. Flooding at Railway Cottages, Ballsbridge, Dublin 4 on 24th Oct 2011 — Start Date: 24/Oct/2011
County: Dublin — Flood Quality Code:2

Additional Information: Reports (1) More Mapped Information

---

16. Flooding at RDS, Ballsbridge, Dublin 4 on 24th Oct 2011 — Start Date: 24/Oct/2011
County: Dublin — Flood Quality Code:2

Additional Information: Reports (1) More Mapped Information

---

17. Flooding at Herbert Cottages, Ballsbridge, Dublin 4 on 24th Oct 2011 — Start Date: 24/Oct/2011
County: Dublin — Flood Quality Code:2

Additional Information: Reports (1) More Mapped Information

---

18. Rock Road Merrion Gates Nov 2000 — Start Date: 05/Nov/2000
County: Dublin — Flood Quality Code:3

Additional Information: Reports (1) Press Archive (2) More Mapped Information

---

19. Nutley Stream June 1989

Start Date: 14/Jun/1989

County: Dublin

Flood Quality Code: 4

Additional Information: Reports (1) More Mapped Information

---

20. Dodder Oct 1987

Start Date: 21/Oct/1987

County: Dublin

Flood Quality Code: 4

Additional Information: Photos (3) More Mapped Information

---

21. Booterstown/Ailesbury Park November 1965

Start Date: 17/Nov/1965

County: Dublin

Flood Quality Code: 3

Additional Information: Reports (1) More Mapped Information

---

22. Bath Avenue June 1963

Start Date: 11/Jun/1963

County: Dublin

Flood Quality Code: 2

Additional Information: Photos (1) Reports (2) More Mapped Information

Appendix E. Sandymount Observed 2011 Flood Extent



Key:

C1 — Location and direction of photograph C1 in Appendix C2

Possible flood paths

Flood areas as identified by FCC & DCC staff

Additonal Flood areas identified by site inspection and through discussions with public but not confirmed

Source:
Ordnance Survey Ireland. All rights reserved.
Licence Number 2003/07CCMA/Dublin City Council.

Title:
AREAS KNOWN TO HAVE FLOODED ON 1st FEBRUARY 2002: 9 of 9

Project:
DUBLIN COASTAL FLOODING PROTECTION PROJECT

Client:
DUBLIN CITY COUNCIL

IN ASSOCIATION WITH :

FINGAL COUNTY COUNCIL
THE DEPARTMENT OF COMMUNICATIONS, MARINE AND NATURAL RESOURCES IN ASSOCIATION WITH OFFICE OF PUBLIC WORKS

Date:
OCT 2004

Scale:
Nominal Scale

Figure:
C1.9

Dublin City Council

safer

OPW

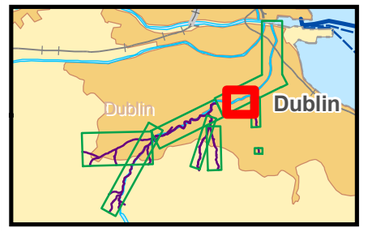
Appendix F. CFRAMS Mapping

© Ordnance Survey Ireland. Licence number 2010/22/CCMA/Dublin City Council



NodeLabel	Water Level (mOD) per AEP		
	WL 10%	WL 1%	WL 0.1%
DR-18492	2.77	3.10	3.37
DR-18602	2.74	3.08	3.36
DR-18692	2.73	3.06	3.35
DR-18802	2.71	3.01	3.30
DR-18802	2.70	3.00	3.30
DR-18992	2.67	2.97	3.28
DR-19102	2.67	2.97	3.28
DR-19303	2.67	2.96	3.27
DR-19482	2.67	2.97	3.28
DR-19589	2.67	2.97	3.28
DR-19594	2.67	2.97	3.28

Location Plan:



Legend:

- 0.5 % AEP Flood Extent (1 in 200 chance in any given year)
- 0.1 % AEP Flood Extent (1 in 1000 chance in any given year)
- Defended Area
- River Centreline
- Node Point
- OS_2975 — Node Label (refer to table)
- Flow reporting location
- 10% Flow = 1.20 / 1% Flow = 1.56 / 0.1% Flow = 2.17 — Peak flow during design flood extent

USER NOTE:

USERS OF THESE MAPS SHOULD REFER TO THE DETAILED DESCRIPTION OF THEIR DERIVATION, LIMITATIONS IN ACCURACY AND GUIDANCE AND CONDITIONS OF USE PROVIDED AT THE FRONT OF THIS BOUND VOLUME. IF THIS MAP DOES NOT FORM PART OF BOUND VOLUME, IT SHOULD NOT BE USED FOR ANY PURPOSE.

Client:

Dublin City Baile Átha Cliath · South Dublin County Council · Dún Laoghaire-Rathdown County Council Comhairle Contae Dhún Laoghaire-Ráth an Dúin · OPW

Project:

DODDER CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT STUDY

Map:

DODDER

Map Type: FLOOD EXTENT

Source: TIDAL FLOODING

Map Area: URBAN AREA

Scenario: CURRENT

Drawn By : A.A.B **Date :** 26 November 2010

Checked By : A.J. **Date :** 26 November 2010

Approved By : A.G.B **Date :** 26 November 2010

Figure No. :

DR/EXT/UA/TIDAL/101

Map Series : Page 1 of 2

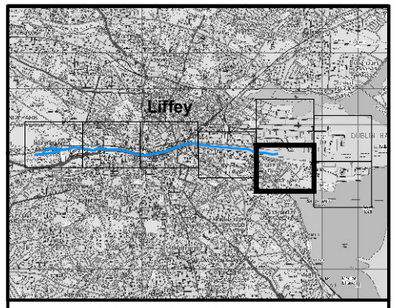
Drawing Scale : 1: 5,000 **Plot Scale : 1:1 @ A3**

0 0.1 0.2 Kilometers

RPS Consulting Engineers
ELMWOOD HOUSE
74 BOUCHER ROAD
BELFAST BT12 6RZ
TEL : 028 9066 7914
FAX : 028 9066 8286
www.rpsgroup.com/Ireland



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
09LIFF00007	2.67	244.31	3.11	250.36	3.34	253.81
E0924C0003	2.67	N/A	3.11	N/A	3.34	N/A
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
E0924C0017	2.67	N/A	3.11	N/A	3.34	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 Node Label

FINAL

REV:	NOTE:	DATE:

EASTERN CFRAM STUDY
CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT

OPW
Oifig na nOibreacha Poiblí
The Office of Public Works

RPS

The Office of Public Works
Jonathan Swift Street
Trim
Co Meath

Elmwood House
74 Boucher Road
Belfast
BT12 6RZ

T +44(0) 28 90 667914
F +44(0) 28 90 668286
W www.rpsgroup.com
E ireland@rpsgroup.com

Map:
Liffey Tidal Flood Extents

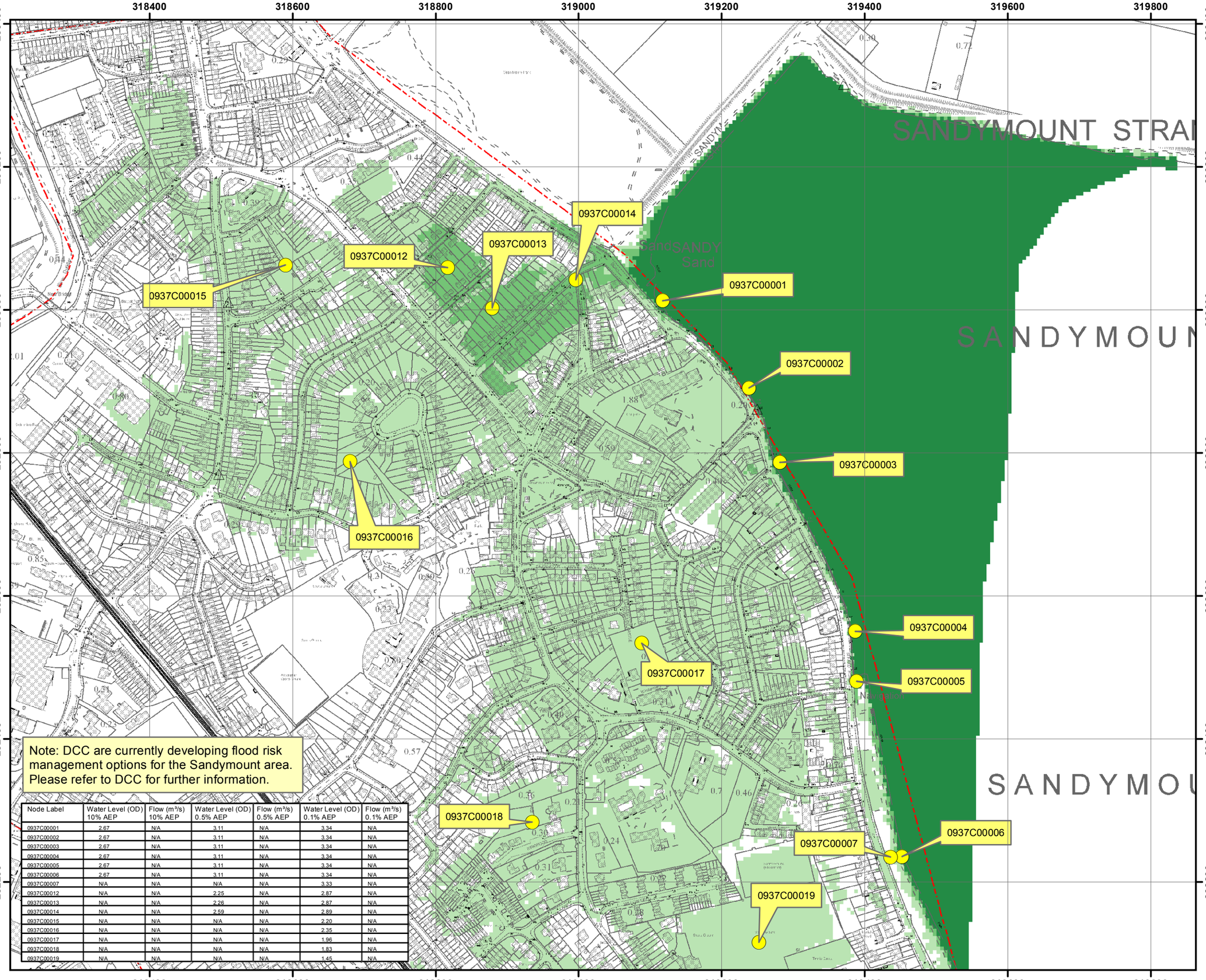
Map Type:	**EXTENT**		
Source:	**TIDAL**		
Map Area:	**COASTAL**		
Scenario:	**CURRENT**		
Drawn By :	**C.C.**	**Date :**	**28 July 2016**
Checked By :	**A.S.**	**Date :**	**28 July 2016**
Approved By :	**S.P.**	**Date :**	**28 July 2016**

Drawing No. :
E09LIF_EXCCD_F0_05

Map Series : Page 5 of 8

Drawing Scale : 1:5,000 @ A3

© Ordnance Survey Ireland. All rights reserved. Licence number EN 0021016/OfficeofPublicWorks.

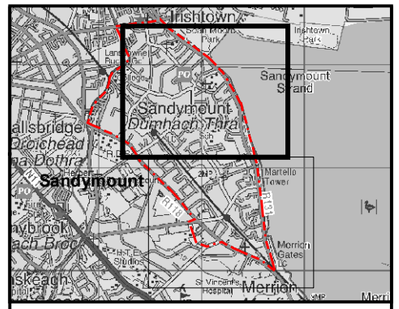


Note: DCC are currently developing flood risk management options for the Sandymount area. Please refer to DCC for further information.

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
0937C00001	2.67	N/A	3.11	N/A	3.34	N/A
0937C00002	2.67	N/A	3.11	N/A	3.34	N/A
0937C00003	2.67	N/A	3.11	N/A	3.34	N/A
0937C00004	2.67	N/A	3.11	N/A	3.34	N/A
0937C00005	2.67	N/A	3.11	N/A	3.34	N/A
0937C00006	2.67	N/A	3.11	N/A	3.34	N/A
0937C00007	N/A	N/A	N/A	N/A	3.33	N/A
0937C00012	N/A	N/A	2.25	N/A	2.87	N/A
0937C00013	N/A	N/A	2.26	N/A	2.87	N/A
0937C00014	N/A	N/A	2.59	N/A	2.89	N/A
0937C00015	N/A	N/A	N/A	N/A	2.20	N/A
0937C00016	N/A	N/A	N/A	N/A	2.35	N/A
0937C00017	N/A	N/A	N/A	N/A	1.96	N/A
0937C00018	N/A	N/A	N/A	N/A	1.83	N/A
0937C00019	N/A	N/A	N/A	N/A	1.45	N/A

0 50 100 200 300 400 500 Metres

© Ordnance Survey Ireland. All rights reserved. Licence number EN 0021016/OfficeofPublicWorks.



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
- AFA Extents
- Node Point
- Node ID: Node Label

FINAL

REV:	NOTE:	DATE:

EASTERN CFRAM STUDY
CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT

OPW Oifig na nOibreacha Poiblí The Office of Public Works

RPS

The Office of Public Works
Jonathan Swift Street
Trim
Co Meath

Elmwood House
74 Boucher Road
Belfast
BT12 6RZ

T +44(0) 28 90 667914
F +44(0) 28 90 668286
W www.rpsgroup.com
E ireland@rpsgroup.com

Map: Sandymount Tidal Flood Extents

Map Type:	EXTENT	
Source:	TIDAL	
Map Area:	COASTAL	
Scenario:	CURRENT	
Drawn By :	C.McG.	Date : 9 August 2016
Checked By :	A.S.	Date : 9 August 2016
Approved By :	S.P.	Date : 9 August 2016

Drawing No. : **E09SAN_EXCCD_F0_01**

Map Series : Page 1 of 2

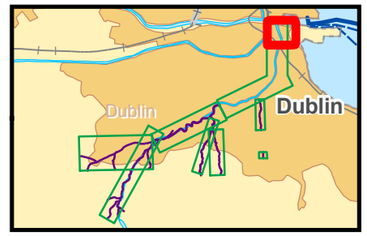
Drawing Scale : 1:5,000 @ A3

© Ordnance Survey Ireland. Licence number
2010/22/CCMA/Dublin City Council



Node Label	Water Level (mOD) per AEP		
	WL 10%	WL 1%	WL 0.1%
LD1-18492	2.79	3.11	4.79
LD1-18602	2.70	3.00	4.75
LD1-18729	2.61	2.86	4.07
LD1-18752	2.60	2.84	3.94
LD1-18902	2.52	2.69	3.33
LD1-19102	2.46	2.58	2.98
LD1-19303	2.45	2.58	2.84
LD1-19482	2.45	2.57	2.75
LD1-19594	2.44	2.56	2.73

Location Plan:



Legend:

- 10 % AEP Flood Extent (1 in 10 chance in any given year)
- 1 % AEP Flood Extent (1 in 100 chance in any given year)
- 0.1 % AEP Flood Extent (1 in 1000 chance in any given year)
- Defended Area
- High Confidence (<20m) (10% AEP)
- Medium Confidence (<40m) (10% AEP)
- Low Confidence (>40m) (10% and 0.1% AEP)
- High Confidence (<20m) (1% AEP)
- Medium Confidence (<40m) (1% AEP)
- Low Confidence (>40m) (1% AEP)
- River Centreline
- Node Point
- OS_2975 — Node Label (refer to table)
- Flow reporting location
- 10% Flow = 1.20 / 1% Flow = 1.56 / 0.1% Flow = 2.17 — Peak flow during design flood extent

USER NOTE:

USERS OF THESE MAPS SHOULD REFER TO THE DETAILED DESCRIPTION OF THEIR DERIVATION, LIMITATIONS IN ACCURACY AND GUIDANCE AND CONDITIONS OF USE PROVIDED AT THE FRONT OF THIS BOUND VOLUME. IF THIS MAP DOES NOT FORM PART OF BOUND VOLUME, IT SHOULD NOT BE USED FOR ANY PURPOSE.

Client:

Dublin City Baile Átha Cliath · South Dublin County Council · Dún Laoghaire-Rathdown County Council Comhairle Contae Dhún Laoghaire-Ráth an Dúin · OPW

Project:

DODDER CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT STUDY

Map:

PRESENT DAY DODDER

Map Type: FLOOD EXTENT

Source: FLUVIAL FLOODING

Map Area: URBAN AREA

Scenario: CURRENT

Drawn By :	A.A.B	**Date :**	26 November 2010
Checked By :	A.J.	**Date :**	26 November 2010
Approved By :	A.G.B	**Date :**	26 November 2010

Figure No. :

DR/EXT/UA/CURS/101

Map Series : Page 10 of 12

Drawing Scale : 1: 5,000 **Plot Scale : 1:1 @ A3**

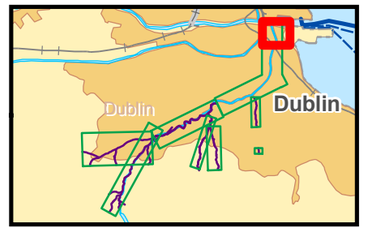
0 0.1 0.2
Kilometers

RPS Consulting Engineers
ELMWOOD HOUSE
74 BOUCHER ROAD
BELFAST BT12 6RZ
TEL : 028 9066 7914
FAX : 028 9066 8286
www.rpsgroup.com/Ireland

© Ordnance Survey Ireland. Licence number 2010/22/CCMA/Dublin City Council



Location Plan:



Legend:

Depth Grid [m]

- 0 - 0.25 m
- 0.25 - 0.50 m
- 0.50 - 1.00 m
- 1.00 - 1.50 m
- 1.5 - 2.00 m
- > 2.00 m
- River Centreline

USER NOTE:

USERS OF THESE MAPS SHOULD REFER TO THE DETAILED DESCRIPTION OF THEIR DERIVATION, LIMITATIONS IN ACCURACY AND GUIDANCE AND CONDITIONS OF USE PROVIDED AT THE FRONT OF THIS BOUND VOLUME. IF THIS MAP DOES NOT FORM PART OF BOUND VOLUME, IT SHOULD NOT BE USED FOR ANY PURPOSE.

Client:

Dublin City Baile Átha Cliath | South Dublin County Council | Dún Laoghaire-Rathdown County Council Comhairle Contae Dhún Laoghaire-Ráth an Dúin | OPW

Project:

DODDER CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT STUDY

Map:

DODDER

Map Type:	DEPTH
Return Period:	0.1% AEP EVENT
Source:	FLUVIAL FLOODING
Map Area:	URBAN AREA
Scenario:	CURRENT

Drawn By :	A.A.B	Date :	26 November 2010
Checked By :	A.J.	Date :	26 November 2010
Approved By :	A.G.B	Date :	26 November 2010

Figure No. :

DR/EXT/UA/DEP/1000/101A

Map Series : Page 10 of 12

Drawing Scale : 1: 5,000 **Plot Scale : 1:1 @ A3**

0 0.1 0.2
Kilometers

RPS Consulting Engineers
ELMWOOD HOUSE
74 BOUCHER ROAD
BELFAST BT12 6RZ
TEL : 028 9066 7914
FAX : 028 9066 8286
www.rpsgroup.com/Ireland

309000 312000 315000 318000 321000

234000

231000

228000

225000

PHOENIX PARK
Páirc an Fhionnuisce

DUBLIN HARBO

Baile Átha

Sandymount Strand

South Bull

Merrion Strand

Clondalkin
Cluain Dolcáin

Ballyfermot
Baile Formaid

Palmerston
Baile Pháma

Drumcondra
Cluain Tarbh

Ballsbridge

Ringsend
Rinn

Irishtown

Donnybrook
Domhnach Mór

Rathfarnham
Ráth Fearnáin

Churchtown
Baile an Teampaill

Windy Arbour

Mount Merrion
Cnoc Mhuirfean

Goatstown
Baile na nGabhar

Dundrum
Dún Droma

Kilmacud
Cill Mochuda

Stillorgan
Stigh Lorgan

Ballinteer
Baile an tSaoir

Sandyford
Áth an Ghairmín

Leopardstown

Foxrock
Carraig an tSi

Stepaside

Carrickmines
Carraig Mhai

Ballyogan

Kilmashogue Mountain
Sliabh Cuilinn Mochoig

Three Rock Mountain

Tallaght
Tamhlacht

Templeogue
Teach Mealóg

Terenure

Greenhills
Na Glaschnoic

Kilnamanagh
Cill na Manach

Tymon North
Tigh Mothain Thuaidh

Willbrook

Rathfarnham

Ballyboden
Baile Bodáin

Firhouse
Teach na Giúise

Oldbawn
Scanbhabhán

Jobstown
Bóthar Montain

Edmondstown

Whitechurch

Marley Park

Clarkstown

Taylorsgrange

Newtown

Rockbrook

Orlagh

Oldcourt

Killinardan

Killipper

Ballymana

Ballymaice

Knockanvinidee

Ballinascorney Lower

Corragreen

Bolgard Door

Friarstown

Jamestown

Kingswood

Newlands Cross Rds

Newlands

Quarryvale

Fonthill

River Liffey

Belgard

Bull Wall

North Bank Lighthouse

Martello Tower

Merrion Gates

Blackrock

Carysfort

Deansgrange

Galloping Green

Race Course

Reservoir

Castle

Megalithic Tomb

Standing Stone

Holy Well

Megalithic Standing Stone

Megalithic Stone Circle

Larch Hill

Barnacullia

Timock

Slackstown

Mountpelier

Ballyroan

Ballycullen

Kiltalown

Grand Canal

Dublin Mountains Way

Wicklow Way

M50

N81

N4

N7

N11

N31

R112

R113

R114

R115

R116

R117

R118

R119

R120

R121

R131

R132

R133

R134

R136

R137

R138

R139

R811

R812

1000 0 1000 2000 3000 4000 Meters

© Ordnance Survey Ireland. All rights reserved. Licence No. EN 0021016

Location Plan:



LEGEND

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

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

OPW
Oifig na nOibreacha Poiblí
The Office of Public Works

The Office Of Public Works
Jonathan Swift Street
Trim
Co. Meath

Comhairle Cathrach Bhaile Átha Cliath
Dublin City Council

Dublin City Council
Civic Offices
Wood Quay
Dublin 8

Project:

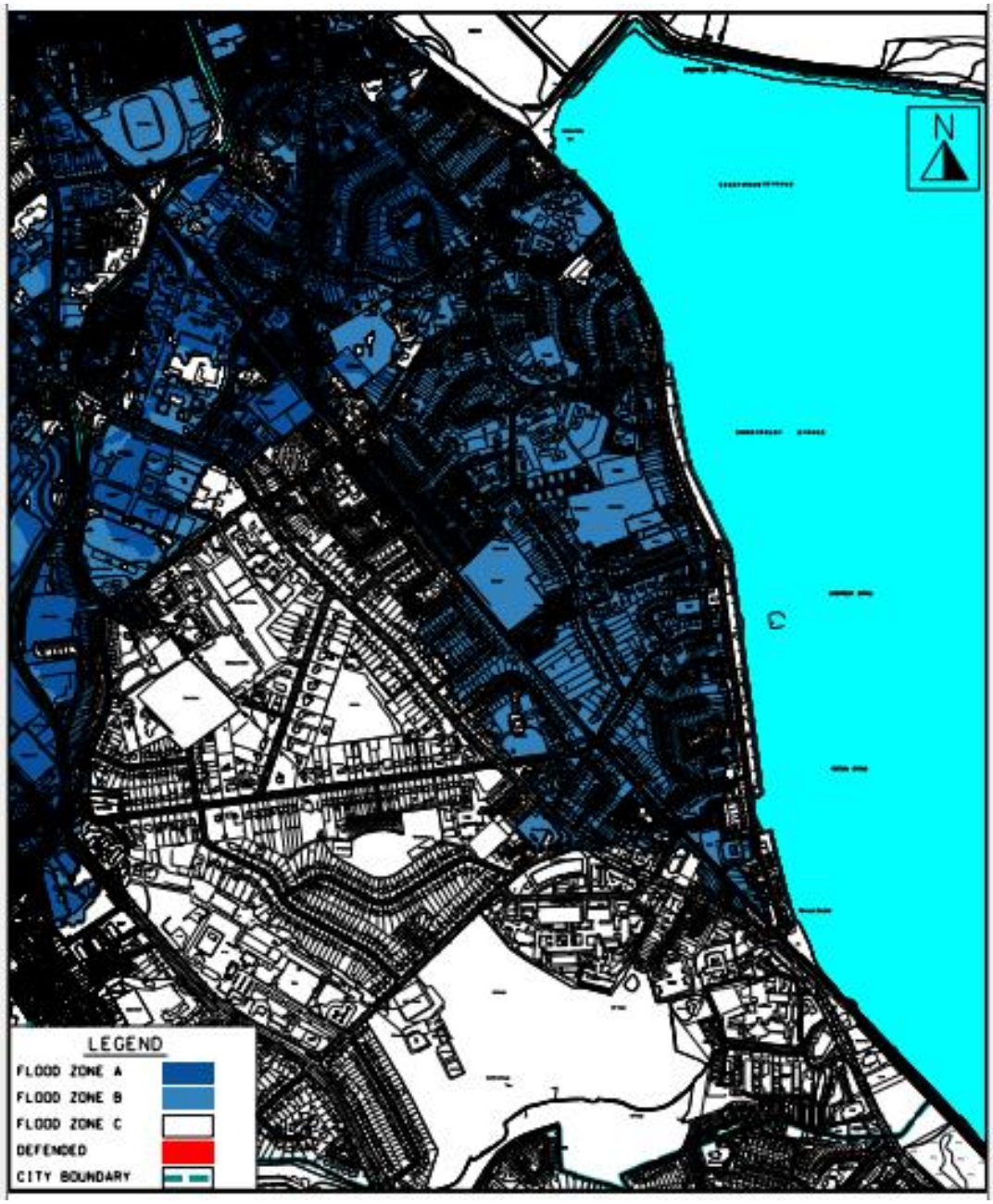
DUBLIN PLUVIAL STUDY (FloodResilienCity)

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_EXPCD_F0_03		
Revision: F0			
Map Scale: 1:50,000		Plot Scale: 1:1 @ A3	

Appendix G. SFRA Justification Tests (Area: 8. Coastal: Sandymount)

Area: 8. Coastal: Sandymount



For Land Use Zoning Maps Overlaid with Flood Zones see Dublin City Council Development Plan 2022 - 2028, Flood Map F and Flood Map H.

Area 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 around the DART Line from Merrion Road near the

Area: 8. Coastal: Sandymount	
	Merrion Gates to the Dodder River and Newbridge Avenue and south of Leahy Terrace on the north of the area. The area includes Sandymount Village. 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, community uses, open space areas and sports areas.
SDRAs within this Area	N/A
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. 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. Planning permission has been granted to put flood gates on these 14 openings and strengthen the sea wall along the Promenade. A consultant is being procured to look at options for the 700m section of sea wall north of the promenade to Sean Moore Park.
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 SFRA flood maps are consistent with previous flooding of this section of Sandymount, however, the map show potential for flooding in an undefended scenario.
Surface Water	All 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

Area: 8. Coastal: Sandymount	
	rainfall event. Should development be permitted, best practice with regard to surface water management should be implemented across the development area, to limit surface water run-off 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 FloodResilienCity 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 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 Plan 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 in this area.

Justification Test for Development Plans

1. **Part 1 of the Justification Test is covered under Section 3.2.1 in the main body of the SFRA report.**

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 residentially developed areas/ built-up and established, with some commercial properties and community uses. There would be limited large development sites within this area. The possible development of infill sites will be small scale infill development 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.

Area: 8. Coastal: Sandymount

Answer: Yes. 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: Yes: The area comprises part of the established / designated urban settlement of Dublin City.

(iv) Will be essential in achieving compact and sustainable urban growth.

Answer: Yes: The area comprises part of the established / designated urban settlement of Dublin 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 denitifed as being in Flood Zones A and B are considered essential to achieving a consolidated urban centre and to comply with the NPF and RSES.

3. Specific Flood Risk Assessment:

- 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 being completed. Small scale development, such as extensions, is acceptable, but larger scale development is premature. Once completed, new flood defences may alter restrictions on such developments and a reappraisal of flood risk would be appropriate as per this SFRA and the main Development Plan.
- Climate change risks are significant and need to be assessed under the site specific FRA with guidance on finished floor levels applied as detailed in the SFRA.
- Groundwater flooding particularly during high tide, should be considered in all development flood risk assessments in this site area.

Conclusion: The subject area <u>passes</u> the Justification Test for Development Plans.