

Parnell Square Cultural Quarter

Flood Risk Assessment

239031-00

Issue 2 | 12 October 2018

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Job number 239031-00



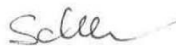
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Executive Summary

Arup was commissioned by the Dublin City Council & PSQ Development Limited to undertake a Flood Risk Assessment (FRA) for the proposed Parnell Square Cultural Quarter Development.

This report details the FRA which forms part of the planning application for the development. It has been undertaken in accordance with the Guidelines for Planning Authorities on 'The Planning System and Flood Risk Management' published in November 2009, jointly by the Office of Public Works (OPW) and the then Department of Environment, Heritage and Local Government (DEHLG).

The risk of tidal, fluvial, pluvial and groundwater flooding to the site is very low. The proposed development will have no impact on floodplain storage and conveyance as it is located outside of the 1 in 1000 year flood plain.

Appropriate drainage design measures to manage the disposal of surface water from the site is proposed including SUDS measures to minimise the risk of flooding.

The site lies within Flood Zone C and a Justification Test is therefore not required for the development.

1 Introduction

1.1 Project Background

Arup was commissioned by the Dublin City Council & PSQ Development Limited to undertake a Flood Risk Assessment (FRA) for the proposed Parnell Square Cultural Quarter Development located at Parnell Square in Dublin.

This report details the FRA, which forms part of the planning application for the development. It has been undertaken in accordance with the Guidelines for Planning Authorities on 'The Planning System and Flood Risk Management' published in November 2009, jointly published by the Office for Public Works (OPW) and the Department of Environment, Heritage and Local Government (DEHLG).

1.2 Scope of Study

The scope of the study includes the following:

- Review of all relevant information and data from:
 - OPW Preliminary Flood Risk Assessment Mapping (PFRA);
 - The 'Rivers of Dublin' book (Sweeney, 1991);
 - Any historic flood information for the area and /or any relevant studies;
 - The available topographical information for the site;
 - Architectural drawings for the development;
 - Proposed engineering drainage drawings for the site;
- Review of available site investigation data;
- Review of the risk of fluvial, tidal, groundwater and pluvial flooding;
- Review of access/egress routes;
- Recommendation on suitable finished floor level;
- Recommendation on potential mitigation measures;
- Preparation of an FRA report.

1.3 Summary of Data used and Assumptions made

In preparing this report, the following data was collated and reviewed:

- Flood history of the site from the National Flood Hazard Mapping website (www.floodmaps.ie) which is maintained by the OPW;
- Preliminary Flood Risk Assessment (PFRA) Mapping produced by the OPW (www.cfram.ie/pfra);
- Site Geological and hydrogeological data from the Geological Survey of Ireland website (www.gsi.ie);
- Guidelines for Planning Authorities on 'The Planning System and Flood Risk Management' published in November 2009, jointly published by the Office of Public Works (OPW) and the then Department of Environment, Heritage and Local Government (DEHLG);
- Results from the Site Investigation carried out at the subject site;
- Aerial photography and mapping from Google Maps.
- The layout drawings for the proposed development;
- The available topographical survey information for the site

All Ordnance Datum (OD) levels referred to in this report are to Malin Head Ordnance Datum unless otherwise stated.

1.4 Site Description and proposed Development

The proposed development is located on Parnell Square in the centre of Dublin as shown in

Figure 1. The development is bordered to the West by the streets Granby Row/ Parnell Square West Garden and to the North by the street Bethesda. The new development will have street frontage on Parnell Square.

The overall proposed development will consist of creation of circa 11,400 m² of cultural facilities at Parnell Square North, which will include the creation of a high-quality city library. These facilities will incorporate both new buildings and existing historic buildings, which will be renovated. The new proposed library will also include the creation of extensive roof gardens on the new buildings.

Figure 1: Site Location



Specifically, the project consists of three key elements:

- **New Build:** Demolition of existing structures and infill site to rear of No. 23-28 Parnell Square North, consisting of approximately 5,000 m² of striking Architectural space, with Library, Conference and Music Hub facilities.
- **Georgian Buildings:** Existing Georgian Buildings on Parnell Square North, consisting of approximately 5,500 m² of multi-use space. Building No.'s 23-28 are located to the West of Hugh Lane Gallery and No. 20 & 21 to the East.
- **Public Realm:** External space to front of buildings incorporating public roads.

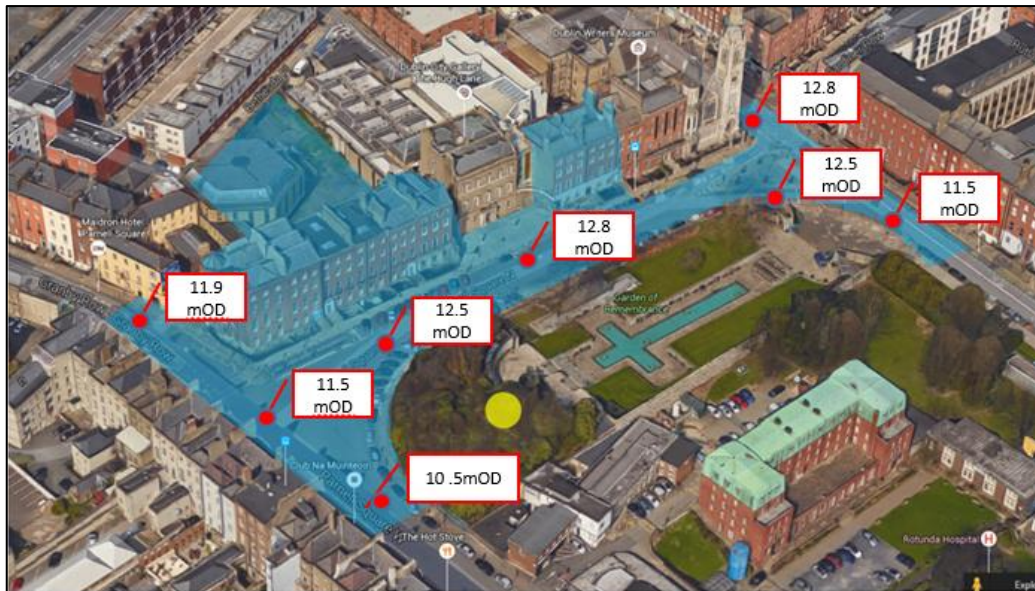
Figure 2: Architectural cross section (in front view)



The existing ground levels around the perimeter of the proposed development vary as indicated in Figure 3. Along the boundary with Parnell Square West the elevations vary from 11.9mOD to

10.5mOD while at the Parnell Square East the elevations vary from 12.8mOD to 11.5mOD.

Figure 3: Site Aerial from the west with spot heights



2 Planning Context

The following planning policy documents are relevant to the assessment of the proposed development:

- The national planning guidelines published by the OPW and the Department of the Environment, Heritage and Local Government in November 2009 entitled 'The Planning System and Flood Risk Management: Guidelines for Planning Authorities' are particularly pertinent and are discussed in the following section;
- In terms of planning policy context, the provisions contained in the following document are relevant:
 - Dublin City Development Plan 2016 - 2022

2.1 The Planning System and Flood Risk Management Guidelines

2.1.1 Introduction

In November 2009, the Department of Environment, Heritage and Local Government and the Office of Public works jointly published a Guidance Document for Planning Authorities entitled "the Planning System and Flood Risk Management".

The guidelines are issued under Section 28 of the Planning and Development Act 2000, and Planning Authorities and An Bord Pleanála are therefore required to implement these Guidelines in carrying out their functions under the Planning Acts.

The aim of the guidelines is to ensure that flood risk is neither created nor increased by inappropriate development.

The guidelines require the planning system to avoid development in areas at risk of flooding, unless they can be justified on wider sustainability grounds, where the risk can be reduced or managed to an acceptable level.

They require the adoption of a Sequential Approach (to Flood Risk Management) of Avoidance, Reduction, Justification and Mitigation and they require the incorporation of Flood Risk Assessment into the process of making decisions on planning applications and planning appeals.

Fundamental to the guidelines is the introduction of flood risk zoning and the classifications of different types of development having regard to their vulnerability.

The management of flood risk is now a key element of any development proposal in an area of potential flood risk and should therefore be addressed as early as possible in the site master planning stage.

2.1.2 Definition of Flood Zones

Flood Zones are geographical areas within which the likelihood of flooding is in a particular range.

There are three types of flood zones defined in the Guidelines as follows:

Flood Zone A	Probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding).
Flood Zone B	Probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 year and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 year and 0.5% or 1 in 200 for coastal flooding); and
Flood Zone C	Probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

2.1.3 Definition of Vulnerability Classes

The following table summarises the Vulnerability Classes defined in the Guidelines and provides a sample of the most common type of development applicable to each.

Highly Vulnerable Development	Includes Garda, ambulance and fire stations, hospitals, schools, residential dwellings, residential institutions, essential infrastructure, such as primary transport and utilities distribution and SEVESO and IPPC sites, etc.
Less Vulnerable Development	Includes retail, leisure, warehousing, commercial, industrial and non-residential institutions, etc.
Water Compatible Development	Includes Flood Control Infrastructure, docks, marinas, wharves, navigation facilities, water based recreation facilities, amenity open spaces and outdoor sport and recreation facilities

2.1.4 Types of Vulnerability classes appropriate to each zone

The following table illustrates the different types of Vulnerability Class appropriate to each Zone and indicates where a Justification Test will be required.

	Flood Zone A	Flood Zone B	Flood Zone C
Highly Vulnerable	Justification Test	Justification Test	Appropriate
Less Vulnerable	Justification Test	Appropriate	Appropriate
Water Compatible	Appropriate	Appropriate	Appropriate

The flood risk management guidelines recognise that there is a need to reconcile the desire to avoid development in areas at risk of flooding while also ensuring sequential and compact urban development as several large urban centres are already located in areas that are at risk of flooding. Section 3.7 of the guidelines state the following (section 3.7 refers):

"Notwithstanding the need for future development to avoid areas at risk of flooding, it is recognised that the existing urban structure of the country contains many well established cities and urban centres, which will continue to be at risk of flooding. At the same time such centres may also have been targeted for growth in the National Spatial Strategy, regional planning guidelines and the various city and county development plans taking account of historical patterns of development and their

national and strategic value. In addition, development plans have identified various strategically located urban centres and particularly city and town centre areas whose continued growth and development is being encouraged in order to bring about compact and sustainable urban development and more balanced regional development. Furthermore, development plan guidelines, issued by the Minister for the Environment, Heritage and Local Government under Section 28 of the Planning and Development Act 2000, have underlined the importance of compact and sequential development of urban areas with a focus on town and city centre locations for major retailing and higher residential densities.”

2.2 Dublin City Development Plan 2016 - 2022

The Dublin City Development Plan 2016-2022 came into effect in October 2016.

The Plan sets out policies and objectives to create a sustainable and vibrant city at the heart of the Greater Dublin Region and is a guide to how and where development will take place in the city over the years covered. The following paragraphs summarise the relevant provisions contained within the Plan which deal with Flood Risk Management.

Section 9.5.3 of the Plan deals with Flood Management and outlines the key policies and objectives of Dublin City Council in relation to flood risk.

The policies are listed as:

SI9: To assist the Office of Public Works in developing catchment-based Flood Risk Management Plans for rivers, coastlines and estuaries in the Dublin city area and have regard to their provisions/recommendations.

SI10: To have regard to the Guidelines for Planning Authorities on the Planning System and Flood Risk Management, and Technical Appendices, November 2009, published by the Department of the Environment, Community, and Local Government as may be revised/updated when assessing planning applications and in the preparation of plans both statutory and non-statutory.

SI11: To put in place adequate measures to protect the integrity of the existing Flood Defence Infrastructure in Dublin City Councils ownership and identified in the Strategic Flood Risk Assessment and to ensure that the new developments do not

have the effect of reducing the effectiveness or integrity of any existing or new flood defence infrastructure and that flood defence infrastructure has regard also to nature conservation, open space and amenity issues.

SI12: To implement and comply fully with the recommendations of the Strategic Flood Risk Assessment prepared as part of the Dublin City Development Plan.

SI13: That development of basements or any above-ground buildings for residential use below the estimated flood levels for Zone A or Zone B will not be permitted.

SI14: To protect the Dublin City coastline from flooding as far as reasonably practicable, by implementing the recommendations of the Dublin Coastal Flood Protection Project and the Dublin Safer Project.

SI15: To minimise the risk of pluvial (intense rainfall) flooding in the city as far as is reasonably practicable and not to allow any development which would increase this risk.

SI16: To minimise the flood risk in Dublin City from all other sources of flooding, including fluvial, reservoirs and dams and the piped water system. **SI17:** To require an environmental assessment of all proposed flood protection or flood alleviation works

The Objective of Dublin City Council are listed as:

SI08: All development proposals shall carry out, to an appropriate level of detail, a Site Specific Flood Risk Assessment (SSFRA) that shall demonstrate compliance with:

The Planning System and Flood Risk Management, Guidelines for Planning Authorities, Department of the Environment, Community and Local Government, November 2009, as may be revised/updated and the Strategic Flood Risk Assessment (SFRA) as prepared by this Development Plan.

The site-specific flood risk assessment (SSFRA) shall pay particular emphasis to residual flood risks, site-specific mitigation measures, flood-resilient design and construction, and any necessary management measures (the SFRA and Appendix B4 of the above mentioned national guidelines refer). Attention shall be given in the site-specific flood risk assessment to building design and creating a successful interface with the public realm through good design that addresses flood concerns but also maintains appealing functional streetscapes. All potential sources of flood risk must be addressed in the SSFRA.

SIO9: Proposals which may be classed as 'minor development', for example small-scale infill, small extensions to houses or the rebuilding of houses or paving of front gardens to existing houses, most changes of use and small-scale extensions to existing commercial and industrial enterprises in Flood Zone A or B, should be assessed in accordance with the Guidelines for Planning Authorities on the Planning System and Flood Risk Management & Technical Appendices, November 2009 as may be revised/updated, with specific reference to Section 5.28 and in relation to the specific requirements of the Strategic Flood Risk Assessment. The policy shall be not to increase the risk of flooding and to ensure risk to the development is managed.

SIO10: That recommendations and flood maps arising from the Fingal-East Meath CFRAM Study, the Dodder CFRAM Study and the Eastern CFRAM Study are taken into account in relation to the preparation of statutory plans and development proposals.

This will include undertaking a review of the Strategic Flood Risk Assessment for Dublin city following the publication of the Final Eastern CFRAM Study, currently being produced by the OPW.

SIO11: To work with neighbouring Local Authorities when developing cross-boundary flood management work programmes and when considering cross-boundary development.

SIO12: To ensure each flood risk management activity is examined to determine actions required to embed and provide for effective climate change adaptation as set out in the Dublin City Council climate change adaptation policy and in the OPW Climate Change Sectoral Adaptation Plan Flood Risk Management applicable at the time.

Regarding the provision of SuDS, the Plan also outlines specific policies and objectives. The policies are listed as:

It is the Policy of Dublin City Council:

SI18: To require the use of Sustainable Urban Drainage Systems (SuDS) in all new developments, where appropriate, as set out in the Greater Dublin Regional Code of Practice for Drainage Works. The following measures will apply:

- The infiltration into the ground through the development of porous pavement such as permeable paving, swales, and detention basins
- The holding of water in storage areas through the construction of green roofs, rainwater harvesting, detention basins, ponds, and wetlands

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

3 Overview of Flood Hazard and Historical Record of Flooding at the Site

3.1 Overview of Potential Flood Hazards

In broad terms, the potential sources of flooding to the National Concert Hall can be categorised as follows:

- Tidal/Coastal Flooding;
- Fluvial Flooding;
- Urban Drainage/Pluvial Flooding;
- Groundwater Flooding;

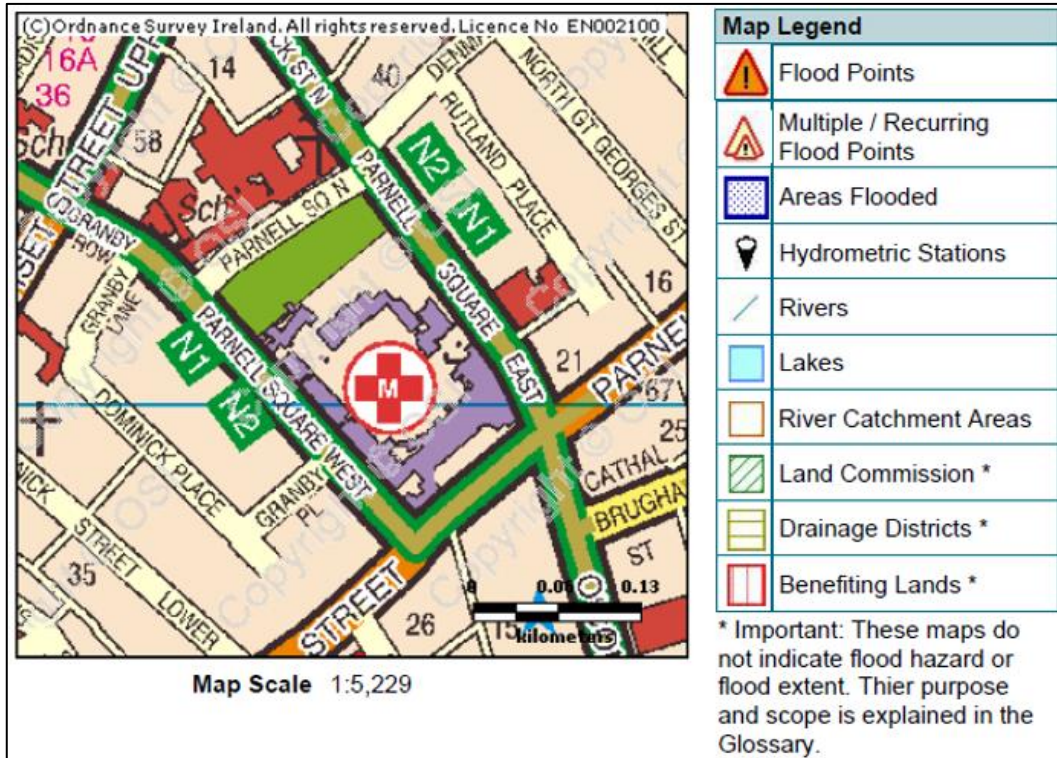
Each of these potential sources of flood risk are discussed in this FRA.

3.2 Historic Flooding

Figure 4 presents a flood report for the site of interest from the National Flood Hazard Mapping website, 'floodmaps.ie'. As can be seen from the figure there are no flood records located in the immediate vicinity of the site.

While there is no record of past flooding on the site, it is still possible that unrecorded flooding has occurred on the site in the past.

Figure 4: Extract of historical floods from the National Flood Hazard Mapping website

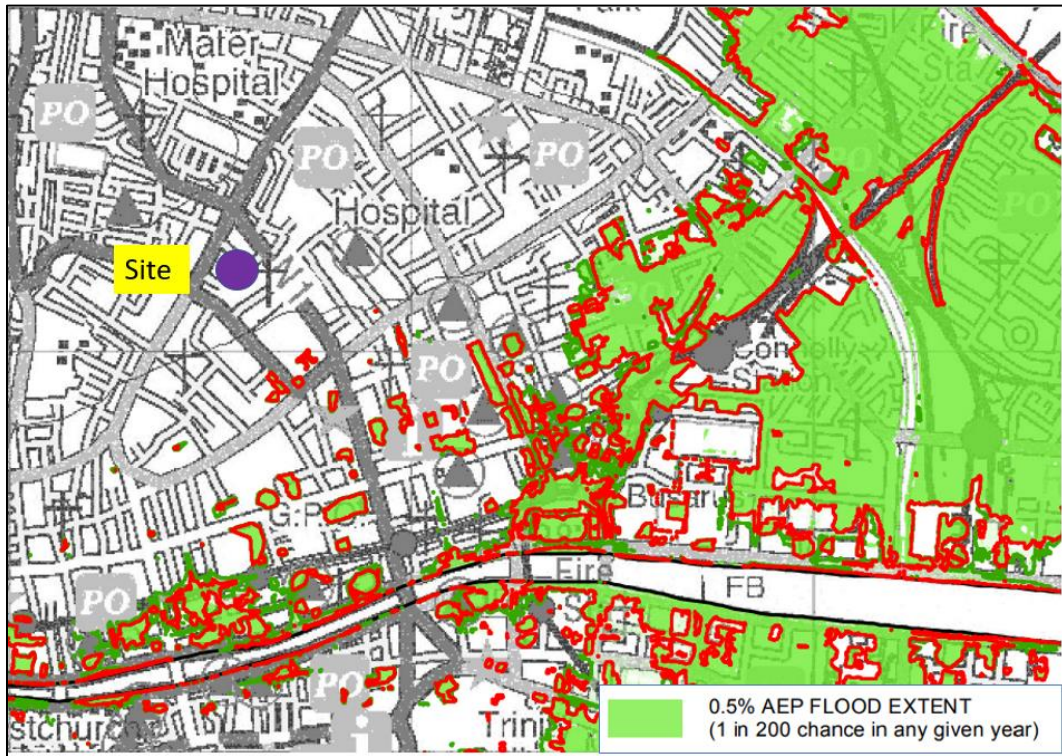


4 Tidal Flood Risk

The ICPSS predicted 1 in 200 year tidal floodplain for Dublin is presented in

Figure 5. It can be seen that the site of interest (highlighted in red) is located well outside from the predicted extent. Further we note that 1 in 200 year tidal water level in Dublin port is 3.07mOD which is over eight meters lower than existing ground levels at the site. The risk of tidal flooding to the site is therefore remote.

Figure 5: PFRA tidal extent map (area of interest highlighted in purple)



We note that the risk of tidal flooding in a climate change scenario will also be remote.

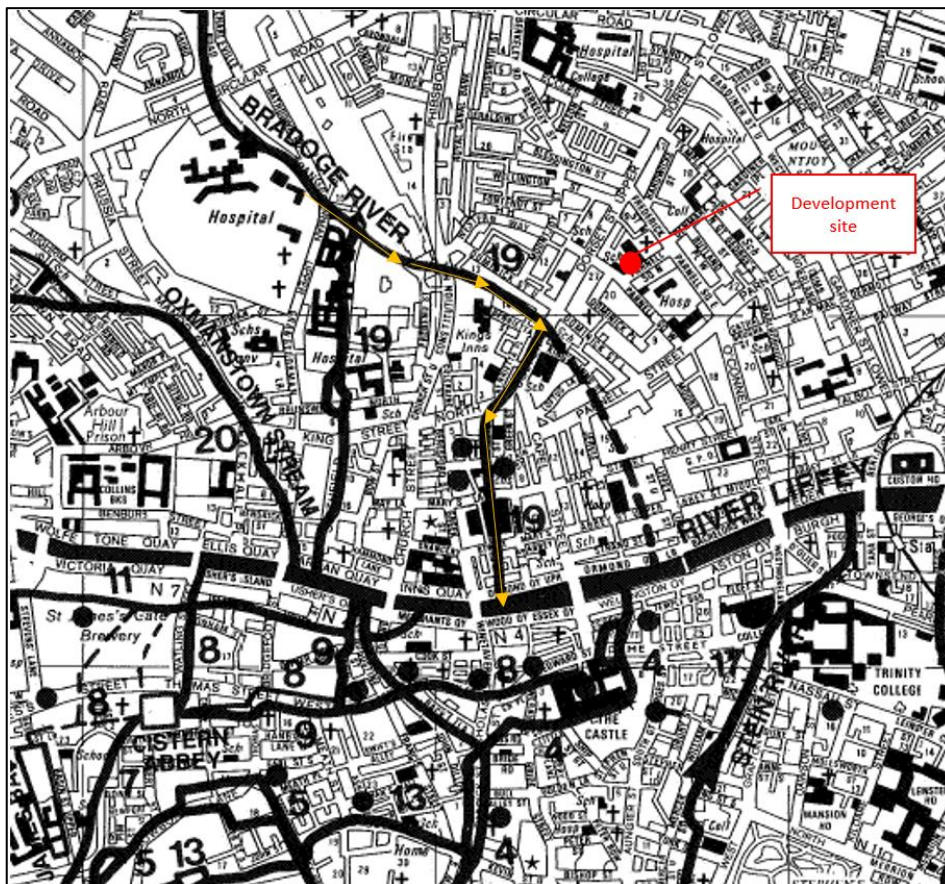
5 Fluvial Flood Risk

5.1 Bradoge River

The subject site lies in the catchment of the Bradoge River which is a tributary of the River Liffey. Figure 6 presents the orientation of the river as presented in the 'Rivers of Dublin' book. We note that the watercourse is culverted through most of its reach in the vicinity of the site.

The original line of the watercourse (dashed black line in Figure 6) continued toward the River Liffey at Ormond Quay Lower but some years back it was diverted into a culvert that ran from Bolton Street under the city until its outfall in the River Liffey.

Figure 6: Orientation of the River Bradoge taken from the 'Rivers of Dublin' book



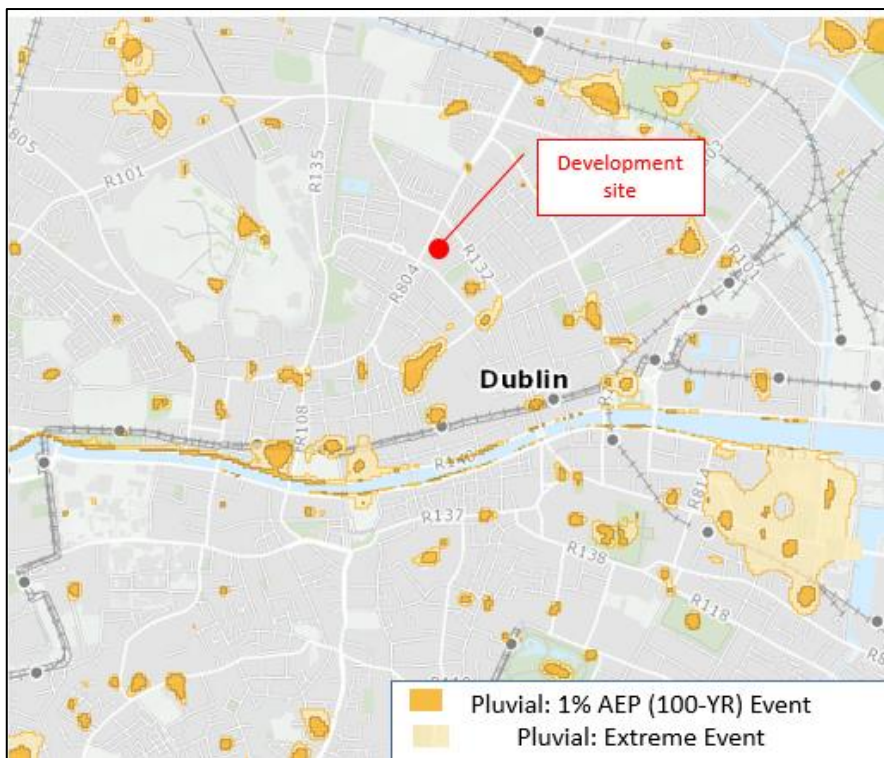
Since the proposed development site is at least 3 m higher than the surface elevations in the vicinity of the Bradoge River, the fluvial flooding risk will be remote. Additionally, ground elevations fall towards the River Liffey from the Bradoge. Should water exit the Bradoge river/culvert system it will therefore be conveyed away from the site.

We note that the risk of fluvial flooding from the Bradoge River in a climate change scenario will also be remote.

6 Pluvial Flood Risk

The PFRA maps produced by OPW have also been used to assess the risk of pluvial flooding to the site. It can be seen from the map (Figure 7) that the subject site is not within the predicted 1% AEP and 0.1% AEP pluvial extents.

Figure 7: Pluvial risk areas based on OPW's (subject site highlighted in red).



We note that the risk of pluvial flooding in a climate change scenario will also be remote.

7 Groundwater Risk

Groundwater flooding can occur during lengthy periods of heavy rainfall, typically during late winter/early spring when the groundwater table is already high. If the groundwater level rises above ground level, it can pond at local low points and cause periods of flooding.

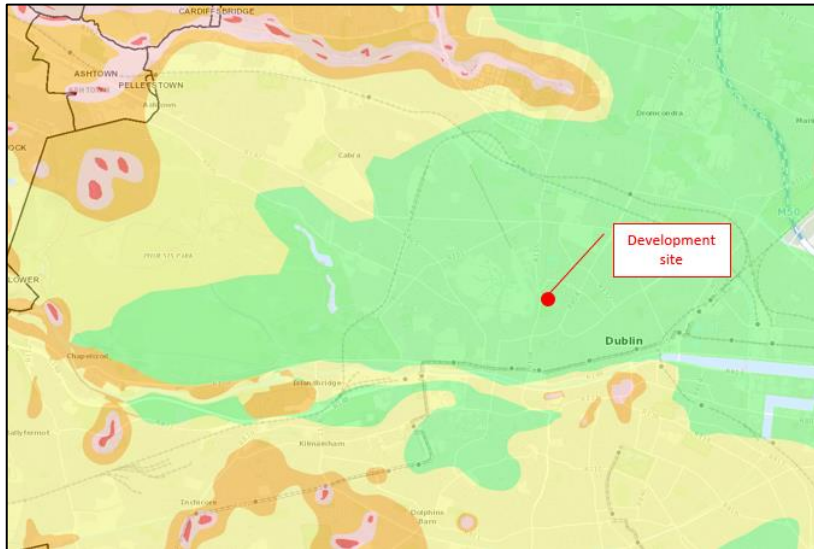
Geological and groundwater maps of the site and surrounding areas, as shown below, have been obtained from the Geological Survey of Ireland (GSI) website (www.gsi.ie). As would be expected, according to the GSI sub soils maps, the subsoil surrounding the site consists of made ground, as can be seen in Figure 8.

Figure 8: Teagasc subsoils map



The groundwater vulnerability is indicated as low in Figure 9 and suggests that the groundwater table isn't particularly high and/or the overburden may be moderately permeable. This dataset however is only indicative and may not represent the risk of groundwater flooding at the site.

Figure 9: Groundwater vulnerability at site



Ground investigations undertaken on adjacent sites (namely the Sheridan Court & Hugh Lane Gallery Extension) suggest groundwater levels in the vicinity of the site of interest range from +0.3 to +1.2mOD and are therefore circa 12 - 13m below ground level. It is therefore considered that the risk of groundwater flooding is very low. The development will not alter the existing groundwater flow regime as there is no alteration to the existing underground structure.

8 Establishment of suitable finished Floor Levels

Given the very low risk of flooding to the site, the finished floor level of the development needs to be considered in the content of the existing floor levels in the properties adjacent to the development and also of minimising the low of risk of pluvial flooding.

The floor levels are proposed to set at 13.675mOD in order to tie in with neighbouring buildings. This is sufficiently elevated to minimise the risk of surface water ingress onto the site.

9 Management of residual Flood Risk at Site

9.1 Access and Egress Routes to the Site

Given the absence of a significant risk of flooding of the site, access and egress routes is unlikely to be compromised during flood events.

9.2 Storage and Conveyance

The proposed development will have no impact on floodplain storage and conveyance as it is located outside of the 1 in 1000 year flood plain.

9.3 Proposed Surface Water Drainage

In accordance with the Sustainable Drainage Policies of DCC, the surface water from the site will be managed through the use of sustainable water measures which will improve water quality, reduce the quantity of water discharges and provide bio-diversity and amenity value in the development.

This will be achieved by the use of green roofs, rainwater butts, and other SUDS measure within the building development and the maximum usage possible of bio-retention tree pits, soft landscaping, permeable paving, and other SUDS measure within the public realm area of the Parnell Square North.

Any excess surface water remaining, following attenuation will be pumped, following silt removal into the combined sewer, subject to Irish Water formal approval.

9.3.1 Design Exceedance Event

In the event of an extreme high-intensity rainfall event and/or gully blockages, the capacity of the drainage system for the site could be exceeded leading to localised surface runoff ponding in the vicinity of the site. Given that ground levels fall in a north south direction from the site and the proposed floor level is circa 0.5m above ground levels external to the site, the risk of surface water entering the proposed development is very remote.

10 Application of 'Flood Risk Management Guidelines'

10.1 Vulnerability Classification

It is considered that the proposed development should be classed as a 'Less vulnerable development' as per the vulnerability classification below.

Figure 10: Vulnerability Classification

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

10.2 Flood Zones

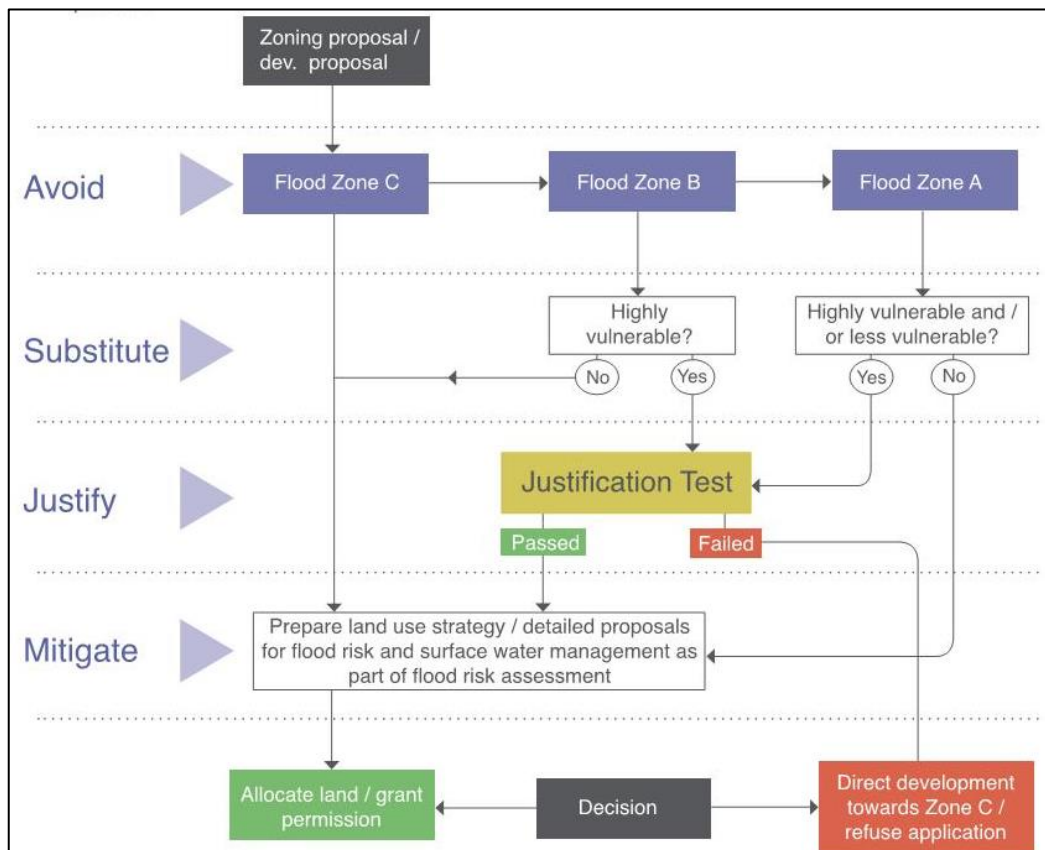
As indicated in Section 5, the proposed development is not indicated as being within either the 1000 or 100 year floodplains.

In accordance with the OPW's planning guidelines, the site lies within Flood Zone C.

10.3 Sequential Approach

The figure below illustrates the sequential approach to be adopted under the 'Planning System and Flood Risk Management' guidelines.

Figure 11: Sequential Approach



As the proposed development lies within Flood Zone C, a Justification Test is not required and it is necessary only to identify mitigation measures for any residual risks. This has been discussed in Section 9 of this report.

11 Conclusions

There is no record of historic flooding at the site. The risk of tidal, fluvial, pluvial and groundwater flooding to the site is very low including the climate change scenario. The site lies in Flood Zone C and a Justification Test is not required.

In order to tie in with neighbouring buildings, the floor levels are proposed to be set at 13.675mOD. This is also sufficiently elevated to minimise the risk of surface water ingress onto the site.

Given the absence of a significant risk of flooding of the site, access and egress routes are unlikely to be compromised during flood events.

The proposed development will have no impact on floodplain storage and conveyance as it is located outside of the 1 in 1000 year flood plain.

Surface water from the site will be managed through the use of sustainable surface measures which will improve water quality, reduce the quantity of water discharging and provide bio-diversity and amenity value to the development.