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Site Specific Flood Risk Assessment

Spencer Place Residential

Block 2, Spencer Dock, Dublin 1

Client: Spencer Place Development Company Limited

Job No. R043

March 2019

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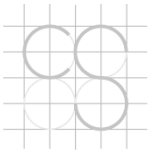

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SITE SPECIFIC FLOOD RISK ASSESSMENT

SPENCER PLACE RESIDENTIAL, BLOCK 2, SPENCER DOCK, DUBLIN 1

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1.0 INTRODUCTION

In conjunction with the multi-disciplinary Design Team, CS Consulting were commissioned by Spencer Place Development Company Limited, to prepare an appropriate Flood Risk Assessment Report to accompany a planning application for the site at City Block 2, bound by Sheriff Street to the north, Mayor Street to the south and New Wapping Street to the east, Spencer Dock, Dublin 1.

The purpose of this report is to review the potential causes and likelihood of flooding effecting the proposed subject lands.

Development comprising of an amendment to permitted development Reg. Ref. DSDZ2896/18 and as amended by Reg. Ref. DSDZ4279/18 at Spencer Place North, City Block 2, Spencer Dock, Dublin 1. The proposed development seeks revisions to the permitted Block 1 and 2 to provide for an increase in the number of residential units from 349 no. to 464 no. apartment units and the change of use of the permitted aparthotel development to shared accommodation. The proposed development will increase the height of the permitted development) increasing the maximum height of Block 1 from 7 no. storeys (27.5 m) to a maximum height of 13 no. storeys (46.8m) and increasing the maximum height of Block 2 (27.5m) to 11 no. storeys (40.5m). The proposed development will also include the provision of a link bridge between Block 1 and Block 2 at 6th floor level, revised landscaping, the provision of communal open space, revised under croft level, provision of roof terraces and all other associates site development works to facilitate the development.

A full description of the scheme is outlined in the Planning Report prepared by John Spain and Associates which accompanies this submission.

The site, of 1.26Ha, is bound by Sheriff Street to the north, Mayor Street to the south and New Wapping Street to the east.

The site also includes the existing operational North Lotts Pumping Station and its associated infrastructure – the development of the planning application involves building adjacent to, and over, the Pumping Station.

The site has an average topographical level of approximately 2.5mOD (Malin Head). The site is located within the Strategic Development Zone (SDZ) for the North Lotts and Grand Canal Dock Planning Scheme 2014.

All associated and ancillary site development and landscaping works will be undertaken including provision of internal routes for pedestrians, hard and soft landscaping with integrated lighting and provision of communal open space for amenities as well as all other site excavation and development works above and below ground.

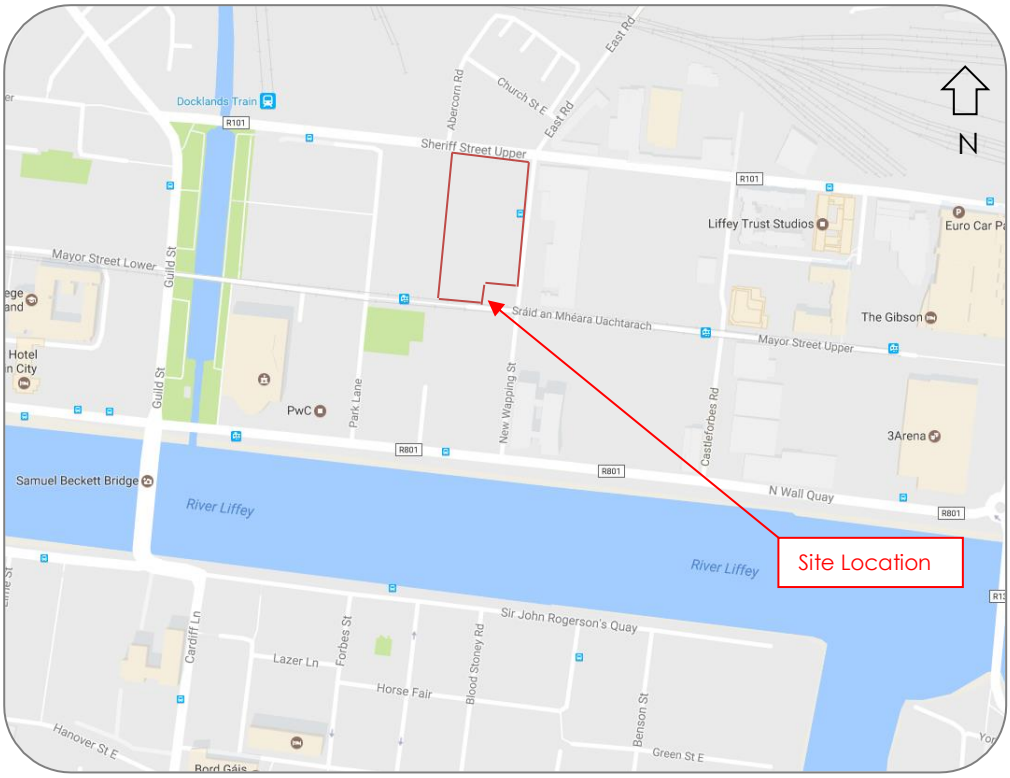


Figure 1 - Site Location
(Image source: Google Maps)

2.0 SCOPE OF WORKS

CS Consulting were commissioned by Spencer Place Development Company Limited to prepare the following Flood Risk Assessment Report to accompany a planning application for the site at City Block 2, bound by Sheriff Street to the north, Mayor Street to the south and New Wapping Street to the east, Spencer Dock, Dublin 1.

In preparing this report CS Consulting have made reference to the following:

- North Lotts & Grand Canal Dock Planning Scheme, 2014,
- Dublin City Council Development Plan, 2016 – 2022,
- Greater Dublin Strategic Drainage Study, (GDSDS),
- Greater Dublin Regional Code of Practice for Drainage Works,
- Office of Public Works, (OPW),
- Ordnance Survey of Ireland, (OSI),
- Geological Survey of Ireland, (GSI),
- The Department of the Environment, Community & local Government – flooding documents, notably, The Planning System & Flood Risk Management: Guidelines for Planning Authorities & Technical Appendices.

3.0 SITE CONTEXT

The site, of C.1.26Ha, is bound by Sheriff Street to the north, Mayor Street to the south and New Wapping Street to the east.

The site also includes the existing operational North Lotts Pumping Station and its associated infrastructure – the development of the planning application involves building adjacent to, and over, the Pumping Station.

The site has an average topographical level of approximately 2.5mOD (Malin Head). The site is located within the Strategic Development Zone (SDZ) for the North Lotts and Grand Canal Dock Planning Scheme 2014.

The site is currently under construction except for the fenced-off area outlining the demise of the existing operational North Lotts Pumping Station.

4.0 LEVEL OF SERVICE

There is an existing inherent risk of any flood event occurring during any given year. Typically, this likelihood of occurrence was traditionally expressed as a 1-in-100 chance of a 100-year storm event happening in any given year. A less ambiguous expression of probability is the Annual Exceedance Probability (AEP), which may be defined as the probability of a flood event being exceeded in any given year. Therefore a 1-in-100-year event has a return period of 1% AEP flood event, similarly a 100% AEP can be expressed as a 1-in-1-year event.

The Planning System and Flood Risk Management, Guidelines for Planning Authorities set out the best practice standards for flood risk assessment in Ireland. These are summarised in **Table 1** below.

Table 1 – Summary of Level of Service – Flooding Source

Flooding Source	Drainage	River	Tidal/Coastal
Residential	1% AEP	0.1% AEP	0.1% AEP
Commercial	1% AEP	1% AEP	0.5% AEP
Water-compatible (docks, marinas)	-	>1% AEP	>0.5% AEP

Under these guidelines, a proposed development site has first to be assessed to determine the flood zone category it falls under.

It is a requirement of both Dublin City Councils, Greater Dublin Strategic Drainage Study, (DCC 2005) & the Department of the Environment, Community & Local Government flooding guidelines, The Planning System and Flood Risk Management, Guidelines for Planning Authorities, that the predicted effects of climate change are incorporated into any proposed design. **Table 2** below indicates the predicted climate change variations.

Table 2 – The predicted climate change variations.

Design Category	Predicted Impact of Climate Change
Drainage	20% Increase in rainfall
Fluvial (River flows)	20% Increase in flood flow
Tidal / Coastal	Minimum Finished Floor Level 4.0m AOD

The flooding guidelines categorise the risks associated with flooding into three areas, Zone A, B & C. This categorisation is indicated below.

- **Zone A** – High Probability of Flooding. Where the average probability of flooding from rivers and sea is highest (greater than 1% annually or 1 in 100 for river flooding or 0.5% annually or 1 in 200 for coastal flooding).

- **Zone B** – Moderate Probability of Flooding. Where the average probability of flooding from rivers and sea is moderate (risk between 0.1% annually or 1 in 1000 years and 1% annually or 1 in 100 years for river flooding, and between 0.1% or 1 in 1000 years and 0.5% annually or 1 in 200 for coastal flooding).

- **Zone C** – Low Probability of Flooding. Where the probability of flooding from rivers and sea is moderate (risk is less than 0.1% annually or 1 in 1000 years for both rivers and coastal flooding).

In accordance with the *Planning Systems and Flood Risk Management Guidelines for Planning Authorities*, residential are classified as 'highly vulnerable developments'. The proposed development is located within the **Zone A** designation. See Fig 2.0 and **Appendix A**.

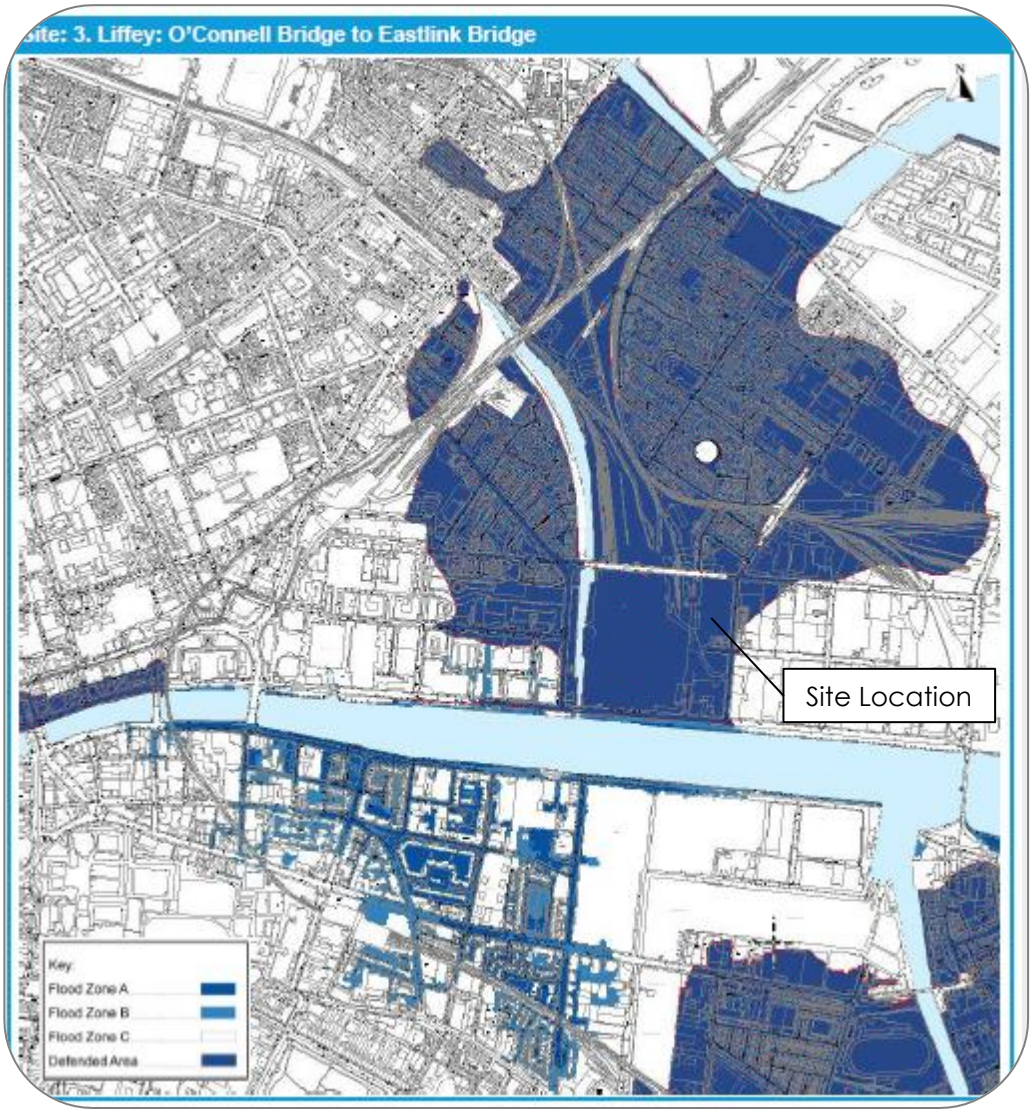


Figure 2 – Site Location
(Source Dublin City Development Plan, Strategic Flood Risk Assessment Vol 7)

The flooding guidelines have developed an 'appropriateness' matrix for various developments and their potential risk factor. The table indicates if further analysis is required in the form of a Justification Test, for Development Management. It should be noted that Dublin City Council have carried out the first requirement of a Justification Test as part of their Strategic Flood Risk Assessment undertaken for the North Lotts and Grand Canal Dock, Planning Scheme 2014. *It is an objective of the scheme under S16: To require all proposed developments to carry out a site-specific flood risk assessment.*

The Planning Scheme states: The site-specific flood risk assessment shall not be required to carry out a Justification Test given that this exercise has already been carried out in the Planning Scheme, which is a blue print for a mixed-use development of the Strategic Development Zone area.

Table 3 – Flood Zone Matrix

	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 noted above the site is located within Flood Zone A, and the proposed development is in the Highly Vulnerable category, as such a Justification Test for Development Management is required. See **Section 6.0** for Justification Test for Development Management for the proposed scheme.

As the subject lands are located within the Docklands SDZ cognizance must be given to the North Lotts & Grand Canal Dock Planning Scheme, DCC 2014.

The North Lotts & Grand Canal Dock Planning Scheme document reviews the current and potential for flooding within the SDZ area and highlights the requirements to be followed to comply with both the Development Plan and the SDZ. In addition to the standard flooding mechanism to be reviewed, tidal, fluvial, pluvial etc. The document does give beneficial advice pertaining to the flood defences in place and Dublin City's monitoring mechanism for tidal levels and these elements have been reviewed in the preparation of this report.

5.0 HISTORICAL FLOODING

A review of the historical flood mapping information from floodmaps.ie has been included in **Appendix B** of this report.

6.0 FLOOD RISKS & MITIGATION MEASURES

Under the current flooding guidance flooding can take the place due to a number of different mechanisms, namely:

- Fluvial,
- Tidal,
- Pluvial,
- Infrastructural Failure,
- Groundwater Flooding.

See **Figure 3** below which gives a pictorial indication of potential flood routes.

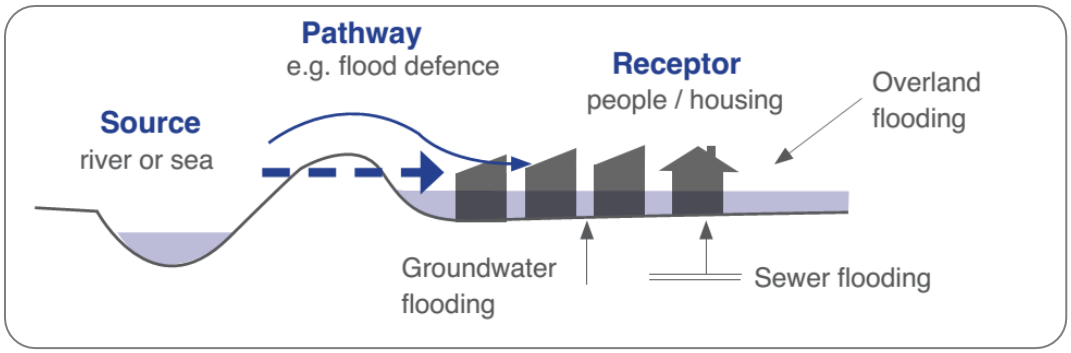


Figure 3 – Source-pathway-receptor model from Flood Risk Management Guidelines.

6.1 Fluvial Flooding

The site is located approximately 150m to the north of the River Liffey. A review of the Office of Public Works flood maps database, *www.floodmaps.ie*, for the area does not indicate historical flooding at the site. See the OPW Map-report included in **Appendix B**.

Recent modelling of the area as part of the Eastern Catchment Flood Risk Assessment Mapping, CFRAM, project indicates that the subject lands is deemed to be located outside of the 0.1% AEP fluvial floodplain, based on the currently available maps, see **Appendix C**.

Therefore, the risk of fluvial flooding is deemed to be within acceptable limits and mitigation measures are not required.

6.2 Tidal Flooding

Based on the current flood risk mapping developed for Dublin City Council the subject lands are located in potential flood zone due to tidal action. Notwithstanding, that flood defences have been installed and commissioned this offers a greater degree of security.

As part of Dublin City Councils – Flood Resilient City Project, a series of maps were generated to give an indication of the flooding levels for a 1-in-200-year tidal event. Map No.17 of this series indicated the subject lands would be defended against this type of flooding once the required flood defences are in place, these include the lock-gates between the River Liffey and the Royal Canal.

These defences are now in place and the latest tidal mapping for the area developed by the Office of Public Works as part of the CFRAMS scheme indicates that the subject lands are now located outside of the 1-in-200-year tidal flood zone, see Office of Public Works Map Tidal Flooding – E09LIF_EXCCD_F0_04.

Notwithstanding that the flood defences are in place and that the site is now deemed to outside the 0.5 & 0.1% flood zones, there is always a risk, albeit small, that the subject site may be vulnerable to tidal flooding should an extreme high tidal occur combined with a failure of the Royal Canal / River Liffey lock-gate. As such a mechanism will be installed where by demountable flood barriers will be available to be installed to prevent tidal flood waters entering the lower ground floor and any access points below 4.0m AOD of the proposed development. The entrance to the lower ground floor is currently proposed to occur at c.2.00mOD i.e. tying in with the varying street level along New Wapping Street. This method is deemed

acceptable as tidal water is a more predictable event that pluvial/fluvial flooding.

Dublin City Council have a number of warning systems in place to aid the early notification of predicted high tide levels, notably Triton & Tidewatch. The proposed development will have emergency response plan in place to facilitate the 24-hour installation of demountable flood defence barriers, as necessary, based on warning advice from the Local Authority.

See **Appendix D** for tidal flood maps.

6.3 Pluvial Flooding

Pluvial flooding is flooding which has originated from overland flow resulting from high intensity rain fall. As part of Dublin City Councils participation in the international Flood Resilient City project maps have been prepared to illustrate potential risk zones within Dublin. The map, included in **Appendix E**, indicates that the subject lands are located in a zone predicted to be at potential risk from pluvial flood events. The prepared guidance maps are generally only useful as a high-level tool and they lack sufficient detail.

However, should the pluvial rainfall build up on New Wapping Street it would drain into the existing combined sewer. The proposed development will be required to drain all surface water into the existing combined sewers surrounding the site.

6.4 Potential for Site to Contribute to Off-Site Flooding.

The site currently does not have any attenuation systems in place and all storm water generated on site drained into the local network.

In accordance with Dublin City Council requirements all proposed redevelopment of sites are to provide attenuated systems to prevent storm

water leaving the site at unregulated rates. As such the proposed redevelopment of the site will require attenuation to be provided.

In general, a site must limit its storm water runoff to 2l/s/Ha and provide on-site storage to cope with the storm water generated from a 1 in 100-year storm events, increased by 20% for the predicted effects of climate change.

The proposed re-development of the subject lands will adhere to these general guidelines – please refer to the Engineering Services Report submitted as part of this application for details. Storm water drainage from the subject lands will be collected and stored on site and released at a controlled rate into the existing public drainage on New Wapping Street. This proposed drainage arrangement will therefore add additional storm water to the existing public system and the potential for the development to contribute to off-site flooding is therefore required to be mitigated by way of providing attenuation. Details of the proposed attenuation system are detailed in the Engineering Services Report submitted as part of this application.

6.5 Existing Off-Site Drainage

The subject lands have an existing combined sewer on the eastern boundary (300 – 600mm on New Wapping Street).

As part of The Greater Dublin Strategic Drainage Study, GDSDS, the existing public drainage system in the Dublin was modelled for a number of different development scenarios. At present the predicted future scenario, 2031, is the most relevant hydraulic model to review. The predicted future scenario for 2031 indicates that the sewers located to the west & east surcharges for a 1- or 2-year return period.

All connection locations from lower levels of the proposed development for foul effluent will be pumped, if and as required, to ground level and outfall under gravity into the existing combined sewer along New Wapping St. The internal system will be fitted with non-return valves to prevent effluent from surcharging sewers backing up into the proposed development.

See **Appendix F** for GDSDS Map indicating the predicted hydraulic pressure on the public drainage network for the 2031 scenario.

6.6 Groundwater Flooding

According to the Geological Survey of Ireland, GSI, interactive maps, the subject site is underlain with Calp Limestone. The area is listed as overlaying a locally important aquifer which has bedrock which is moderately productive only in local zones.

The groundwater vulnerability assessment of the site shows that the vulnerability of groundwater in the area is moderate. The nature and type of the proposed development with its lower ground floor indicates that to prevent any potential risk of groundwater intrusion into the lower structure the basement will be constructed as a water tight box, the proposed grade for the basement is Grade 1, as per BS 8102:2009. The proposed structural integrity of the lower ground floor (reinforced concrete box) and its ability to prevent groundwater intrusion into the site is deemed sufficient to mitigate the potential risk to acceptable limits.

See **Appendix G** for GSI mapping information for background groundwater & geology data for the subject lands.

7.0 JUSTIFICATION TEST

In accordance with The Planning system and Flood Risk Management issued by the Department of the Environment, Heritage and Local Government should a site be classified as per **Table 3**, then a Justification Test for Development Management should be carried out on the site.

The subject lands are deemed 'highly vulnerable' but in accordance with Dublin City Councils Development Plan 2016 – 2022 – Strategic Flood Risk Assessment the site is located within the Flood Zone A and as such a Justification Test for Development Management is required.

There are two parts to the Justification Test, (A) Justification Test for Development Plans and (B) Justification Test for Development Management. The Justification Test for Development Plans is intended to inform land-use zoning decisions in the preparation of a Development Plan.

The subject lands are zoned for development in the current Dublin City Council Development Plan 2016 – 2022.

Justification Test for Development Management

Justification Test for Development Management	
1.0	The subject lands have been zoned or otherwise designated for the particular use or form of development in an operative development plan, which has been adopted or varied taking account of these guidelines.
2.0	The proposal has been subject to an appropriate flood risk that demonstrates:
(i)	*The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk;* **Yes – the proposed use of attenuation system, sized for a 1 in 100-year storm event and increased by 20% for predicted climate change will restrict storm water discharge rates during extreme**

storm events. This will aid in freeing up capacity in the public drainage network, as the volume entering the public combined system will be reduced to greenfield levels. In addition, the site currently does not have any form of onsite attenuation and the inclusion of same will have a net local benefit.

(ii) *The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably possible;*

Yes – the proposed use of a demountable barrier system around the sites lower ground floor entrance will prevent potential flood waters from entering the lower levels of the site. The proposed site will also have a finished floor level of 4.00m AOD which will ensure it is above the predicted 1/100-year flood level.

(iii) *The development proposed includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and provisions for emergency services access;*

Yes – the nature and type of the proposed development which will have 24hour management staff will ensure that, in the highly unlikely event that the flood defence works were breached or failed, then an orderly evacuation of the site could be carried out in accordance with management safety protocols, if required.

(iv) *The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes;*

Yes – the proposed development is in accordance with planning objectives and in accordance with development and flooding prevention guidelines.

Conclusion: The site passes the Justification Test for Development Management.

8.0 ASSOCIATED FLOOD RISK REGARDING ADJACENT INFRASTRUCTURE

As noted in the main body of this report the main mechanism for flooding of the subject lands and by association the North Lotts Pumping Station & associated ESB Sub Station is from a tidal event.

The access into the pumping station is to the west, has a proposed ground level of 3.78mOD. The pumping station has a secondary emergency, access/egress location to the east at existing ground level of 1.95mOD. The current 1-in-200-year tidal value is 3.11mOD and a predicated tidal level of 3.34mOD for the 1-in-1000 year tidal level.

Therefore, the pumping station would be susceptible to an extreme tidal event affecting the Pumping Station form flood waters from the east, along New Wapping St. The Pumping Station, as with the whole of the North Lotts area, is protected from tidal flood waters by the new hydraulic flood gates at the intersection point of the Royal Canal & the River Liffey. The monitoring of the tide levels combined with the maintenance regime in place to inspect the flood defences would mean that the likelihood of an unexpected breach of these defences to occur is low.

While the Pumping Station is located within the subject site there is no interconnecting elements between them, i.e. there is no physical access from the proposed buildings into the Pumping Station and no interconnection of services or conduits. Therefore, should the eastern side of the pumping station be affected by flood waters the water would not drain into the proposed development and vice versa as both the existing Pumping station and the proposed building are standalone structures.

The existing Pumping Station is of regional importance and is designed to convey, via twin large diameter rising mains, a large volume of effluent from the adjacent catchment. In the unlikely event that the facility loses power or that the pumping arrangements fails and cannot be repaired or replaced and the storage capacity

within the Pumping Station is exceeded there is an emergency overflow sewer from the Pumping Station down New Wapping St. which outfalls into the River Liffey. Therefore, should the Pumping Station suffer an operational failure the effluent would drain to the Liffey and not cause local flooding.

Therefore, as both the Pumping Station and the ESB Substation are not connected to the proposed development and are standalone structures, they will not create a flood risk to each other. The proposed development will therefore not affect the Pumping Station or its operation either during construction or operation phase.

The applicant held a meeting with Irish Water to review a number of observations Irish Water made pertaining to the proposed development. Regarding the potential for flooding of the Pumping Station, as noted above the proposed development does not share services or conduits with the Pumping Station. The Pumping station has an access/egress location on both the west & eastern sides of the facility, the proposed works will not affect these in any way, there are no proposals to infringe on the operational or safety requirements of the Pumping Station either during the construction phase or the operational phase of the proposed development post construction. During the construction phase the Pumping Station will be cordoned off only allowing Dublin city Council / Irish Water or their representatives access to the facility.

The proposed mitigation measures for the proposed development will have no adverse effects on the operation of the Pumping Station and both facilities emergency protocols can be implemented without relying on each other. Prior to commencement of the proposed development discussions will be held to ensure that both emergency flood management plans take cognisance of each other's plans and requirements.

9.0 PLANNING BOARDS OPINION

As part of the SHD process the intimal submission was reviewed by Dublin City Council who provided their comments back to the applicate via the Planning Board. A query was raised which pertained to the proposed volume of storm water attenuation to be provided. CS Consulting can confirm that the proposed volume of storm water to be provided is in accordance with the requirements of the North Lotts LAP, which requires an additional 570m3/Ha of storage to avoid any flooding issues with regards to 'tidal locking'. Therefor the proposed development has provided attenuation storage for the predicated 1-in-100 year extreme storm event increased by 20% for climate change with an additional 570m3/Ha provided. Refer to **Appendix D** of CS Consulting's Engineering Services Report for calculations of same.

10.0 CONCLUSION

The proposed development is required to be assessed for historical on-site flooding events and for the potential future risk from flooding events from a number of sources. Notably tidal, fluvial, pluvial, potential infrastructure failures and groundwater.

A review of historical data compiled by the Office of Public Works did not indicate on site flooding for the development.

Tidal and fluvial mapping prepared by the Office of Public Works as part of the CFRAMS project addressing the potential for future flooding events indicated that the subject site is not located in the 0.5% Tidal or 0.1% fluvial flood zones

As part of Dublin City Councils recently adopted development plan, Dublin City Development Plan 2016 -2022, a Strategic Flood Risk Assessment (SFRA) was issued, giving guidance for areas of the city which have been deemed to be located in potentially vulnerable areas to flooding. The flood maps indicated that the subject site is located in Flood Zone A.

The proposed nature of the development (residential) designate the development to be classified as highly vulnerable in accordance with OPW Planning Guidelines for Local Authorities. With the site being located in Flood Zone A requires a Justification Test for Development Management to be carried out to establish the potential for the site to be affected by extreme flooding events.

The site was reviewed for pluvial/fluvial/groundwater and infrastructure flooding sources and any risk associated risk is deemed to be within acceptable limits.

The sites vulnerability as indicated by Dublin City Councils Strategic Flood Risk Assessment is the predicted effects of extreme tidal flooding should the

recently installed flood defences fail. The predicted risks have been assessed and the nature of the proposed development combined with the ability to predict high tides due to monitoring devises currently in place in addition to the fact that the proposed development will have a finished floor level set at 4.0m AOD, as per the requirements of North Lotts & Grand Canal Planning Scheme, deems the potential tidal flood risk to be within acceptable limits.

The close proximity of the North Lotts Pumping Station and associated infrastructure has been assessed to identify if the proposed development would affect the existing Pumping Station during a flood event or if the Pumping station would impact the proposed development. The review indicated that as the proposed development and the existing Pumping Station are not connected that the likelihood of flooding arising from the proposed development or from the Pumping Station affecting each other is negligible and deemed low risk.

On behalf of CS Consulting

Robert Fitzmaurice

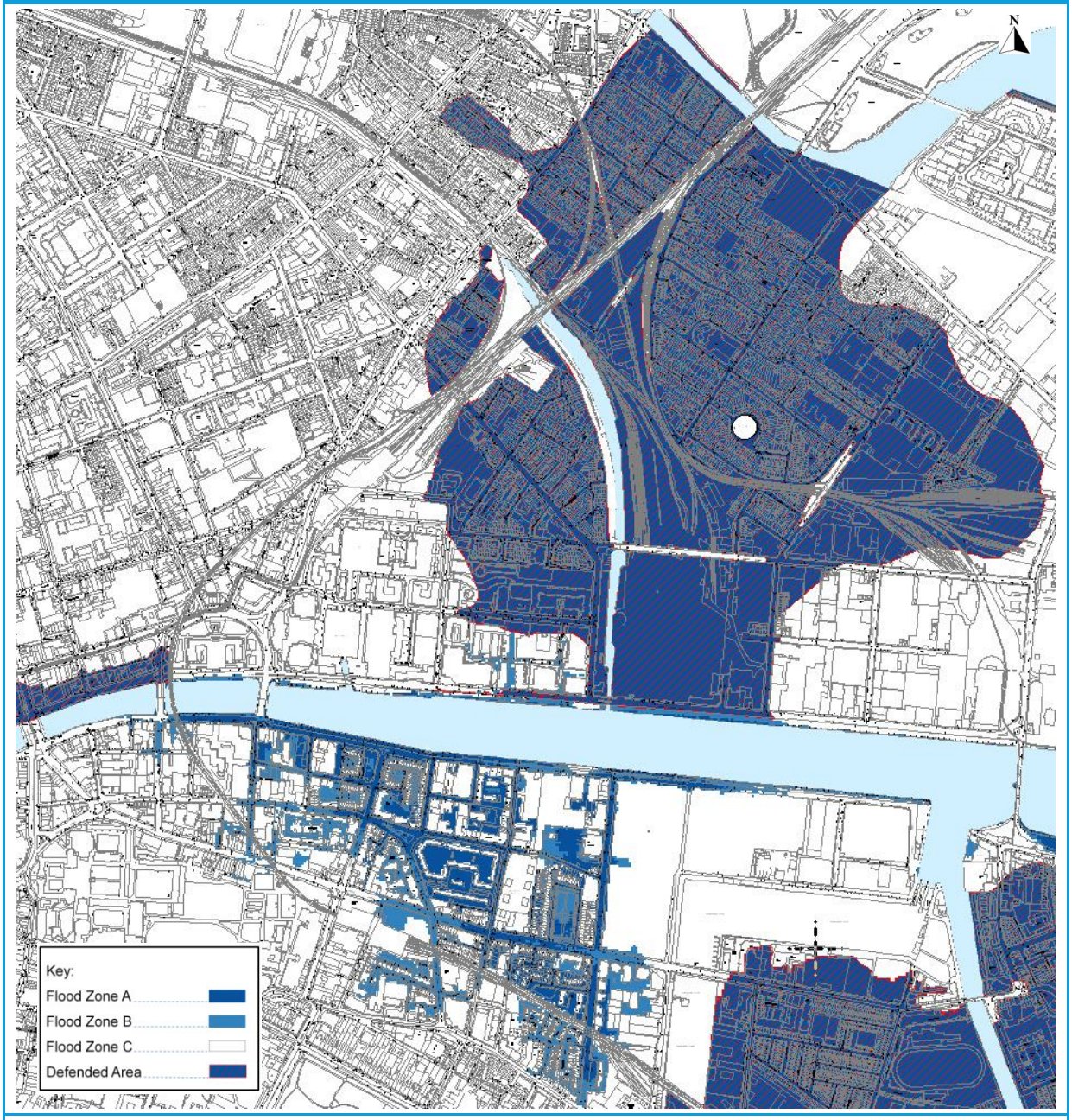
Robert Fitzmaurice

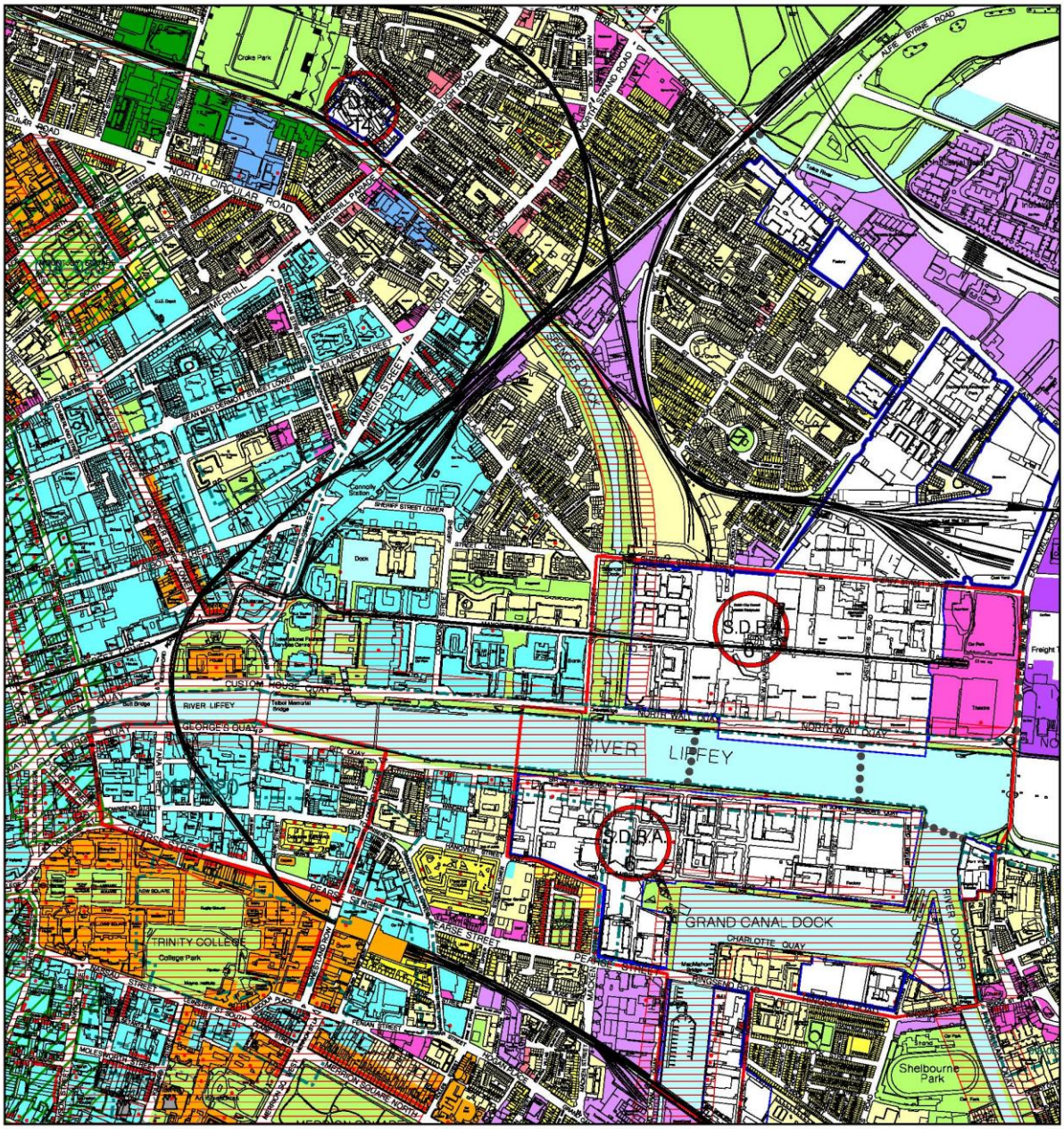
Chartered Engineer

BEng(Hons), PG Dip Env. Eng, M.I.E, MIEI.

Appendix A: Extract from DCC – Strategic Flood Risk Assessment

Site: 3. Liffey: O'Connell Bridge to Eastlink Bridge



Site: 3. Liffey: O'Connell Bridge to Eastlink Bridge	
 ***Dublin City Council Development Plan 2016-2022(zoning map key at back of tables)***	
Site Description	The area on the south side (right bank) includes Sir John Rogerson's Quay, City Quay, George's Quay and Burgh Quay and areas south of these roughly to the railway line. On the north side (left bank) it includes North Wall Quay, Custom House Quay, Eden Quay and areas north of these including areas adjacent to the Royal Canal flooded in 2002. The areas include the Docklands Strategic Development Zone (SDZ) and the Royal Canal exit to the Liffey Estuary. Development in this area is a mixture of high density Commercial and Residential.
Benefitting from Defences (flood relief scheme works)	Some areas to the west of this area have existing Quay Walls but their design standards and capacity for flood defence is unknown. Georges Quay has recently had flood defences constructed to a level of 4.0m Malin head. A new sea lock (triple gate) was installed at Spencer Dock to reduce the risk of tidal waters flooding houses and commercial building to the north of it. This sea lock is

Site: 3. Liffey: O'Connell Bridge to Eastlink Bridge	
	maintained by Waterways Ireland. City Quay and Sir John Rogerson's Quay to Cardiff Lane have flood defences programmed for construction in 2015 and 2016.
Sensitivity to Climate Change	Climate change impacts of +0.5-1.0m on sea levels would have a significant impact on the area.
Residual Risk	Any proposed developments in the protected areas on Georges Quay and elsewhere require residual risk from overtopping or other cause to be mitigated against. Where defences are formal, of recent construction and maintained by DCC / OPW, the risk of breach is likely to be low and assessment can be quantitative rather than involving detailed modelling.
Historical Flooding	The flood maps attached are consistent with previous flooding of this section of the Liffey Estuary.
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 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 runoff to current values. All Developments shall have regard to the Pluvial Flood Maps in their Site Specific Flood Risk Assessment, see Flood ResilienCity Project, Volume 2 City Wide Pluvial Flood Risk Assessment at http://www.dublincity.ie/main-menu-services-water-waste-and-environment-drains-sewers-and-waste-water/flood-prevention-plans

Commentary on Flood Risk:

The flood extents indicate flow paths generally coming directly out of the tidal region, some are through quay walls and underground chambers near quay walls.

The flood maps were produced based on the OPW CFRAMS Study and checked against historic flooding in the area. The south Campshires area which has a flood defence under construction from Butt Bridge to Cardiff Lane is the most at risk area. The North Campshires will require flood defences to combat 0.5-1.0m estimated climate change in the future. This is being further reviewed under the Eastern CFRAM Study, and recommendations for defence works will be reported on in the resulting Flood Risk Management Plan.

Development Options:

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

Justification Test for Development Plans

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

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

(i) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement

Answer: Yes: This part of the City is a key redevelopment area. Part of the area identified above (where the Flood Cell is identified) forms part of the George's Quay Local Area Plan, 2012. The George's Quay LAP area is framed by the iconic River Liffey to the north and by the unique built heritage footprint of Trinity Campus to the south. The area is highly connected to other parts of Dublin and beyond with two of the busiest heavy rail stations in Dublin, Tara Street Station and Pearse Street

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

(ii) Comprises significant previously developed and/or under-utilised lands

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

(iii) Is within or adjoining the core of an established or designated urban settlement

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

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

Answer: Yes: This area is a key redevelopment area in the city. Part of the lands above form part of the George's Quay LAP and part of the lands form part of the SDZ for the North Lotts Grand Canal Dock. This area is key in achieving compact and sustainable urban growth.

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

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

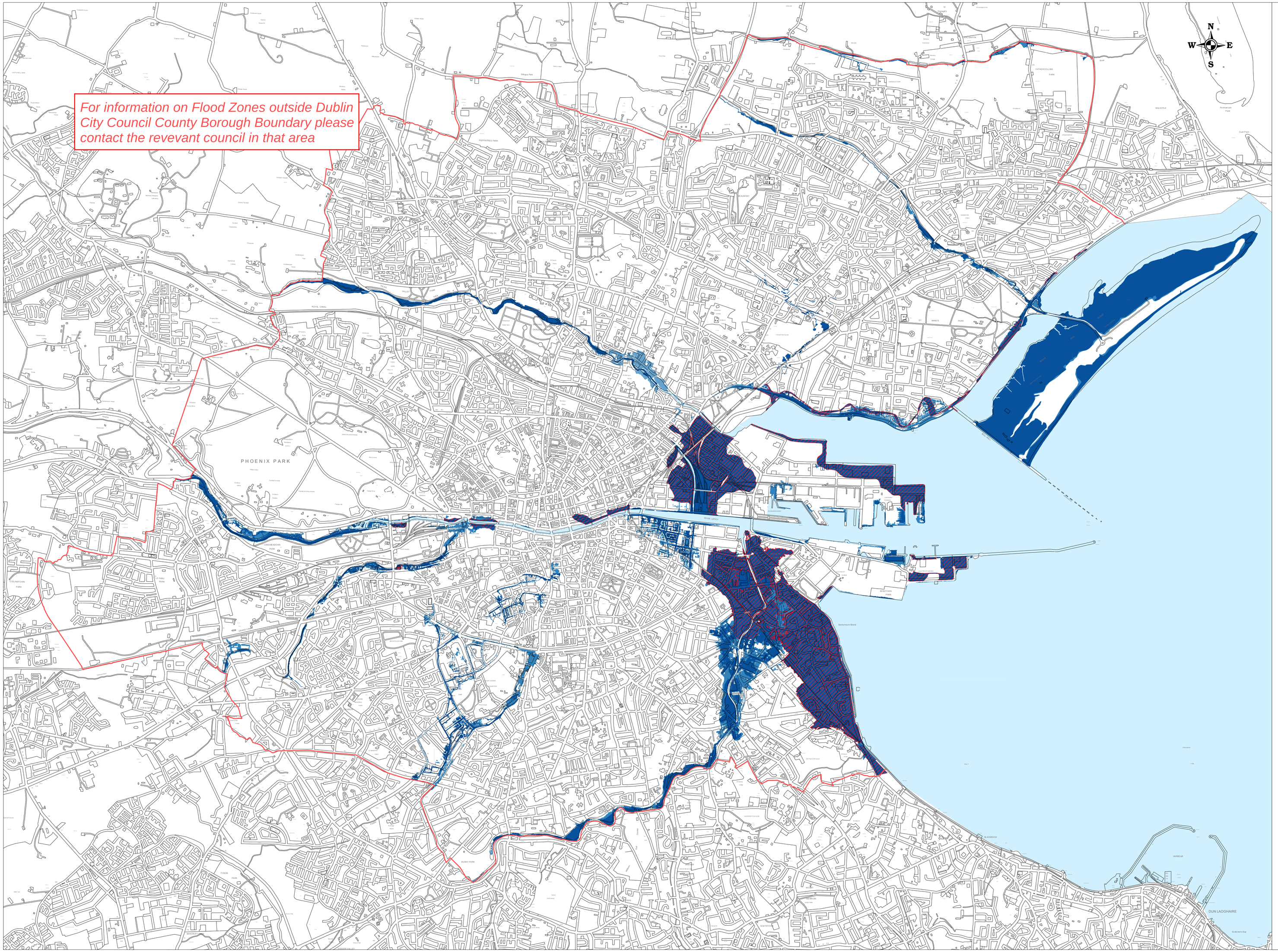
3. Specific Flood Risk Assessment

- Where possible, small scale redevelopment and refurbishment should be focused behind flood defences where flood risks are more limited. Such development should be accompanied by a site specific assessment flood risk assessment which should consider the likelihood and impact of defence failure, which may be through overtopping (either due to an extreme event in the current situation or through sea level risk linked to climate change). Where appropriate, consideration should be given to the impacts of demountable sections of flood defence not being

Site: 3. Liffey: O'Connell Bridge to Eastlink Bridge

erected. Whilst it is unlikely that the findings of such an assessment will indicate development should not go ahead, an emergency plan will be required, fully considering the issue and receipt of flood warnings and emergency evacuation routes and procedures as well as how the operation will ensure it can retain functionality / recover following an extreme flood event.

- In undefended areas, the risk to small scale redevelopments and refurbishments will need to be assessed and a decision made as to whether the risks can be managed through design and emergency planning, or whether permissions are premature pending construction of defences. Management of risks may be through design of access levels, flood resilient construction techniques and avoiding locating vulnerable development at ground flood level. Climate change risks will need to be considered, but it may not be possible to fully mitigate against these in an already developed situation.
- Larger scale redevelopment, involving new building, can be facilitated within undefended Flood Zone A and B through master planning and landscaping rather than through reliance on flood walls. The assessment and design should include appropriate consideration of sea level rise and climate change impacts.
- Compensatory storage is not required as risks along the Quays are linked to tidal flooding.
- Specific FRA's should be carried out for all basements and underground structures with respect to any human access. No underground offices or residential units (whether temporary or permanent) will be allowed. Underground toilets and bathrooms will not be allowed.



No Window

Dublin City Development Plan 2016-2022

Dublin City Council

Composite Flood Map

Flood Zone A _____

Flood Zone B _____

Flood Zone C _____

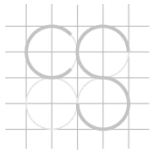
Defended Area _____

County Borough Boundary _____

See Appendix 3 Strategic Flood Risk Assessment report for details

John O'Hara

Head of Land Use Policy



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Appendix B: OPW Historical Flood Maps

OPW National Flood Hazard Mapping

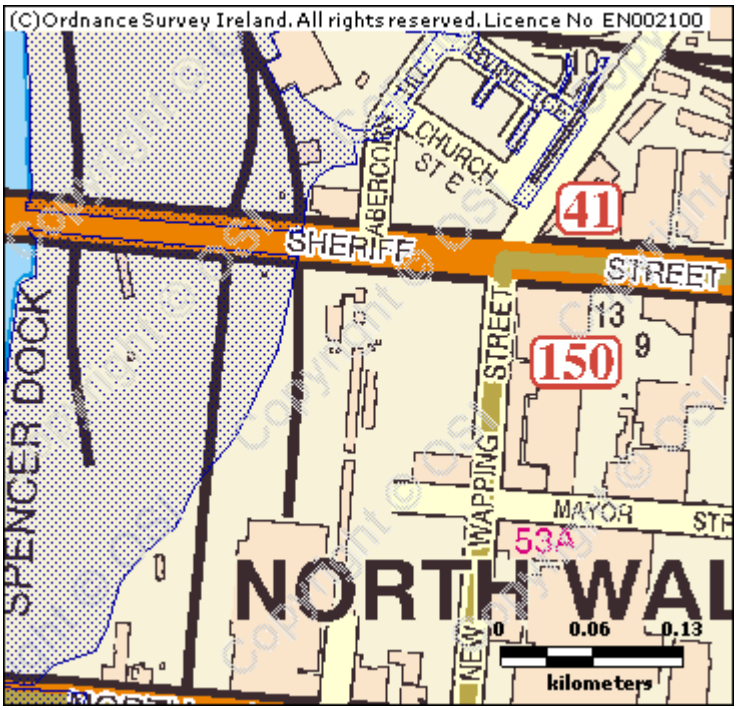
Summary Local Area Report

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

The map centre is in:

County: Dublin

NGR: O 174 346



Map Scale 1:5,229

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.

28 Results

1. Flooding at Bessborough Avenue, North Strand, Dublin 3 on 24th Oct 2011
County: Dublin
Start Date: 24/Oct/2011
Flood Quality Code:3
Additional Information: Reports (1) More Mapped Information

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

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

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

5. Tolka Richmond Road Drumcondra Nov 2000
County: Dublin
Start Date: 05/Nov/2000
Flood Quality Code:3

Additional Information: Reports (5) Press Archive (5) More Mapped Information

---

6. Tolka Richmond Road August 1986 — Start Date: 25/Aug/1986
County: Dublin — Flood Quality Code: 1

Additional Information: Reports (4) More Mapped Information

---

7. Tolka Nov 1965 — Start Date: 25/Nov/1965
County: Dublin — Flood Quality Code: 3

Additional Information: Photos (2) Reports (6) Press Archive (2) More Mapped Information

---

8. Tolka September 1946 — Start Date: 20/Sep/1946
County: Dublin — Flood Quality Code: 3

Additional Information: Reports (10) More Mapped Information

---

9. Tolka September 1931 — Start Date: 03/Sep/1931
County: Dublin — Flood Quality Code: 3

Additional Information: Reports (10) Press Archive (1) More Mapped Information

---

10. Tolka November 1915 — Start Date: 12/Nov/1915
County: Dublin — Flood Quality Code: 3

Additional Information: Reports (10) More Mapped Information

---

11. Tolka November 1901 — Start Date: 12/Nov/1901
County: Dublin — Flood Quality Code: 3

Additional Information: Reports (9) More Mapped Information

---

12. Tolka November 1898 — Start Date: 23/Nov/1898
County: Dublin — Flood Quality Code: 3

Additional Information: Reports (9) More Mapped Information

---

13. Tolka October 1880 — Start Date: 28/Oct/1880
County: Dublin — Flood Quality Code: 3

Additional Information: Reports (7) More Mapped Information

---

14. 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

---

15. 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

---

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

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

---

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

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

---

18. North Strand Road June 1963 — Start Date: 11/Jun/1963
County: Dublin — Flood Quality Code: 3

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

---

19. Flooding at Herbert Cottages, Ballsbridge, Dublin 4 on 24th Oct 2011
County: Dublin
Start Date: 24/Oct/2011
Flood Quality Code:2
Additional Information: Reports (1) More Mapped Information

20. Flooding at ESB Sportsco, Ringsend, Dublin 4 on 24th Oct 2011
County: Dublin
Start Date: 24/Oct/2011
Flood Quality Code:2
Additional Information: Reports (1) More Mapped Information

21. Flooding at Railway Cottages, Ballsbridge, Dublin 4 on 24th Oct 2011
County: Dublin
Start Date: 24/Oct/2011
Flood Quality Code:2
Additional Information: Reports (1) More Mapped Information

22. Flooding at Bath Avenue, Sandymount, Dublin 4 on 24th Oct 2011
County: Dublin
Start Date: 24/Oct/2011
Flood Quality Code:2
Additional Information: Reports (1) More Mapped Information

23. Flooding at Havelock Square, Sandymount, Dublin 4 on 24th Oct 2011
County: Dublin
Start Date: 24/Oct/2011
Flood Quality Code:2
Additional Information: Reports (1) More Mapped Information

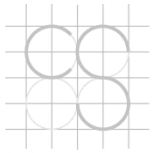
24. Clontarf Rd Seaview Avenue August 2004
County: Dublin
Start Date: 23/Aug/2004
Flood Quality Code:3
Additional Information: Reports (3) More Mapped Information

25. Clontarf Oulton road area August 2004
County: Dublin
Start Date: 23/Aug/2004
Flood Quality Code:3
Additional Information: Reports (1) More Mapped Information

26. Dodder Oct 1987
County: Dublin
Start Date: 21/Oct/1987
Flood Quality Code:4
Additional Information: Photos (3) More Mapped Information

27. Bath Avenue June 1963
County: Dublin
Start Date: 11/Jun/1963
Flood Quality Code:2
Additional Information: Photos (1) Reports (2) More Mapped Information

28. Tolka April 1909
County: Dublin
Start Date: 03/Apr/1909
Flood Quality Code:4
Additional Information: Reports (4) More Mapped Information



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Appendix C: CFRAM Fluvial Maps

316600 316800 317000 317200 317400 317600 317800 318000

234800 234600 234400 234200 234000 233800 233600

09LIFF00180

09LIFF00131

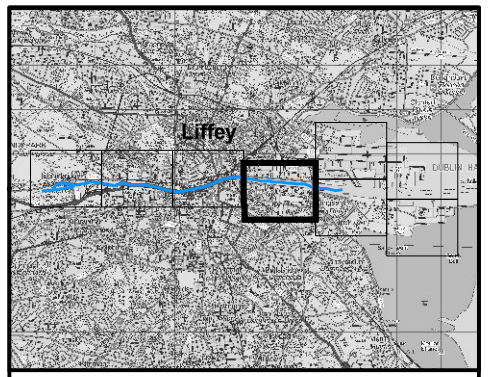
09LIFF00072

For river Dodder flood extents and depths
Refer to Dodder maps.

Node Label	Water Level (OD) 10% AEP	Flow (m³/s) 10% AEP	Water Level (OD) 1% AEP	Flow (m³/s) 1% AEP	Water Level (OD) 0.1% AEP	Flow (m³/s) 0.1% AEP
09LIFF00180	2.45	194.47	2.45	245.61	2.45	313.04
09LIFF00131	2.44	211.11	2.44	262.02	2.45	329.68
09LIFF00072	2.44	233.19	2.44	283.68	2.44	351.20

316600 316800 317000 317200 317400 317600 317800 318000

0 50 100 200 300 400 500 Metres



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

Legend

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

The Office of Public Works
Jonathan Swift Street
Trim
Co Meath

RPS

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Belfast
BT12 6RZ

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

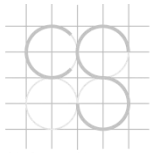
Map:
Liffey Fluvial Flood Extents

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

Drawing No. :
E09LIF_EXFCD_F0_04

Map Series : Page 4 of 8

Drawing Scale : 1:5,000 @ A3



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Appendix D: CFRAM Tidal & Flood Defence Maps

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
09LIFF00180	2.67	N/A	3.12	N/A	3.35	N/A
09LIFF00131	2.67	N/A	3.11	N/A	3.34	N/A
09LIFF00072	2.67	199.56	3.11	205.11	3.34	208.47

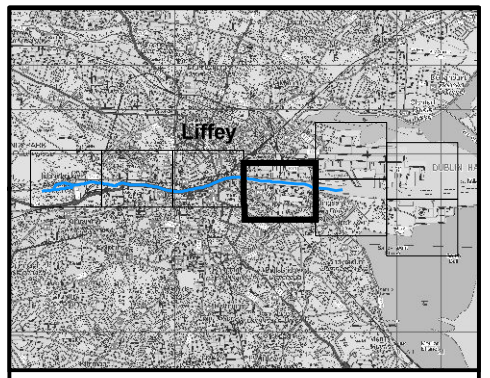
09LIFF00180

09LIFF00131

09LIFF00072

For river Dodder flood extents and depths refer to Dodder maps.

Please note that the South Docklands Campshire Works are currently not included in the mapping shown here.



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

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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_04

Map Series : Page 4 of 8

Drawing Scale : 1:5,000 @ A3

316600 316800 317000 317200 317400 317600 317800 318000

234800 234600 234400 234200 234000 233800 233600

0 50 100 200 300 400 500 Metres

316500 317000 317500 318000

234500 234000

Note 17.1
Note 17.2
Note 17.3
Note 17.4
Note 17.5

RIVER LIFFEY

DUBLIN BAY

GRAND CANAL DOCK

Flood Defence Initiative Notes

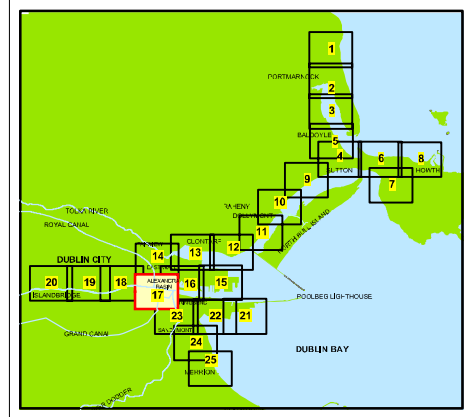
Note 17.1 - New Flood Gate at Spencer Dock at Tender Stage. Temporary Cofferdam in Place.

Note 17.2 - Area defended due to temporary cofferdam in canal pending new flood gate at Spencer Dock, Flood risk in this area should be reviewed following comletion of Spencer Dock and Adjacent DDDA developments. CIE should maintain sandbags at boundary wall gaps pending completion of these developments and this review.

Note 17.3 - Development currently underway flood risk to be re-evaluated when complete.

Note 17.4 - Lower Dodder new defences under development at design stage

Note 17.5 - Sir John Rogerson's Quay defences at survey stage.



Legend:

- 1/200 Flood Hazard Extent
- 1/200 Flood Hazard Area
- Protected Area (Based on 200 Year Event)
- Flood Defence
- Gap/Demountable Flood Defences
- Coastal Area/Rivers/Canals
- Ongoing Flood Defence Initiatives and Notes

Notes :

1) These maps present the indicative tidal flood hazard for a 200 year return period event (shown as flood extent) for the category shown in the legend and as described in the notes below. The justification for these maps and the information presented on them arises through the flood risk assessment work undertaken as part of the Dublin Coastal Flooding Protection Project completed by Royal Haskoning for Dublin City Council and Fingal County Council in April 2005.
2) Before use is made of these maps the following notes should be read carefully to avoid incorrect interpretation of the information presented. The maps must only be used in conjunction with and in acceptance of the information, exclusions and disclaimers set out in these notes.
3) Tidal flood hazard is taken to mean areas at risk from combinations of
   a. Extreme tide levels with wave action as appropriate along the open coastline
   b. Extreme tide levels with a component of fluvial discharge as appropriate within the tidal reaches of the rivers.
4) Definition of flood hazard area and protected area in the context of the information presented on these maps

   - 1/200 Flood Hazard Area/Extent – Indicative flood hazard extent for a 200 year event taking into consideration the effect of the existing defences and the possibility of plausible failure scenarios of those defences at any given location.
   - Protected Area (Based on 200 Year Event) – The indicative area within the 1/200 Flood Hazard Area that is protected or defended against flooding for a 200 year event as a result of the existence of the current defences. i.e. if the existing defences remain intact then the area shown green hatched with light grey background will be protected against flooding for the 200 year event. The area is a protected flood hazard area.

Note: The residual blue area within the 1/200 Flood Hazard Area (not overlain with green hatch and light grey background) shows the indicative flood area extent taking into account the effect of the existing defences. i.e. the standard of protection (SoP) of some or all of the defences is less than 200 years. The blue area is not defended to a 200 year event.

For more detail of the definitions and a description of how the areas have been assessed for the production of these maps, see the definitions presented at the beginning of these maps and also the Flood Hazard Manual produced to accompany these maps.

A 200 year extreme tide level at Dublin Port has been assessed as 3.13mODM (5.64mLAT).

5) The work undertaken and hence the information presented on these maps is relative to the year 2005.
   As such none of the categories presented make any allowance for climate change.
6) These type 1 maps show the indicative extent of flooding for the categories presented in note 4 and also the legend.
7) The maps do not show indicative flood hazard associated with any of the following:
   - Extreme fluvially dominated combinations within the tidal reaches of the rivers
   - Extreme pluvial events
   - Blocked drains
   - High ground water level conditions
   - Other unforeseen events, e.g. bridge collapse etc.
8) It should be noted that a residual risk remains for the other areas (light grey), located outside those defined as being at risk from tidal flooding on this map, as a result of flooding through the mechanisms identified in note 7 above.
9) For a more detailed description of the information presented on these Flood Hazard maps, see the Flood Hazard Map Manual.
10) All level information presented on these maps relates to ordnance datum Malin Head (mODM). For conversion from mODM to mLAT relative to Dublin Bay add 2.51m.
11) These maps are to be used and read in conjunction with the DCFPP final report and the Flood Hazard Map Manual produced to accompany them. The manual presents details of the work undertaken to produce the maps together with the constraints and assumptions as appropriate for given locations.
12) Whilst the utmost care and quality control has been undertaken in the interpretation of level data and modelling results for the production of these maps, the information presented is indicative only and is subject to the normal uncertainties associated with ground level and modelling accuracy. Accordingly, the maps should not be used in addition for decision making purposes and should be read and interpreted by suitably experienced persons using all associated and additional data available for the area to aid in the decision making process.
13) Dublin City Council makes no representations, warranties or undertakings about any of the information in these maps including, without limitation, their accuracy, their completeness or their quality or fitness for any particular purpose.
14) Dublin City Council reserves the right to change the content and/or presentation of any of the information contained in these maps at its sole discretion, including these notes and disclaimers. Use of the maps is subject to the understanding of these notes and any disclaimers and by so using the maps for whatever purpose, the user has signified his or her agreement to be bound by these notes and any disclaimers.

0 50 100 200 Metres

Scale: 1:2,500 @ A1

DUBLIN CITY FLOOD HAZARD MAPS TYPE 1 - 200 YEAR FLOOD EXTENT

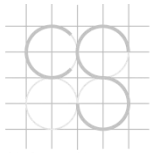
Map 17 - LOWER LIFFEY AND EASTWALL

Dublin City Council
Comhairle Cathrach Bhaile Átha Cliath

OPW

Department of Communications, Marine and Natural Resources
Roinn Cumarsáide, Mara agus Acmhainní Nádúrtha

safer
STRATEGIES AND ACTIONS FOR FLOOD EMERGENCY RISK MANAGEMENT



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Appendix E: CFRAM Pluvial Flood Maps

309000 312000 315000 318000 321000

234000

231000

228000

225000

PHOENIX PARK
Páirc an Fhionnuisce

DUBLIN HARBO

Sandymount Strand

South Bull

DUB
Baile Átha

Merrion Strand

Clondalkin
Cluain Dolcáin

Newlands

Kingswood

Greenhills
Na Glaschnoic

Kilnamanagh
Cill na Manach

Tymon North
Tigh Mothain Thuaidh

Templeogue
Teach Mealog

Willbrook

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

Tallaght
Tamhlacht

Ballyboden
Baile Bodáin

Firhouse
Teach na Giúise

Oldbawn
Seanbhaile

Jobstown
Bóthar Montain

Ballinteer
Baile an tSaoir

Edmondstown

Sandyford
Áth an Ghaimhnín

Leopardstown

Foxrock
Carraig an tSi

Dublin Mountains

Ballymana

Knockanvinidee

Friarstown

Ballinascorney Lower

Corrageen

Mountpelier

Bolgard Door

Kilnardan

Killipper

Oldcourt

Woodtown

Newtown

Rockbrook

Orlagh

Kilmashogue Mountain

Jamestown

Stepaside

Carrickmines

Ballyogan

Taylorsgrange

Barnacullia

Three Rock Mountain

1000 0 1000 2000 3000 4000 Meters

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)

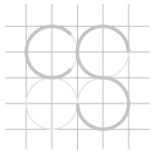
Map: **DUBLIN CITY - PLUVIAL FLOOD EXTENT MAP**

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



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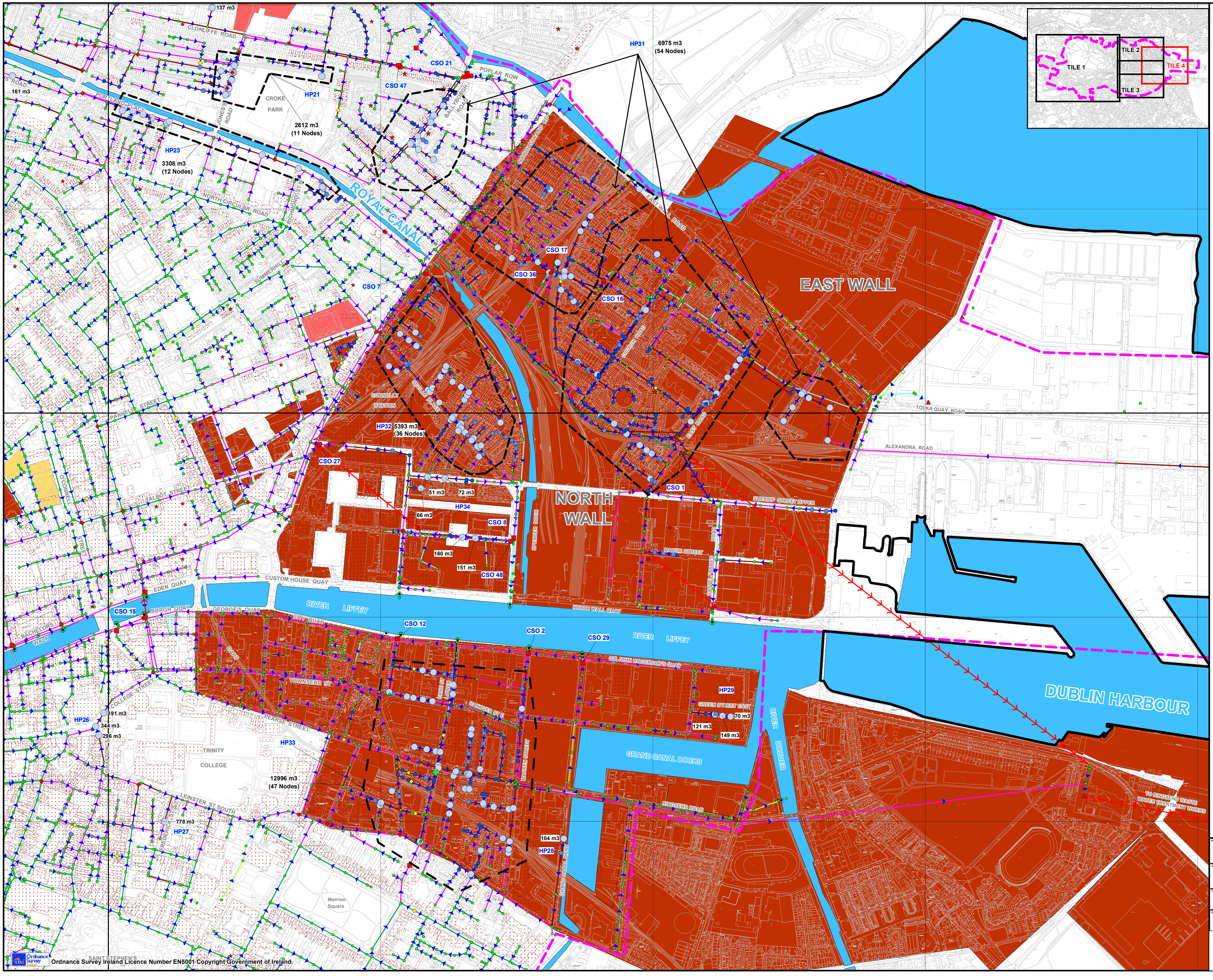
Appendix F: Greater Dublin Strategic Drainage Study & Council Drainage Records



Legend

- Wastewater Treatment Works
- County Council Boundaries
- Catchment Boundary
- Rising Main (Coloured as sewer)
- Sewer not included in hydraulic model
- Direction of Flow (on sewer line)
- River/Watercourse
- Culverted River/Watercourse
- 1:1000 OS Grid Line Boundaries
- 1:5000 OS Grid Line Boundaries
- Combined Sewer Overflow
- Foul/Combined Pumping Station
- Foul/Combined Bifurcation
- Foul/Combined Apex Manhole
- Foul/Combined Flow Management Chamber
- Storm Water Overflow to Foul/Combined
- Storm Water Bifurcation
- Storm Water Apex Manhole

Flooding Performance Key

- Flooding greater than 50m3 Volume for 5yr Return Period Event (Volume m3)
- Flooding between 25m3 and 50m3 Volume for 5yr Return Period Event
- Flooding less than 25m3 Volume for 5yr Return Period Event
- Modelled Manhole does not flood for 5 year Return Period Event
- 75m3 1:5 year Foul/Combined flood volume
- 75m3 1:5 year Storm flood volume
- Historically Reported Flooding Incidents caused by Hydraulic Overloading
- Outfall

Foul/Combined Hydraulic Performance Key

- Foul/Combined Sewer floods for 30 year return period or less.
- Foul/Combined Sewer surcharges for 1 or 2 year return period events
- Foul/Combined Sewer does not surcharge for 1 or 2 year return period events and does not flood for a 30 year return period event or below. (eg 1,2,5,10,20)

Storm Hydraulic Performance Key

- Storm Sewer floods for 30 year return period or less.
- Storm Sewer surcharges for 1 or 2 year return period events
- Storm Sewer does not surcharge for 1 or 2 year return period events and does not flood for a 30 year return period event or below. (eg 1,2,5,10,20)
- Area Covered by EDS/DCC Asset Survey

Important Hydraulic Considerations

- Location of Known Basements
- Zoned Residential Land
- Zoned Science/Technology Parks/Land
- Zoned Industrial Land
- Zoned Commercial Land
- Zoned Land for Mixed Development
- Recently Completed Developments

Catchment Deficiency Reference Key

- HP 1 Hydraulic Deficiency Reference No (Foul/Combined) (Not included for EDS/DCC Asset Survey area).
- CSO 1 CSO Deficiency Reference No. (Hydraulic or Environmental)
- OP 1 Operational Deficiency Reference No.

Notes

1. Results are based on assessment of sewer system under 1, 2, 5, 10, 20, 30, 50 and 100 year return period rainfall events.
2. For colour coding, flooding takes priority over surcharging.
3. Levels referenced in meters to Ordnance Survey Datum, which is Mean Sea Level at Malin Head, Co. Donegal (1970 Adjustment).

Project: GREATER DUBLIN STRATEGIC DRAINAGE STUDY

Catchment: CITY CENTRE/DOCKLANDS CATCHMENT

Title: PHASE 3 - 2031 System Performance Assessment

Dr'g. No.: GDSDS/MAR3079/F001/P3-003_Tile4

Drawn: JGA | Chk'd: MCB | Approved: MCB | Scale: N.T.S. | Date: 7/5/04 | REVISION: A

Dublin Drainage
A Strategic Study for Greater Dublin

UISCE ÉIREANN : IRISH WATER

Legend

- Unknown Meter ; Other Meter
- Sluice Valve Open
- Sluice Valve Closed
- Double Air Control Valve

Water Hydrants

Hydrant Function

- Fire Hydrant
- Telemetry Kiosk
- Cap
- Other Fittings

Water Distribution Mains

Owned By

- Irish Water
- Water Abandoned Lines

Sewer Manholes

Manhole Type

- Standard
- Pump Station
- Gravity - Combined
- Gravity - Foul
- Gravity - Overflow
- Pumping - Combined
- Pumping - Foul
- Syphon - Overflow

Storm Manholes

Manhole Type

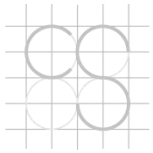
- Standard
- Surface Gravity Mains

1:500 at A0

Last edited: 16/03/2018

Metres

0 25 50 100



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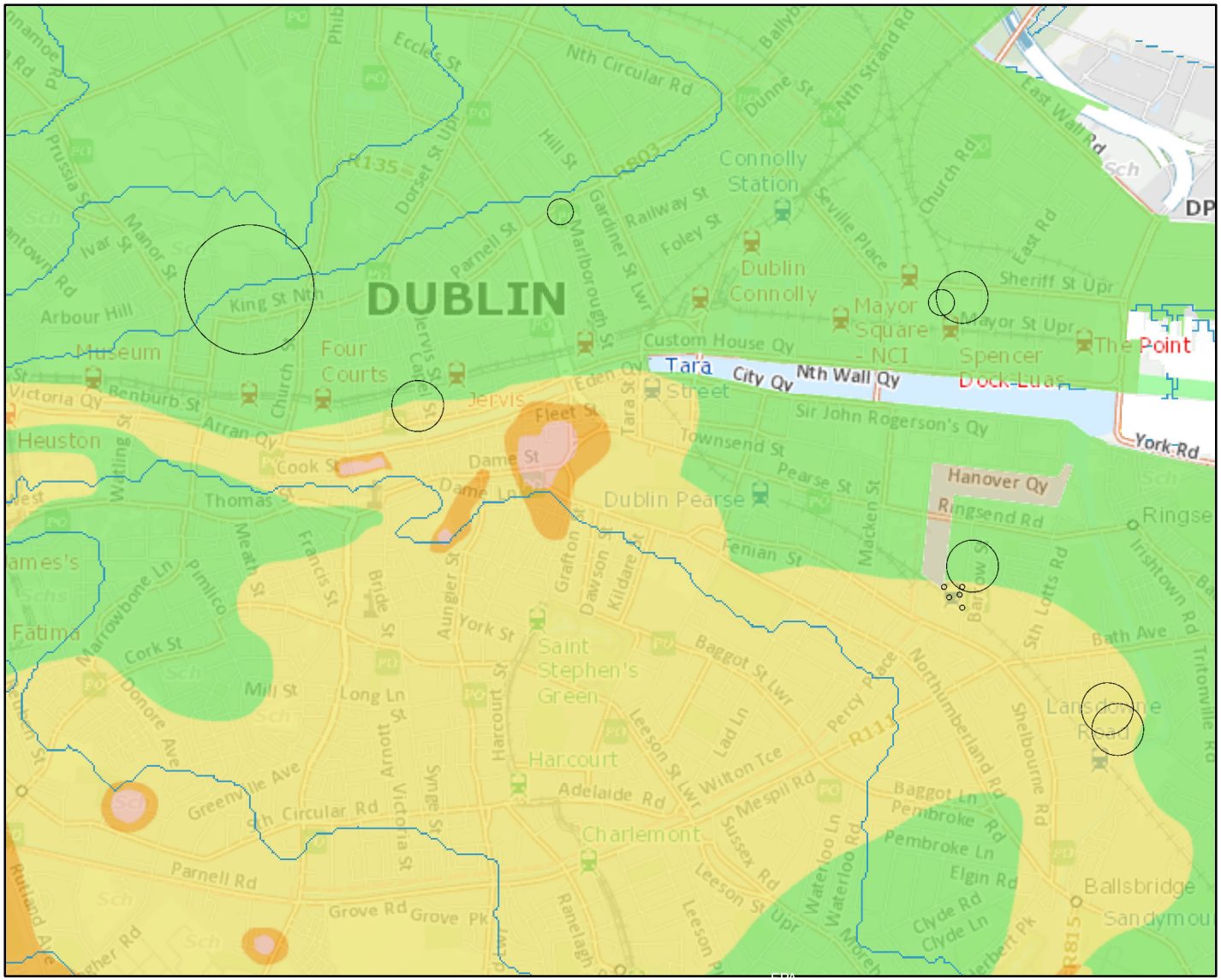
Appendix G: GSI Mapping

Geological Survey
Suirbhéireacht Gheolaíochta
Ireland | Éireann

Job No. R025 - Hydrogeology



Scale: 1:25,000

Geological Survey Ireland

Geological Survey of Ireland

N W E S

0 0.175 0.35 0.7 mi

0 0.275 0.55 1.1 km

Map Centre Coordinates (ITM) 716,069 733,999

Snapshot Date: January 31, 2017

Legend

Groundwater Wells and Springs

Karst Landforms

Borehole
Cave
Dry Valley
Enclosed Depression
Spring
Superficial Solution Features
Swallow Hole
Turlough

Traced Underground Connections

EPA CONTOUR 20m

0; 10; 20; 30; 40; 50; 60; 70; 80; 90; 100
110; 120; 130; 140; 150; 160; 170; 180; 190; 200
210; 220; 230; 240; 250; 260; 270; 280; 290; 300
310; 320; 330; 340; 350; 360; 370; 380; 390; 400
410; 420; 430; 440; 450; 460; 470; 480; 490; 500
510; 520; 530; 540; 550; 560; 570; 580; 590; 600
610; 620; 630; 640; 650; 660; 670; 680; 690; 700
710; 720; 730; 740; 750; 760; 770; 780; 790; 800
810; 820; 830; 840; 850; 860; 870; 880; 890; 900
910; 920; 930; 940; 950; 960; 970; 980; 990; 1000
1010; 1020

Groundwater Vulnerability

X - Rock at or near surface or Karst
E - Extreme
H - High
M - Moderate
L - Low
W - Water

Bedrock Aquifer Faults

Gravel Aquifer

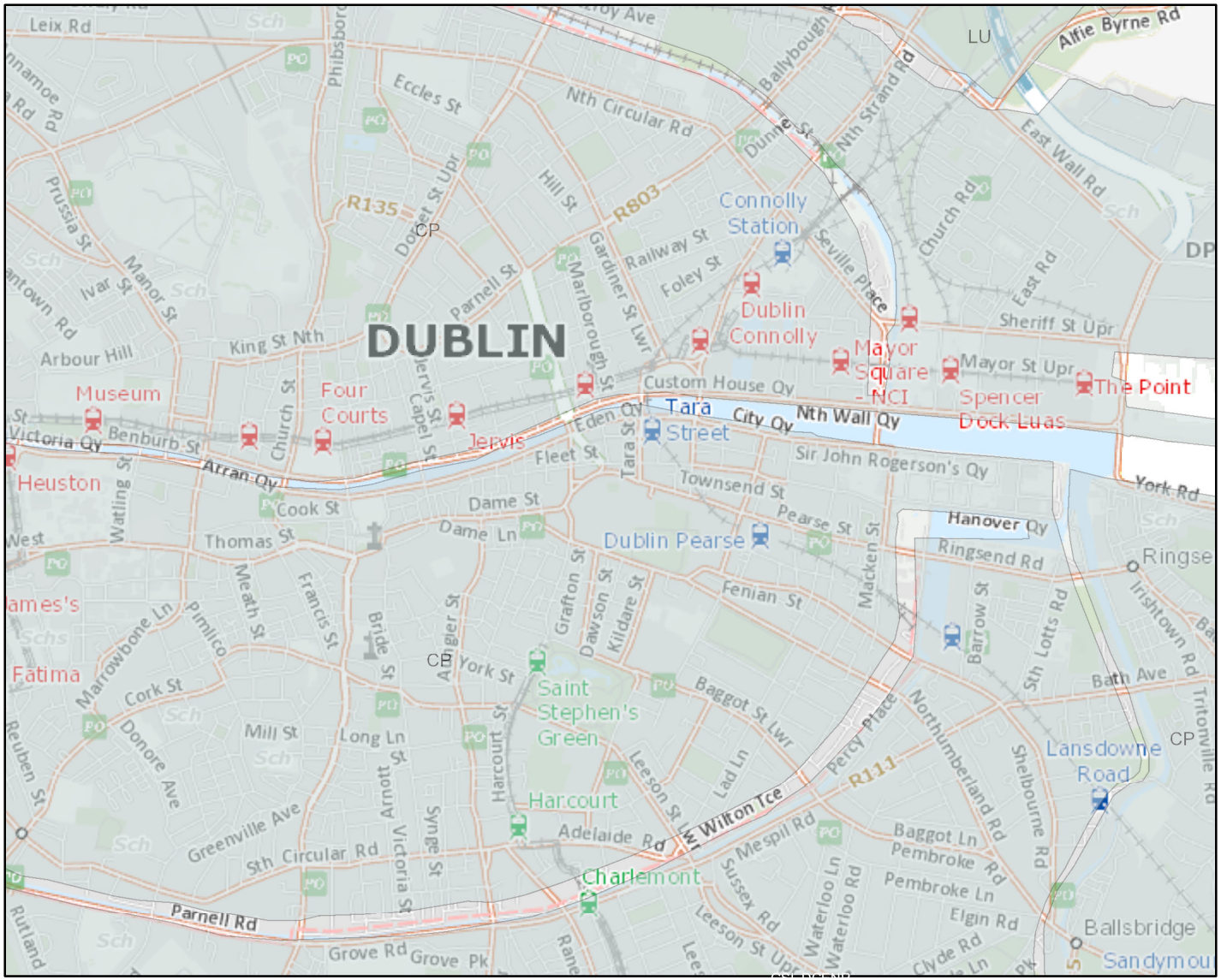
Locally Important Gravel Aquifer
Regionally Important Gravel Aquifer

Bedrock Aquifer

Rkc - Regionally Important Aquifer - Karstified (conduit)
Rkd - Regionally Important Aquifer - Karstified (diffuse)
RK - Regionally Important Aquifer - Karstified
Rf - Regionally Important Aquifer - Fissured bedrock
Lm - Locally Important Aquifer - Bedrock which is Generally Moderately Productive
Lk - Locally Important Aquifer - Karstified
Ll - Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones
Pl - Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones
Pu - Poor Aquifer - Bedrock which is Generally Unproductive
Lake

Geological Survey
Suirbhéireacht Gheolaíochta
Ireland | Éireann

Job No. R025 - Geology



Scale: 1:25,000

Geological Survey Ireland

Geological Survey of Ireland

N W E S

0 0.175 0.35 0.7 mi

0 0.275 0.55 1.1 km

Map Centre Coordinates (ITM) 716,069 734,161

Snapshot Date: January 31, 2017

Legend

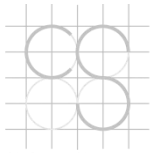
Structrual Symbol Labels

Bedrock Stratigraphy

- Boundary of Igneous Intrusion
- Dyke
- Unconformity
- Formation lines
- Boundary of dolomization
- Outer limit of metamorphic aureole
- Outer limit of higher grade aureole
- Lithological Boundary
- Shear Zone Boundary
- Ghost line
- Coal seam/Tertiary dolorite dyke
- Metadolerite sheet/....Limit of granite sheeting(Ox Mountains)
- 3Z

Generalised Bedrock (Rock Unit Groups)

- Basalts & other Volcanic rocks
- Permo-Triassic Sandstones
- Permo-Triassic Mudstones and Gypsum
- Westphalian Sandstones
- Westphalian Shales
- Namurian Shales
- Namurian Sandstones
- Namurian Undifferentiated
- Dinantian Shales and Limestones
- Dinantian Mixed Sandstones, Shales and Limestones
- Dinantian Sandstones
- Dinantian Pure Bedded Limestones
- Dinantian Upper Impure Limestones
- Dinantian Dolomitised Limestones
- Dinantian Pure Unbedded Limestones
- Dinantian Lower Impure Limestones
- Dinantian (early) Sandstones, Shales and Limestones
- Dinantian Mudstones and Sandstones (Cork Group)
- Devonian Kiltorcan-type Sandstones
- Devonian Old Red Sandstones
- Granites & other Igneous Intrusive rocks
- Silurian Metasediments and Volcanics
- Ordovician Metasediments
- Ordovician Volcanics
- Cambrian Metasediments
- Precambrian Quartzites, Gneisses & Schists
- Precambrian Marbles



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