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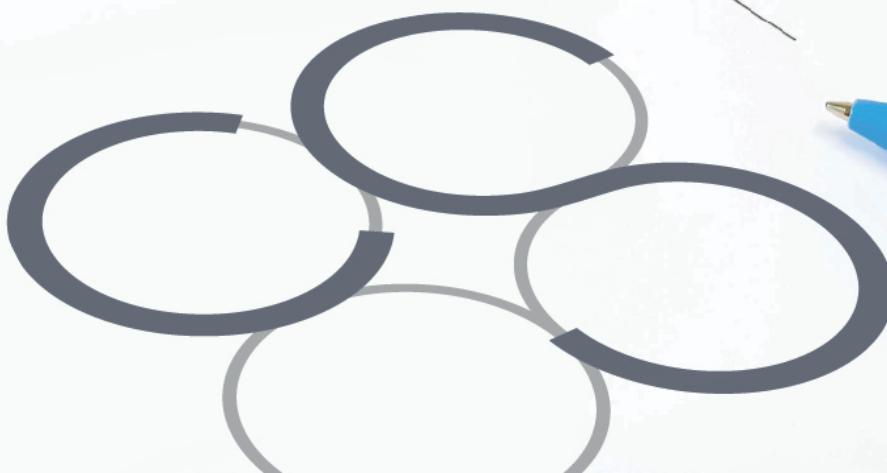
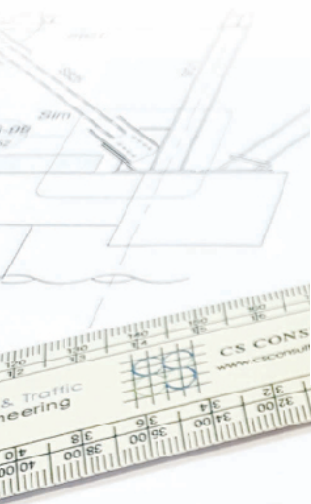
Site Specific Flood Risk Assessment

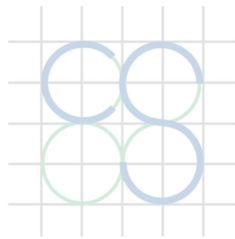
Proposed Strategic Housing Development, Waterfront South Central ABP 306158-19

North Wall Quay, Dublin 1

Client: Waterside Block 9 Developments Limited

Job No. R064





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SITE SPECIFIC FLOOD RISK ASSESSMENT

PROPOSED STRATEGIC HOUSING DEVELOPMENT, WATERFRONT SOUTH CENTRAL ABP 306158-19, NORTH WALL QUAY, DUBLIN 1

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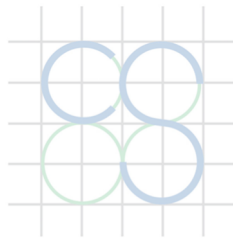
Appendix H: GSI Mapping

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R064 FRA 2019.11.21 Draft

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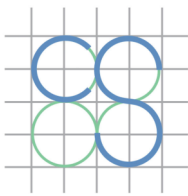
1.0 INTRODUCTION

In conjunction with the multi-disciplinary Design Team, Cronin & Sutton Consulting Engineers (CS Consulting) have been commissioned by Waterside Block 9 Developments Limited to prepare a Site Specific Flood Risk Assessment to accompany a planning application for a proposed Strategic Housing Development at City Block 9, Dublin Docklands.

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

- Dublin City Development Plan 2016–2022;
(including Strategic Flood Risk Assessment)
- Greater Dublin regional Code of Practice for Works;
- Office of Public Works Flood Maps;
- Department of the Environment Flooding Guidelines;
- Geological Survey of Ireland Maps;
- Local Authority Drainage Records.

The Site Specific Flood Risk Assessment is to be read in conjunction with the engineering drawings and documents submitted by CS Consulting and with the various additional information submitted by the other members of the design team, as part of the Planning Submission.



2.0 SITE LOCATION AND PROPOSED DEVELOPMENT

2.1 Site Location

The site of the proposed development forms part of City Block 9 within the North Lotts and Grand Canal Dock Strategic Development Zone, and is bounded by North Wall Avenue to the east, Mayor Street Upper to the north, North Wall Quay to the south, and Castleforbes Road to the west. City Block 9 has a total area of approx. 1.95ha and is located in the administrative jurisdiction of Dublin City Council. The site of the SHD application is 1.10ha as shown in figure 2.

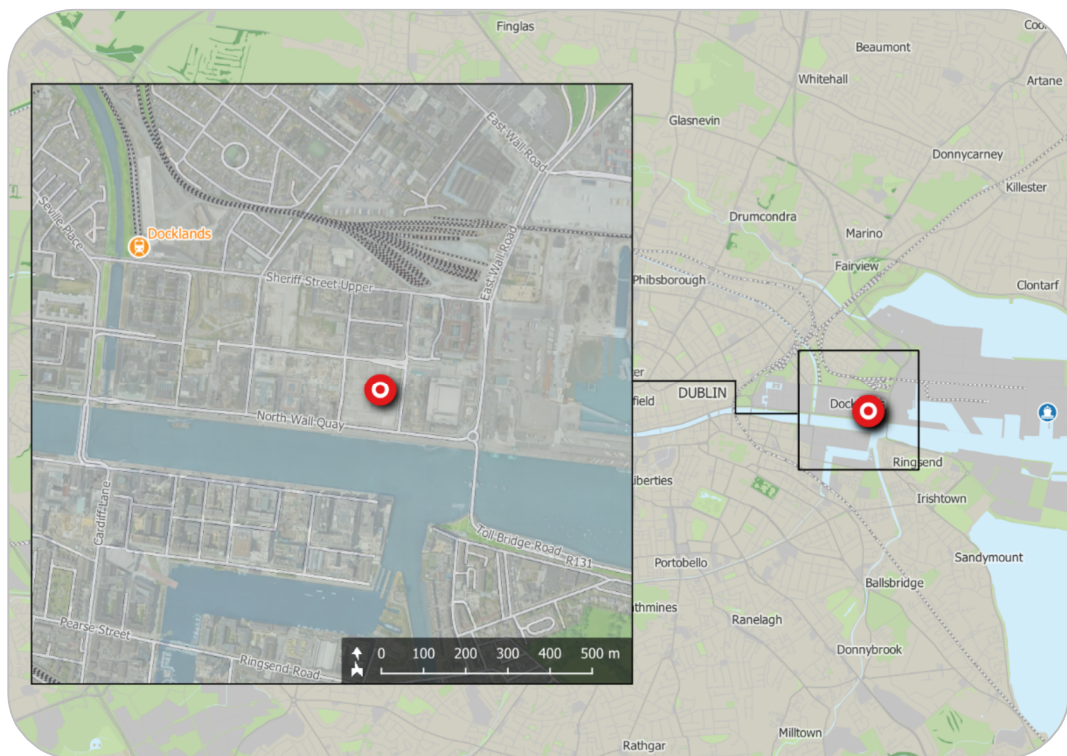


Figure 1 – Location of proposed development site
(map data & imagery: EPA, OSi, OSM Contributors, Google)

The location of the proposed development site is shown in Figure 1 above; the indicative extents of the development site, as well as relevant elements of the surrounding road network, are shown in more detail in Figure 2.

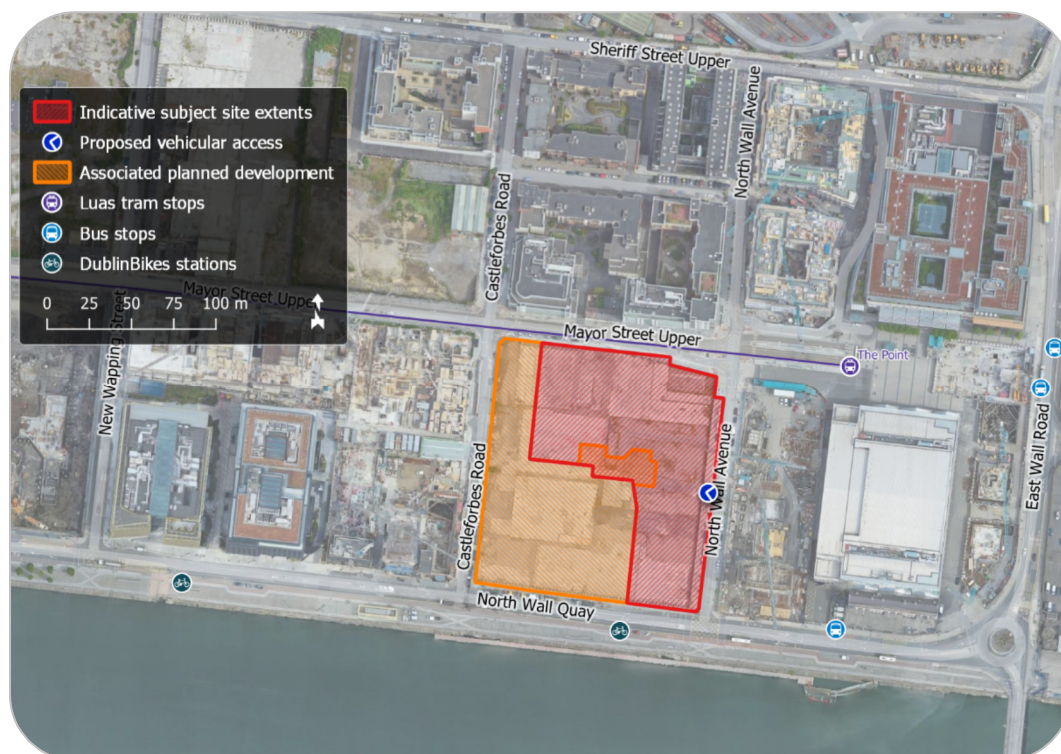


Figure 2 – Site extents and environs
(map data & imagery: NTA, OSM Contributors, Google)

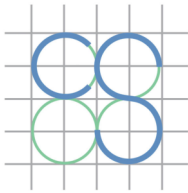
2.2 Existing Land Use

The subject site is brownfield and predominantly occupied by existing hardstanding areas. No extant structures are present on the site and the site currently generates no significant vehicular traffic.

2.3 Description of Proposed Development

The scheme, totalling 125,388 sq m, provides 22,499 sq m at basement levels, with 102,889 sq m from ground upwards. The development will consist of the:

1. Construction of 1,005 No. residential units (with balconies and winter gardens) arranged in 3 No. blocks ranging in height from 8 No. storeys to 45 No. storeys over a triple-level basement, the former comprising: Block A (8-



14 No. storeys (with extended core to access roof level); with an apartment mix of: 116 No. 1-bed; and 92 No. 2-bed; with landscaped terraces at Level 1 (south east elevation), Level 8 (south west elevation), Level 11 (south west elevation) and Level 14 (north east elevation)); Block B (8-41 No. storeys (with extended core to access roof terrace); with an apartment mix of: 172 No. 1-bed; and 247 No. 2-bed; with landscaped terraces at Level 5 (south west elevation), Level 8 (north west elevation and south west elevation), Level 11 (north elevation), Level 12 (west elevation), Level 13 (east elevation), Level 14 (east elevation), and at Level 41 (roof level)); and Block C (11-45 No. storeys (with extended core to access roof level); with an apartment mix of: 207 No. 1-bed; 168 No. 2-bed; and 3 No. 3-bed units; with landscaped terraces at Level 11 (north elevation), Level 24 (south elevation), Level 32 (south elevation), and Level 45 (roof level), incorporating a public viewing deck at Levels 44 and 45).

2. Provision of ancillary residential amenities and support facilities including: live/work suites (321 sq m), a gym/spa reception (52 sq m), a residents' games room (91 sq m), a residents' common room (110 sq m), a residents-only social space (193 sq m), a management office (96 sq m), a security office (50 sq m), concierge spaces (GFA of c. 381 sq m) all located at ground floor level; a residents' games room (90 sq m) located at Level 1 of Block B; a residents' common room (86 sq m) located at Level 14 of Block B; a residents' wellness club and common room (408 sq m) located at Level 24 of Block C;

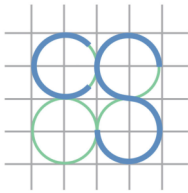
3. Construction of triple height basement which will comprise double basement with mezzanine plant level (total basement area 22,499 sq m), accommodating: waste storage areas (659 sq m), plant rooms (4,228 sq m), maintenance / management offices (GFA of 92 sq m), residents' courier / parcel rooms (GFA of 210 sq m), residents' laundry rooms (GFA of 138 sq m), ancillary residential storage (GFA of 291 sq m), residents' WCs (65 sq m), a residents' gym / spa (1,529 sq m) and ancillary gym storage room (100 sq

m), residents' screening rooms (240 sq m), a residents' indoor plant cultivation room (356 sq m), 176 No. car parking spaces, 10 No. motorcycle parking spaces and 1,693 No. bicycle parking spaces, with vehicular access provided by ramp from North Wall Avenue.

4. Provision of "other uses" as defined by the Planning and Development (Housing) and Residential Tenancies Act 2016, comprising: a childcare facility (450 sq m), a restaurant (110 sq m), an indoor Farmer's Market/foodhall (299 sq m), an external market area, a winter garden/seating area (130 sq m), and 3 No. café units (110 sq m, 167 sq m and 261 sq m, respectively), all located at ground floor level; a restaurant (609 sq m) located at Level 32 of Block C; office use (1,894 sq m) from Floor Level 41 to 43 inclusive at Block C; and a public bar / function room (407 sq m) located at Level 44 of Block C. The total area of "other uses" provided is 4,307 sq m.

5. Provision of a pocket park and new pedestrian lanes from North Wall Quay, North Wall Avenue and Mayor Street Upper to the center of the site.

6. All enabling and site development works, landscaping (including living walls), lighting, services and connections, waste management and all other ancillary works above and below ground including the use of existing secant piling permitted under Reg. Ref. DSDZ3779/17 and DSDZ3780/17 (as amended by DSDZ3042/19



3.0 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 as 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 summarized in Table 1 below (Table 8.1 from Guidelines document).

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

Table 1 – Summary of Level of Service – Flooding Source

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 Council, 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.

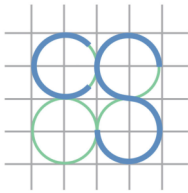
Design Category	Predicted Impact of Climate Change
Drainage	20% Increase in rainfall
Fluvial (River flows)	20% Increase in flood flow
Tidal / Coastal	Minimum Finished Floor Level 4.0 – 4.15m AOD

Table 2 - The predicted climate change variations.

The flooding guidelines categorize the risks associated with flooding into three areas, Zone A, B & C. This categorization 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*, dwellings are classified as 'highly vulnerable developments'.



Following a review of the DCC flood maps, the subject site is located in Flood Zone C. See **Appendix A**.

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. Table 3 below outlines the conditions that require a justification test.

	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

Table 3 - Flood Zone Vs Justification Test Matrix

As noted above the subject site is located within **Flood Zone C**, as such a justification test is not required.

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.

4.0 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.

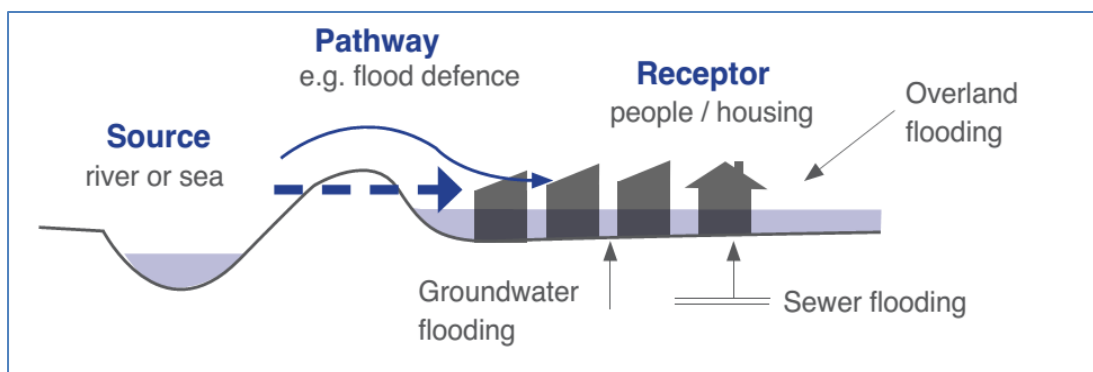
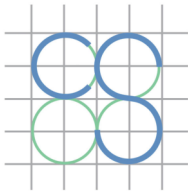


Figure 3 – Source-pathway-receptor model
(imagery: *The Planning System and Flood Risk Management Guidelines*)

4.1 Fluvial Flooding

The site is located approximately 30m 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** for CFRAM Fluvial Flood Extent Map.

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

4.2 Tidal Flooding

The coast of Ireland has been modelled by the OPW as part of the Irish Coastal Protection Strategy Study – Phase 3. This study looked at the potential future flooding should climate change have a dramatic effect on sea levels. The study took a 'mid-range' level for sea level rise of 500mm above current levels and a 'high end' level of 1000mm above existing levels and then re-modelled the effects. The effects indicate that the site would be outside the flooded area. The site's location is such that it is not affected by tidal water bodies and as such the risk of tidal flooding is negligible. See **Appendix D**.

In addition to that, the current flood risk mapping developed for Dublin City Council and the *Eastern Catchment Flood Risk Assessment Mapping, CFRAM* the subject site is located outside of the 0.1% AEP tidal floodplain. See **Appendix E** for CFRAM Tidal Flood Extent Map

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

4.3 Pluvial Flooding

Pluvial flooding is flooding which has originated from overland flow resulting from high intensity rain fall. A high level pluvial flood map has been produced but it is of for high level use than for a specific site. See **Appendix F** for the Dublin Pluvial Study map.

Previous flood events in the area can be reviewed on the Office of Public Works web site, www.floodmaps.ie. The historical flood mapping does not indicate flood events in the area. In addition, the councils flood zone map indicates areas where pluvial flooding has been experienced in the past, 'hotspots' the subject site is not located on the indicated 'hotspots'.

Therefore, the potential risk is acceptable for the proposed development.

4.4 Potential for Site to Contribute to Off-Site Flooding

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.

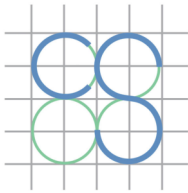
In general, a site must limit its stormwater runoff to 2l/s/Ha and provide on-site storage to cope with the storm water generated from a 1 in 100 year storm events, increased by 20% for the predicated effects of climate change.

The proposed re-development of the subject lands will adhere to these general guidelines, refer to the Engineering Services Report submitted as part of this application for details. Storm water drainage from the subject site will be collected and stored on site and released at a controlled rate into the existing 225mm diameter storm water sewer on North Wall Avenue.

4.5 Existing Off-Site Drainage

Records obtained from Dublin City Council indicate a number of public stormwater and combined sewer adjacent to the subject site.

- A 225mm diameter stormwater sewer and a 225-375mm diameter concrete stormwater sewer to the south, flowing east to west on North Wall Quay connecting with a 1090mmx920mm brick



stormwater sewer, flowing north to south on Castleforbes Road, which flows into River Liffey.

- A 225mm diameter concrete stormwater sewer to the north, flowing east to west on Mayor Street Upper into the 1090mmx920mm brick stormwater sewer;
- A 450mm diameter vitrified clay combined sewer to the south, flowing east to west on North Wall Quay, into a pumping station on Castleforbes Road, which a 150mm diameter cast iron is place on Castleforbes Road towards a 225mm diameter vitrified clay foul sewer on Mayor Street Upper; and
- A 375mm diameter concrete foul sewer to the north, flowing east to west on Mayor Street Upper, connects into a 1420mm concrete on Castleforbes Road, which is also direct to the pump station on Castleforbes Road.

In addition, previous granted planning permission indicates a 225mm diameter storm water sewer flowing south to north on North Wall Avenue, which flows into the 225mm diameter storm water sewer on Mayor Street Upper. Storm water drainage from the subject site will released into the same storm water sewer, previously granted.

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 predicated future scenario, 2031, is the most relevant hydraulic model to review. The predicted future scenario for 2031 indicates that the sewers located to the south and west surcharges for a 1 or 2 year return period. Storm water drainage from the subject site will be collected and stored on site and released at a controlled rate into the existing 225mm diameter storm water sewer on North Wall Avenue. Therefore, it is not proposed to connect any storm water from the proposed

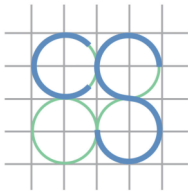
development into these sewers the overall hydraulic capacity of these sewers will increase post development. The increased capacity will have the beneficial effect of reducing the likelihood of flooding issues occur due to off-site drainage network surcharging or flooding.

All connection locations from lower levels of the proposed development for foul effluent will be pumped to ground level and outfall under gravity into the existing 225mm diameter storm water sewer on North Wall Avenue. The internal system will be fitted with non-return valves to prevent effluent from surcharging sewers backing up into the proposed development.

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

4.6 Groundwater Flooding

According to the Geological Survey of Ireland interactive maps, the subject site is underlain with *Dark limestone & shale*. The area is listed as overlaying a locally important aquifer which has bedrock which is *unproductive except for local zones*. The groundwater vulnerability assessment of the site shows that the vulnerability of groundwater in the area is *extreme*. The proposed development and the general geology of the subject lands means that the potential risk from groundwater is deemed acceptable. Refer to **Appendix H** for GSI mapping information.



4.7 Mitigation Flood Defenses

The proposed development is located in Flood Zone 'C' and is in accordance with the planning requirements for the proposed development. Notwithstanding this it is proposed to locate all buildings above the 4.00mAOD datum and to include for flood defences to a level of 4.00mAOD to ensure that the development is future-proofed against extreme storm water events. The proposed flood defences would be placed at vulnerable locations (i.e. basement entrance locations) should a warning be issued by Dublin City Council or the Office of Public Works. The monitoring of these warns and the positioning of these temporary flood defences would be carried out by the management company responsible for the operation of the building.

5.0 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, 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.

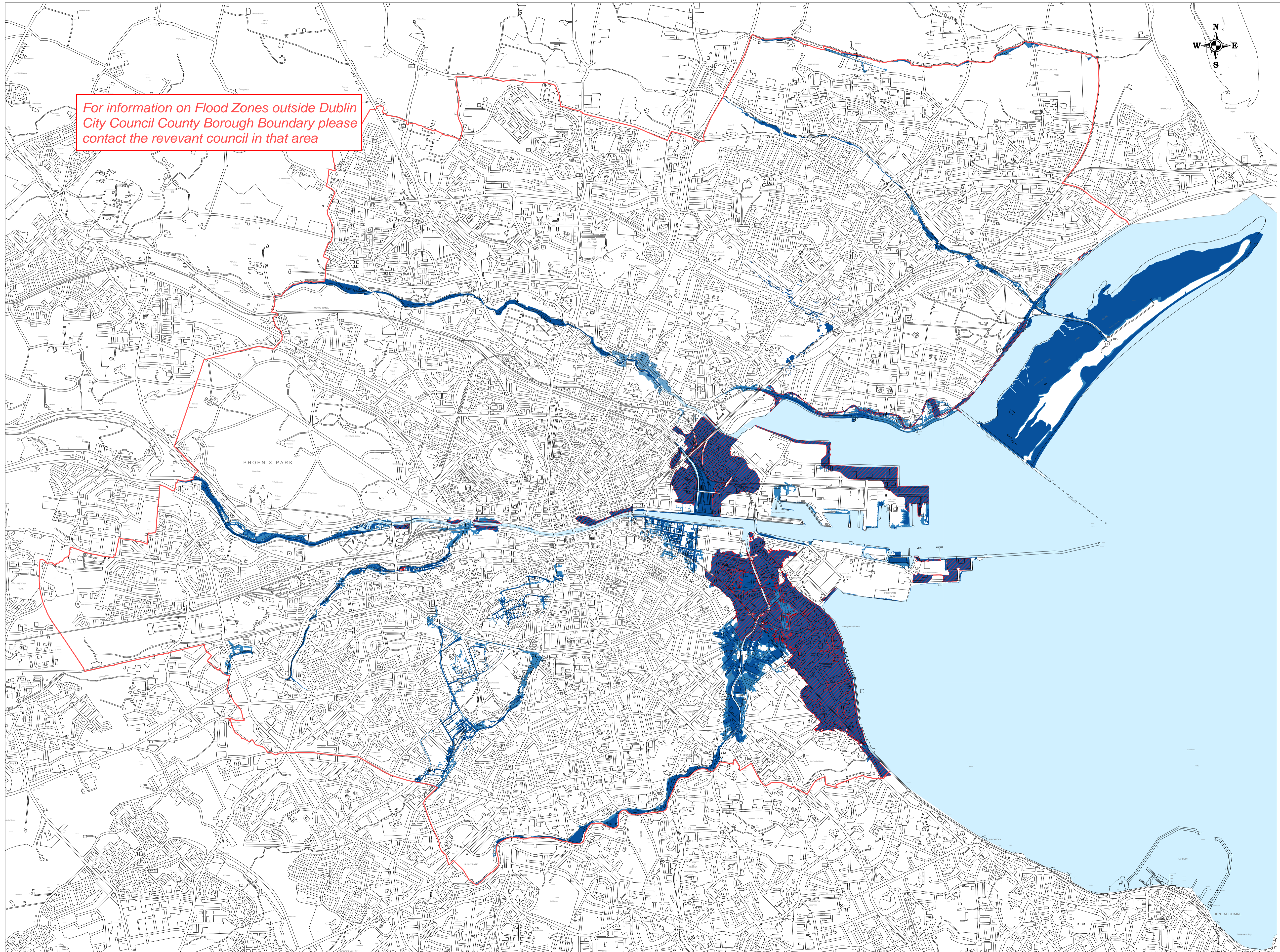
Tidal and fluvial mapping prepared by the Office of Public Works as part of the CFRAMS project addressing the potential for future flooding events indicated that the subject site is not located in the 0.5% Tidal or 0.1% fluvial flood zones

As part of Dublin City Councils 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 C**.

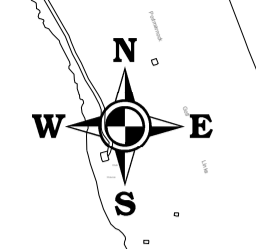
The site was reviewed for pluvial/fluvial/groundwater and infrastructure flooding sources and any risk associated risk is deemed to be within acceptable limits.

The proposed development, while located in Flood Zone 'C' will have all buildings located above the 4.00mAOD datum & emergency temporary flood defences can be installed at vulnerable locations should they be required, following notification from Dublin City Council or the OPW.

Appendix A: Dublin City Council Strategic Flood Risk Assessment - Extract



For information on Flood Zones outside Dublin City Council County Borough Boundary please contact the relevant council in that area



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

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John O'Hara
Head of Land Use Policy

Appendix B: Office of Public Works - Historical Flood Map

Summary Local Area Report

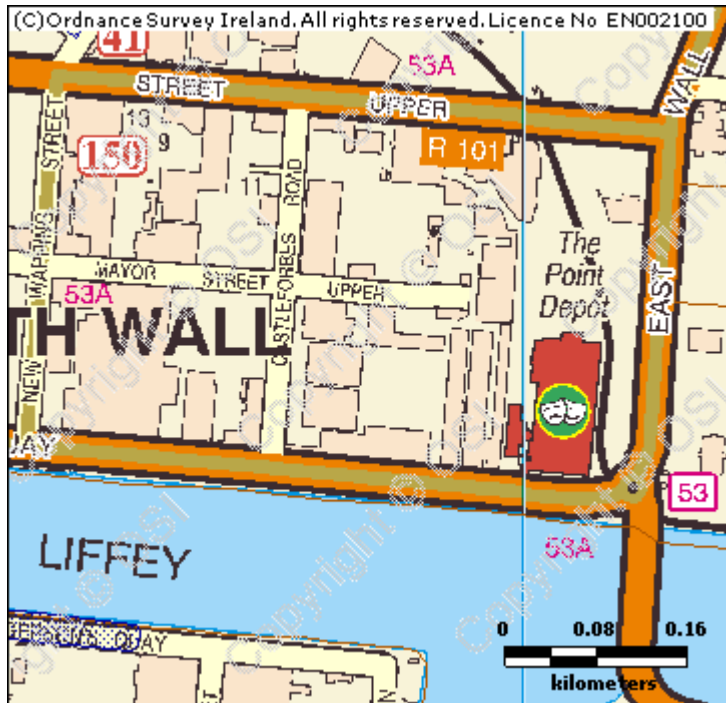
This Flood Report summarises all flood events within 2.5 kilometres of the map centre.

The map centre is in:

County: Dublin

NGR: O 178 345

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



Map Scale 1:6,745

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. Their purpose and scope is explained in the Glossary.

22 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 Nov 1965 County: Dublin	Start Date: 25/Nov/1965 Flood Quality Code:3

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



6. 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



7. Dodder Anglesea Road Nov 1965

Start Date: 17/Nov/1965

County: Dublin

Flood Quality Code:2

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



8. Dodder Anglesea Road Dec 1958

Start Date: 18/Dec/1958

County: Dublin

Flood Quality Code:3

Additional Information: Reports (7) More Mapped Information



9. 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



10. 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



11. Ringsend June 1963

Start Date: 11/Jun/1963

County: Dublin

Flood Quality Code:3

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



12. 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



13. Flooding at RDS, Ballsbridge, Dublin 4 on 24th Oct 2011

Start Date: 24/Oct/2011

County: Dublin

Flood Quality Code:2

Additional Information: Reports (1) More Mapped Information



14. Flooding at Herbert Cottages, Ballsbridge, Dublin 4 on 24th Oct 2011

Start Date: 24/Oct/2011

County: Dublin

Flood Quality Code:2

Additional Information: Reports (1) More Mapped Information



15. Flooding at Havelock Square, Sandymount, Dublin 4 on 24th Oct 2011

Start Date: 24/Oct/2011

County: Dublin

Flood Quality Code:2

Additional Information: Reports (1) More Mapped Information



16. Flooding at ESB Sportsco, Ringsend, Dublin 4 on 24th Oct 2011

Start Date: 24/Oct/2011

County: Dublin

Flood Quality Code:2

Additional Information: Reports (1) More Mapped Information



17. Flooding at Bath Avenue, Sandymount, Dublin 4 on 24th Oct 2011

Start Date: 24/Oct/2011

County: Dublin

Flood Quality Code:2

Additional Information: Reports (1) More Mapped Information



18. Flooding at Railway Cottages, Ballsbridge, Dublin 4 on 24th Oct 2011

Start Date: 24/Oct/2011

County: Dublin

Flood Quality Code:2

Additional Information: Reports (1) More Mapped Information



19. Clontarf Rd Seaview Avenue August 2004

Start Date: 23/Aug/2004

County: Dublin

Flood Quality Code:3

Additional Information: Reports (3) More Mapped Information



20. Clontarf Oulton road area August 2004

Start Date: 23/Aug/2004

County: Dublin

Flood Quality Code:3

Additional Information: Reports (1) More Mapped Information



21. Dodder Oct 1987

Start Date: 21/Oct/1987

County: Dublin

Flood Quality Code:4

Additional Information: Photos (3) More Mapped Information



22. Bath Avenue June 1963

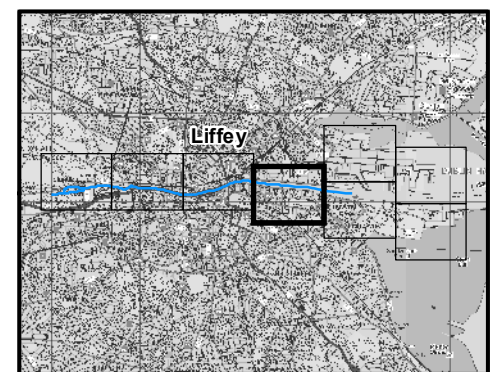
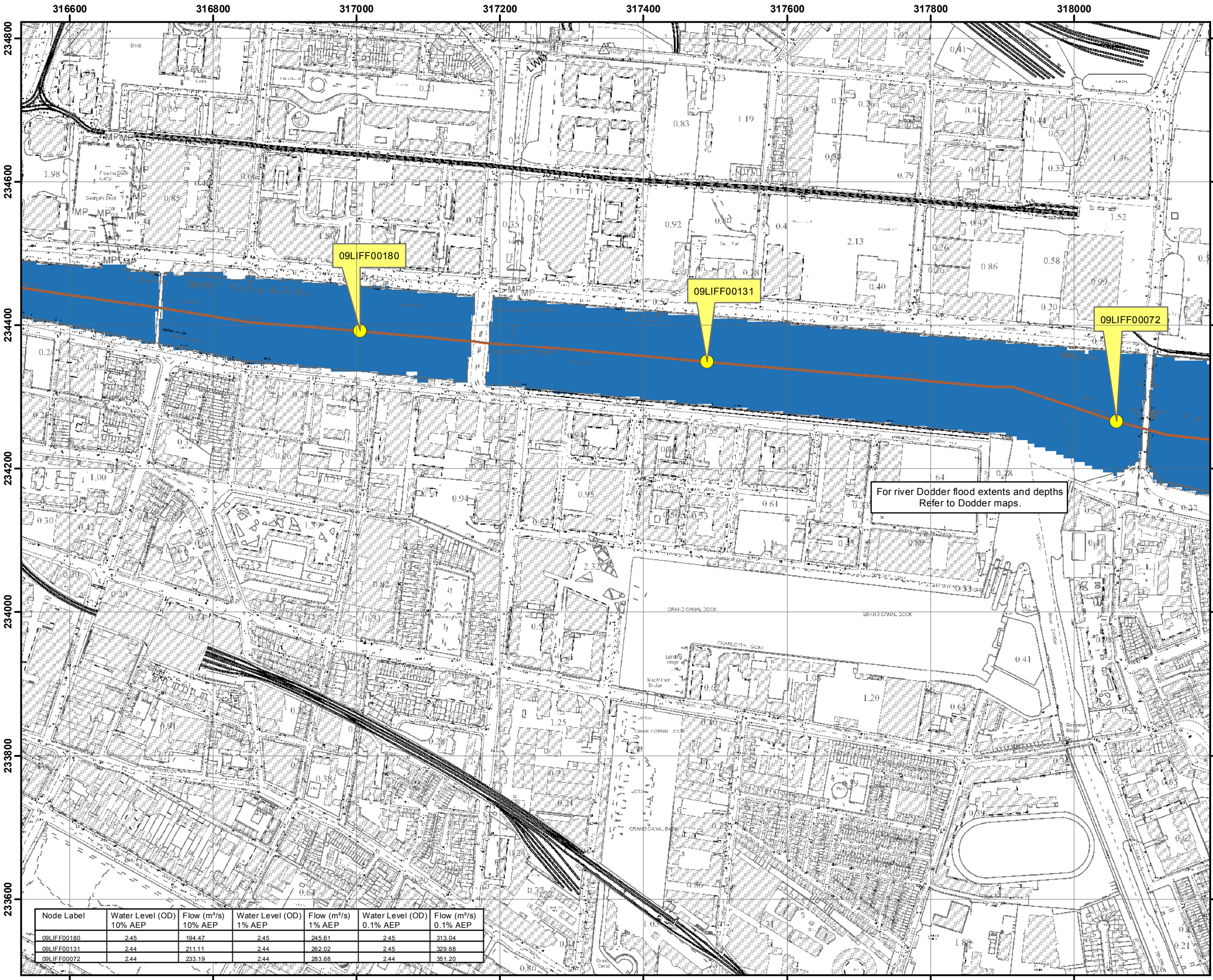
Start Date: 11/Jun/1963

County: Dublin

Flood Quality Code:2

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

**Appendix C: Eastern Catchment Flood Risk Assessment and Management
(CFRAM) Fluvial Map**



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

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

FINAL

REV: 01	NOTE: Amendments to Flood Extents.	DATE: 05/12/16
---------	------------------------------------	----------------



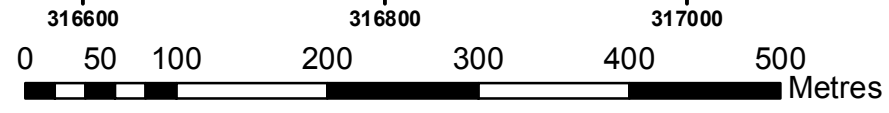
The Office of Public Works
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E ireland@rpsgroup.com

Map:	
Liffey Fluvial Flood Extents	
Map Type: EXTENT	
Source: FLUVIAL	
Map Area: HPW	
Scenario: CURRENT	
Drawn By: C.C.	Date: 9 May 2017
Checked By: A.S.	Date: 9 May 2017
Approved By: S.P.	Date: 9 May 2017
Drawing No.:	
E09LIF_EXFCD_F1_04	
Map Series: Page 4 of 8	
Drawing Scale: 1:5,000 @ A3	

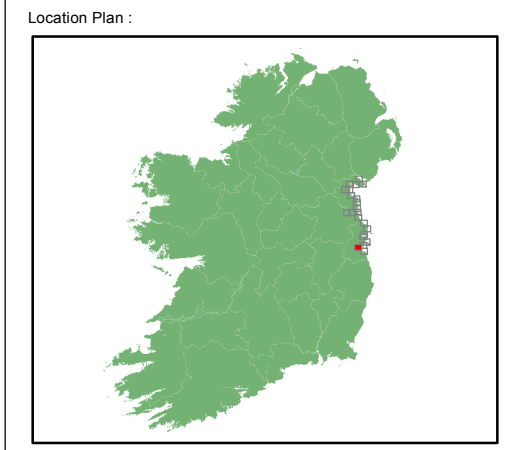
Node Label	Water Level (OD)		Flow (m ³ /s)		Water Level (OD)		Flow (m ³ /s)	
	10% AEP	10% AEP	1% AEP	1% AEP	0.1% AEP	0.1% AEP	0.1% AEP	0.1% AEP
09LIFF00180	2.45	194.47	2.45	245.61	2.45	313.04		
09LIFF00131	2.44	211.11	2.44	262.02	2.45	329.68		
09LIFF00072	2.44	233.19	2.44	283.68	2.44	351.20		



Appendix D: Coastal Protection Study Phase 3 Map

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Osi permit number EN-002-1012

NOTE: MORE DETAILED MAPS SHOWING COMBINED TIDAL AND FLUVIAL FLOOD HAZARD FOR PART OF THIS AREA (DODDER CATCHMENT ONLY) HAVE BEEN PREPARED UNDER THE RIVER DODDER CATCHMENT FRAM STUDY. PLEASE REFER TO WWW.DUBLINCITY.IE/PAGES/DODDERFLOODINGSTUDY.ASPX FOR MORE INFORMATION



EXTENT MAP

Legend:

- 0.5% AEP FLOOD EXTENT (1 in 200 chance in any given year)
- 0.1% AEP FLOOD EXTENT (1 in 1000 chance in any given year)
- High Water Mark (HWM)
- Node Point

Point 34 Node Label (refer to table)

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

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Northern Ireland

OPW
Office of Public Works
17-19 Lower Hatch Street
Dublin 2
Ireland

Project:
IRISH COASTAL PROTECTION STRATEGY
STUDY - PHASE III

Map:
NORTH EAST COAST FLOOD EXTENT MAP

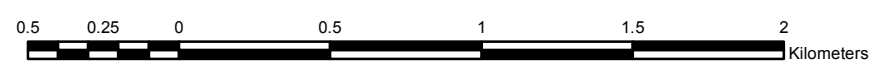
Map Type: FLOOD EXTENT
Source: TIDAL FLOODING
Map area: RURAL AREA
Scenario: HIGH END FUTURE SCENARIO

Figure By: PJW Date: Sept 2012
Checked By: JMC & JR Date: Sept 2012

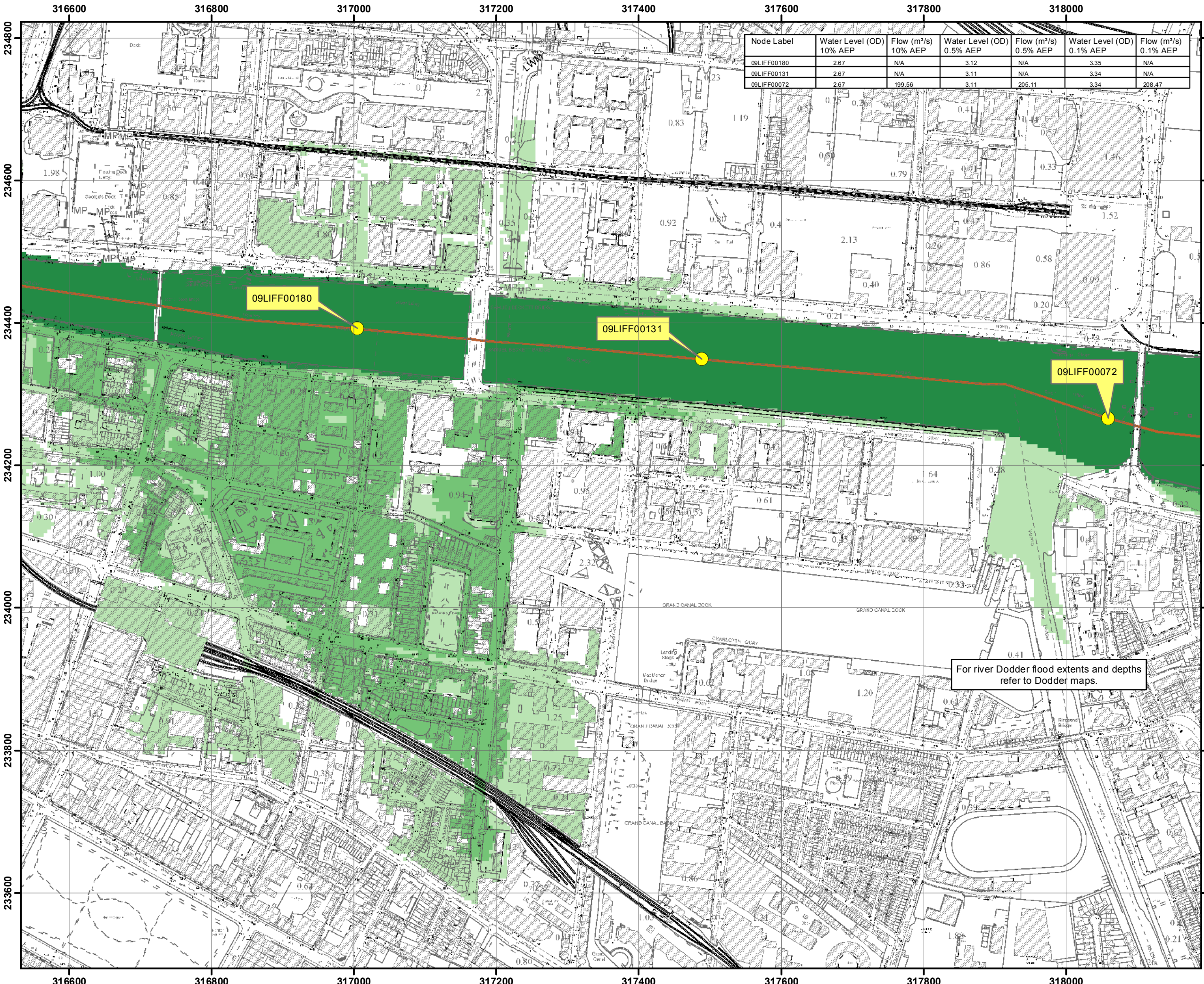
Figure No.: NE / RA / EXT / HEFS / 19
Revision: 0

Drawing Scale: 1:25,000 Plot Scale: 1:1 @ A3

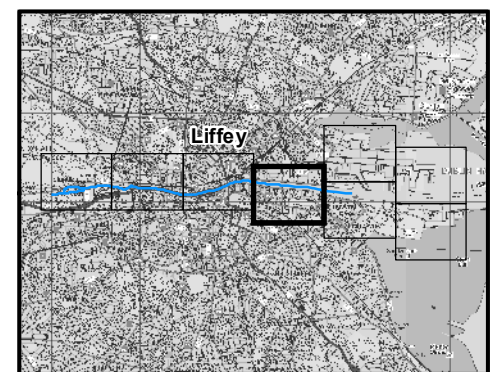
Node Label	Water Level (mOD Malin) per AEP		
	WL 10%	WL 0.5%	WL 0.1%
Point 22	3.67	4.07	4.28



Appendix E: CFRAM Tidal



Node Label	Water Level (OD) 10% AEP	Flow (m ³ /s) 10% AEP	Water Level (OD) 0.5% AEP	Flow (m ³ /s) 0.5% AEP	Water Level (OD) 0.1% AEP	Flow (m ³ /s) 0.1% AEP
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



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:
01	Amendments to Flood Extents.	05/12/16



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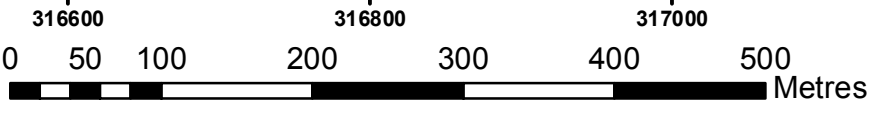
Map:	
Liffey Tidal Flood Extents	
Map Type: EXTENT	
Source: TIDAL	
Map Area: COASTAL	
Scenario: CURRENT	
Drawn By : C.C.	Date : 9 May 2017
Checked By : A.S.	Date : 9 May 2017
Approved By : S.P.	Date : 9 May 2017

Drawing No. :
E09LIF_EXCCD_F1_04

Map Series : Page 4 of 8

Drawing Scale : 1:5,000 @ A3

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

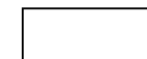





Appendix F: Dublin Pluvial Study Map

FloodResilienCity Project

DUBLIN CITY
Type 1 Pluvial Flood Hazard Map
1% AEP Event - 3Hr Duration Model

Legend:

Flood Hazard	
	Low (0.0m - 0.75)
	Moderate (0.75 - 1.25)
	Significant (1.25 - 2.00)
	Extreme (> 2.00)

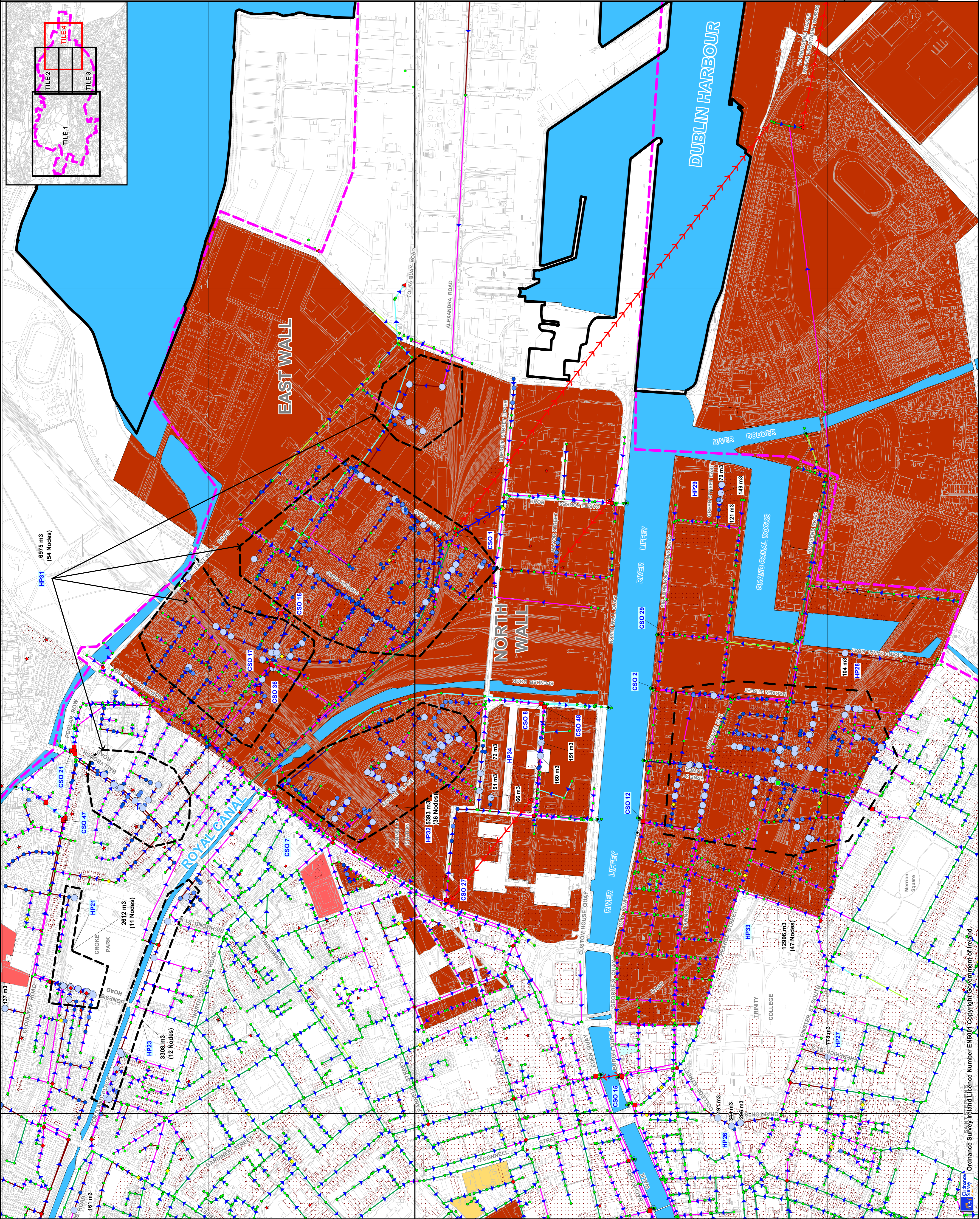
Notes

Thresholds for Flood Hazard Rating $H = d \times (y+0.5) \cdot DF$	Degree of Flood Hazard	Description
<0.75	Low	Caution - Flood zone with shallow flowing water or deep standing water.
0.75 - 1.25	Moderate	Dangerous for some (i.e. children) Danger - Flood zone with deep or fast flowing water.
1.25 - 2.0	Significant	Dangerous for most people. Danger - Flood Zone with deep and fast flowing water.
> 2.00	Extreme	Dangerous for all - Extreme Danger - Flood Zone with deep and fast flowing water.
Debris Factor	Debris Factor of 0.5 has been applied for depths 0.25m and a debris factor of 1 has been used for depths >=0.25	

The Flood ResilienCity Dublin Pluvial Study final report can be viewed on the Dublin City Council website www.dublincity.ie under Flood Prevention Plans



**Appendix G: 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)

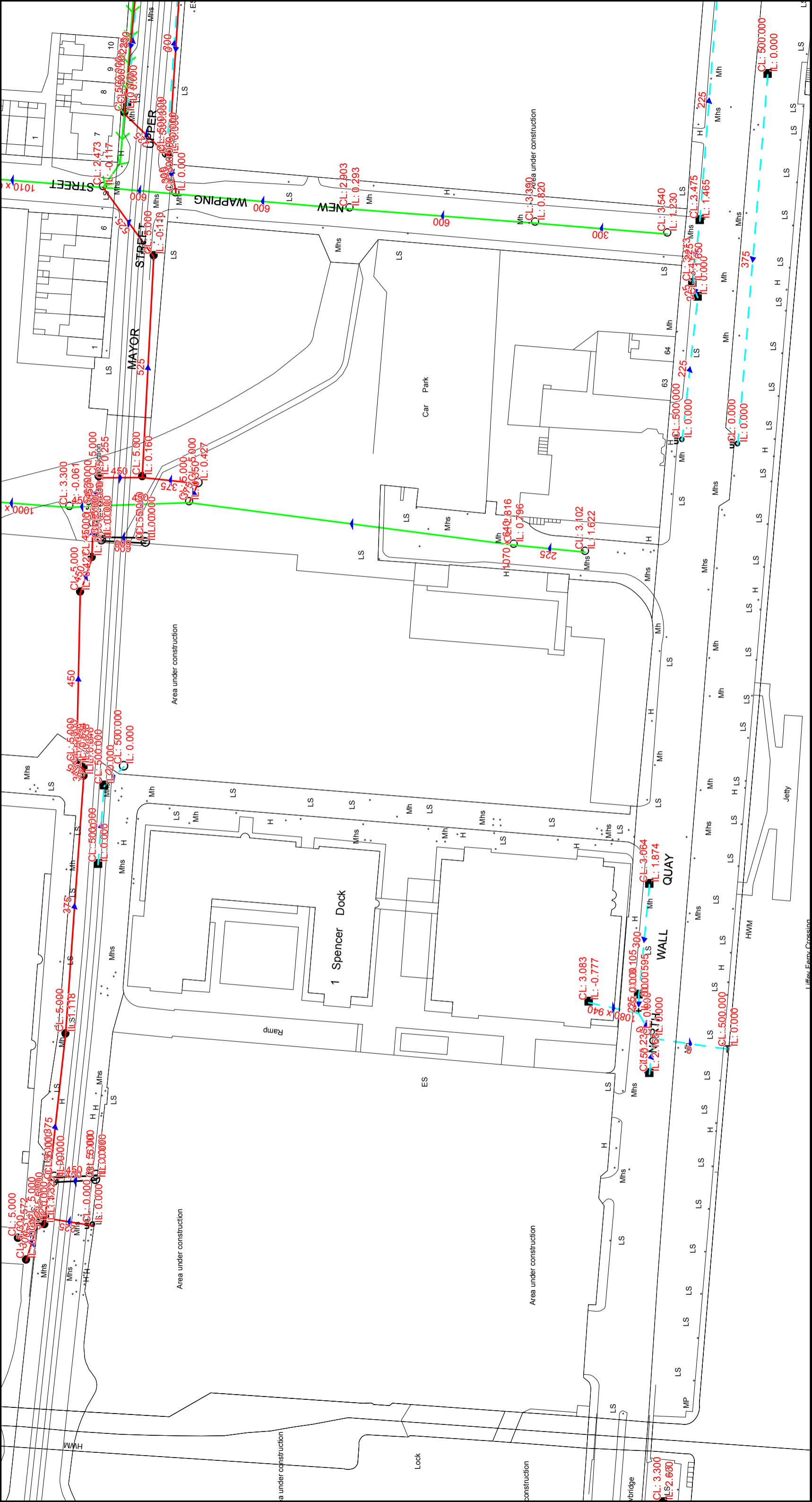
- Storm Hydraulic Performance Key**
- Storm Sewer floods for 30 year return period or less.
 - Storm Sewer surcharges for 1 or 2 year return period events
 - Storm Sewer does not surcharge for 1 or 2 year return period events and does not flood for a 30 year return period event or below. (eg 1,2,5,10,20)

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

GREATER DUBLIN STRATEGIC DRAINAGE STUDY	
CITY CENTRE/DOCKLANDS CATCHMENT	
PHASE 3 - 2031 System Performance Assessment	
GDS/MS/MAR3079/F001/PS-003_Tile4	
Author	JGA
Check	MCB
Drawn	N.T.S.
Revision	7/2004



Scale: 1: 1000
Date: 2 Apr 2015

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LEGEND








Trunk Sewer	Manhole	Surface Water Sewer	Foul Sewer	Overflow	Pumping
Combined Sewer	Manhole	Surface Water Sewer	Foul Sewer	Overflow	Pumping
gully catch pit cover	storm overflow	pumping station	junction	other node	hatch box
outfall	right point	vent column	catchpit	cascade	unknown feature
flap valve	rodding eye	Inverted siphon			






Appendix H: GSI Mapping

Legend

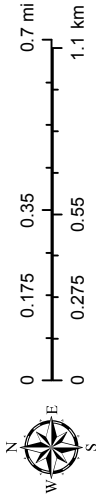
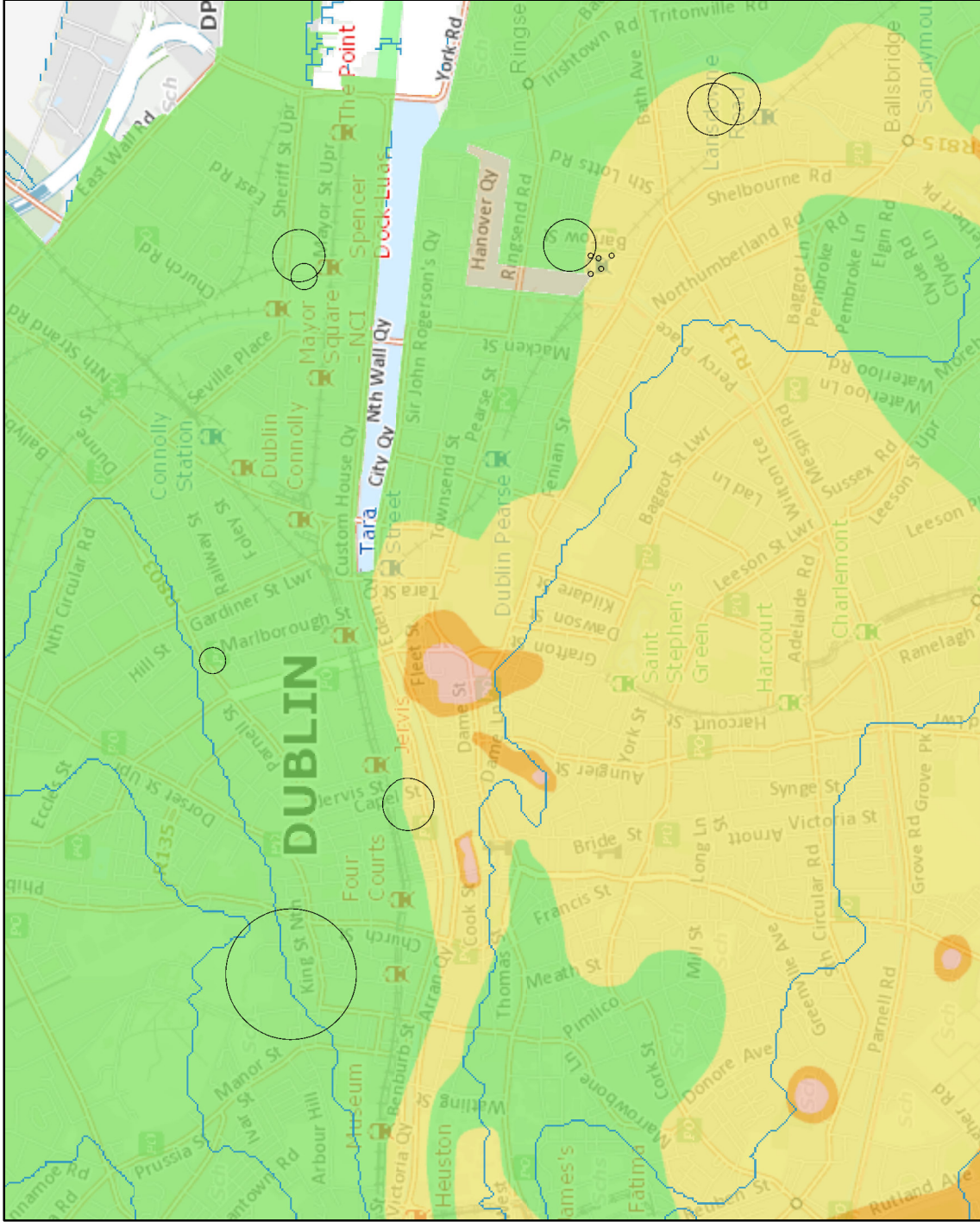
-  Groundwater Wells and Springs
- Karst Landforms**
 -  Borehole
 -  Cave
 -  Dry Valley
 -  Enclosed Depression
 -  Spring
 -  Superficial Solution Features
 -  Swallow Hole
 -  Turlough
-  Traced Underground Connections

- 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**
 -  Rlc - Regionally Important Aquifer - Karstified (conduit)
 -  Rld - Regionally Important Aquifer - Karstified (diffuse)
 -  RK - Regionally Important Aquifer - Karstified

- RF - Regionally Important Aquifer - Frissured bedrock**
- Lm - Locally Important Aquifer - Bedrock which is Generally Moderately Productive**
- Lk - Locally Important Aquifer - Karstified which is Moderately Productive only in Local Zones**
- Pp - Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones**
- Fu - Poor Aquifer - Bedrock which is Generally Unproductive**
-  Lake



Map Centre Coordinates (ITM) 716,069 733,989
Snapshot Date: January 31, 2017



Scale: 1:25,000
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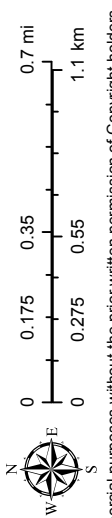
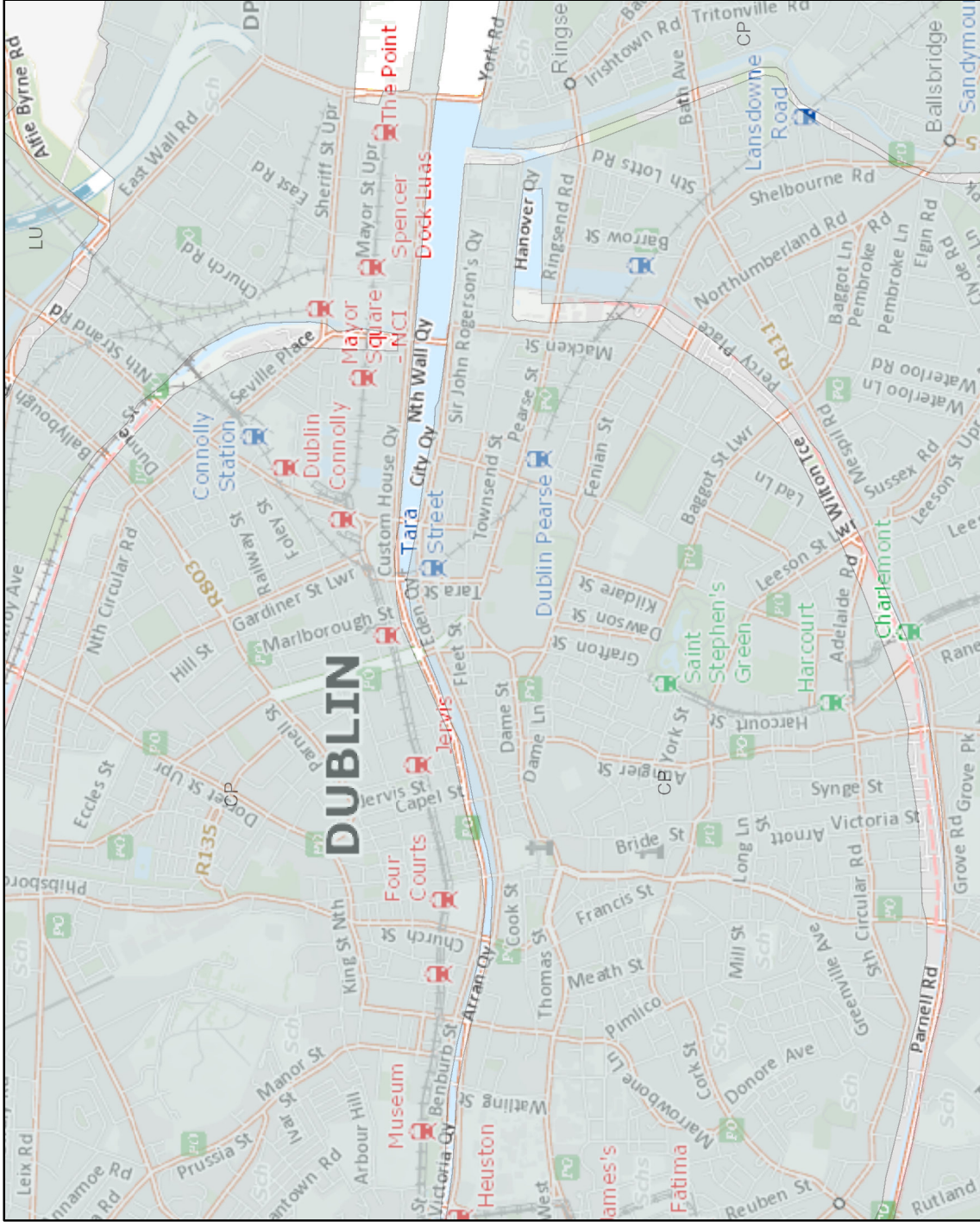
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Legend

- Structural Symbol Labels**
- Ordovician Volcanics
 - Cambrian Metasediments
 - Precambrian Quartzites, Gneisses & Schists
 - Precambrian Marbles
- Bedrock Stratigraphy**
- Boundary of Igneous Intrusion
 - Dyke
 - Unconformity
 - Formation lines
 - Boundary of dolomitization
 - Outer limit of metamorphic aureole
 - Outer limit of higher grade aureole
 - Lithological Boundary
 - Shear Zone Boundary
 - Ghost line
 - Coal seam/Tertiary dolomite dyke
 - Metadiorite sheet/...Limit of granite sheeting(Ox Mountains)

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 Kiltoran-type Sandstones
- Devonian Old Red Sandstones
- Granites & other igneous intrusive rocks
- Silurian Metasediments and Volcanics
- Ordovician Metasediments



Map Centre Coordinates (ITM) 716,069 794,161
 Snapshot Date: January 31, 2017



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