

SITE-SPECIFIC FLOOD RISK ASSESSMENT

PROPOSED STRATEGIC HOUSING DEVELOPMENT,
BLACKGLEN ROAD, SANDYFORD, DUBLIN 18

Zolbury Limited

Project No. Z040

19th July 2022



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for

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OCSC

O'CONNOR | SUTTON | CRONIN

Multidisciplinary
Consulting Engineers

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SITE-SPECIFIC FLOOD RISK ASSESSMENT

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1 INTRODUCTION

1.1 Appointment

O'Connor Sutton Cronin & Associates (OCSC) have been appointed by *Zolbury Ltd.* to carry out a Site-Specific Flood Risk Assessment (SSFRA) associated with the Strategic Housing Development for 360 no. residential units, associated resident amenity facilities and a childcare facility at Blackglen road, Sandyford.

1.2 Administrative Jurisdiction

The proposed development is located in the jurisdiction of Dun Laoghaire Rathdown County Council (DLRCC), and therefore this SSFRA was carried out with reference to the following:

- Dun Laoghaire Rathdown County Council Development Plan (2022 – 2028);
- Strategic Flood Risk Assessment for the DLRC CDP 2022-2028;
- Greater Dublin Strategic Drainage Study (GDSDS);
- The Planning System and Flood Risk Management Guidelines for Planning Authorities (Department of Environment, Heritage and Local Government and the Office of Public Works).

1.3 Site Location

The subject site is located at lands at Blackglen Road in Sandyford, Co. Dublin as shown in *Figure 1.1 – Site Location*. The proposed development site is immediately bound by:

- Residential properties to the east & west,
- Blackglen Road to the north,
- Woodside Road to the south.
- Diswellstown Road, to the east;

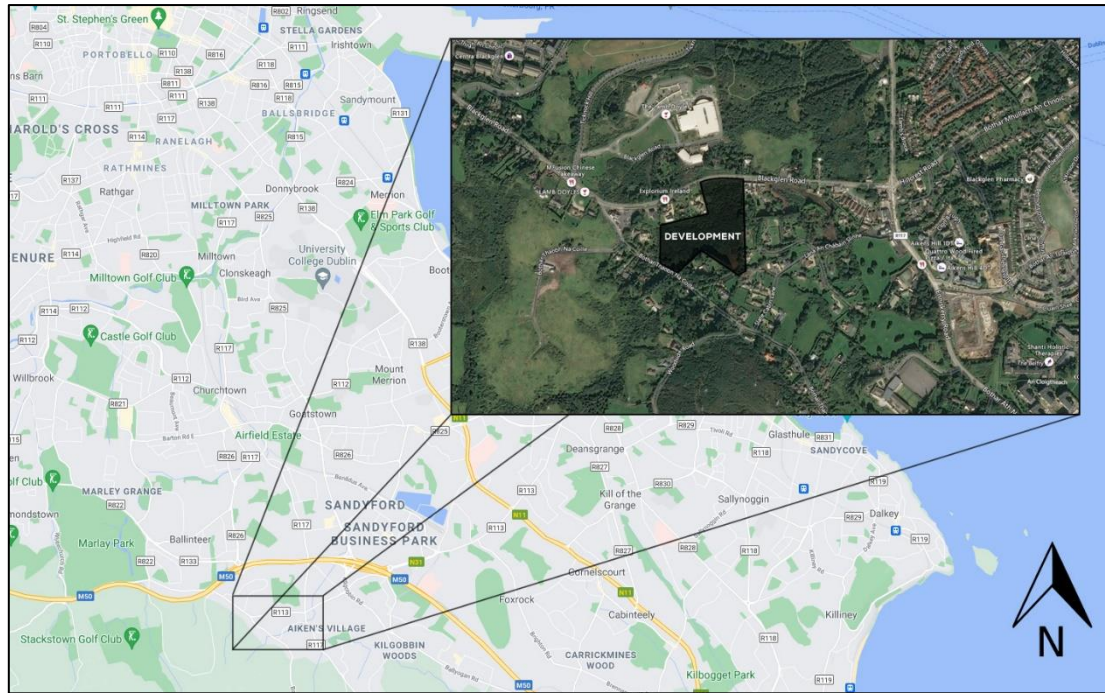


Figure 1-1: Site Location

1.4 Information Consulted

This flood risk assessment has been prepared on the information available from the following sources:

- OPW Flood Maps www.floodinfo.ie;
- DECLG website www.myplan.ie;
- OPW website www.floodmaps.ie;
- Geological Survey of Ireland Maps (GSI);
- Architectural drawings;
- Topographical survey.

2 SITE CONTEXT

2.1 Existing Site Overview

The overall development site area is c. 3.7 -hectares. The site is currently greenfield in nature. The Site is generally graded towards south of the site with the highest point of the site being located at the south-west boundary and is approximately +160.12m AOD with lowest the point being located at the north-east boundary of the site and is approximately +138.72m AOD. This gives a typical gradient of approximately 8.2% across the site.

2.2 Site Zoning

The overall site area is located within the lands zoned as "Objective A" by Dún Laoghaire-Rathdown County Council which is "To provide residential development and improve residential amenity while protecting the existing residential amenities."

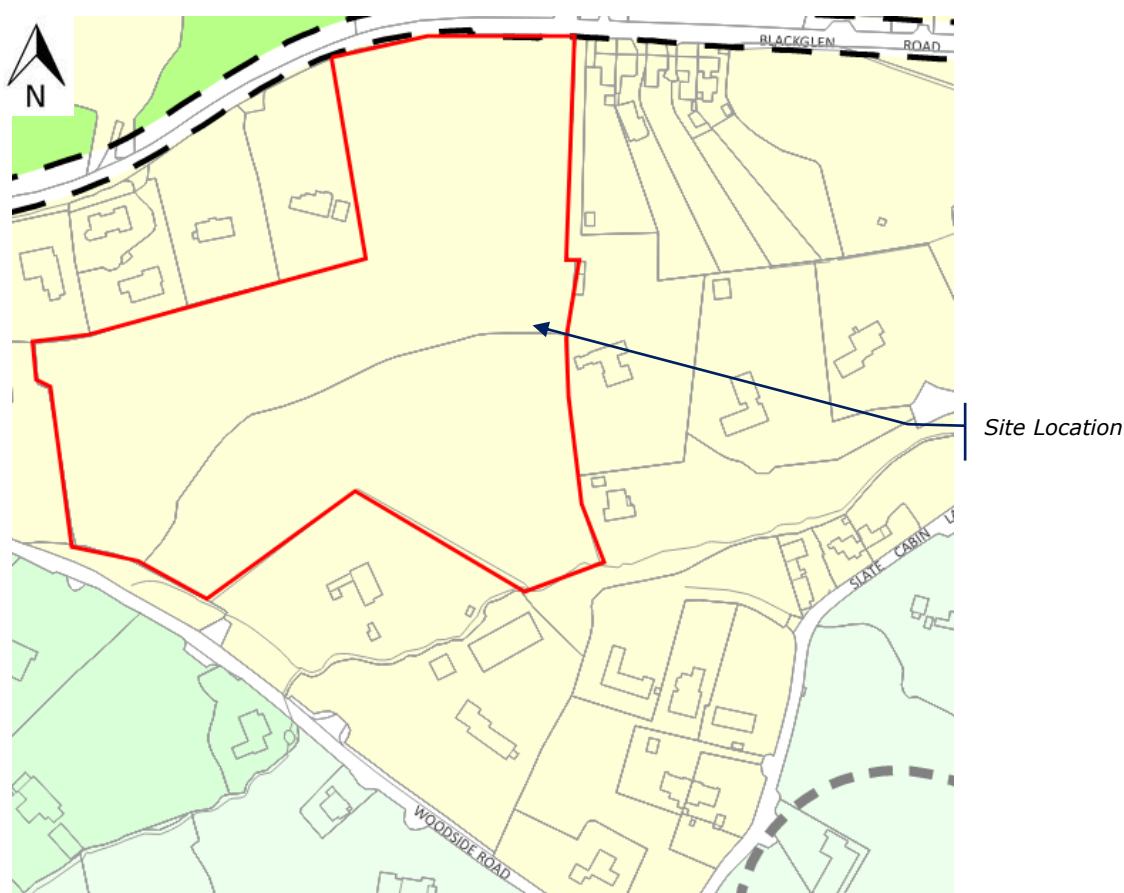


Figure 2-1: Extract from the Land Use Zoning Maps (Dún Laoghaire-Rathdown County Development Plan 2022-2028)

2.3 Proposed Development Context

The development shall consist of a new residential scheme comprising 360 no. residential units, associated resident amenity facilities and a childcare facility in the form of 9 no. new apartment buildings (A1 – C3) as follows:

- Block A1 (4 storeys) comprising 18 no. apartments (3 no. 1 bed units and 15 no. 2 bed units); a crèche facility of approx. 401 sq. m with associated outdoor play space of approx. 20 sq. m; and resident amenity facilities of approx. 30 sq. m.
- Block A2 (3-4 storeys) comprising 24 no. apartments (2 no. 1 bed units and 22 no. 2 bed units) and resident amenity facilities of approx. 390m².
- Blocks B1 and B2 (2-6 storeys) comprising 69 no. apartments (30 no. 1 bed units, 34 no. 2 bed units, 5 no. 3 bed units).
- Blocks B3 and B4 (2-6 storeys) comprising 62 no. apartments (30 no. 1 bed units, 27 no. 2 bed units and 5 no. 3 bed units).
- Blocks C1, C2 and C3 (3-6 storeys) comprising 187 no. apartments (58 no. 1 bed units, 126 no. 2 bed units and 3 no. 3 bed units); and resident amenity facilities of approx. 187.5 sq. m.

Each residential unit is afforded with associated private open space in the form of a terrace / balcony.

Total Open space (approx. 22,033 sq. m) is proposed in the form of public open space (approx. 17,025 sq. m), and residential communal open space (approx. 5,008 sq. m).

Podium level / basement level areas are proposed adjacent to / below Blocks A2, B1, B2, B3, B4, C1, C2 and C3 (approx. 12,733 sq. m GFA). A total of 419 no. car parking spaces (319 no. at podium/basement level and 100 no. at surface level); to include 80 no. electric power points and 26 no. accessible parking spaces; and 970 no. bicycle spaces (740 no. long term and 230 no. short term), and 19 no. Motorcycle spaces are proposed. 10 no. car spaces for creche use are proposed at surface level.

Vehicular/pedestrian and cyclist access to the development will be provided via Blackglen Road to tie in with the Blackglen Road Improvement Scheme. A second access is also proposed via Woodside Road for emergency vehicles, pedestrian and cyclist access only.

The proposal also provides for Bin Storage areas and 4 No. ESBN substations to supply the development. 3 no. sub-stations shall be integrated within the building structures of Blocks B and Blocks C. In addition, one Sub-station shall be classed as a unit sub-station mounted externally on a dedicated plinth.

The associated site and infrastructural works include provision for water services; foul and surface water drainage and connections; attenuation proposals; permeable paving; all landscaping works; green roofs; boundary treatment; internal roads and footpaths; electrical services; and all associated site development works.



Figure 1-2: Site Layout

3 RELEVANT GUIDANCE

3.1 The Planning System and Flood Risk Management Guidelines

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

The Flood Risk Management Guidelines give guidance on flood risk and development. The guidelines recommend a precautionary approach when considering flood risk management in the planning system.

The core principle of the guidelines is to adopt a flood risk sequential approach to managing flood risk and to avoid development in areas that are at risk. The sequential approach is based on the identification of flood zones for river and coastal flooding. The guidelines include definitions of Flood Zones A, B and C. It should be noted that these do not consider the presence of flood defences, as there remain risks of overtopping and breach of the defences.

Table 3-1: Flood Risk Zones

Zone A	High Probability of Flooding Where the annual probability of flooding is: greater than 1% for fluvial flooding or greater than 0.5% for coastal flooding
Zone B	Moderate Probability of Flooding Where the annual probability of flooding is: between 0.1% and 1% for fluvial flooding or between 0.1% and 0.5% for coastal flooding
Zone C	Low Probability of Flooding Where the annual probability of flooding is: less than 0.1% for fluvial flooding and less than 0.1% for coastal flooding

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

3.2 Dún Laoghaire-Rathdown County Development Plan 2022 – 2028

The Dún Laoghaire-Rathdown County Development Plan 2022 – 2028 identifies a number of policies relating to flooding, some are outlined below:

EI21: Catchment Flood Risk Assessment and Management (CFRAM)

EI22: Flood Risk Management

EI24: Coastal Defence

3.3 Strategic Flood Risk Assessment for Dún Laoghaire-Rathdown CDP 2022-2028

A Strategic Flood Risk Assessment (SFRA) was prepared in conjunction with the Dún Laoghaire-Rathdown County development Plan 2022-2028 by JBA. The SFRA includes flood maps and review of the flood risk to the 'Carrickmines/Shanganagh' river catchment.

3.4 Climate Change

Both the Greater Dublin Strategic Drainage Study (GDSDS) and PSFRM Guidelines require that account be taken of the effects of climate change over the design life of a development, typically 100 years. Design parameters to take account of climate change were established in the GDSDS and revised following later studies and Climate Change Sectorial Adaptation Plan Flood Risk Management (2015-2019) Development published by the OPW. These parameters are set out in Table 3-2, below.

Table 3-2: Climate Change - Impact on Design Parameters

Design Category	Impact of Climate Change
Drainage	20% increase in rainfall
Fluvial (River)	20% increase in flood flow
Tidal/Coastal	Sea level rise of 500 mm ¹

4 FLOOD RISK IDENTIFICATION

4.1 Existing Hydrological Environment

The Carrickmines/Shanganagh Stream is located along the south-eastern boundary of the site, see Figure 4-1. The development is set back approximately 25m from the Carrickmines Stream.



Figure 4-1: Existing Hydrological Environment

4.2 Existing Surface Water Drainage

There is no existing surface water network on the site.

As part of the proposed development, a new surface water network will be constructed to manage all surface water onsite. Please refer to OCSC Engineering Services Report for details.

The proposed gravity network for the development is to be discharged to the new surface water sewer on Blackglen Rd., which bounds the site to the north of the site.

4.3 Topographical Survey

The Site is generally graded towards south of the site with the highest point of the site being located at the south-west boundary and is approximately +160.12m AOD with lowest the point being located at the north-east boundary of the site and is approximately +138.72m AOD. This gives a typical gradient of approximately 8.2% across the site.

4.4 Historical Maps

The historical 6" (1837 – 1842) and the 25" (1888 – 1913) mapping have been examined. Historical mapping is often a very useful source of information for assessing the flood history of an area. The historical maps examined do not indicate flooding in the area proposed for this development.

4.5 Historical Flooding

The Office of Public Works (OPW) gathers and collates data from reported flood events throughout the country. From a review of the OPW's National Flood Hazard Mapping database (www.floodmaps.ie), there are no reported incidents of flooding in the vicinity of the site.

Please see Past Flood Event Local Area Summary Report included in Appendix C which summarises all past flood events within 2.5 kilometres of the site.

Figure 4-2 shows the historical reported flood events in area surrounding the site. There are no reports of flooding occurring within the proposed site or in the vicinity of the proposed site.



Figure 4-2: National Flood Hazard Mapping

4.6 Groundwater Flooding

An assessment of the flood risk posed by ground water is currently generated by Geological Survey Ireland (GSI) and will be openly available information when published. There are no reported incidents of ground water flooding in the vicinity of the site, see Figure 4-3.

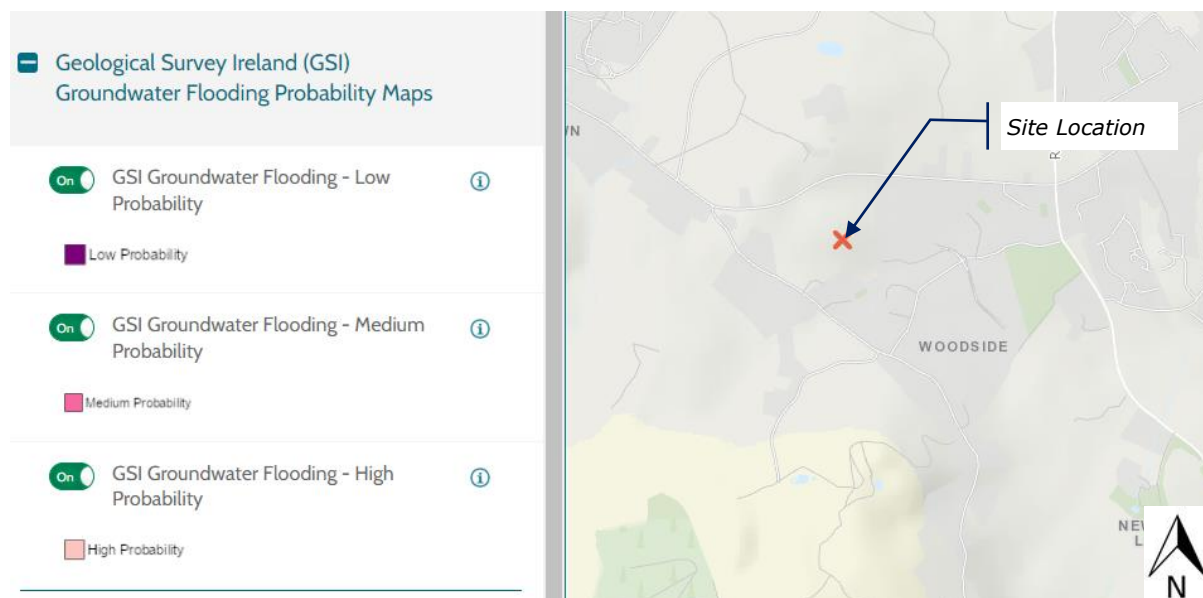


Figure 4-3: Extract from www.floodinfo.ie GSI Groundwater Flooding Probability Maps

According to data obtained from the GSI the subject site is located on Bedrock at or close to surface. Refer to Figure 4-6.

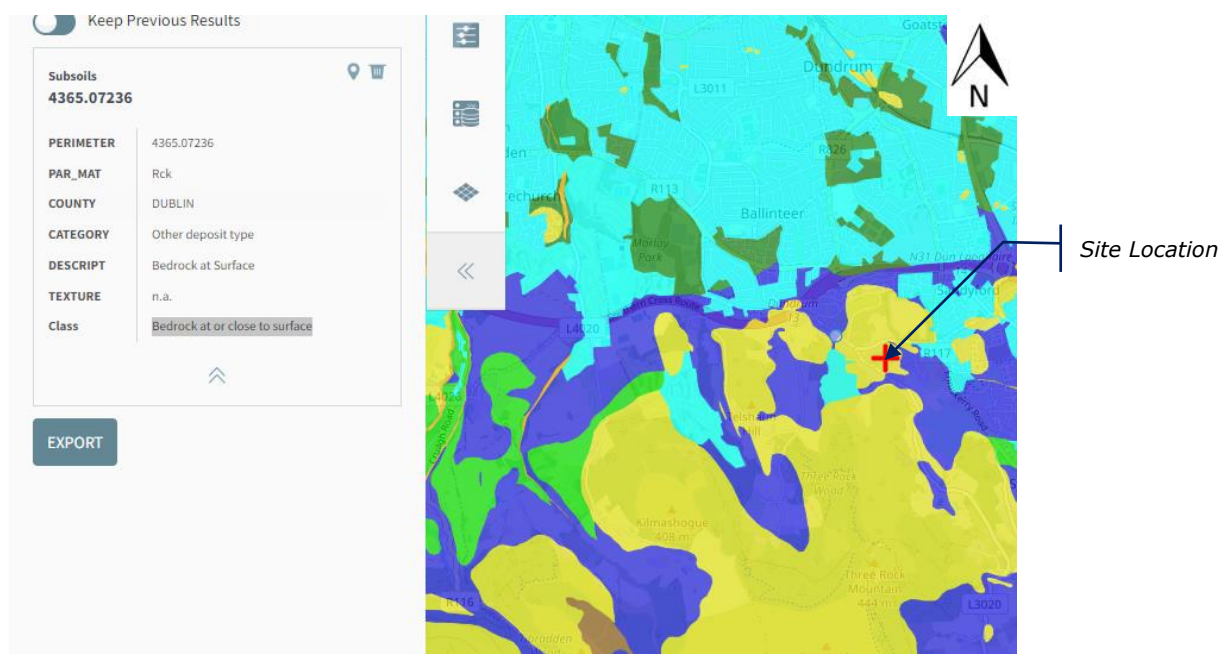


Figure 4-6: Extract from the EPA maps - subsoils

The site is located on a Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones (refer to Figure 4-7).

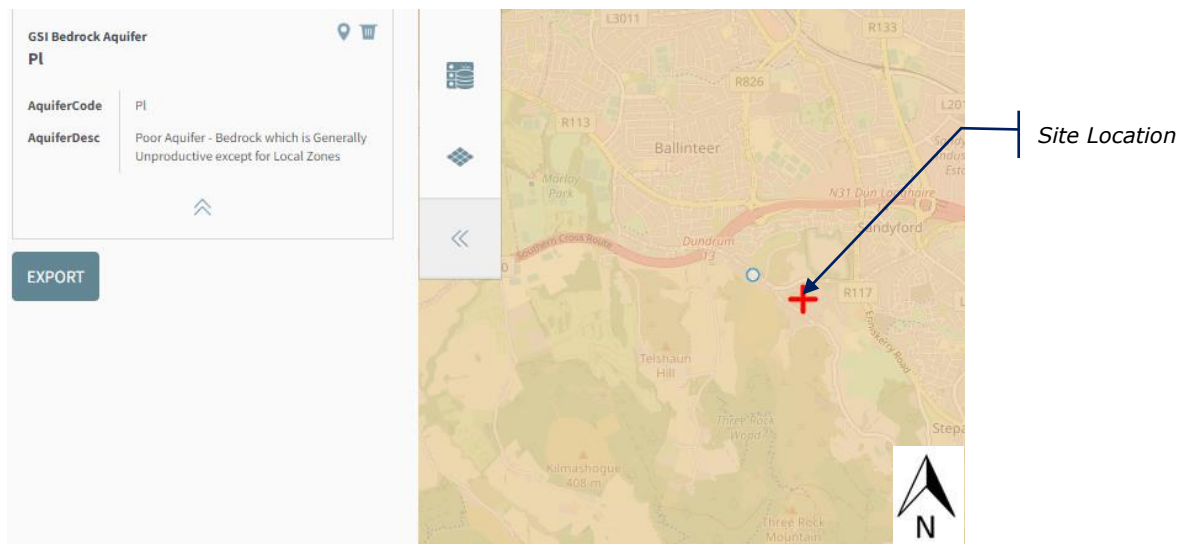


Figure 4-7: Extract from the EPA maps – GSI Bedrock Aquifer

The groundwater vulnerability assessment of the site shows that the vulnerability of groundwater in the area is High (refer to Figure 4-8).

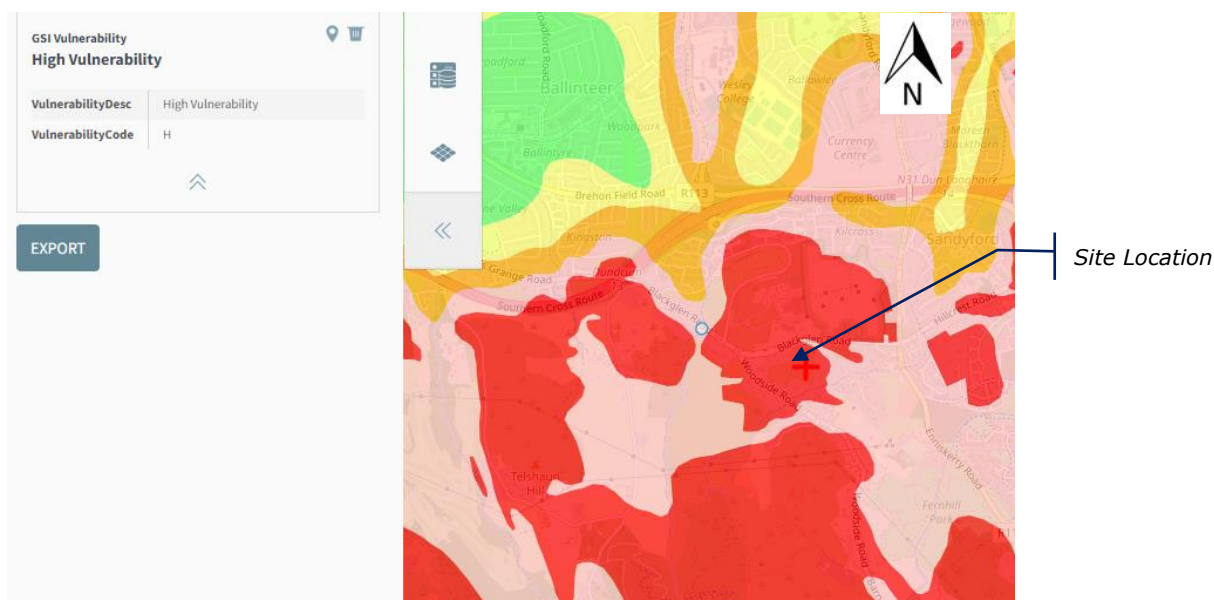


Figure 4-8: Extract from the EPA maps – GSI Vulnerability

4.7 Preliminary Flood Risk Assessment

The Catchment Flood Risk Assessment and Management Study (CFRAMS) is a national programme which to date has produced both a series of Preliminary Flood Risk Assessments (PFRA) which cover the entire country, as well as more detailed flood maps in certain catchments across the country.

Prior to the publication of the detailed CFRAMS flood mapping, a series of Preliminary Flood Risk Assessment (PFRA) maps were published. These maps indicated preliminary tidal and fluvial flood zones along with pluvial and groundwater risks.

These maps have been superseded by the more detailed CFRAMS maps in the area surrounding the site for tidal and fluvial flood risk.

Refer to Figure 4.9 for details of the predicted pluvial flood extent. The extent of the area modelled to show pluvial flooding does not extend to the area of the proposed development..

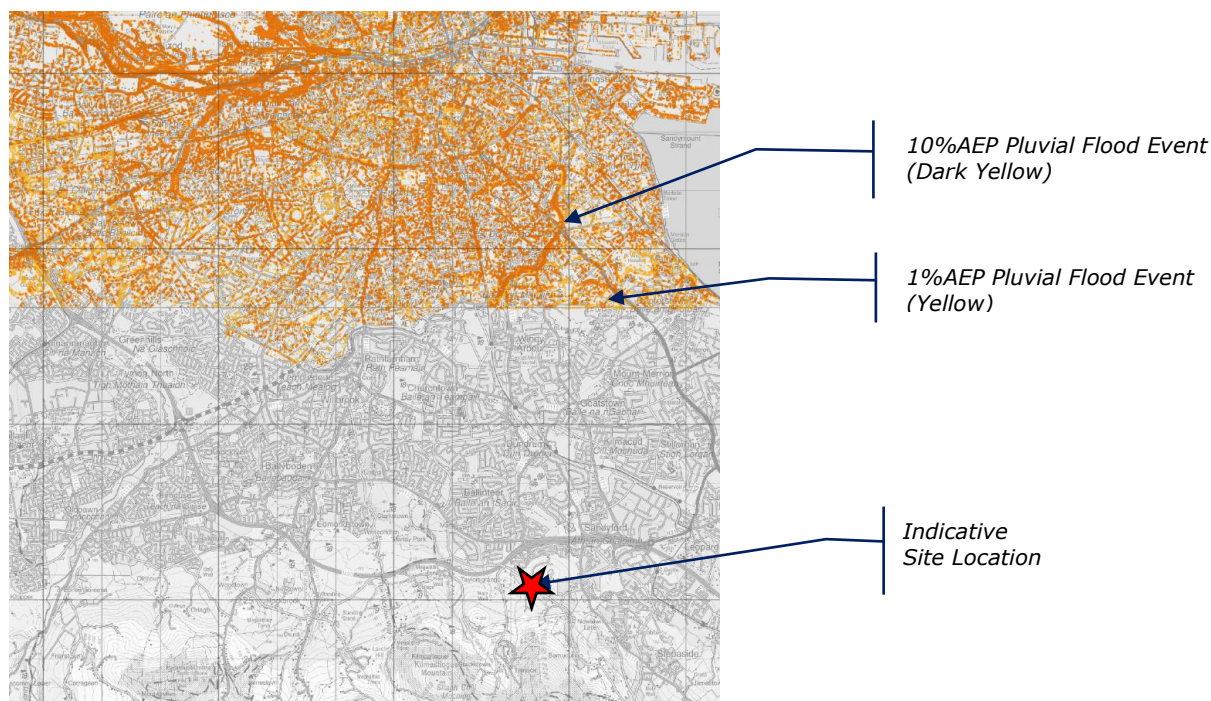


Figure 4-9: Preliminary Flood Risk Assessment Pluvial Flooding

The proposed development includes the construction of a new surface water network which will manage surface water runoff onsite and mitigate the risk of pluvial flooding onsite.

4.8 Catchment Flood Assessment and Management

The OPW in conjunction with Dublin City Council have developed the Flood Risk and Hazard maps as part of the CFRAMS programme. The site of the proposed development has been included in the CFRAMS model.

Figure 4-10 below is an extract from the CFRAM fluvial flood map for the area surrounding the proposed development site. Full CFRAMS maps for the area are included in Appendix E of this report. The flood map indicates that the site lies outside the 1 in 100 and 1 in 1000-year fluvial flood extents.

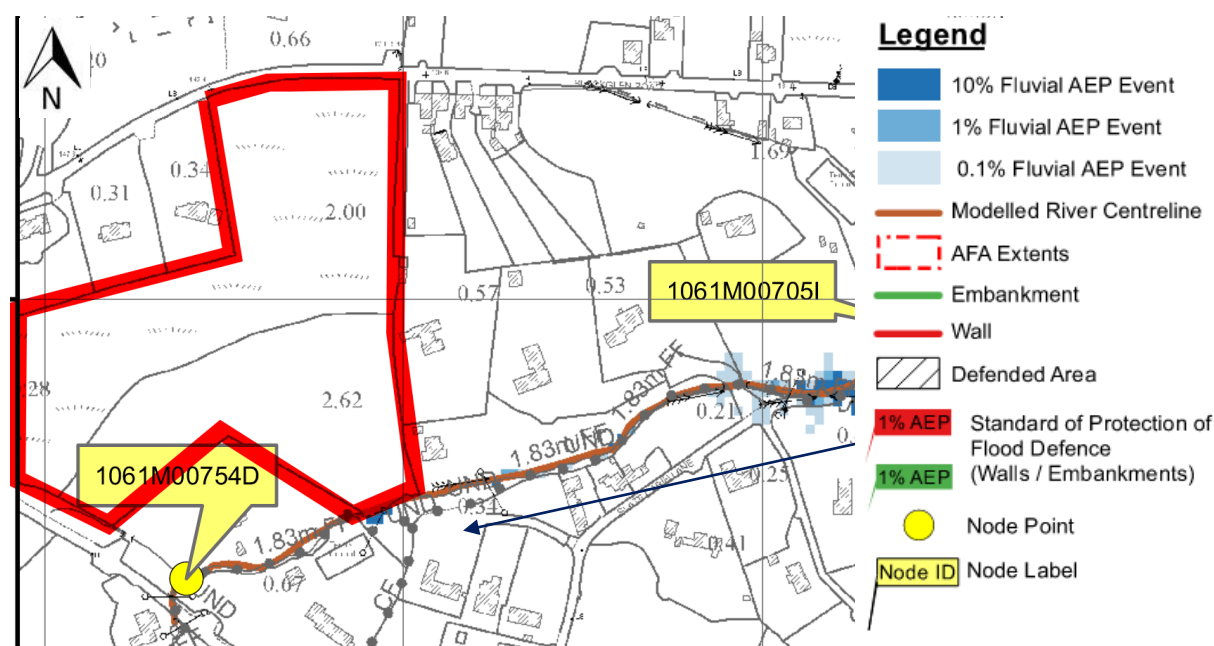


Figure 4-10: Extract from CFRAM maps

The site is not identified as being within a defended area.

4.9 Dún Laoghaire-Rathdown County Development Plan Strategic Flood Risk Assessment

The Dun Laoghaire Rathdown Council Development Plan 2022-2028 Strategic Flood Risk Assessment outlines the flood risk in the area associated with the "Carrickmines/Shanganagh" catchment. The flood extents shown in Figure 4-11 are taken from CFRAMS mapping.

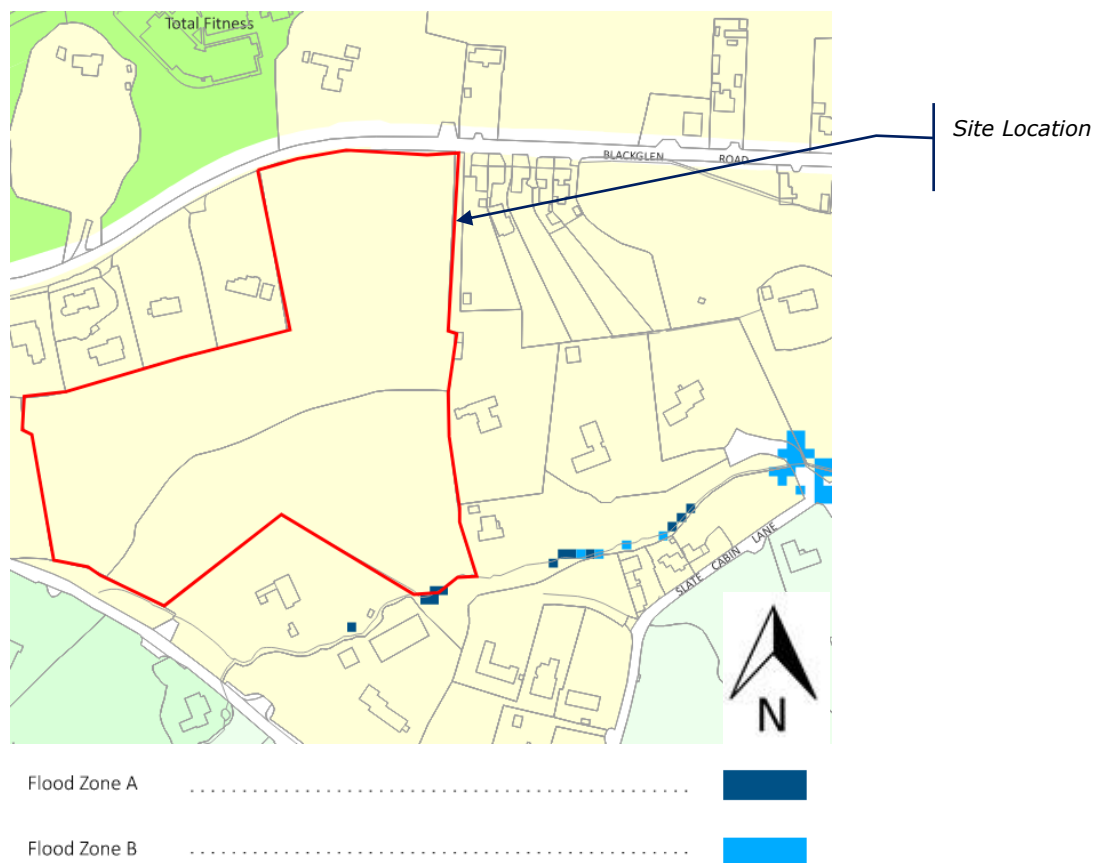


Figure 4-11: Extract from the Strategic Flood Risk Assessment for DLR CDP 2022-2028

This review identifies the majority of the site is in Flood zone C. It notes that development in the area should be accompanied with a detailed FRA, which must include for the design of finished floor levels in excess of the 100-year flood level plus climate change and freeboard.

This site specific flood risk assessment report addresses any such concerns, and confirms that all proposed development is clearly located in Flood Zone C, with all FFLs having sufficient freeboard to the 100-year flood level.

5 FLOOD RISK ASSESSMENT

5.1 Sources of Flooding

Fluvial Flooding

Fluvial flooding is the result of a river exceeding its capacity and excess water spilling out onto the adjacent floodplain. The proposed site is located close to the Carrickmines/Shanganagh Stream. The CFRAM maps indicate that the site is located in Flood Zone C except of the southern site boundary which aligns with flood zone A but as indicated by the pixelated flood extent on the maps, this appears to be confined to the stream channel and no alterations of existing levels in that area will occur.

Pluvial Flooding

Pluvial flooding is the result of rainfall-generated overland flows which arise before run-off can enter any watercourse or sewer. It is usually associated with high-intensity rainfall.

The proposed development includes the construction of a new surface water network which will manage surface water runoff onsite and mitigate the risk of pluvial flooding onsite.

Coastal Flooding

Coastal flooding is the result of sea levels which are higher than normal and result in sea water overflowing onto the land during high tides or storm surges. Given the location of the site of the proposed development, we consider that tidal flooding does not pose a flood risk in the area.

Groundwater Flooding

Groundwater flooding occurs when the level of the water stored in the ground rises as a result of prolonged rainfall. There are number basements proposed as part of this development; therefore, the risk of groundwater must be considered.

5.2 Development Vulnerability

The *PSFRM Guidelines* classify potential development in terms of its vulnerability to flooding. The types of development falling within each vulnerability class are described in *Table 3.1* of the *PSFRM Guidelines*, which is reproduced in Table 5-1.

Table 5-1: Development Vulnerability Class

Vulnerability Class	Land uses and types of development which include:
Highly vulnerable development (including essential infrastructure)	<p>Garda, ambulance and fire stations and command centres required to be operational during flooding;</p> <p>Hospitals;</p> <p>Emergency access and egress points;</p> <p>Schools;</p> <p>Dwelling houses, student halls of residence and hostels;</p> <p>Residential institutions such as residential care homes, children's homes and social services homes;</p> <p>Caravans and mobile home parks;</p> <p>Dwelling houses designed, constructed or adapted for the elderly or, other people with impaired mobility; and</p> <p>Essential infrastructure, such as primary transport and utilities distribution, including electricity generating power stations and sub-stations, water and sewage treatment, and potential significant sources of pollution (SEVESO sites, IPPC sites, etc.) in the event of flooding</p>
Less vulnerable development	<p>Buildings used for: retail, leisure, warehousing, commercial, industrial and non-residential institutions;</p> <p>Land and buildings used for holiday or short-let caravans and camping, subject to specific warning and evacuation plans;</p> <p>Land and buildings used for agriculture and forestry;</p> <p>Waste treatment (except landfill and hazardous waste);</p> <p>Mineral working and processing; and</p> <p>Local transport infrastructure.</p>
Water-compatible development	<p>Flood control infrastructure;</p> <p>Docks, marinas and wharves;</p> <p>Navigation facilities;</p> <p>Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location;</p> <p>Water-based recreation and tourism (excluding sleeping accommodation);</p> <p>Lifeguard and coastguard stations;</p> <p>Amenity open space, outdoor sports and recreation and essential facilities such as changing rooms; and</p> <p>Essential ancillary sleeping or residential accommodation for staff required by uses in this category (subject to a specific warning and evacuation plan).</p>

The proposed development comprises of residential units and therefore, is considered to be **Highly Vulnerable Development**.

The *PSFRM Guidelines* define the zones in which each class of development is appropriate – this is summarised in Table 5-2. The *PSFRM Guidelines* recognises that flood risks should not be the only deciding factor in zoning for development. They also recognise that circumstances will exist where development of a site within a floodplain is desirable; in order to achieve compact and sustainable development of the core of urban settlements. In order to allow consideration of such development, the *PSFRM Guidelines* provide a **Justification Test**, which establishes the criteria under which desirable development of a site in a floodplain may be warranted.

Table 5-2: "Appropriateness" 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 the proposed development is considered highly vulnerable and no residential buildings are within Flood Zone A as per the DLR CDP, a Justification Test **is not required**.

5.3 Mitigation Measures

With reference to the above, a review of flood maps obtained from the OPW indicate that the site falls outside the 1 in 1000-year flood extent.

While there is no flooding shown onsite, mitigation measures in line with the Strategic Flood Risk Assessment for DLR CDP 2022-2028 are considered below.

5.3.1 Infrastructure

The proposed development includes the construction of a surface water network which consists of SuDS measures which will minimize the impact to the receiving environment and manage the pluvial flood risk at the site. Please refer to OCSC Engineering Services Report for details.

The proposed surface water network has been designed with an allowance for climate change as per the Dun Laoghaire Rathdown CDP 2022-2028.

5.3.2 Infrastructure Blockage

The proposed development includes the construction of a surface water network which consists of SuDS measures which will minimize the impact to the receiving environment and manage the pluvial flood risk at the site. Please refer to OCSC Engineering Services Report for details.

The proposed surface water network has been designed with an allowance for climate change as per the Dun Laoghaire Rathdown CDP 2022-2028. The proposed drainage system to be maintained on a regular basis to reduce the risk of a blockage.

5.3.3 Emergency Access & Egress

It is necessary to ensure that access and egress will remain possible to the development in the event of an emergency during an extreme flood event.

In the event of storms exceeding the 100-year design capacity of the drainage system, then possible flood routing for overland flows towards open green space to the east should not be blocked.

5.4 Flood Risk Management

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

As noted above, emergency access can be maintained to and from the site in the event of a flood. The proposed development is located outside the 1 in 1000-year flood extent.

6 CONCLUSIONS AND RECOMMENDATIONS

The assessment is carried out in full compliance with the requirements of “The Planning System & Flood Risk Management Guidelines” published by the Department of the Environment, Heritage and Local Government in November 2009.

As detailed with in the previous sections of this report, the proposed buildings for this development are located within Flood Zone C except of the southern site boundary which aligns with flood zone A but this appears to be confined to the Carrickmines stream channel and no alterations of existing levels in that area will occur.

Pluvial and groundwater flooding will be managed through the implementation of the mitigation measures outlined in Section 5.3. Therefore, in accordance with the Planning System and Flood Risk Management Guidelines for Planning Authorities, there is no significant risk for flooding in the proposed development and it appropriate for use.

6.1 Recommendations

It has been demonstrated in the earlier sections that the site is not at risk of flooding from external sources, or as result of the proposed development.

In order to minimise the risk of flooding within the development, it is recommended that all drainage infrastructure is designed and installed in accordance with the relevant standards.

The proposed units are located outside the 1 in 1000-year flood extents and above the 1 in 1000-year flood level.

APPENDIX A. PROPOSED SITE LAYOUT

Appendix A

Proposed Site Layout



Second Floor Level Site Plan

36.1

36.1

36.1

RELEVANT CPO STRIP

RELEVANT CPO STRIP

RELEVANT CPO STRIP

APPLICATION SITE 3.70 Ha OUTLINED IN RED

LANDS IN OWNERSHIP OF APPLICANT (CIRCA 4.022 Ha OUTLINED IN BLUE)

CPO LANDS (SHADED IN YELLOW)

Scale @ A0: 1:500

Date Printed: 08/09/22

Current Rev: -

Project Code: 20006

Project Lead: DM

Drawn By: FCN

Job No.: 20006

Purpose: PLANNING

Client: Zolbury Ltd

Location: Blackglen Road, Lambs Cross, Sandyford, Dublin 18

Drawing Title: Proposed Site Plan

Drawing No.: 20006-DWP-00-ZZ-DR-A-1002

Revision Description

Date

Rev. No.

Issued by

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architectural urban design

Dublin

Cork

architectural urban design

Dublin

Cork

architectural urban design

Dublin

Cork

Project Lead: DM

Drawn By: FCN

Job No.: 20006

Purpose: PLANNING

Scale @ A0: 1:500

Date Printed: 08/09/22

Current Rev: -

APPENDIX B. TOPOGRAPHICAL SURVEY

Appendix B

Topographical Survey

APPENDIX C. PAST FLOOD SUMMARY REPORT

Appendix C

Past Flood Summary Report

Past Flood Event Local Area Summary Report

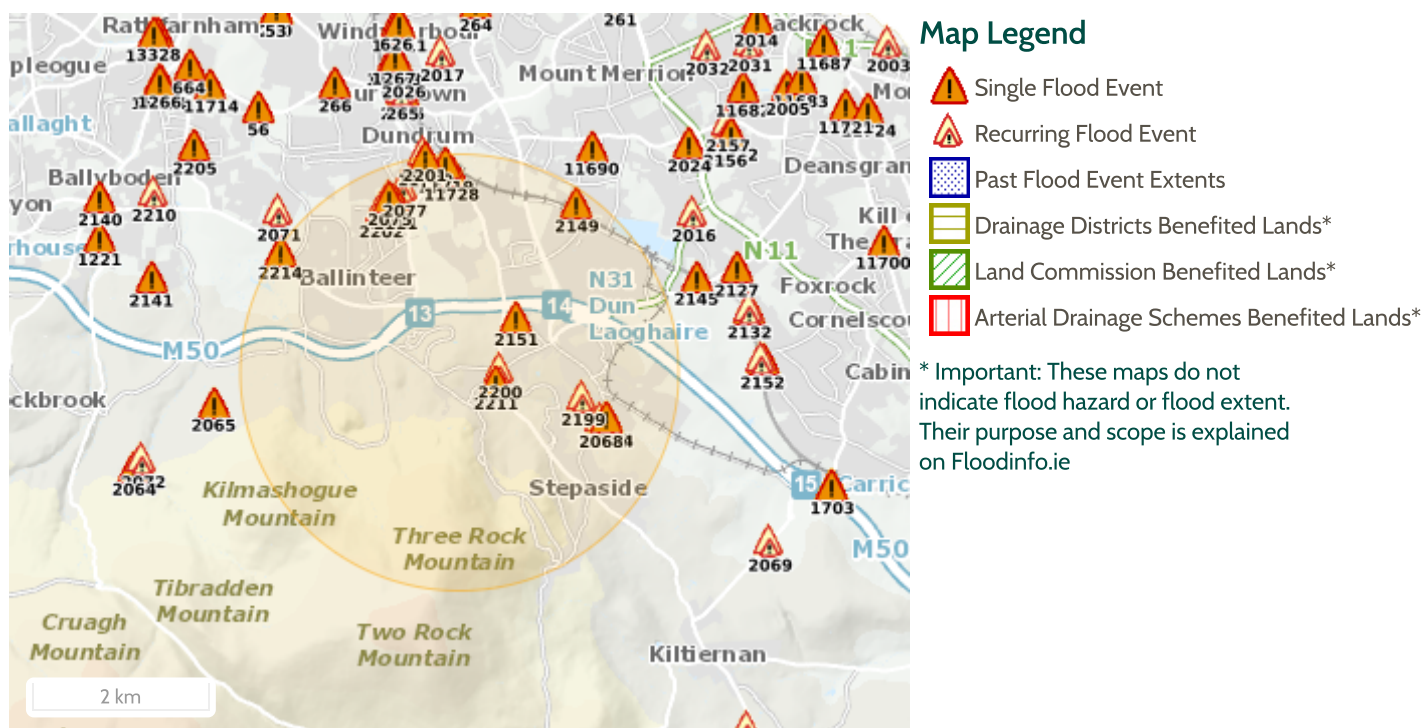


OPW Oifig na nOibreacha Poiblí
Office of Public Works

Report Produced: 3/6/2022 12:36

This Past Flood Event Summary Report summarises all past flood events within 2.5 kilometres of the map centre.

This report has been downloaded from www.floodinfo.ie (the "Website"). The users should take account of the restrictions and limitations relating to the content and use of the Website that are explained in the Terms and Conditions. It is a condition of use of the Website that you agree to be bound by the disclaimer and other terms and conditions set out on the Website and to the privacy policy on the Website.














Map Legend

- Single Flood Event
- Recurring Flood Event
- Past Flood Event Extents
- Drainage Districts Benefited Lands*
- Land Commission Benefited Lands*
- Arterial Drainage Schemes Benefited Lands*

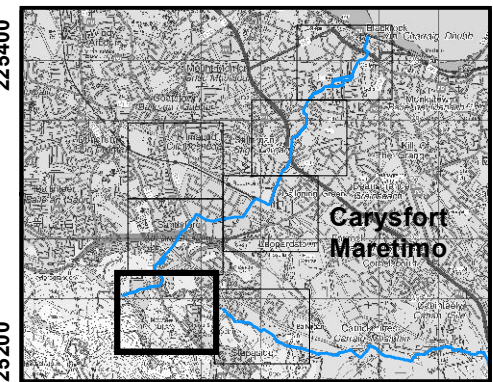
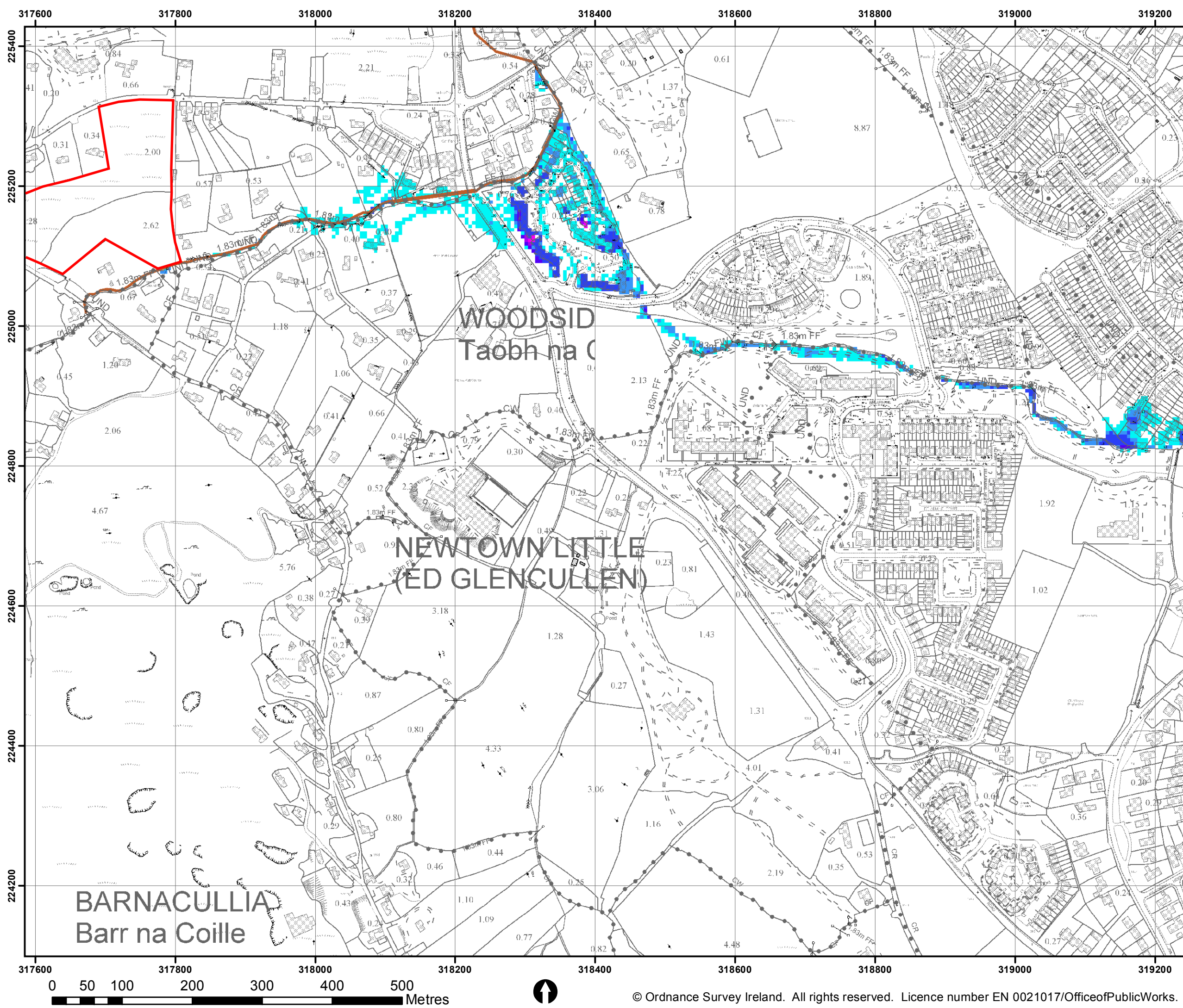
* Important: These maps do not indicate flood hazard or flood extent. Their purpose and scope is explained on Floodinfo.ie

17 Results

Name (Flood_ID)	Start Date	Event Location
1. Slang Old Ballinteer Road Recurring (ID-2077) Additional Information: Reports (4) Press Archive (0)	n/a	Exact Point
2. Kilgobbin Road Recurring (ID-2068) Additional Information: Reports (2) Press Archive (0)	n/a	Exact Point
3. Pine Copse Willow Road Recurring (ID-2075) Additional Information: Reports (2) Press Archive (0)	n/a	Exact Point
4. Ashlawn Ballinteer Road June 1993 (ID-2111) Additional Information: Reports (1) Press Archive (0)	11/06/1993	Approximate Point
5. Lakelands Close Stillorgan Jan 1980 (ID-2149) Additional Information: Reports (1) Press Archive (0)	21/01/1980	Approximate Point
6. Sandyford Church Jan 1980 (ID-2151) Additional Information: Reports (1) Press Archive (0)	21/01/1980	Exact Point

Name (Flood_ID)	Start Date	Event Location
7.  Carrickmines River Sandyford Hall Recurring (ID-2199) Additional Information: Reports (1) Press Archive (0)	n/a	Exact Point
8.  Ballyogan Stream Lambs Cross Recurring (ID-2200) Additional Information: Reports (1) Press Archive (0)	n/a	Exact Point
9.  Ludford Area Ballinteer Recurring (ID-2202) Additional Information: Reports (1) Press Archive (0)	n/a	Approximate Point
10.  School House Lane Sandyford Nov 1982 (ID-2211) Additional Information: Reports (1) Press Archive (0)	26/11/1982	Approximate Point
11.  Little Dargle Grange Road Nov 1982 (ID-2214) Additional Information: Reports (1) Press Archive (0)	07/11/1982	Approximate Point
12.  Flooding at Willow Bank Apartments, Sandyford Rd, Dublin 14 on 24th Oct 2011 (ID-11728) Additional Information: Reports (1) Press Archive (0)	24/10/2011	Exact Point
13.  Flooding at Riverdale, Dundrum, Dublin 14 on 24th Oct 2011 (ID-11719) Additional Information: Reports (1) Press Archive (0)	24/10/2011	Exact Point
14.  Flooding at Dundrum Shopping Centre and Taney Cross, Co. Dublin on 24th Oct 2011 (ID-11720) Additional Information: Reports (1) Press Archive (0)	24/10/2011	Exact Point
15.  Pine Copse Road Ballinteer Nov 1982 (ID-2137) Additional Information: Reports (1) Press Archive (0)	05/11/1982	Exact Point
16.  Flooding at Clonskeagh Road, Dublin 6 on 24th Oct 2011 (ID-11704) Additional Information: Reports (1) Press Archive (0)	24/10/2011	Exact Point
17.  Flooding at Kilgobbin Road, Stepside, Co. Dublin on 24th Oct 2011 (ID-11712) Additional Information: Reports (1) Press Archive (0)	24/10/2011	Exact Point

APPENDIX D. OPW CFRAM MAPS



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

Legend

0.1% Fluvial AEP Flood Depth

- 0 - 0.25m
- 0.25 - 0.5m
- 0.5 - 1m
- 1.0 - 1.5m
- 1.5 - 2m
- >2m

Modelled River Centreline

AFA Extents

FINAL		
REV: 01	NOTE: Amendment to Label.	DATE: 08/12/16





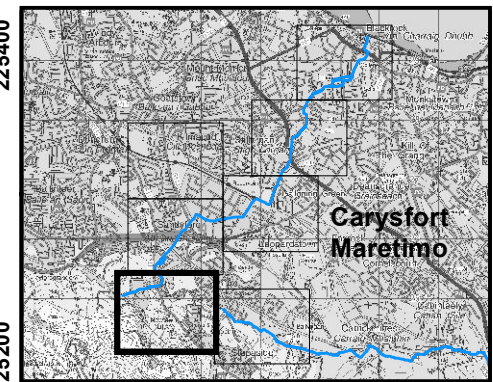
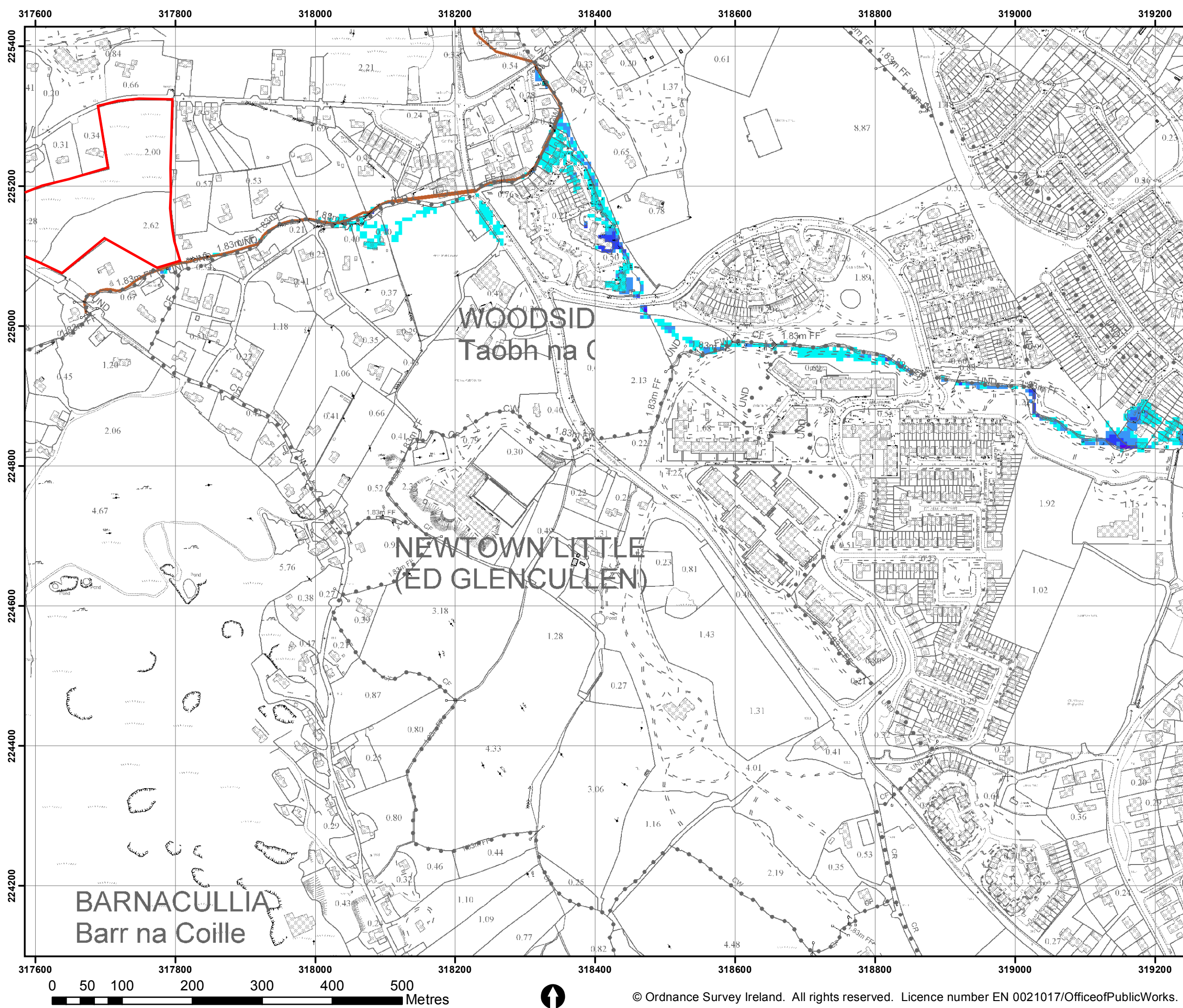
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Jonathan Swift Street
Trim
Co Meath



Elmwood House
74 Boucher Road
Belfast
BT12 6RZ

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

Map:	
Carysfort Maretime Fluvial Flood Depths	
Map Type:	DEPTH
Source:	FLUVIAL
Map Area:	HPW
Scenario:	CURRENT
Drawn By:	C.McG. Date: 27 October 2017
Checked By:	A.S. Date: 27 October 2017
Approved By:	G.G. Date: 27 October 2017
Drawing No.:	
E09CAR_DPFCD001_F2_02	
Map Series: Page 2 of 7	
Drawing Scale: 1:5,000 @A3	



IMPORTANT USER NOTE:
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AND CONDITIONS OF USE THAT
ACCOMPANY THIS MAP.

Legend

1% Fluvial AEP Flood Depth

- 0 - 0.25m
- 0.25 - 0.5m
- 0.5 - 1m
- 1.0 - 1.5m
- 1.5 - 2m
- >2m

- Modelled River Centreline
- AFA Extents

FINAL

REV:	NOTE:	DATE:
01	Amendment to Label.	08/12/16

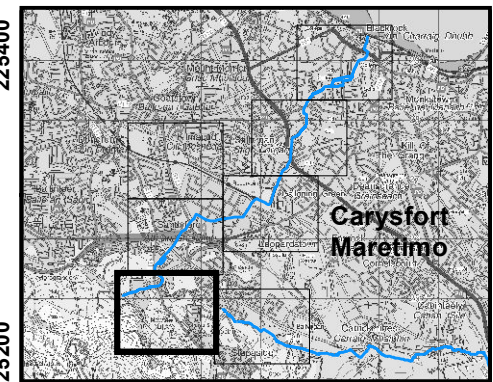
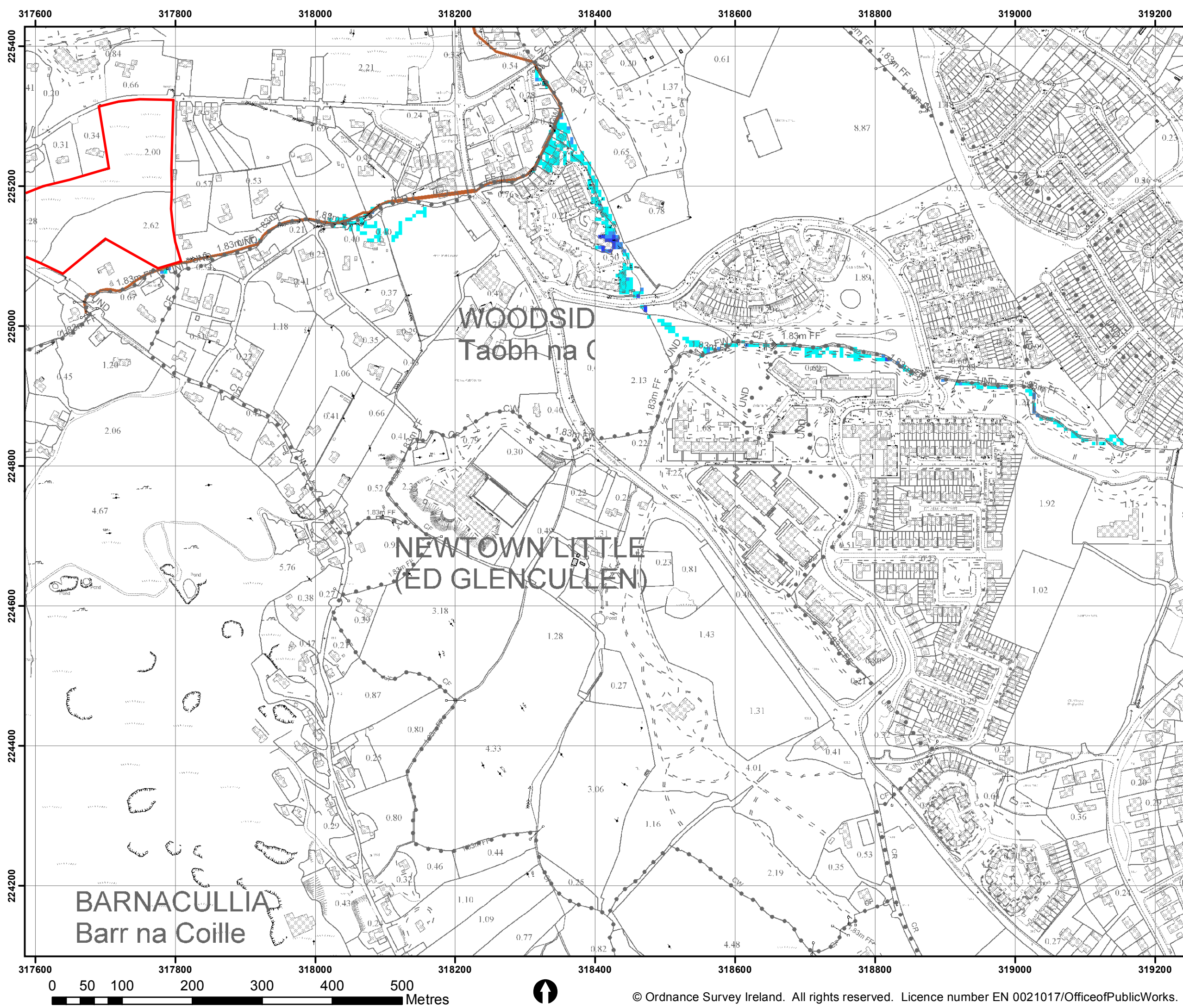


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Co Meath

Elmwood House
74 Boucher Road
Belfast
BT12 6RZ

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E ireland@rpsgroup.com

Map: Carysfort Maretimo Fluvial Flood Depths	
Map Type:	DEPTH
Source:	FLUVIAL
Map Area:	HPW
Scenario:	CURRENT
Drawn By :	C.McG.
Date :	27 October 2017
Checked By :	A.S.
Date :	27 October 2017
Approved By :	G.G.
Date :	27 October 2017
Drawing No. : E09CAR_DPFCD010_F2_02	
Map Series : Page 2 of 7	
Drawing Scale : 1:5,000 @A3	



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AND CONDITIONS OF USE THAT
ACCOMPANY THIS MAP.

Legend

10% Fluvial AEP Flood Depth

- 0 - 0.25m
- 0.25 - 0.5m
- 0.5 - 1m
- 1.0 - 1.5m
- 1.5 - 2m
- >2m

Modelled River Centreline

AFA Extents

FINAL		
REV:	NOTE:	DATE:
01	Amendment to Label.	08/12/16





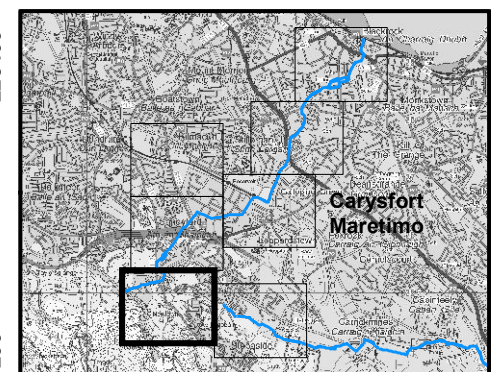
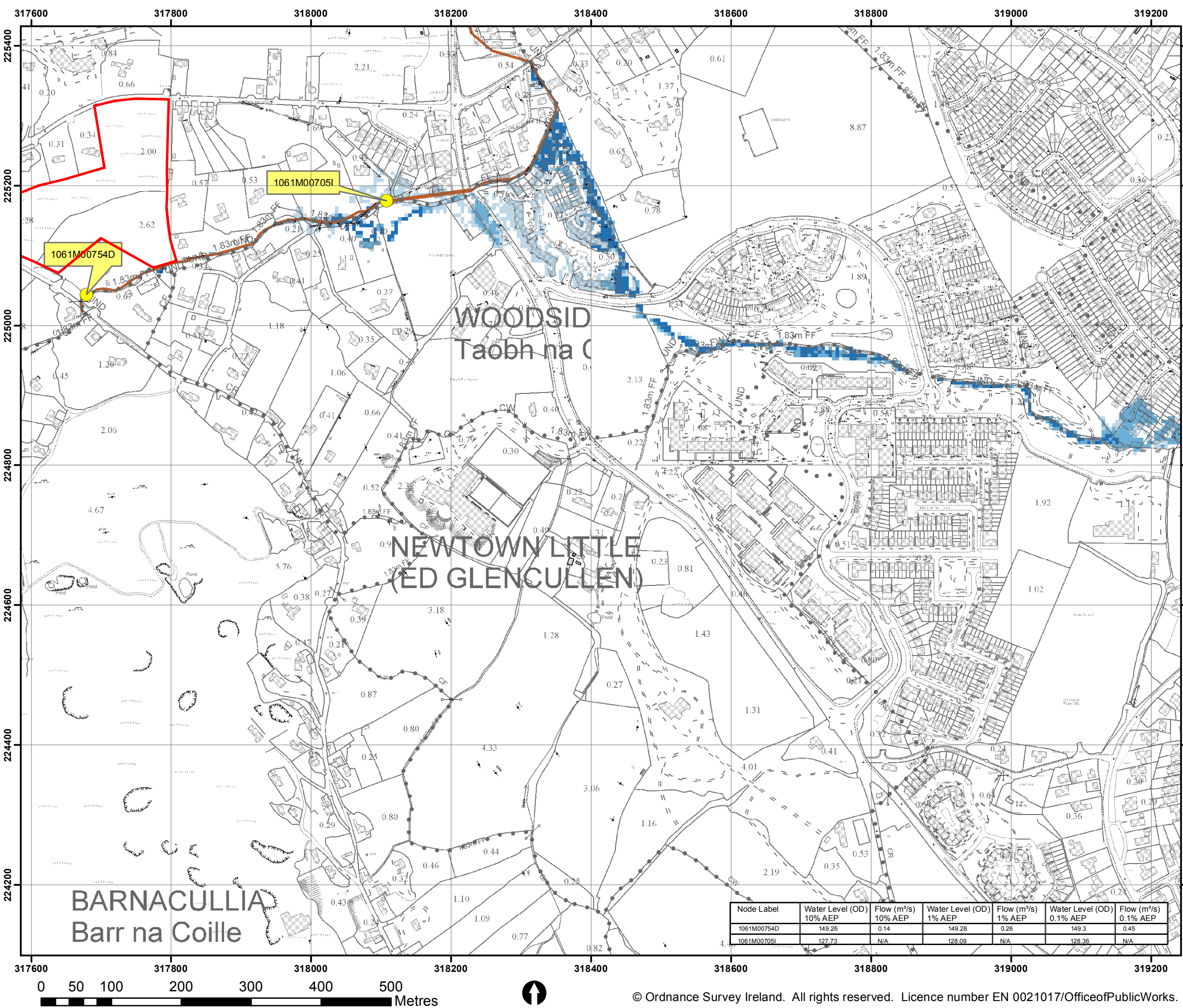
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74 Boucher Road
Belfast
BT12 6RZ

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E ireland@rpsgroup.com

Map:	
Carysfort Maretimo Fluvial Flood Depths	
Map Type:	DEPTH
Source:	FLUVIAL
Map Area:	HPW
Scenario:	CURRENT
Drawn By :	C.McG. Date : 27 October 2017
Checked By :	A.S. Date : 27 October 2017
Approved By :	G.G. Date : 27 October 2017
Drawing No. :	
E09CAR_DPFCD100_F2_02	
Map Series : Page 2 of 7	
Drawing Scale : 1:5,000 @A3	



IMPORTANT USER NOTE:
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- Legend**
- 10% Fluvial AEP Event
 - 1% Fluvial AEP Event
 - 0.1% Fluvial AEP Event
 - Modelled River Centreline
 - AFA Extents
 - Embankment
 - Wall
 - Defended Area
 - Standard of Protection of Flood Defence (Walls / Embankments)
 - Node Point
 - Node ID

FINAL

REV:	NOTE:	DATE:
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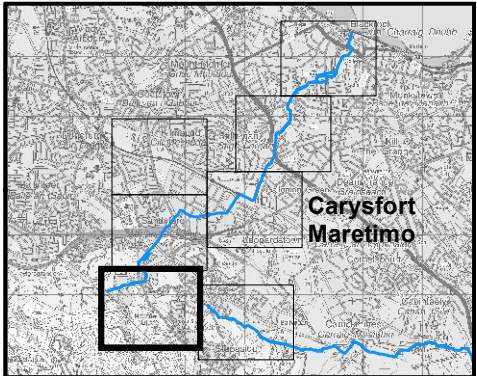
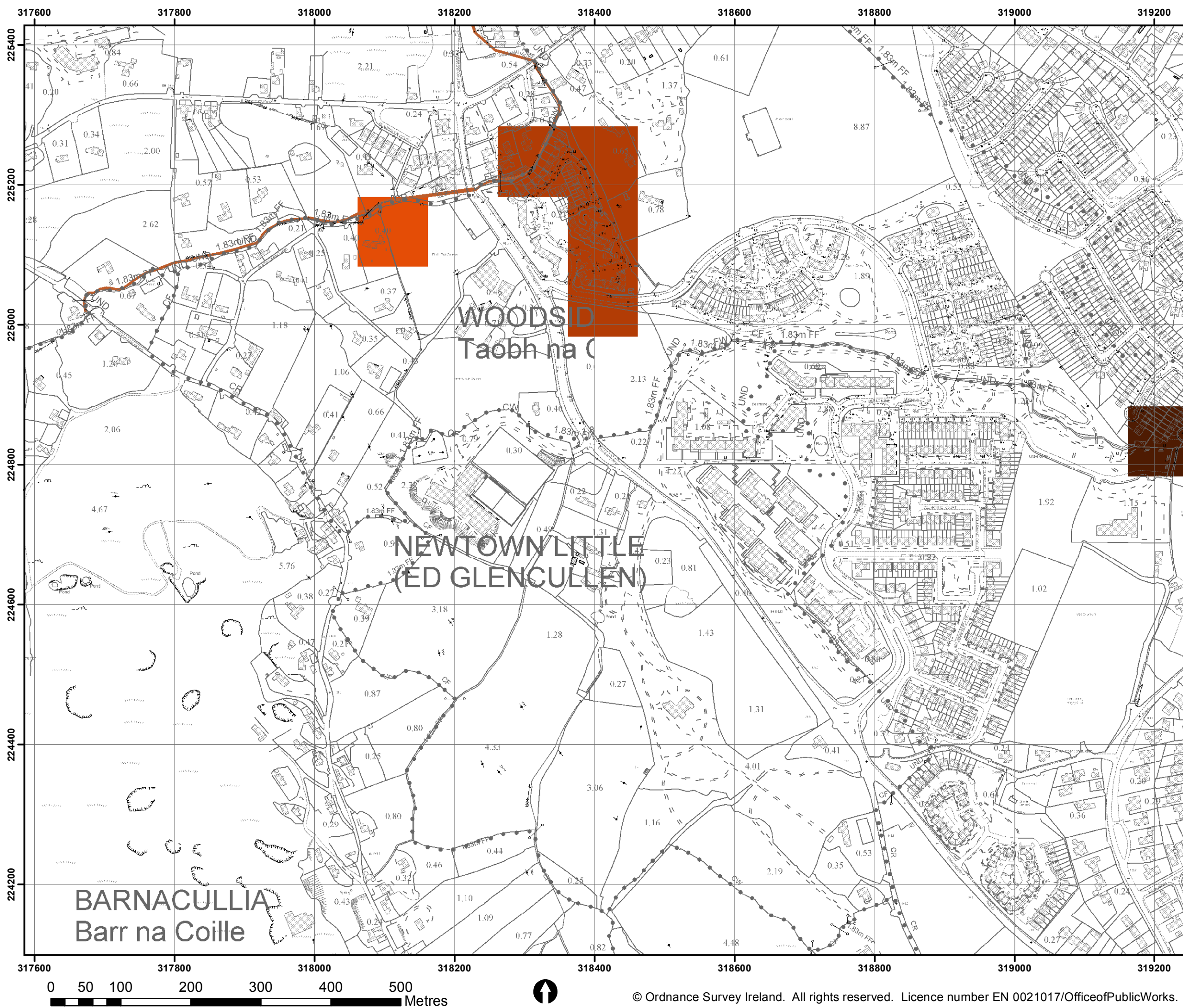


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Co Meath

Elmwood House
74 Boucher Road
BT12 6RZ
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F +44(0) 28 90 668286
W www.rpsgroup.com

Map:	
Carylfort Maretime Fluvial Flood Extents	
Map Type:	EXTENT
Source:	FLUVIAL
Map Area:	HPW
Scenario:	CURRENT
Drawn By :	C.C.
Date :	27 October 2017
Checked By :	A.S.
Date :	27 October 2017
Approved By :	S.P.
Date :	27 October 2017
Drawing No. :	
E09CAR_EXFCD_F2_02	
Map Series :	
Page 2 of 7	
Drawing Scale :	
1:5,000 @ A3	



IMPORTANT USER NOTE:
THE VIEWER OF THIS MAP SHOULD REFER
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AND CONDITIONS OF USE THAT
ACCOMPANY THIS MAP.

Legend

Modelled River Centreline

**No. of Inhabitants at Risk/Ha
1% Fluvial AEP Event**

- 1 - 5
- 5 - 20
- 20 - 40
- >40

FINAL

REV:	NOTE:	DATE:





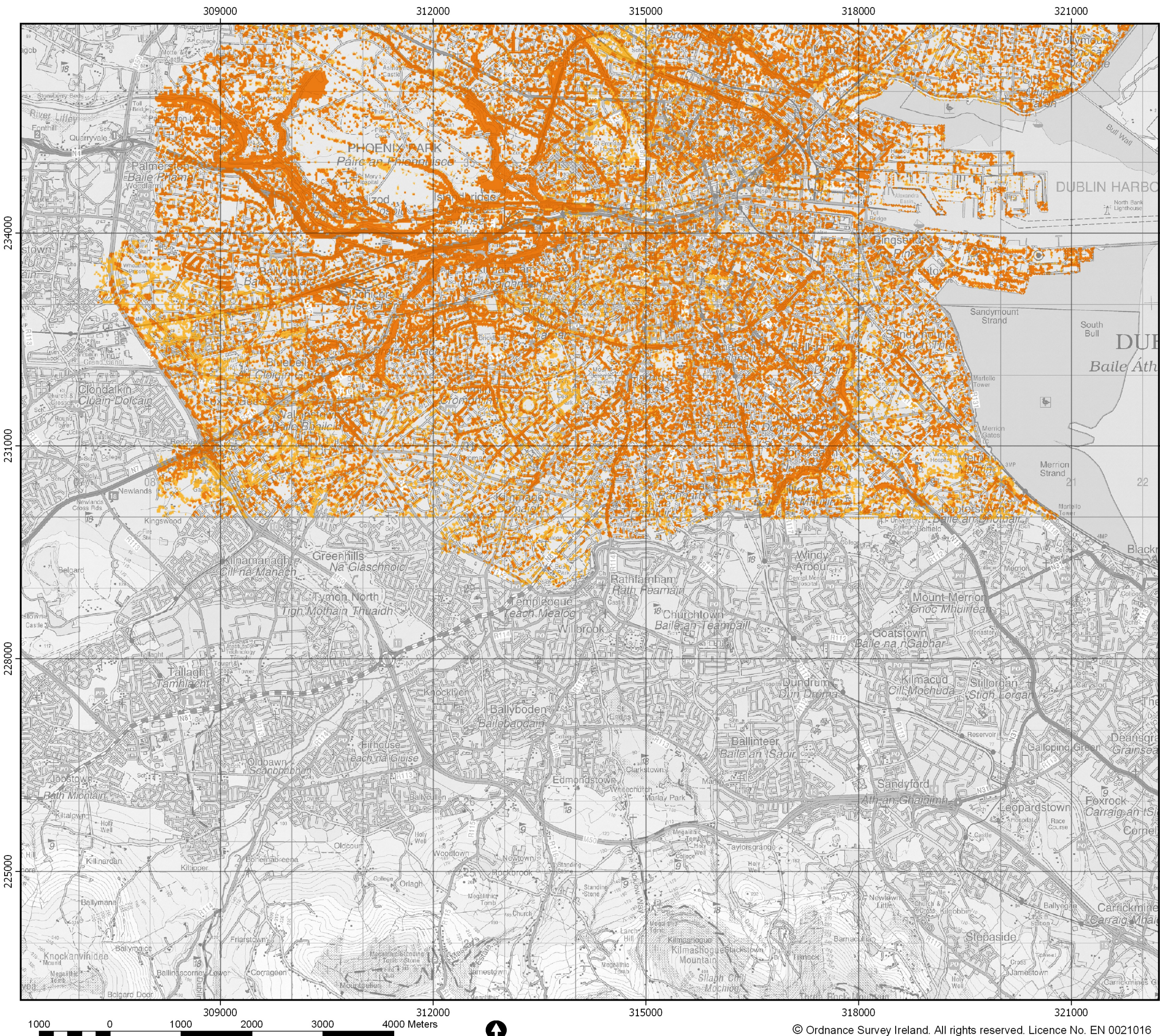
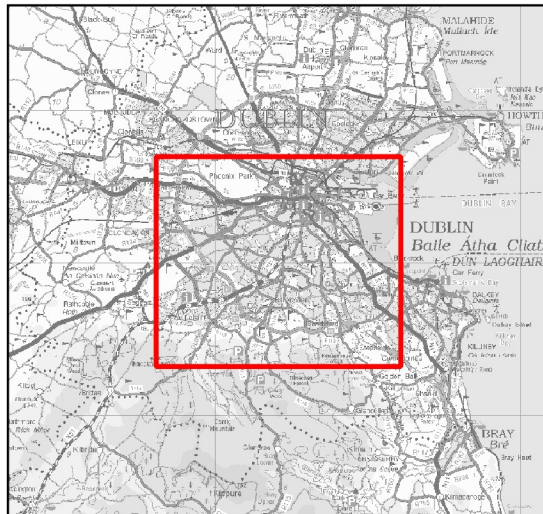
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Co Meath



Elmwood House
74 Boucher Road
Belfast
BT12 6RZ

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

Map:	
Caryl'sfort Maretime No. of Inhabitants at Risk Map	
Map Type: SPECIFIC RISK - NO. INHABITANTS	
Source: FLUVIAL	
Map Area: HPW	
Scenario: CURRENT	
Drawn By : C.McG.	Date : 27 October 2017
Checked By : A.S.	Date : 27 October 2017
Approved By : G.G.	Date : 27 October 2017
Drawing No. : E09CAR_RIFCD010_F2_02	
Map Series : Page 2 of 7	
Drawing Scale : 1:5,000 @ A3	

**Location Plan:**

LEGEND

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

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Co. Meath



Cornhairle 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:

Checked by: MC Date: _____

Approved by: JM Date: 11/11/2014

Map No.:

E09DCC_EXPCD_F0_03

Revision: F0

Map Scale: 1:50,000

Plot Scale: 1:1 @ A3

APPENDIX E. DLRCC DEVELOPMENT PLAN STRATEGIC FLOOD RISK ASSESSMENT

Appendix E

DLRCC DEVELOPMENT PLAN STRATEGIC FLOOD RISK ASSESSMENT

3 Strategic Flood Risk Assessment of Dún Laoghaire-Rathdown

3.1 Description of Study Area

Dún Laoghaire-Rathdown covers an area of 125 km² to the south of Dublin City. Along the east of the County runs 17 kilometres of coastline which includes beaches cliffs and marshes. It is along the coast that the County town of Dún Laoghaire is located. In terms of settlement, approximately two thirds of the County is made up of the built-up area which forms part of suburban Dublin. This suburban area is made up of a network of smaller towns and villages which have been subsumed into the urban form. To the south and west the built-up area gives way to agricultural lands and then rises into the upland scenic area of the Dublin Mountains.

3.2 Identification of Flood Risk (Stage 1)

One of the first tasks within the SFRA is to undertake a data collection exercise which will allow Flood Zone maps to be developed. The Flood Zones relate to risk arising from fluvial (river) and coastal flooding. Other sources of flooding, such as surface water and groundwater, are also taken into account through the SFRA but are not part of the initial assessment process.

It is important to note that the Flood Zones do not take into account the benefits of flood defences. The sequential approach and Justification Test should be applied using the undefended outlines, but the benefits of the defences can be used to inform the requirements for detailed flood risk assessment and development design, if the Justification Test for Plan Making has been passed.

Due to the number of flood investigation and management studies that have focused on Dún Laoghaire-Rathdown, there are a number of datasets which record either historical or predicated flood extents. The aim of this phase of work is to identify flood risk based on the data available, including historical records, considering all sources of flooding, and to appraise the quality and usefulness of the data. Table 3-1 below summarises the data available and its quality, includes an assessment of confidence in its accuracy (when attempting to incorporate it into the Flood Zone map) and gives an indication of how it was used in the SFRA study.

The Office of Public Works (OPW) is the lead Authority on flooding in the Country. The OPW commissioned an Eastern Catchment Flood Risk Assessment and Management (CFRAM) Study, which included Dún Laoghaire-Rathdown. The study was finalised in 2016, with flood maps and supporting reports available online³. The ECFRAM incorporated the earlier study of the Dodder River, which was completed in its own right in 2012. A study of the Dundrum Slang was completed in 2020 which provides up to date flood mapping for this area. These studies have been used to provide the majority of the baseline data for this Strategic Flood Risk Assessment.

The plan area of Dún Laoghaire-Rathdown has also been subject to a number of other flood assessments at both the County and local scales. These have looked at risks arising from sources such as coastal inundation and wave overtopping, surface water and manhole surcharge, culvert blockage and direct fluvial flooding. There have also been a number of recorded flood events. This information has been compiled to form the Flood Zone maps that are the basis for this SFRA.

The Flood Zone maps have been developed using the most appropriate data available to Dún Laoghaire-Rathdown at the time of preparing the Development Plan. The Flood Zone maps have been created specifically to inform the application of the Justification Test and to guide development policy within the County and have been through several iterations of review and are now considered to be fit for purpose. However, it should be borne in mind that the input data was developed at a point in time and there may be changes within the catchment that mean a future study, or more localised assessment of risk may result in a change in either flood extent or depth. This means a site-specific flood risk assessment may result in locally appropriate information which could show a greater or lesser level of risk than is included in the Flood Zone maps. This is to be expected and it will require discussion between the developer and the Dún Laoghaire-Rathdown Planning and Municipal Services sections to ensure the assessment is appropriate and relevant to the site in question.

³ www.floodinfo.ie

The Flood Zone maps show Flood Zones A, B and C and also shows "areas of flood risk concern".

Flood Zone A refers to areas where the probability of flooding from rivers is greater than 1% AEP or 1 in 100 year for river flooding, or 0.5% AEP or 1 in 200 for coastal flooding. Flood Zone B refers to areas where the probability of flooding from rivers and seas is up to 0.1% AEP or 1 in 1000. The rest of the map shows Flood Zone C, where there is less than a 0.1% AEP or 1 in 1000 chance of flooding.

The "areas of flood risk concern" include historical flood locations (both fluvial and pluvial) and information from other modelling studies. Historical surface water locations are those where Dún Laoghaire-Rathdown County Council has a record of a flood occurring, although in some cases work has been carried out to remediate the issue. The predicted areas of concern are based on modelling and indicate where surface water has the potential to pond to depths of greater than 0.3m. More detail on these locations is available from the Municipal Services section.

The flood maps are shown in Section 6 of this document and are also reproduced at a larger size in Appendix A and B, and maps for the whole county are shown in the Mapping section of the County Development Plan.

Table 3-1: Flood Risk Datasets

Data	Description / Coverage	Quality	Data used in developing Flood Zones
Dodder CFRAM Flood Extents	Flood extents (defended) covering the Dodder River and its tributaries, the Dundrum Slang and the Little Dargle	Low. The data is old (study carried out between 2007 and 2014) and methods of assessment have progressed in the intervening years.	Superseded in the main by the Dundrum Slang ICM modelling study (see below).
Eastern CFRAM extents and defence layers, finalised in 2016	Flood extents covering the Crinken Stream, Shanganagh River, Loughlinstown River, Deansgrange Stream, Carrickmines River and Carysfort Maritimo, as well as the coastline of the County.	High in most locations, having been subject to several iterations of review through the CFRAM development process.	Flood extents, defence lines and defended area polygons have been used to develop Flood Zones.
Dundrum Slang ICM modelling study, completed in 2020	The Dundrum Slang catchment. Includes fluvial, pluvial and combined risk	High	Yes
Whitechurch Stream modelling study	Limited to the boundary of Dún Laoghaire-Rathdown (DLR)	Moderate	Yes
Coastal risk and wave overtopping Study, commissioned by DLR and completed as part of a Stage 3 assessment to this SFRA.	DLR coastline	Moderate	Still water flood zones reviewed against ICPSS, but not used as little difference. Overtopping extents indicate a screening area for site specific FRAs.
Irish Coastal Protection Strategy Study (ICPSS)	Tidal extents for 200 year and 1000 year events	High	Used to define the tidal risk within Flood Zone A and B.
JFLOW® (JBA's multi-scale two-dimensional hydraulic fluvial flood modelling software)	Covers full study area, including all watercourses with catchment greater than 3km ² .	Low - Moderate	Some minor watercourses, and the upstream reach of some CFRAM watercourses. Flood zones developed from this source will be treated as a guidance/flagging tool only and will not be relied upon by either

Data	Description / Coverage	Quality	Data used in developing Flood Zones
			the Planning Authority or applicant in the making of planning decisions.
OPW Preliminary Flood Risk Assessment (PFRA) flood maps	The PFRA was a national screening exercise that was undertaken by OPW to identify areas at potential risk of flooding.	Low	Some minor watercourses, and the upstream reach of some CFRAM watercourses. Flood zones developed from this source will be treated as a guidance/flagging tool only and will not be relied upon by either the Planning Authority or applicant in the making of planning decisions.
LiDAR	Digital terrain model covering the whole County	High, but not direct representation of flood zones.	Not used directly but has helped define the undefended floodplain.
Historical event outlines and point observations and reports	Various: 2011 event outlines received. OPW flood maps.ie also to be consulted. Surface water risk locations mapped	Various – based on anecdotal evidence and post flood survey	Indirectly used to validate flood zones and identify non-fluvial and tidal flooding
Deansgrange and Kilbogget Park flood extents	Localised studies as part of flood relief scheme appraisal	High	Indicates defended areas and guides requirements for site specific FRAs.
Wave overtopping from DART Drainage Impact Study	Merrion Gate to Monkstown. Indicates risks associated with wave overtopping	Moderate to high	Not used to create Flood Zones but mapped to indicate ‘other’ risk areas.
Culvert blockage	The impact of blockage was tested at 21 culverts across the County	Moderate to high (but based on an assumption of 100% blockage)	Not used to create Flood Zones but reviewed to indicate residual risk areas.
Site specific flood risk assessments	SSFRA have been submitted in support of various planning applications across the county.	Variable, and depends on the site location and nature of the development proposed.	Not used as the coverage and quality of the assessments could be variable.

3.3 Areas of Flood Risk Concern shown on Flood Zone Maps

Non-specific address locations that may be subject to localised flooding from sources other than out-of-bank river flooding have been identified in the flood maps by triangles as follows:

- “P” (green triangle) - pluvial (rainfall) foul sewage overflow
- “P” (blue triangle)- pluvial (rainfall) surface water overflow
- “F” (blue triangle)- Fluvial - (river/watercourse) surface water overflow

The purpose of identifying these areas is to alert potential applicants of the necessity to consult with the Local Authority as to the nature, source, and possible extent(s) that may be impacted. Following such consultations a site specific flood risk assessment to factor in and mitigate against flood risk identified, if any, needs to be prepared, the details of such measures being set out in Section 5.

3.4 Summary of flood sources

Using the information detailed above, along with the knowledge of engineering staff, the following potential sources of flooding have been identified with the development plan area.

3.4.1 Fluvial Flooding

Flooding of watercourses is associated with the exceedance of channel capacity during higher flows. The process of flooding on watercourses depends on a number of characteristics associated with the catchment including; geographical location and variation in rainfall, steepness of the channel and surrounding floodplain and infiltration and rate of runoff associated with urban and rural catchments. Generally, there are two main types of catchments; large and relatively flat or small and steep, both giving two very different responses during large rainfall events.

In a large, relatively flat catchment, flood levels will rise relatively slowly, and natural floodplains may remain flooded for several days, acting as the natural regulator of the flow. In small, steep catchments, such as some of the tributaries, local intense rainfall can result in the rapid onset of deep and fast-flowing flooding with little warning. Such “flash” flooding, which may only last a few hours, can cause considerable damage and possible threat to life.

The form of the floodplain, either natural or urbanised, can influence flooding along watercourses. The location of buildings and roads can significantly influence flood depths and velocities by altering flow directions and reducing the volume of storage within the floodplain. Critical structures such as bridge and culverts can also significantly reduce capacity creating pinch points within the floodplain. These structures are also vulnerable to blockage by natural debris within the channel or by fly tipping and waste.

In Dún Laoghaire-Rathdown, flood risk arises from a number of different watercourses, each of which has its own specific characteristics. These have been taken into account when flood risk to specific potential development sites was reviewed. Where zoning for development is proposed within Flood Zones A or B, the Justification Test for development plans must be applied, and passed.

There may be situations where a watercourse is identified at Development Management stage which has not been assessed under the SFRA. In such circumstances, it should not be assumed that the Development Plan Justification Test has been passed.

3.4.2 Tidal Flooding

Ireland is affected by coastal flooding that can pose an extreme hazard to coastal infrastructure and communities. Coastal flooding events are associated with storm surge events, particularly those that occur in combination with spring tides. Local or remote storms produce large wind or swell waves, which can overtop coastal defences and cause flooding and erosion.

The eastern county boundary is subject to flood risk from the Irish Sea. As well as direct inundation associated with high tides and storm surge, which form part of the Flood Zones, wave overtopping is a significant risk in certain parts of the coast.

The 2018 Storm Emma impacts on the east coast, for example at Bullock Harbour, and the winter 2014 storms, when large numbers of properties were flooded along the east coast, are examples of the hazard posed by coastal processes.

The tide can also impact on flood risk from rivers, particularly at the downstream end of those which discharge directly into the sea. On such watercourses, if high river flows coincide with high tides, the rivers can't discharge and may cause flooding locally.

Peak tide levels were calculated as part of ICPSS and the Eastern CFRAM Study and should be referred to in any site-specific FRA.

The Government has recently established an Inter-Departmental Group on Coastal Change Management to scope out an approach for the development of a national coordinated and integrated strategy to manage the projected impact of coastal change to our coastal communities, economies, heritage, culture and environment. The Inter-Departmental Group is jointly chaired by the Department of Housing, Planning and Local Government and the OPW and will bring forward options and recommendations for the Government to consider as soon as possible. Should these recommendations be available during the lifetime of the plan they will be given due consideration and assessed for impacts on the SFRA.

3.4.3 Residual Risks arising from Flood Defence Overtopping or Breach

Residual risk is the risk that remains after measures to control flood risk have been carried out. Residual risk can arise from overtopping of flood defences and / or from the breach from structural failure of the defences.

The concept of residual risk is explained in the Planning Guidelines as follows:

"Although flood defences may reduce the risk of flooding, they cannot eliminate it. A flood defence may be overtopped by a flood that is higher than that for which it was designed or be breached and allow flood water to rapidly inundate the area behind the defence. In addition, no guarantee can be given that flood defence will be maintained in perpetuity. As well as the actual risk, which may be reduced as a result of the flood defence, there will remain a residual risk that must be considered in determining the appropriateness of particular land uses and development. For these reasons, flooding will still remain a consideration behind flood defences and the flood zones deliberately ignore the presence of flood defences."

Owing to an extensive and frequent history of flooding in some parts of the County, there are a number of flood relief schemes in Dún Laoghaire-Rathdown. These include large scale OPW managed schemes on the River Dodder, and some smaller works which have been constructed, or are due for construction, on smaller watercourses. It should be noted that whilst existing development clearly benefits from the construction of defences, it is against sustainability objectives, and the general approach of the OPW, to construct defences with the intention of releasing land for development. It is also not appropriate to consider the benefits of schemes which have not been constructed, and which may only be at pre-feasibility or design stage. Overtopping of flood defences will occur during flood events greater than the design level of the defences. Overtopping is likely to cause more limited inundation of the floodplain than if defences had not been built, but the impact will depend on the duration, severity and volume of floodwater. However, and more critically, overtopping can destabilise a flood defence, cause erosion and make it more susceptible to breach or fail.

Overtopping may become more likely in future years due to the impacts of climate change and it is important that any assessment of defences includes an appraisal of climate change risks.

Breach or structural failure of flood defences is hard to predict and is largely related to the structural condition and type of flood defence. 'Hard' flood defences such as solid concrete walls are less likely to breach than 'soft' defence such as earth embankments. Breach will usually result in sudden flooding with little or no warning and presents a significant hazard and danger to life. There is likely to be deeper flooding in the event of a breach than due to overtopping.

Defence locations in Dún Laoghaire-Rathdown have been identified through the Eastern CFRAM Study, which has included an assessment of the defences' ability to provide an effective function, and to what standard of protection, and in discussion with council Engineers. Individual defence locations have been highlighted in the consideration of specific risks. Where walls and embankments are not discussed it is highly likely that they are informal or ineffective structures which should not be relied upon in a flood event. For the purposes of a site-specific flood risk assessment it should be assumed that the site is undefended.

3.4.4 Pluvial Flooding

Flooding of land from surface water runoff is usually caused by intense rainfall that may only last a few hours. The resulting water follows natural valley lines, creating flow paths along roads and through and around developments and ponding in low spots, which often coincide with fluvial floodplains. Any areas at risk from fluvial flooding will almost certainly be at risk from surface water flooding.

Although having potentially severe consequences, pluvial flooding can generally be managed through site design, layout and drainage. However, SFRA's require a strategic assessment of the likelihood of surface water flooding, which includes consideration of the following:

- Are there zoned lands which may need to accommodate and retain surface water flow routes?
- Are there zoned lands which might discharge upstream of an area vulnerable to surface water flooding?

A preliminary screening of areas of flood risk concern has been carried out for this SFRA, drawing on historical flood records and the OPW's PFRA mapping amongst other sources. For development within or near these areas, particular attention to surface water risk is required. Drainage impact assessments, with an emphasis on surface water risk and its management, are required for all development proposals, and are further detailed in Section 5.6.

3.4.5 Flooding from Drainage Systems

Flooding from artificial drainage systems occurs when flow entering a system, such as an urban storm water drainage system, exceeds its discharge capacity and becomes blocked or it cannot discharge due to a high-water level in the receiving watercourse.

Flooding in urban areas can also be attributed to sewers. Sewers have a finite capacity which, during certain load conditions, will be exceeded. In addition, design standards vary and changes within the catchment areas draining to the system, in particular planned growth and urban creep, will reduce the level of service provided by the asset. Sewer flooding problems will often be associated with regularly occurring storm events during which sewers and associated infrastructure can become blocked or fail. This problem is exacerbated in areas with under-capacity systems. In the larger events that are less frequent but have a higher consequence, surface water will exceed the sewer system and flow across the surface of the land, often following the same flow paths and ponding in the same areas as overland flow.

Foul sewers and surface water drainage systems are spread extensively across the urban areas with various interconnected systems discharging to treatment works and into local watercourses.

3.4.6 Groundwater Flooding

Groundwater flooding is caused by the emergence of water originating from underground and is particularly common in karst landscapes. This can emerge from either point or diffuse locations. The occurrence of groundwater flooding is usually very local and unlike flooding from rivers and the sea, does not generally pose a significant risk to life due to the slow rate at which the water level rises. However, groundwater flooding can cause significant damage to property, especially in urban areas and pose further risks to the environment and ground stability. There are many underground streams within Dún Laoghaire-Rathdown, particularly in the Dalkey, Killiney, Dún Laoghaire, Glenageary and Glasthule areas. Some of these streams continue to give issues in private properties, and care should be taken to ensure high-water tables do not impact on basements, foundations, percolation areas or other sub-ground construction works. Data available on the Geological Survey Ireland map viewer⁴ has been examined and found no particular karst or other ground water systems within the catchment, although one spring / well is noted to the west of Cherrywood. There are no recorded historic or predictive groundwater flood extents within the County. Groundwater risks should be assessed on a site by site basis through percolation testing and bore holes as appropriate.

⁴ <https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228>