

INFRASTRUCTURE

Project

R132 Connectivity Project

Report Title

Flood Risk Assessment

Client

Fingal County Council



DBFL CONSULTING ENGINEERS

MAY 2021

Job Title: R132 Connectivity Project

Report Title: Flood Risk Assessment

Job Number: p200021

Report Ref: p200021-DBFL-Rep-004

Author: Maciej Nowak

Checked by: Cathal O'Connor

Approved by: Bill Bates

Date: 4th May 2021

Distribution: Client
DBFL Consulting Engineers (File)

Dublin Office
Ormond House
Upper Ormond Quay
Dublin 7
D07 W704

Tel 01 4004000
Fax 01 4004050
Email info@dbfl.ie
Web www.dbfl.ie

Waterford Office
Unit 2 The Chandlery
1-2 O'Connell Street
Waterford
X91 W028

Tel 051 309500
Fax 051 844913
Email info@dbfl.ie
Web www.dbfl.ie

Cork Office
Phoenix House
Monahan Road
Cork
T12 H1XY

Tel 021 2024538
Email info@dbfl.ie
Web www.dbfl.ie

Revision	Issue Date	Description	Prepared	Reviewed	Approved
Draft	28/01/2021	DRAFT	MMN	COC	WBA
Draft	29/03/2021	Final Review	MMN	COC	RJK
-	04/05/2021	ISSUED FOR PLANNING	MMN	COC	RJK

Contents

1.0	INTRODUCTION	4
1.1	Background	4
1.2	Project Description	7
2.0	PLANNING GUIDELINES AND FLOOD RISK ASSESSMENT	9
2.1	The Planning System and Flood Risk Management	9
2.2	Flood Risk	10
2.3	Flood Risk Assessment	10
2.4	Staged Approach of Flood Risk Assessment	11
2.5	Flood Zones	11
2.6	Proposed Development's Vulnerability	13
3.0	STAGE 1 – INITIAL FLOOD RISK IDENTIFICATION	15
3.1	Available Flood Risk Information	15
3.1.1	Topographical Survey	16
3.1.2	Other Sources	16
3.2	Coastal Flood Risk	21
3.2.1	Eastern Catchment Flood Risk Assessment and Management (CFRAM) Study	21
3.2.2	Irish Coastal Protection Strategy Study (ICPSS)	22
3.3	Fluvial Flood Risk	24
3.3.1	Eastern Catchment Flood Risk Assessment and Management (CFRAM) Study	24
3.4	Source-Pathway-Receptor Model	25
3.5	Vulnerability Classification	27
4.0	STAGE 2 – INITIAL FLOOD RISK ASSESSMENT STAGE	28
4.1	Initial Fluvial/Tidal Flood Risk Assessment	28
4.1.1	CFRAM	28
4.1.2	ICPSS	29
4.1.3	FEM FRAMS	29
4.2	Initial Pluvial Flood Risk Assessment	29
4.3	Initial Fluvial & Tidal Flood Risk Assessment	30
5.0	STAGE 3 – DETAILED FLOOD RISK ASSESSMENT	33
5.1	Introduction	33
5.2	Justification Test	33

5.3	Effect of Climate Change on Fluvial Flooding	35
5.4	Surface Water Management & SuDS	36
5.5	Flood Risk Exceedance	38
5.5.1	Fluvial Flooding	38
5.5.2	Pluvial Flooding	39
5.6	Impact on Adjacent Areas.....	39
5.7	Access and Egress for Emergency Services During Flood Events	39
5.8	Flood Risk Mitigation	40
6.0	<i>CONCLUSIONS</i>	41
	<i>Appendix A – Topographical Surveys</i>	43
	<i>Appendix B – Drainage Records</i>	44
	<i>Appendix C – Eastern CFRAM Flood Maps</i>	45
	<i>Appendix D – ICPSS Flood Maps</i>	46
	<i>Appendix E – OPW Flood Hazard Report</i>	47

1.0 INTRODUCTION

1.1 Background

DBFL Consulting Engineers were requested by Fingal County Council (FCC) to prepare a supplementary flood risk assessment (FRA) in support of a planning application for the improvements and upgrades proposed as part of the R132 Connectivity Project.

FCC will be applying for a planning permission to carry out the upgrade works on the R132. This FRA has been prepared to comply with current planning legislation. The aim of this report is to assess the risks to the proposed development from all potential sources of flooding and propose suitable mitigation measures where appropriate.

The proposed works are located on the existing R132 dual carriageway as show on Figure 1-1 below. The scheme extends from the north of Pinnockhill Roundabout to approximately 450m north of the Estuary Roundabout. The scheme length is approximately 2.6km.

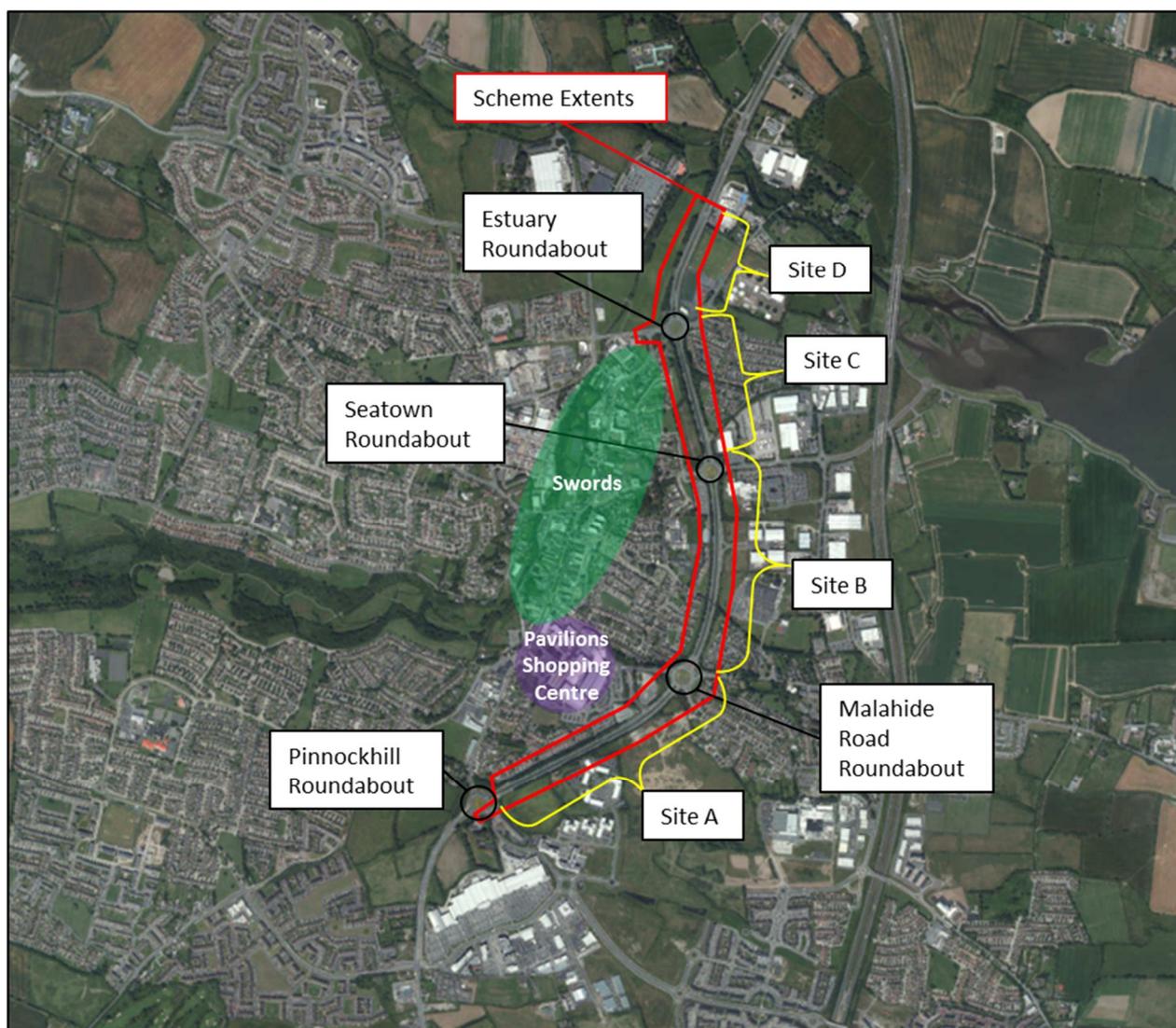


Figure 1-1: Scheme Extents, R132 Swords

Due to the extensive nature of the scheme, the scheme will be considered in four different sites for the purpose of this assessment, as shown on Figure 1-1 and described in Table 1-1.

Name	Description of Site Extents
Site A	North-East of Pinnockhill Roundabout to North of Malahide Road Roundabout
Site B	North of Malahide Road Roundabout to North of Seatown Roundabout
Site C	North of Seatown Roundabout to North of Estuary Roundabout
Site D	North of Estuary Roundabout to End of Scheme

Table 1-1: Scheme Division into Sites

The scheme extents are located mostly in the Broadmeadow river catchment, although some of Site A in the south of the scheme is located in the Mayne-Santry coastal catchment, as shown on Figure 1-2. The surface water falling within the Mayne-Santry coastal catchment will be collected by the

existing drainage network and subsequently directed to the Broadmeadow catchment. The scheme does not consist of any river/stream crossings. The northern extents of the scheme are in close proximity to the Broadmeadow River and Ward River confluence. The Broadmeadow River Estuary forms part of the Broadmeadow/Swords Estuary Special Protection Area (SPA) and the Malahide Estuary Special Area of Conservation (SAC).

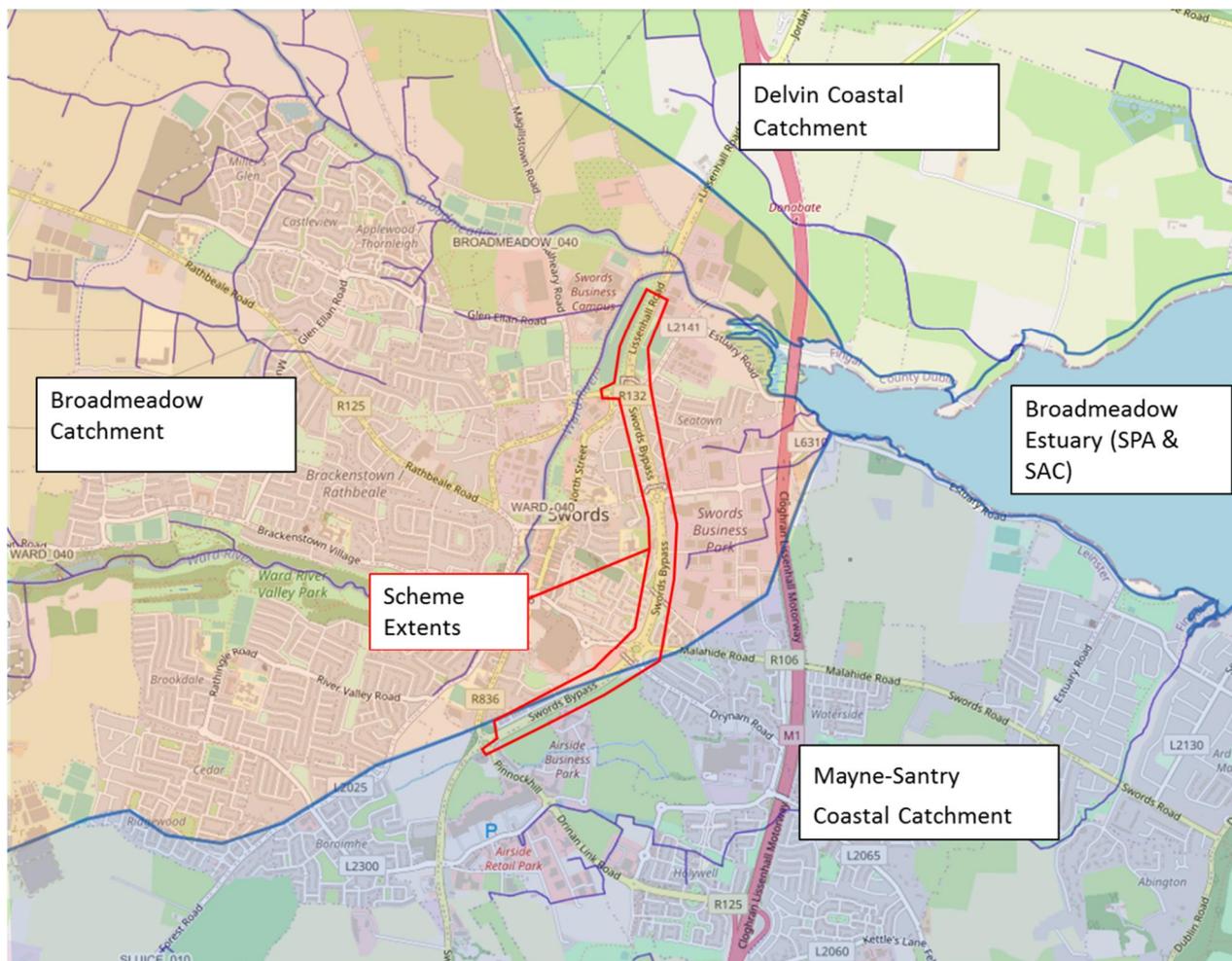


Figure 1-2: Rivers Surrounding R132 Scheme (Extract from EPA online mapping)

1.2 Project Description

The principal scheme requirement is to enhance facilities at key intersections and crossing points along the R132 Swords Road, improving connectivity for pedestrians and cyclists travelling across the R132 Swords Road from existing and proposed development lands to town centres.

The upgrade works are expected to take place over a 2-year construction period commencing in 2021/2022. The works envisaged for the scheme include:

1. Conversion of three existing intersections along the R132 (Estuary, Seatown and Malahide Road Roundabouts) to signalised intersections with 'at-grade' pedestrian and cyclist crossing points;
2. Installation of signalised toucan crossings at three separate points along the R132;
3. Pedestrian linkages to Chapel Lane and Ashley Avenue at the proposed Chapel Lane toucan crossing;
4. Installation of turning areas at two separate points along the R132;
5. Carriageway alterations including the establishment of designated 3m wide bus lanes and 2m wide cycleways and 2m wide pedestrian walkways along each side of the carriageway;
6. Reconfiguration of the Drynam Road arm of the Malahide Road Roundabout to link directly to Malahide Road as a one-way road;
7. Construction of new bus stops on Malahide Road;
8. Installation of a sub-surface attenuation system; and
9. Landscaping and other ancillary works.

A typical cross-section along the route can be seen on Figure 1-3 below.

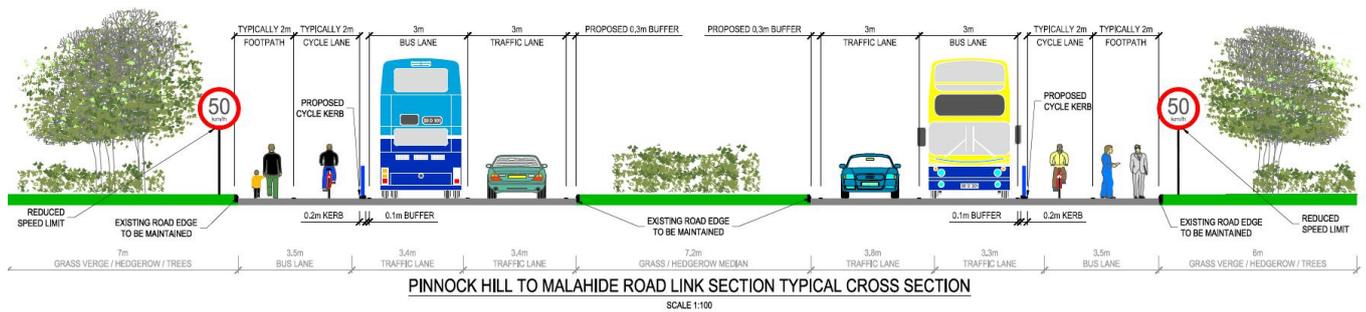


Figure 1-3: Typical Cross section

The existing grass median strip shall be maintained under the proposals and all measures will be generally restricted to within the existing road reservation and will not generate additional surface water run-off. An increase in surface water runoff is anticipated from the conversion of roundabouts to signalised intersections, provisions of toucan crossings and turning areas. Further information is provided in the Infrastructure Design Report (IDR), DBFL ref: p200021-DBFL-Rep-003.

2.0 PLANNING GUIDELINES AND FLOOD RISK ASSESSMENT

2.1 The Planning System and Flood Risk Management

“The Planning System and Flood Risk Management”, was published in 2009 by the Department of Environment, Heritage and Local Government and the Office of Public Works (OPW) following a review of flood policy in Ireland (referred to herein as the FRM guidelines). The core objectives of the guidelines are to:

- Avoid inappropriate development in areas at risk of flooding;
- Avoid new developments increasing flood risk elsewhere, including that which may arise from surface water run-off;
- Ensure effective management of residual risks for development permitted in floodplains;
- Avoid unnecessary restriction of national, regional or local economic and social growth;
- Improve the understanding of flood risk among relevant stakeholders; and
- Ensure that the requirements of EU and national law in relation to the natural environment and nature conservation are complied with at all stages of flood risk management.

The key principles of The Flood Risk Management (FRM) guidelines are to apply the sequential approach to the planning process (as shown by Figure 2-1 below):

- Avoid the risk, where possible;
- Substitute less vulnerable uses, where avoidance is not possible; and
- Mitigate and manage the risk, where avoidance and substitution are not possible.

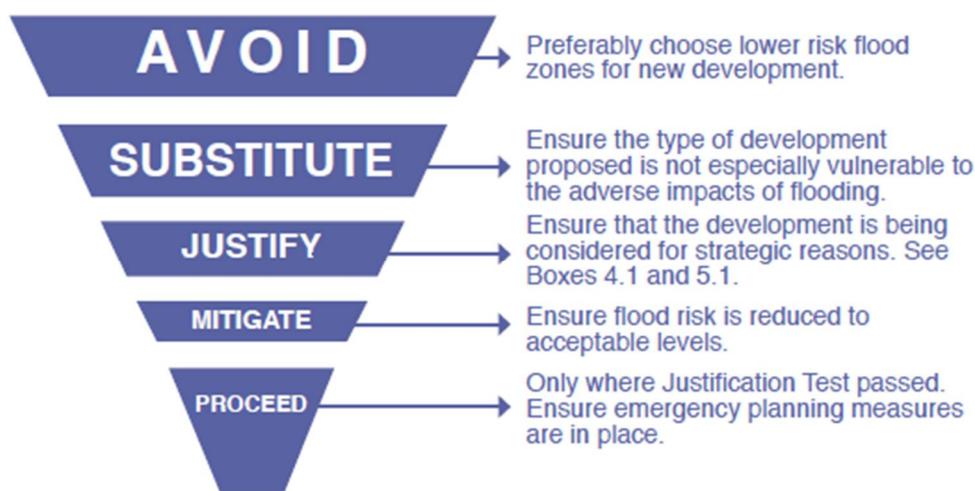


Figure 2-1: Sequential Approach (Source: Planning System and Flood Risk Assessment, 2009)

Where the sequential test's "avoid" and "substitute" principals are not appropriate, then the FRM guidelines propose that a justification test be applied to assess the appropriateness, or otherwise, of particular developments that are being considered in areas of moderate or high flood risk.

2.2 Flood Risk

Flood risk is defined as combination of the likelihood of flooding and the potential consequences arising. The likelihood is normally defined as the percentage probability of a flood of a given magnitude occurring or being exceeded in any given year (Annual Exceedance Probability – AEP). The consequences of flooding depend on the hazard of flooding (e.g. depth of water, speed of flow, rate of onset, etc.) and the vulnerability of the receptor (e.g. age profile of population, type of development, etc.).

2.3 Flood Risk Assessment

The assessment of flood risk requires an understanding of where the water comes from (i.e. the source), how and where it flows (i.e. the pathways) and the people and assets affected by it (i.e. the receptors). This is illustrated on Figure 2-2 below.

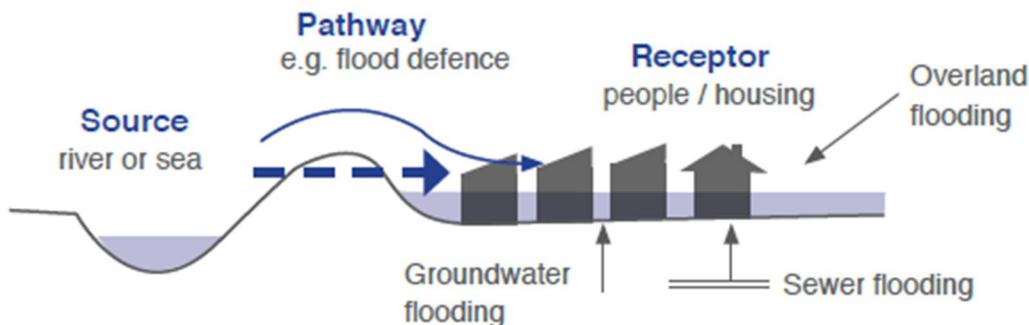


Figure 2-2: Source-Pathway-Receptor Model (Planning System and Flood Risk Assessment, 2009)

The principal sources are tidal, fluvial or pluvial. The principal pathways are overtopping breach, overbank breach or sewer blockage overflows. The receptors can include people, their property and the environment. All three elements are examined as part of the flood risk assessment including the vulnerability and exposure of receptors to determine potential consequences. Mitigation measures typically used in development management can reduce the impact of flooding on people and communities, e.g. by blocking or impeding pathways. The planning process is primarily concerned with the location of receptors and potential sources and pathways that might put those receptors at risk.

Risks to people, property and the environment should be assessed over the full range of probabilities, including extreme events. Flood risk assessment should cover all sources of flooding, including effects of run-off from a development locally and beyond the development site.

2.4 Staged Approach of Flood Risk Assessment

The FRM guidelines outline that a staged approach should be adopted when carrying out a flood risk appraisal or assessment. These stages are:

- Stage 1: Flood Risk Identification
- Stage 2: Initial Flood Risk Assessment
- Stage 3: Detailed Flood Risk Assessment

The FRM guidelines require that an FRA be undertaken to assess flood risk for individual planning applications. This FRA comprises Stages 1, 2 and 3 involving both identification and more detailed assessment of flood risks and surface water management related to the planned development site.

2.5 Flood Zones

The FRM guidelines use flood zones to determine the likelihood of flooding and for flood risk management within the planning process. The three flood zones levels are:

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

The FRM guidelines categorises all types of development as either;

- Highly Vulnerable, e.g. dwellings, hospitals, fire stations, essential infrastructure, substations;
- Less Vulnerable, e.g. retail, commercial or industrial buildings, local transport infrastructure;
- Water Compatible, e.g. flood infrastructure, docks, amenity open space.

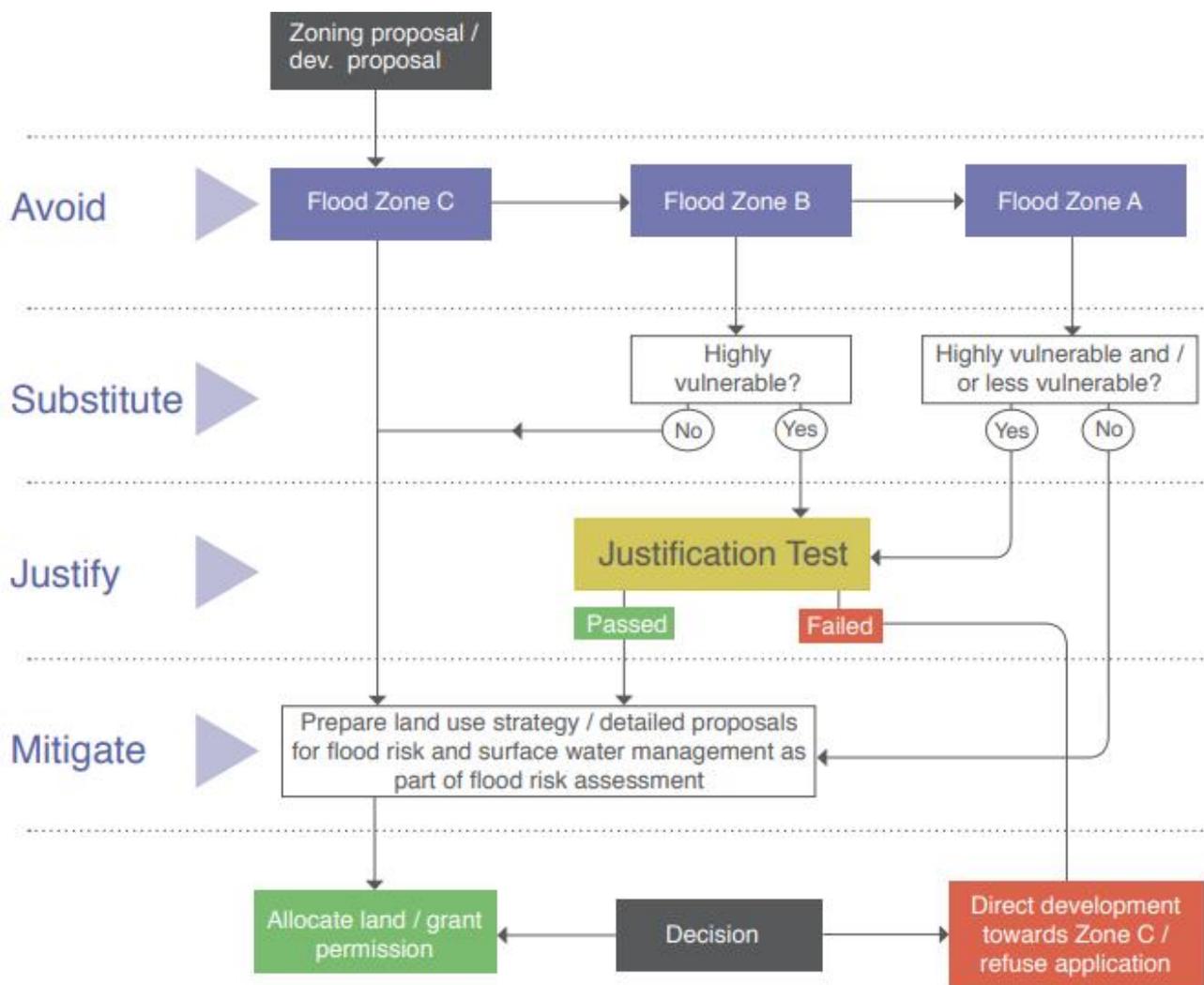


Figure 2-3: Sequential Approach Mechanism in the Planning Process (Planning System and Flood Risk Assessment, 2009)

2.6 Proposed Development’s Vulnerability

The FRM guidelines classify different types of development in terms of their vulnerability class (Table 3.1 of the guidelines). This table has been reproduced as Figure 2-4 below.

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

*Uses not listed here should be considered on their own merits

Figure 2-4: Extract from the FRM Guidelines – Classification of vulnerability of different types of development (Planning System and Flood Risk Assessment, 2009)

Table 3.2 of the Guidelines (reproduced as Figure 2-5 below) illustrates the types of development that would be appropriate to each flood zone and those that would be required to meet the justification test.

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	Justification Test	Justification Test	Appropriate
Less vulnerable development	Justification Test	Appropriate	Appropriate
Water-compatible development	Appropriate	Appropriate	Appropriate

Figure 2-5: Extract from the FRM Guidelines – Matrix of vulnerability versus flood zone to illustrate appropriate development and that required to meet the Justification Test. (Planning System and Flood Risk Assessment, 2009)

3.0 STAGE 1 – INITIAL FLOOD RISK IDENTIFICATION

3.1 Available Flood Risk Information

The initial flood risk identification stage uses existing information to identify and confirm whether there may be flooding or surface water management issues for the lands in question that may warrant further investigation at the planning application level.

To initially identify potential present day flood risks for the existing site and surrounding area a number of available data sources were consulted, these are listed in Table 3-1 below.

	Information Source	Coverage	Quality	Confidence	Identified Flood Risks	Flood Risk
Primary Data Source & Modelled Data	OPW ECFRAM - Fluvial Maps	Regional	High	High	Flood maps indicates that Site D is marginally within the indicated 1% AEP event fluvial flood zone. Large extents of Site D are within the 0.1% AEP. Some areas of Site C and Site A lie withing the indicated 0.1% AEP event. .	✓
	OPW ECFRAM - Tidal Maps	Regional	High	High	No tidal flood risk identified for the scheme.	X
	ICPSS Maps	Nationwide	High	High	ICPSS maps indicated no current coastal flood risk for the development. Coastal flood risk associated with the future flooding scenario.	✓
Primary Data Source	Walkover Survey	Local	Varies	Varies	Not undertaken	N/A
	OPW Historic Flood Records	Nationwide	Varies	Varies	Records of recurring floods at Pinnockhill Roundabout (Site A) and Estuary Roundabout (Site C)	✓
	Drainage Records	Local	Moderate	Moderate	Surface water drainage Irish Water records show two SW networks for each of the lanes of the dual carriageway for the entire scheme Existing Metrolink records also available.	✓
	Geological Survey Ireland Maps	Nationwide	Moderate	Low	Made Ground and/or Boulder Clay. Bedrock expected between 3 to 10m below level	X
	Topographic Survey	Local	High	High	The existing road level varies Max level at Site A of ~29.0mOD; Min level at Site D of ~4.29mOD.	✓
	OSI Mapping	Nationwide	Hight	High	Review of historical mapping and satellite imaging. 6-inch Cassini map indicates "Floods" and "Big Marsh" near the confluence of Broadmeadow and Ward Rivers.	✓
	FEM FRAMS from the Fingal Development Plan	Local	Varies	Moderate	Risk of climate change effect on fluvial flooding identified.	✓

Table 3-1: Review of Available Flood Risk Information

3.1.1 Topographical Survey

A topographical survey was provided to DBFL for the entire scheme, the topographical survey is included in Appendix A for information. The survey provides pavement, street furniture, building, vegetation extents and levels. The locations and cover levels of manholes are also provided.

The site level generally falls north from the Pinnockhill Roundabout at the south extent of the scheme to the Ward River at the north extent of the scheme at gradients ranging from 1:30 to 1:185. The road levels fall from south to north for each of the sites as follows: Site A from ~29.0mOD to ~23.3mOD; Site B from ~23.3mOD to ~11.4mOD; Site C from ~11.4mOD to ~7.1mOD. Levels for Site D range from ~7.1mOD in the south to ~4.37mOD in the northernmost point of Site D. A low point of 4.29mOD occurs approximately 20m from the end point of the scheme.

At each junction, along the roads intersecting with R132 (i.e. Malahide Rd, Seatown Rd and Estuary Rd), the scheme falls generally West to East, at gradients ranging from 1:30 to 1:140. The low point for each of the side arms of the existing roundabouts are as follows: 22.94m OD which occurs on the west arm of the Malahide Road Roundabout; 10.3m OD on the west arm of the Seatown Roundabout and 7.0mOD on the west arm of the Estuary Roundabout.

In cross section, the road typically falls from the median strip to the road edge, which is reflected by the gully locations. There is an exception for the southbound lane at Site A, near to Malahide Roundabout and Site B approximately 125m from the Malahide Roundabout to 80m from the Seatown Roundabout, where this is reversed and the road falls from the road edge to the median strip. This appears to be a form of superelevation and is legacy issue of when the road was the main national route, N1, between Dublin and Belfast. A similar form of superelevation is provided on the northbound lane in Site D at 76m from the Estuary Roundabout.

3.1.2 Other Sources

Other information sources were consulted to determine if there was any additional flood risk to the subject site, which are outlined below.

Soil/ Rock data from GSI (Geological Survey Ireland)

The site typically consists of Made Ground and/ or Boulder Clay. Bedrock is noted by GSI as a Limestone of Malahide Formation. Bedrock is expected between 3 and 10 metres below ground level.

Groundwater information from GSI

The bedrock is classified as a locally important aquifer. There are no records of any karst features in the locality.

The subsoils are classified as low permeability. Made Ground deposits have a groundwater recharge coefficient of 20% and the Boulder Clay has a recharge coefficient of 7.5%.

Fingal East Meath Flood Risk Assessment and Management Study (FEM FRAMS)

The relevant results of the FEM FRAMS were sourced from the Fingal County Development Plan (2017-2023). FEM FRAMS was conducted in 2011. Refer to Section 4.1.3 for information on climate change effect on pluvial flooding, sourced from FEM FRAMS.

Historic OPW Flood Maps

The historic OPW flood records show 2 no. locations where floods have occurred within the extents of the scheme and 2 no. locations where floods occurred in close proximity to the scheme in the past, as shown on Figure 3-1 below. The 4 no. flood locations are summarised on Table 3-2 below. Refer to Appendix E for the Past Flood Event Local Area Summary Record of all 16 no. flood locations within 2.5km of the centre of the scheme.

Flood Report ID	Location	Source	Dates	Information
1459	Pinnock Hill	Low Lying Land	2001-2005	Stream enters an undersized pipes and floods. Roundabout noted to have flooded when diverting water from nearby hotel.
1702	Estuary Roundabout	Ward River	2002	Flooding of the Estuary Roundabout due to high water level in the Ward River. Emergency measures kept N1 open to traffic.
2129	Seatown Villas	Runoff	1982	Residential premises flooded. Not within scheme extents.
10574	Ward Swords	River	2008	Ward river and Broadmeadow river appear to have flooded in several locations in the vicinity of the scheme. Flooding did not appear to have affected existing R132..
1630	Ward North Street	Ward River	2002	North Street, Swords flooded

Table 3-2: Relevant OPW Flood Reports

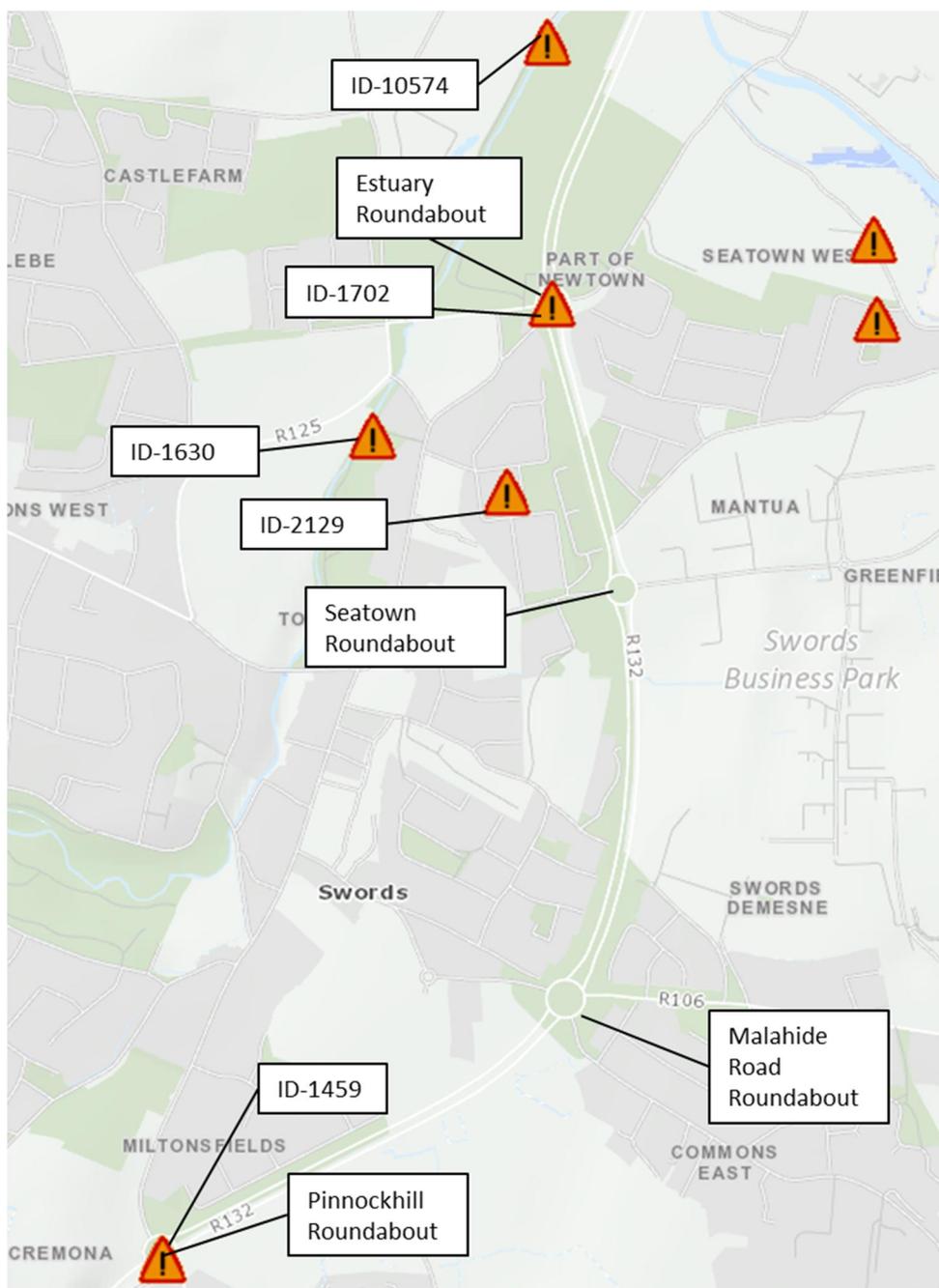


Figure 3-1: Historical Flood Events from OPW Website [accessed online: 20/01/2021]

Ordnance Survey Ireland (OSI) Mapping

It is noted that the 6-inch Cassini map indicates “Floods” and an area called “Big Marsh” near confluence of Broadmeadow and Ward Rivers, therefore indicating that the area was prone to flooding in the past.

The Greenfields Stream indicated on Figure 3-2 below does not appear to be a stream on the historical maps (e.g. 6 inch (1837-1842) historic map), therefore it would appear it is historically a drainage ditch. The ditch appears to be no longer there in most places, and it is assumed that the ditch has

been diverted to underground pipes, this is to be confirmed prior to works taking place. The ditch can be traced back to 1995 satellite imaging, as shown on the OSI review on Figure 3-2, where the Greenfields Stream has also been sketched in blue.

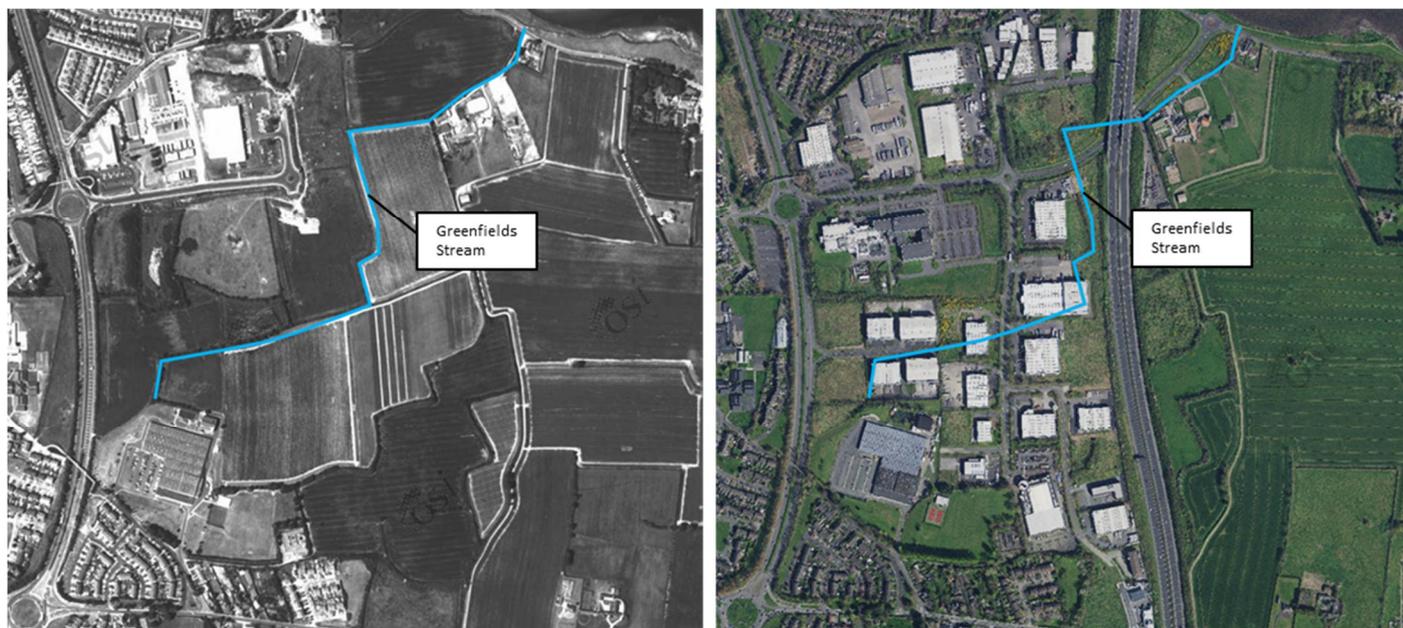


Figure 3-2: Satellite Imaging: Aerial Premium 2013-2018 (left) and Aerial 1995 (right) – Sourced from OSI Geohive

Existing Drainage Records

Beginning at the south end of Site A, (at Pinnockhill Roundabout), the surface water drainage Irish Water (IW) records show two separate surface water branches (Network X), for each of the lanes of the dual carriageway. Irish Water records are included in Appendix B for information. Both branches appear to be a 225mm diameter pipes at the beginning. Network X falls north and gradually increases in diameter as it also captures other branches from adjoining streets. Both branches of Network X end abruptly between the Malahide Road Roundabout and the Seatown Roundabout (within Site B) as shown on the IW records. The pipe servicing the northbound lane appears to be a 675mm diameter concrete pipe at this point.

Using the Metrolink records in combination with the topographical survey, it appears that Network X is diverted to the east in what appears to be an underground pipe and then outfalls to a drainage ditch to the south of the Seatown Roundabout which then outfalls to the Greenfields River.

Another surface water network appears to start again (Network Y) on the IW records within Site B with 2 no. 225mm dia. pipes which run north for approximately 265m. Network Y appears to outfall to the drainage ditch to the south of the Seatown Roundabout. The northbound lane pipe appears to

3.2 Coastal Flood Risk

The following sources of information have been considered to assess the impact of coastal flooding:

- Irish Coastal Protection Strategy Study (ICPSS) –
<https://www.gov.ie/en/publication/eed0fb-irish-coastal-protection-strategy-study-icpss/>
- Catchment Flood Risk Assessment and Management Study (CFRAM) –
<http://www.floodinfo.ie/map/floodmaps>

3.2.1 Eastern Catchment Flood Risk Assessment and Management (CFRAM) Study

The Eastern Catchment Flood Risk Assessment and Management (CFRAM) Study has recently been carried out by OPW, and flood maps are widely available for the public via <http://www.floodinfo.ie/map/floodmaps/>. An extract from these maps of the Site D area is shown below on Figure 3-4. Tidal flooding CFRAM maps are not available for Sites A, B or C as those areas are not affected by tidal flooding. All available CFRAM tidal flood maps from the area are available in Appendix C.

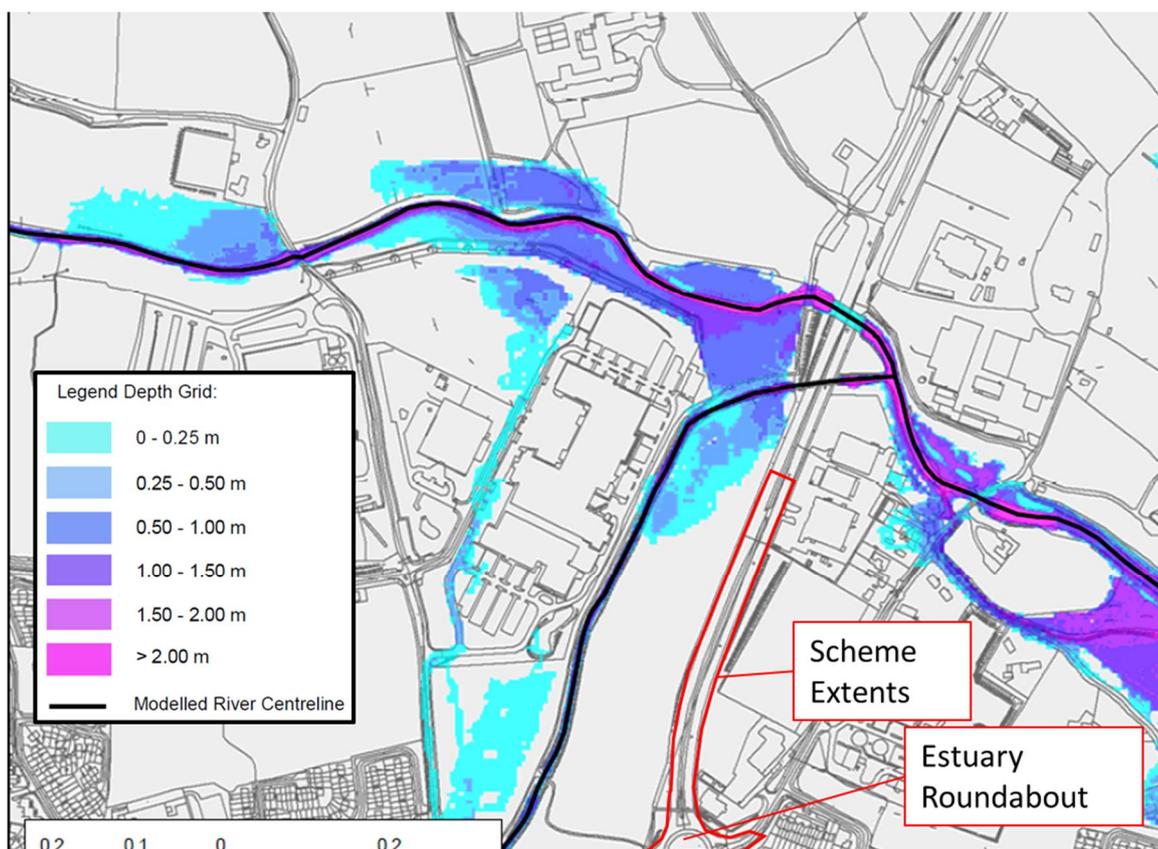


Figure 3-4 Extract from Eastern CFRAM 0.1% AEP Tidal Flood Depth Map (Present Day)

3.2.2 Irish Coastal Protection Strategy Study (ICPSS)

The Irish Coastal Protection Strategy Study (ICPSS) is a national study that was commissioned in 2003 with the objective of providing information to support decision making about how best to manage risks associated with coastal flooding and coastal erosion. The study was completed in 2013 and provides strategic current scenario and future scenario (up to 2100) coastal flood hazard maps and strategic coastal erosion maps for the national coastline.

The predicted flood extents associated with this study were calculated by combining the results of tidal and surge modelling, statistical analysis, and digital terrain models using GIS technology. The resulting predicted coastal flood extent and flood depth maps for Swords Area are presented in Appendix D to this document.

An extract of the extents of the coastal 0.5% AEP flood event for a “present day” scenario is shown on Figure 3-5 with Estuary and Pinnockhill Roundabouts marked for reference.

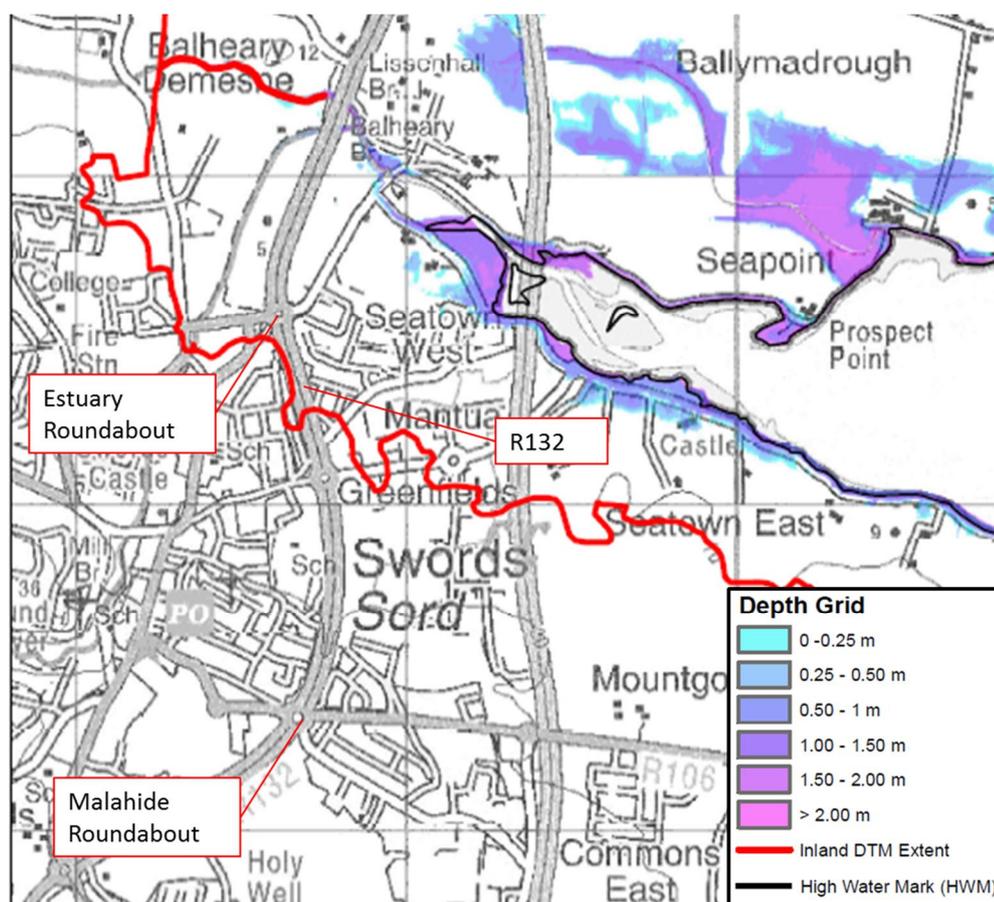


Figure 3-5: Current Coastal Tide Flood Extents (ICPSS – 0.5% AEP Present Day)

The ICPSS maps also provide future flood extents with allowance for climate change. Two scenarios are considered the Mid-Range Future Scenario (MRFS) and High-End Future Scenario (HEFS) for the year 2100. The future scenarios are accounted through an application sea level rise of 0.5 metres and 1.0 metres in addition to the “present-day” flood levels respectively for the MRFS and the HEFS case. The flood extent maps for the MRFS and HEFS scenarios are available in Appendix D. Figure 3-6 is an extract from the HEFS coastal flood map showing the 0.1% AEP and 0.5% AEP flood extents with the approximate scheme extents sketched out. This map indicates that negligible extents of the low-lying areas of Site D are within the future scenario HEFS tidal flooding for a 0.5% AEP. The ICPSS maps indicate that the scheme is not affected by either the 0.1% AEP or the 0.5% AEP MRFS future case tidal flooding event.

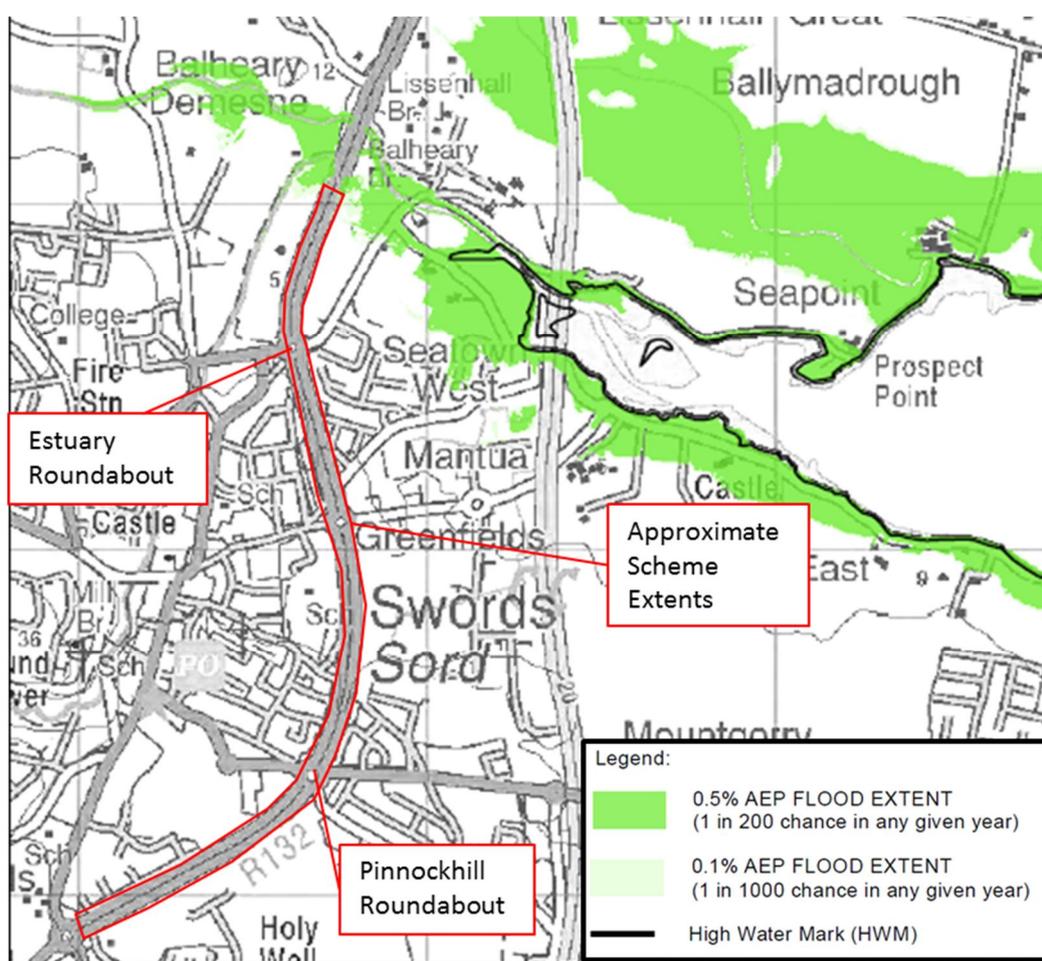


Figure 3-6: Future HEFS Coastal Tide Flood Extents (ICPSS – Future Case HEFS Scenario)

3.3 Fluvial Flood Risk

3.3.1 Eastern Catchment Flood Risk Assessment and Management (CFRAM) Study

The Eastern CFRAM study used for coastal flood risk in Section 3.2.1 also provides separate mapping for fluvial flooding.

- Catchment Flood Risk Assessment and Management Study (CFRAM) – <http://www.floodinfo.ie/map/floodmaps>

All relevant CFRAM fluvial flood maps are available in Appendix C.

The fluvial flood depth map for a 1% AEP event is shown on Figure 3-7 below for Site D. A small portion of Site D is affected by the 1% AEP current fluvial flood event. (100-year return period). The location of anticipated flooding appears to roughly coincide with the low point of the site of 4.29m OD within Site D. No other sites within the scheme are affected by a 1% AEP fluvial event.

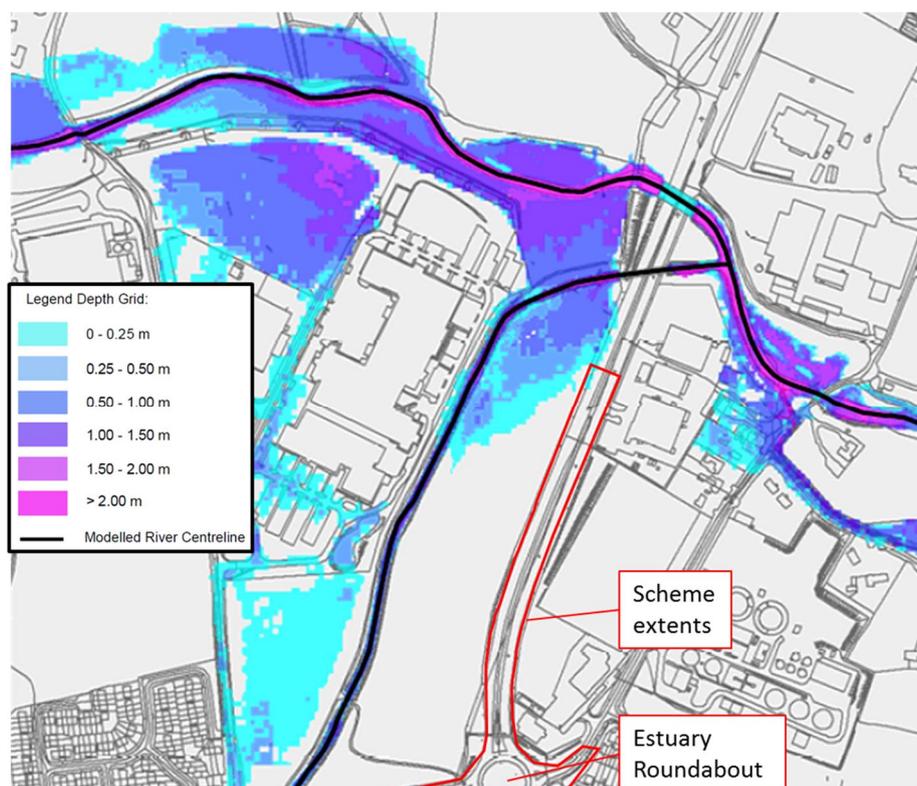


Figure 3-7: Extract from Eastern CFRAM Fluvial Flood Depth Map for 1% AEP Event (Present Day).

A fluvial flood extents map for the entire scheme is shown on Figure 3-8, with the relevant roundabouts and approximate scheme extents indicated for clarity. The extract shows that Site D is slightly more affected by a 0.1% AEP event (1000-year return period) and that Site A and C are only marginally affected a 0.1% AEP event. The rest of the site is not affected by fluvial flooding as seen on Figure 3-8.

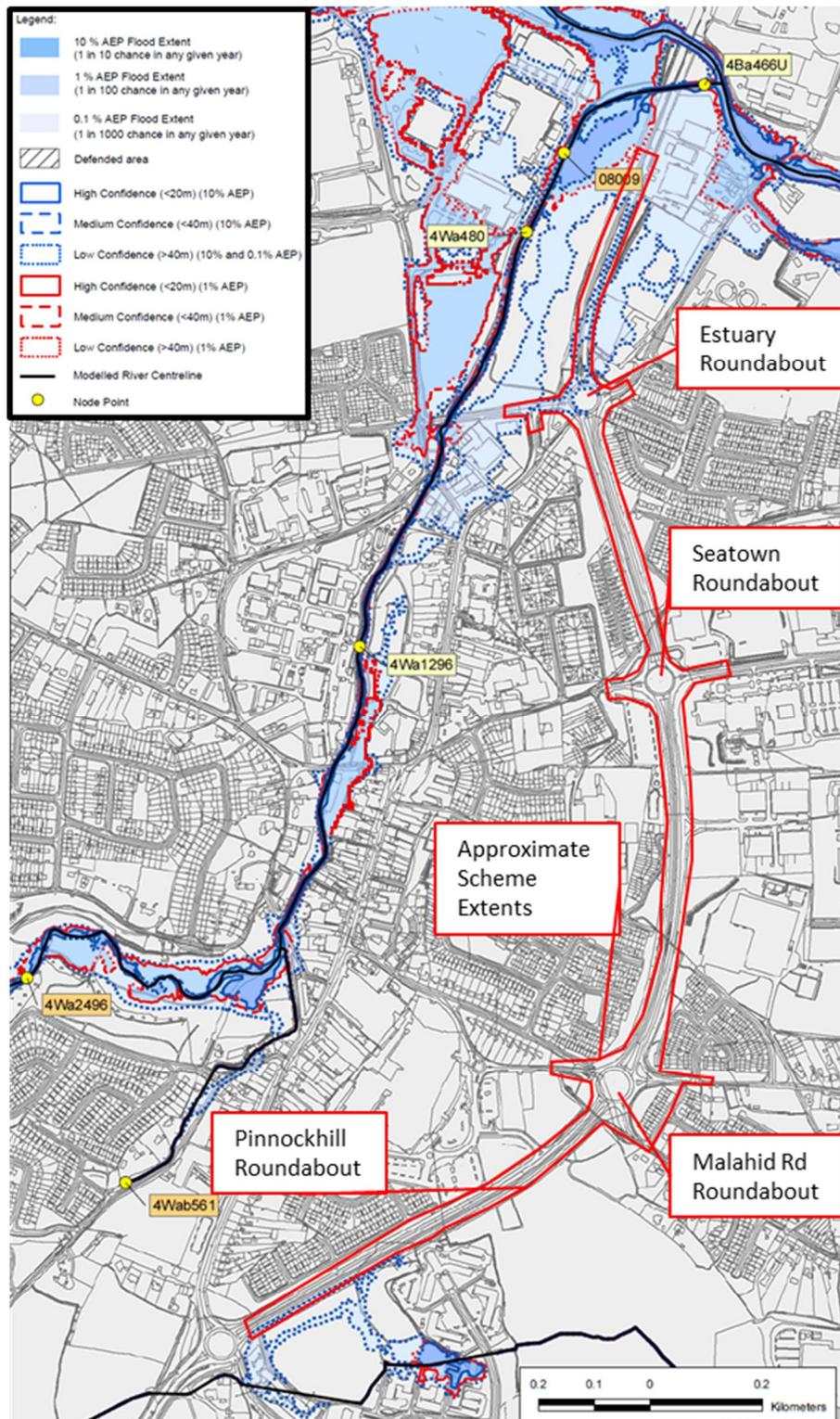


Figure 3-8 Extract from Eastern CFRAM Fluvial Flood Extents Map (Present Day, 0.1%, 1% and 10% AEP, as indicated).

3.4 Source-Pathway-Receptor Model

A Source-Pathway-Receptor model is produced to assess the potential sources of flooding whilst identifying the pathway to the receptor and the receptor itself affected by flooding. The results are outlined in Table 3-3. It provides the probability and magnitude of the sources, the performance and response of pathways and the consequences to the receptors in the context of the development proposal. These sources, pathways and receptors will be assessed further in the initial flood risk assessment stage.

Source	Pathway	Receptor	Likelihood	Impact	Risk
Tidal	Site D is at risk of a coastal flood event (tidal event + surge + sea level rise due to climate change)	Future Development	Unlikely	Very Low	Minor
Fluvial	Site D and Site C affected by fluvial flooding from overbank breach of the Ward/ Broadmeadow Rivers.	Current Development	Possible	Very Low	Minor
	Site A affected by fluvial flooding from overbank breach/ insufficient size of diverted Gaybrook Stream	Current Development	Unlikely	Low	Minor
Pluvial	Flooding from surcharging of the future development's drainage systems.	Future Development	Possible	Medium	Moderate
		Adjacent urban areas			
Groundwater	Rising ground water level on the site	Future Development	Rare	Low	Minor
Infrastructural – Human or Mechanical Error	Blockage of new or existing drainage network	Areas of development draining to SW network	Possible	Medium	Moderate

Table 3-3: Source-Pathway-Receptor Model

There is a moderate risk of pluvial flooding due to the potential surcharging and/or blockage of the new drainage network. Therefore, further consideration must be given to the pluvial flooding scenario in the context of the operation of the development and reducing the impact downstream of the scheme, i.e. flooding of adjacent sites/properties. This is also considered further as part of the Surface Water Management for the revised road layouts within the IDR.

There is a minor risk associated with fluvial flooding at the extremities of Site D and Site A based on a review of the available flood risk information in the preceding sections.

There is also a minor risk associated with tidal flooding at the extremities of Site D, based on a review of the available flood risk information in the preceding sections. However, the proposed scheme is dominated by fluvial flooding and extreme tidal events do not appear to further increase the levels resulting from river flooding. An initial flood risk assessment will follow to provide further detail on the causes, effects and possible mitigation measures for the sources of flood risk identified above.

The risk of groundwater flooding is considered negligible in comparison with the fluvial/coastal flooding risk and therefore will not be addressed any further in this flood risk assessment.

3.5 Vulnerability Classification

The assignment of a vulnerability class for the proposed scheme is a key decision in the level of flood risk that is appropriate.

Prior to construction of the M1 motorway, the R132 was a National Primary Route connecting Dublin and Belfast. The R132 is currently a dual carriageway acting as a local traffic distributor for the town of Swords. The R132 Connectivity Project aims to downgrade the dual carriageway to a high capacity urban street, appropriate to its current use. Therefore, the proposed land use of the R132 can be classified as local transport infrastructure in accordance with Figure 2-4, therefore, the vulnerability is “less vulnerable development”.

Figure 2-5 indicates that less vulnerable developments are appropriate and compatible with flood zones B and C. A justification test will be required to site the proposed development in flood zone A.

4.0 STAGE 2 – INITIAL FLOOD RISK ASSESSMENT STAGE

The initial flood risk identification stage uses existing information to identify and confirm whether there may be flooding or surface water management issues for the subject site which may warrant further investigation.

4.1 Initial Fluvial/Tidal Flood Risk Assessment

4.1.1 CFRAM

Through visual assessment of CFRAM flood map, Site A, Site B or Site C are not affected by present day 1% AEP fluvial events.

The CFRAM fluvial flood map presented on Figure 3-8 indicates that a very small portion of existing area within the extents of the scheme (within Site D) fall within the 1% AEP fluvial floodplain. The fluvial flood levels were predicted for points 08009 and 4Wa480 of the CFRAM drawing No. WAR/HPW/EXT/CURS/003. Both points are located on the Ward river, upstream of the R132 bridge.

The predicted fluvial flood level for the two points is summarised on Table 4-1 below:

The predicted fluvial flood level that is most appropriate for Site D is considered to be the midpoint between point 08009 and Point 4Wa480 as shown on Figure 3-8. This upstream point appears to be where the River Ward first breaches its bank for the 1% AEP event, and it is therefore considered to be a conservative flood level. The interpolated flood levels for the midpoint are noted in the right-hand side column of Table 4-1 below. The present-day scenario is assumed to correlate to year 2010.

Table 4-1: Site D - Fluvial Flood Levels Summary.

Annual Exceedance Probability (AEP)	Point 08009 Level (m DO)	Point 4Wa480 Level (m DO)	Interpolated Level Midpoint Between 080090 and 4Wa480 (m OD)
10%	4.81	5.03	4.92
1%	5.10	5.53	5.315
0.1%	5.62	5.90	5.76

The coastal CFRAM maps show that the tidal flooding does not further increase the extents of flooding resulting from fluvial processes. The predicted tidal flood levels predicted for point 058 on CFRAM drawing No. LIS/HPW/EXT/CURS/T/001 are as follows: 2.6m, 3.09m and 3.39 m OD for tidal AEP of 10%, 0.5% and 0.1%, respectively.

4.1.2 ICPSS

Based on the ICPSS model simulations and map data shown on Figure 3-5, the following flood levels showing combined tidal and storm surge levels were identified and correlated with annual exceedance probabilities for Point 16 (ICPSS Drawing No. NE/RA/EXT/16): 2.79m, 3.21m and 3.43m OD for AEP event of 10%, 0.5% and 0.1% respectively.

4.1.3 FEM FRAMS

The FEM FRAMS carried out sensitivity analysis on climate change effects for a Mid-Range Future Scenario (MRFS) which included a 20% increase in rainfall, 350 mm rise in sea level and 100% increase in urbanisation and the High End Future Scenario (HEFS) was characterised by 30% increase in rainfall, 1000 mm rise in sea level and 400% increase in urbanisation. The FEM FRAMS results of the relevant watercourses are summarised below:

- Broadmeadow River: MRFS or HEFS increase in flows do not significantly increase flood extents and flood risk. Average water level increase of 0.1m and 0.16m for the 1% AEP event MRFS and the HEFS respectively.
- Ward River: Average water level increase of 0.08m and 0.12m for the 1% AEP event MRFS and HEFS respectively due to climate change. Whilst the maximum reported water level increase occurs at the confluence with the Broadmeadow River and it is of the magnitude of 0.62 and 0.73m for the 1% AEP event MRFS and HEFS respectively.
- Gaybrook Stream: Average water level increase of 0.28m and 0.37m for the 1% AEP event MRFS and HEFS respectively.

The effect of climate change on fluvial flooding will be further discussed in Section 5.3.

4.2 Initial Pluvial Flood Risk Assessment

The Source-Pathway-Receptor model identified that there could be potential for pluvial flood risk within the development site related to the future drainage networks and human/ mechanical error.

These have potential to cause local flooding unless they are designed in accordance with the regulations (Greater Dublin Strategic Drainage Study – GDSDS) and to take account of flood exceedance, i.e. for storm return periods over 1% AEP. However, this is not considered an issue for the subject development as the proposed drainage system will improve the predevelopment unconstrained free flowing scenario by employing a surface water management strategy designed using best practice and in accordance with GDSDS guidelines. Further detail is provided as part of the Surface Water Management in the IDR.

4.3 Initial Fluvial & Tidal Flood Risk Assessment

The lands within the proposed scheme are dominated by fluvial flooding and extreme tidal events do not appear to further increase the levels resulting from river flooding. As noted previously, Site A, Site B or Site C are not affected by 1% AEP fluvial events. The flood zones for Site A, Site B and Site C shall be assigned using visual assessment of the flood extents modelled by CFRAM study (CFRAM Drawing No: WAR/HPW/EXT/CURS/003) due to the lack of appropriate predicted fluvial flood levels in the CFRAM study for each of the sites.

Site D is affected by a 1% AEP fluvial event. The fluvial flood level used for the Risk Assessment will be the interpolated level between the CFRAM points 080090 and 4Wa480 as noted in Section 4.1.1. The flood levels shown on Table 4-2 will be used to assign the appropriate flood zones for Site D

Annual Exceedance Probability (AEP)	Return Period	Predicted Flood Level 2010 (m OD Main)
10%	10	4.92
1%	100	5.315
0.1%	1000	5.76

Table 4-2 Predicted 2010 Flood Levels halfway between Point 080090 and 4Wa480 (CFRAM, 2010)

In accordance with the Planning System and Flood Risk Management Guidelines (2009), the flood zones for Site D may be defined as:

- **Flood Zone A:** Areas where the probability of fluvial flooding is highest (greater than 1%). Based on the 2010 predicted fluvial flood levels for midpoint between Point 080090 and Point 4Wa480, this would equate to levels less than 5.315m OD;
- **Flood Zone B:** Areas where the probability of fluvial flooding is moderate (between 1% and 0.1%). Based on the 2010 predicted fluvial flood levels for midpoint between Point 080090 and Point 4Wa480, this would equate to levels between 5.315m OD and 5.76m OD;
- **Flood Zone C:** Areas where the probability of fluvial flooding is low (less than 0.1%). Based on the 2010 predicted fluvial flood levels for midpoint between Point 080090 and Point 4Wa480, this would equate to levels above 5.76m OD.

The sites within the scheme are assigned the following flood zones as indicated on Table 4-3 below.

Site Reference	Minimum Existing Level (mOD)	Fluvial Flood Zone
Site A	23.19	C & B ¹
Site B	11.00	C ¹
Site C	7.20	C & B ¹
Site D	4.29	A & B & C

Table 4-3: Fluvial Flood Zone Summary

The minimum level across the scheme within Site D of 4.29mOD is greater than any of the predicted tidal flood levels, therefore tidal flooding risk is considered negligible and no further assessment is deemed necessary.

As outlined in Section 3.5, the development is classified as “less vulnerable” and it is compatible with Flood Zone B or Flood Zone C. Although, some parts of Site D are within Flood Zone A as noted on Table 4-3 above.

The fluvial flood levels are further assessed to determine an approximate flood level within Site D for the calculation of a maximum height of water for the 1% AEP fluvial event. The flood levels have been interpolated for a flood plain as the river is flowing down in a wider channel as indicated (from Point 1 to Point 2) on Figure 4-1. The interpolated height of water will be taken at Point 3 which coincides with the lowest point of the site (4.29m OD). The interpolated flood level at Point 3 is calculated as 4.73m OD which results in a maximum height of water of approximately 0.44m at the low point of the site. This is considered to be a conservative assessment compared with the maximum height of water of 0.25m predicted by the CFRAM study (refer to Figure 3-7)

¹ Flood Zones assigned using CFRAM map (WAR/HPW/EXT/CURS/003) due to lack of appropriate predicted fluvial flood levels for Site A, Site B and Site C.

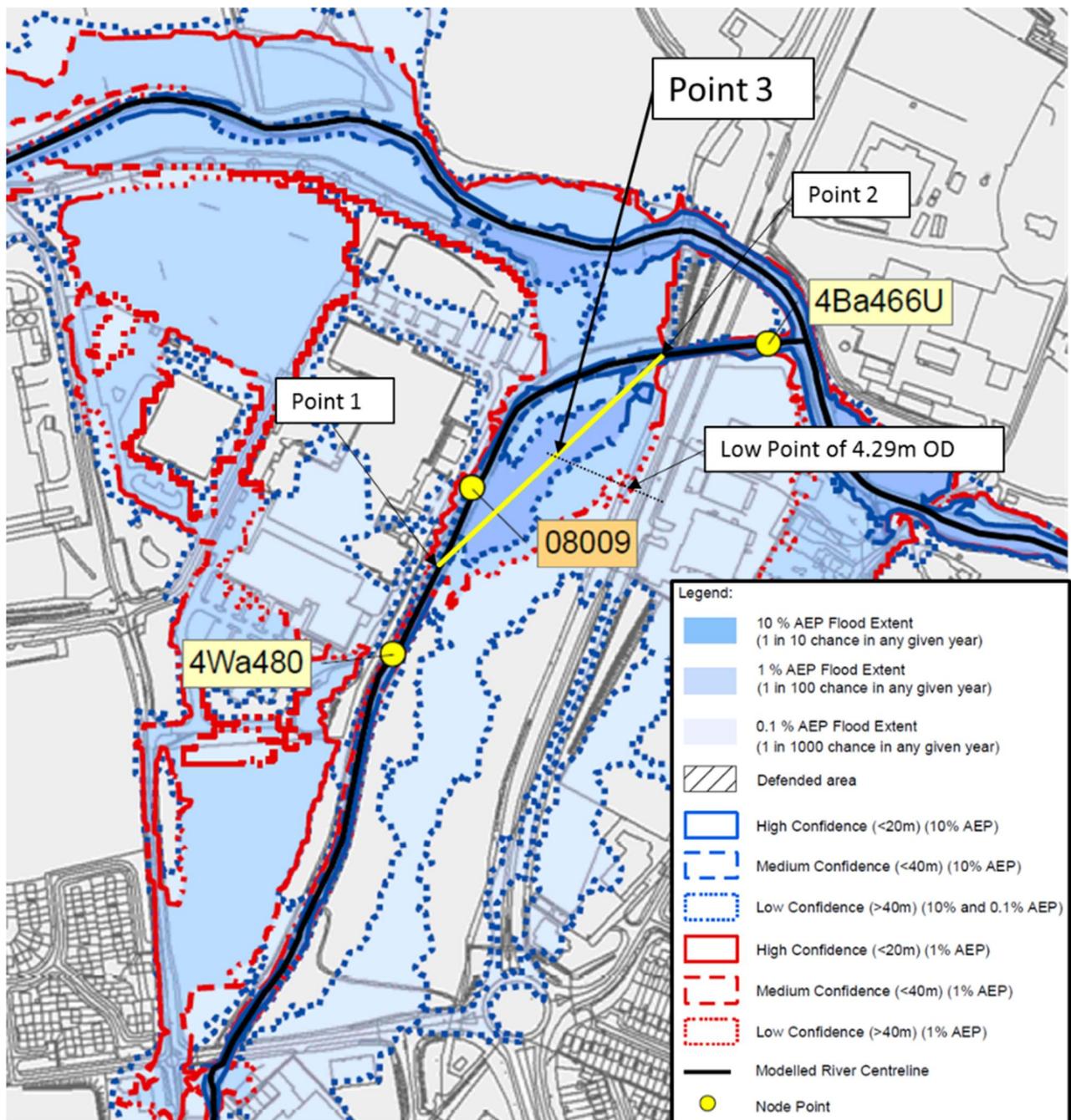


Figure 4-1: Flood Level Interpolation for Height of Water Calculation (CFRAM Flood Extents Map)

5.0 STAGE 3 – DETAILED FLOOD RISK ASSESSMENT

5.1 Introduction

The initial Flood Risk Assessment identified that the most significant flood risk relates to fluvial flooding which is especially prevalent for the Ward river overbank breach at Site D.

The flood zones have been assigned to each site in Table 4-3. It is clear that the majority of the scheme is located within Flood Zone C. Some minor parts of the scheme are located within Flood Zone B. Both Flood Zone B and Flood Zone C are compatible with the proposed scheme and require no further consideration. Minor parts of Site D are situated in Flood Zone A, this will be discussed further in the sections below.

5.2 Justification Test

As indicated by the CFRAM 1% AEP fluvial map, minor parts of Site D are located within Flood Zone A. Based on an interpolated flood level at the flooding location of 4.73m OD (as obtained using Figure 4-1). The maximum height of water is therefore calculated to be approximately 0.44m which occurs within the outside edge of the northbound lane of the existing roadway.

Although Flood Zone A is not compatible with the “less vulnerable” land use of local transport infrastructure, the compatibility of Site D with Flood Zone A can be justified by the fact that the existing roadway is already in existence and the proposed works represent a reallocation of the existing space. Therefore, raising the existing pavement levels of the existing road is considered impractical and commercially restrictive for such a small portion of the subject site. The existing road levels at this point will also need to be maintained to enable a tie-in with the existing R132 roadway and with the Bostik Industries Ltd access road as shown on Figure 5-1.

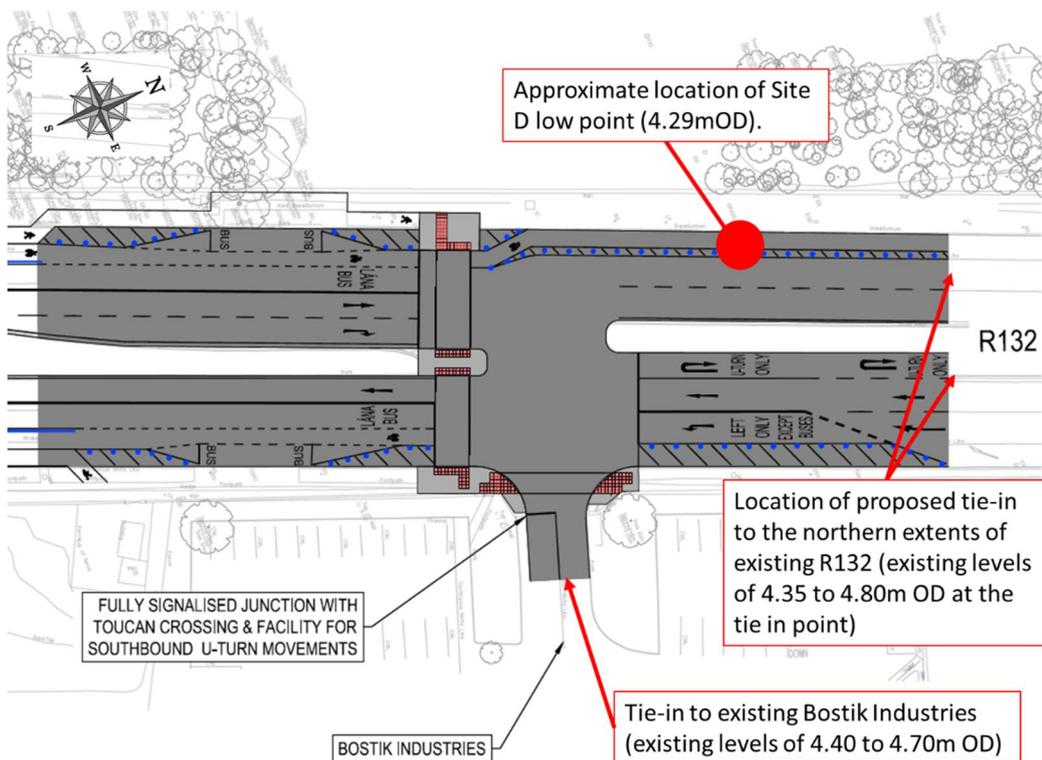


Figure 5-1: Tie-in Point to the Existing Roadway at Site D

With the above in mind the following issues are considered in the context of a Detailed Flood Risk Assessment Stage for the proposed scheme;

- Effect of Climate Change on Fluvial Flooding
- Surface Water Management Measures and SuDS
- Flood Risk Exceedance.
- Impact on Adjacent Areas.
- Access and Egress for Emergency Services during Flood Events.
- Flood Risk Mitigation

5.3 Effect of Climate Change on Fluvial Flooding

The design life of the proposed scheme will be taken as 40 years for the purposes of climate change assessment within this Flood Risk Assessment. The MRFS case is considered sufficient due to the relatively low consequence of flooding for the “less vulnerable” land use. The maximum predicted increase in River Ward flood level due to climate change (MRFS) is reported to be 0.62m for the horizon year of 2100 (FEM FRAMS, 2011). The predicted maximum increase in flood level occurs at the confluence with the Broadmeadow River. The use of the maximum increase in flood level to the upstream point of interest provides additional conservatism in the assessment.

Assuming that construction ends by the year of 2024, the design year for the scheme shall be 2064. The interpolated MRFS 100-year return period flood level of 5.684m OD is achieved for the design year, as shown on Figure 5-2. Therefore, the effect of climate change is equivalent to an increase in flood height by 0.369m at Site D.

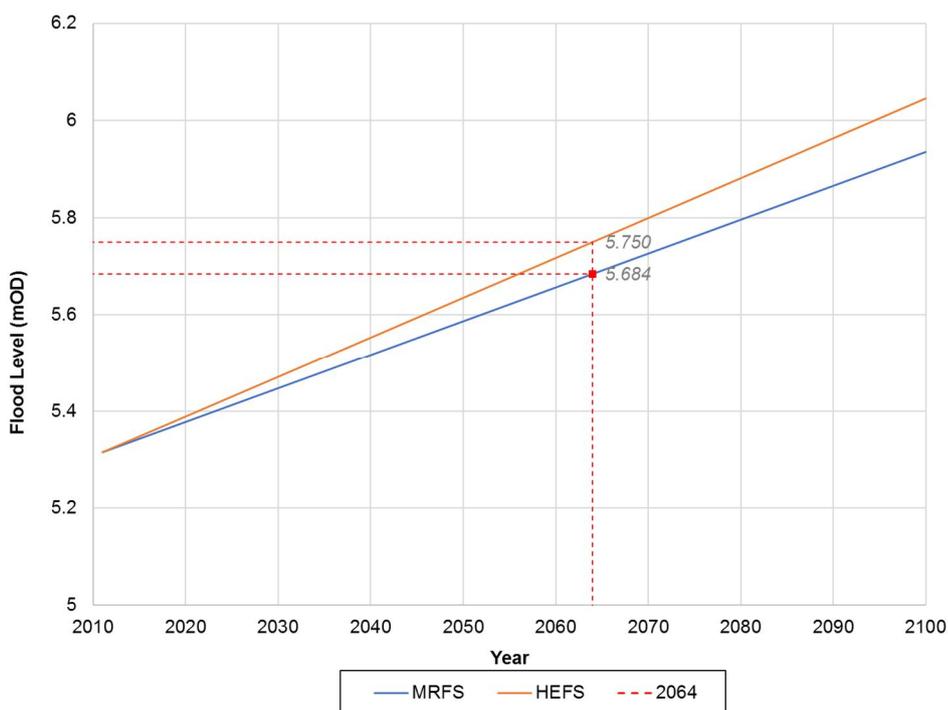


Figure 5-2: Predicted Flood Levels – 100-year Return Period

As reported previously, for the interpolated current day 1% AEP fluvial flood level of 4.73mOD results in a maximum water height equal to 0.44m within the site extents. Therefore, the increase in flood height of 0.369m due to climate change, would result in a future case flood level of 5.1m OD and a maximum height of water equivalent to approximately 0.81m occurring within the verge of the northbound carriageway.

The MRFS future fluvial case is expected to cover the road across its entire width. At this cross section of the dual carriageway, the lowest road level of the southbound carriageway is equal to 4.73mOD. The MRFS flooding would therefore result in a maximum water height of 0.37m in the southbound carriageway.

The highest tidal flood level of 3.21m OD for a 0.5% AEP event was identified by the ICPSS mapping in Section 4.1.2. The application of the sea level rise of 0.5m (MRFS case) as per the latest OPW guidance, gives a future scenario tidal flood level of 3.71mOD. Therefore, the flood risk posed by the effects of climate change on coastal flooding is considered negligible in the context of the subject site.

5.4 Surface Water Management & SuDS

Pluvial risk will be mitigated for the proposed development by way of a surface water management strategy as outlined in the IDR:

The proposed drainage system will be designed using Microdrainage in accordance with current requirements of the GDSDS. Further detail is provided in the IDR.

There are three core forms of surface water run-off applicable to the subject site, influencing type of surface water management measures appropriate. Surface water runoff quality shall be managed at source and at site-wide treatment elements at staged points along different flow paths. The three core forms of surface water run-off along with the surface water management adopted for each is described below:

- Green Space: Receiving environment is generally groundwater and take up by planting. Minor depressions in open areas will be created to slow down the surface water. Extreme pluvial events may locally flood the area over short durations.
- Hard Landscaping (including footpaths and cycleways): Receiving environment is generally groundwater and take up by planting. Where possible, cycleways will be constructed using permeable paving. Runoff from adjacent footpaths will be directed onto the cycleway for percolation into the subgrade. Any excess runoff will be directed to over the edge drainage systems or soft landscape areas.
- Roads: Standard road gullies will collect surface water run-off and discharge to underground pipes or infiltration trenches (where possible). The runoff collected by the infiltration trenches will percolate into the ground or will be taken up by planting, with the excess conveyed to the primary drainage network. Flow control manholes will be used to optimise attenuation storage within the infiltration trenches and pipes for extreme rainfall events up to 1 in 100-year return period. Where trenches and pipes are full, excess flows will be directed to offline attenuation tanks.

- Provision of interception volume storage to receive the runoff from the rainfall depths of 5-10mm if possible. The interception volume will be retained below the invert level of infiltration trenches or taken up by planting.
- The surface water network and attenuation storage will be designed to accommodate a 100-year critical storm (1% AEP).
- The surface water network capacity will be designed to incorporate a 20% increase in extreme rainfall depths to account for climate change (as per the latest government guidance “Flood Risk Management Climate Change Sectoral Approach” – OPW, 2019).
- The runoff rates will be reduced through the provision of flow control devices at each of the outfalls (Hydrobrake or similar) in order to reduce the discharge rate to the greenfield equivalent rate of 2l/s per hectare of contributing catchment. This will reduce the risk of any downstream flooding of the receiving course.
- Proper operation and maintenance of the drainage system should also be implemented to reduce the risk of human or mechanical error causing pluvial flood risk from blockages

Microdraiange surface water network calculations will be conducted during subsequent stages of the project, refer to the IDR for further details.

Due to the fact that the receiving watercourse is influenced by coastal tides, the following should be considered as part of the design.

- Modelling of a surcharged outfall due to tidal effects, if appropriate.
- The outfall invert level will be kept above the high-water mark (HWM) to reduce the risk of the outfall being surcharged.
- Tidal flap valves will be provided on the outfall from the site to prevent backflows during extremely high tide situations and imposing a risk upstream.

5.5 Flood Risk Exceedance

5.5.1 Fluvial Flooding

Fluvial flood events in excess of the 1 in 100-year event (1% AEP), have a potential of posing a flooding risk to greater extents of the site as shown for the 1 in 1000-year fluvial event on Figure 5-3 below where Site D is further affected by the flooding from the River Ward/ Broadmeadow. Site A and C are also marginally affected by the 0.1% AEP fluvial event.

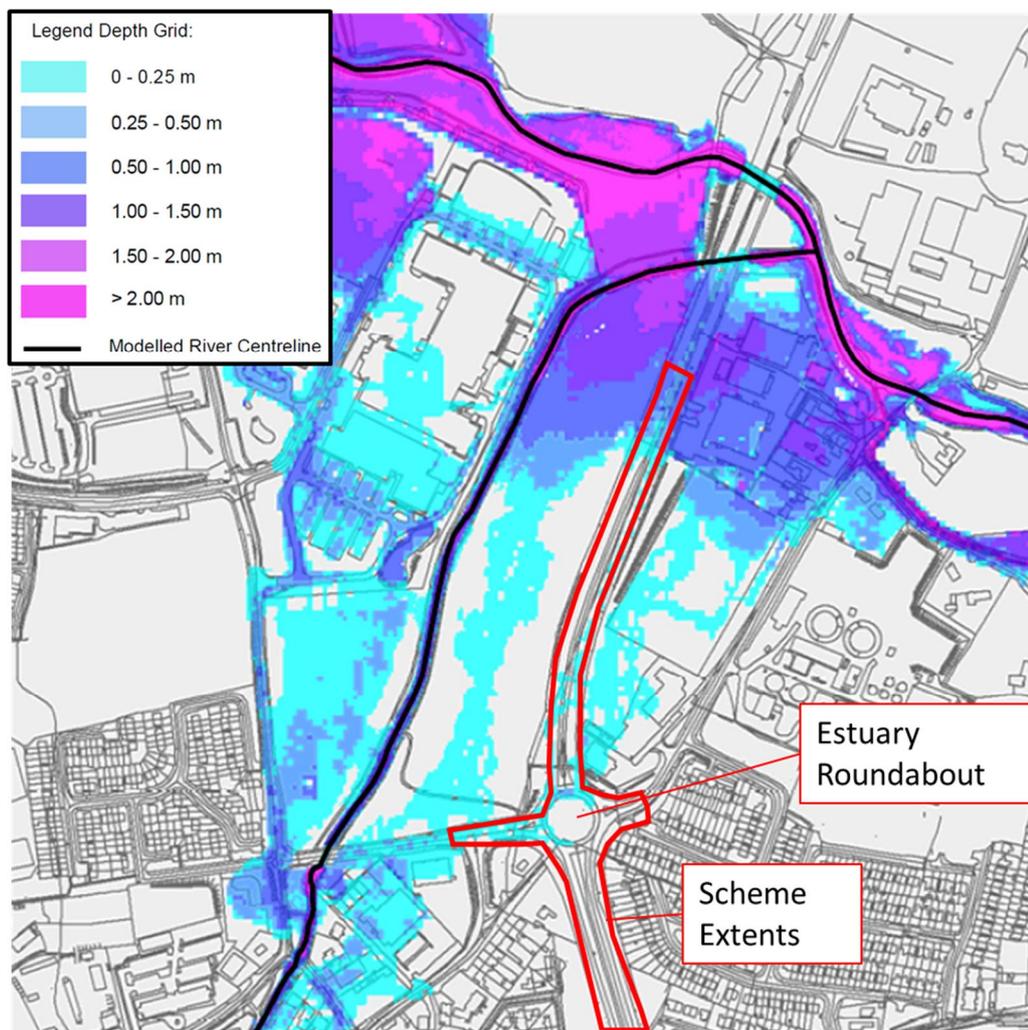


Figure 5-3: Fluvial Flood Risk for 1 in 1000 year Event (CFRAM, 2011)

The maximum water level for the 0.1% AEP event is predicted to be 5.76m OD, for the midpoint between Node 080090 and 4Wa480 as shown on Table 4-2. This is equivalent to an interpolated flood level of 5.4mOD for Point 3 as per Figure 4-1. This results in a maximum water height of 1.11m within the northbound lane near to the tie-in location at the northernmost part of Site D.

It is noted that a significant risk to residential dwellings and commercial premises exists for the fluvial flood event in excess of the 1 in 100-year event as shown on Figure 5-3. Although beyond the extents

of the subject site, consideration should be given to a detailed assessment which includes flood modelling for the provision of flood defences to protect the more vulnerable land uses and to provide a continuous transport corridor

Figure 5-3 shows that other potential fluvial flooding flow paths open up which pose a risk to the scheme. The CFRAM map shows that the River Ward appears to breach its bank at the culverts below the crossing of Balheary Road and the R125. The flood volume appears to create alternative flow channels, one of which is down the R125. This potential flow path appears to flood some of the existing Estuary Roundabout and the R132 northern arm.

5.5.2 Pluvial Flooding

The surface water network will be designed to attenuate a 1 in 100-year pluvial event. The critical storms in excess of this will be managed as follows:

When the surface water network is filled with water and it does not have the capacity to accept any more surface water, the excess runoff will be directed to an overland flood route along the scheme towards the surface water outfall location. The road generally falls in a northward direction at maximum and minimum longitudinal gradients of 1:30 and 1:185 respectively. The existing gradients will prevent surface water ponding.

The surface water drainage network of Site D will also be flooded during the 1% AEP fluvial flood events due to the excessive amounts of fluvial flood volumes entering the network. Refer to Section 5.8 for the proposed mitigation measures.

5.6 Impact on Adjacent Areas

Adjacent areas will not be negatively impacted by the proposed scheme as the proposed levels of the road are not to be altered significantly. The works proposed as part of this scheme are considered to have a positive effect on downstream areas of receiving watercourses as flows which have never been attenuated, will be restricted to the greenfield equivalent discharge rate (for up to 1 in 100 year pluvial event (1% AEP)). Thereby reducing the pluvial flood risk downstream of the site and having a lesser effect on fluvial flooding.

5.7 Access and Egress for Emergency Services During Flood Events

As noted previously, a maximum height of water of 0.44m is expected to flood the outside edge of northbound lane in the northernmost part of Site D. The flood extents due to a present day 1% AEP fluvial flood event are presented on the CFRAM extract shown on Figure 3-7. Following this fluvial event, the road will drain back down into the River Ward. The road and closely associated infrastructure will be cleared by Fingal County Council.

Although the MRFS future case maximum water level of 5.1m OD is expected to cause the northbound lane to be impassable for majority of vehicles. The maximum water level at the inside lane of the southbound carriageway is predicted as approximately 0.37m high which should be passable to emergency vehicles. As noted above, the installation of flood defences would provide protection and retain a clear transport corridor.

Where extreme events occur beyond those considered manageable, it is proposed that Variable Messaging Signs (VMS) in conjunction with temporary traffic signals are to be used to advance warn users of the impact and direct them to alternative route.

5.8 Flood Risk Mitigation

Proposed mitigation measures to address residual flood risk are summarised below:

- The proposed drainage system is to be maintained on a regular basis to reduce the risk of a blockage.
- The surface water drainage network may become flooded due to the 1% AEP fluvial flooding of the north portion of Site D as a result of flood water entering the drainage system. Non-return flap valves shall be installed within the manhole downstream of the attenuation tank upstream of Site D to prevent the backflow of surface water to the upstream manholes of the surface water network.
- The surface water drainage attenuation tank upstream of Site D shall be designed to account for a surcharged outfall due to the fluvial flooding reported in this Flood Risk Assessment. This will prevent the backflows during fluvial flooding events and imposing a risk upstream.
- All highly vulnerable infrastructure (e.g. electrical distribution boards, substations (if required)) mini pillars, etc should be set above the 1 in 100-year tidal flood level including an allowance for climate change and an appropriate freeboard, for example within Site C and Site D: 5.315m OD (for the 1 in 100-year River Ward fluvial flood level in the vicinity of the subject site) + 0.40m (Ward river level increase due to climate change) + 0.50m (freeboard) = 6.215m OD.
- Although beyond the scope of this risk assessment and the extents of the subject site, it is recommended that future consideration be given to conducting a detailed assessment (including flood modelling) for the zone immediately north of the subject site with a view to providing a clear transport corridor and reduce flood risk to existing buildings and houses.
- Tidal flap valves will be provided on the outfall from the site to prevent backflows during extremely high tide situations and imposing a risk upstream

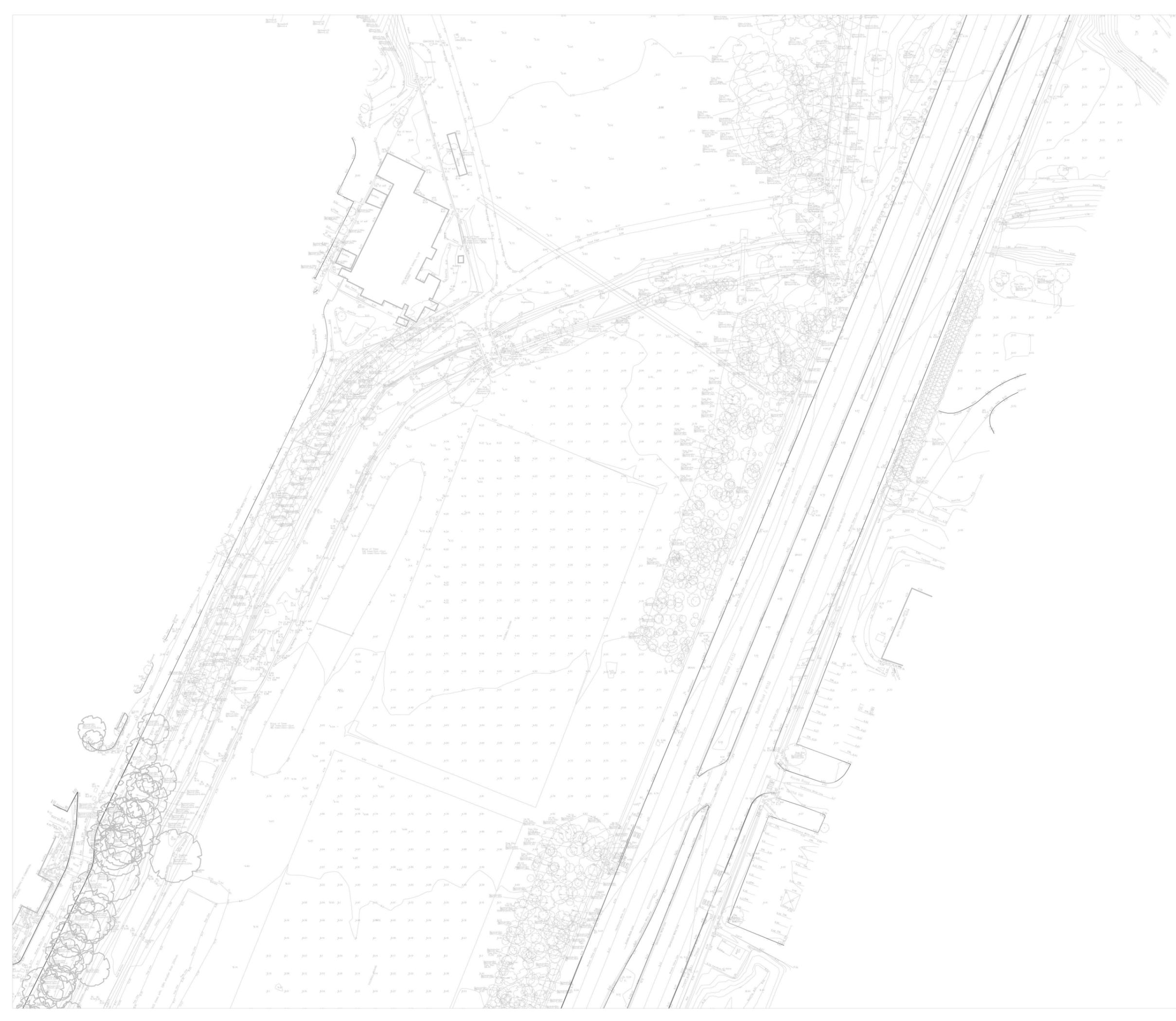
6.0 CONCLUSIONS

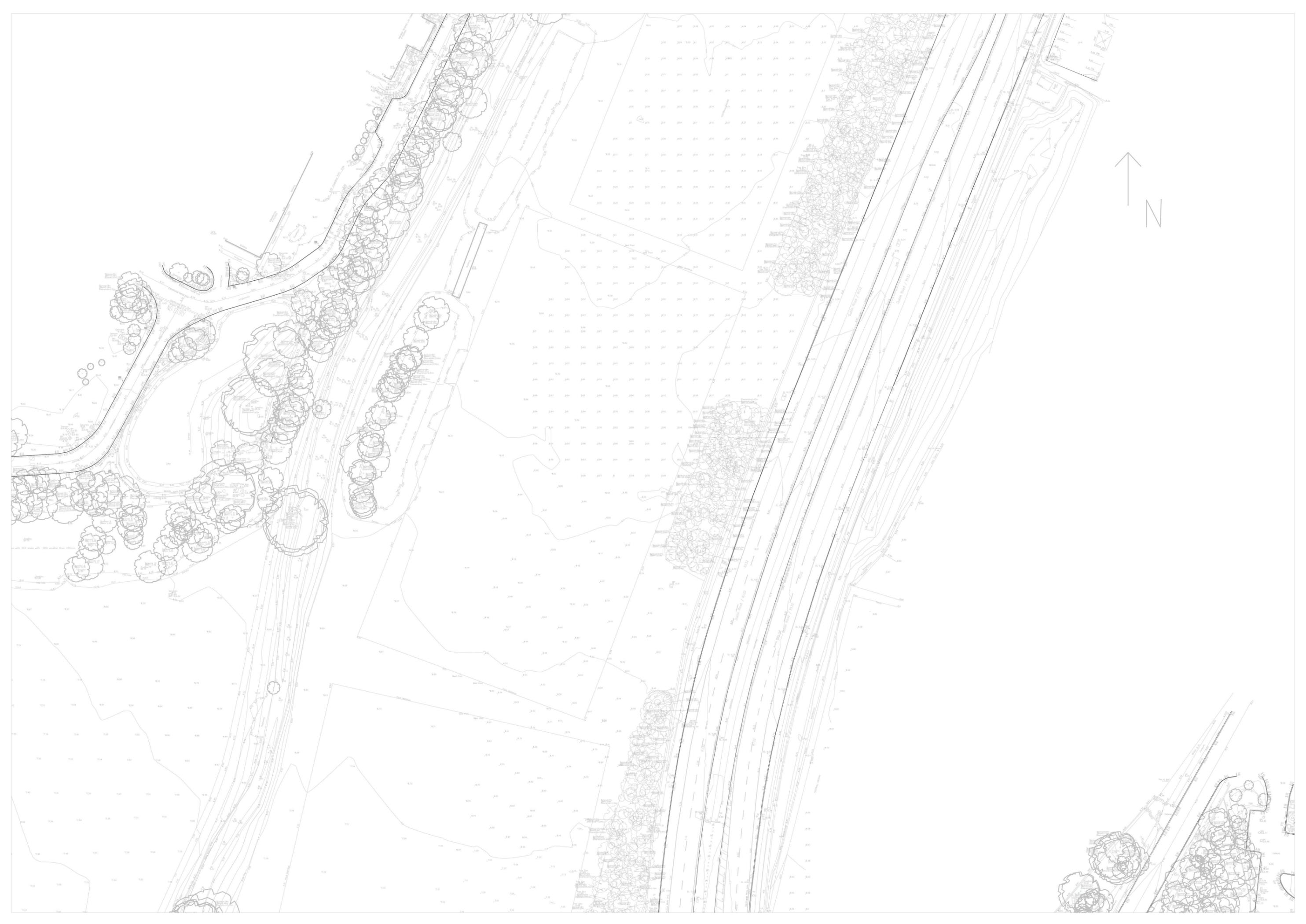
Based on a thorough review and assessment of the flood risks associated with the proposed road the following conclusions can be drawn:

- This FRA for the proposed works was undertaken in accordance with the requirements of the Planning System and Flood Risk Management Guidelines for Planning Authorities, November 2009.
- The proposed scheme can be classified as a “less vulnerable” development as the R132 will act as a local traffic distributor. Therefore, the scheme should be kept above the 1% AEP fluvial event and the 0.5% AEP coastal flood event as far as reasonably practicable. The proposed scheme is compatible with Flood Zone B and Flood Zone C
- Site A, Site B and Site C are located within either Flood Zone B or Flood Zone C, no additional measures or consideration is necessary.
- Northernmost part of Site D is located within Flood Zone A. As the proposed project must tie in with existing levels, this section will remain in Flood Zone A. It is directly alongside an existing road that is constraining any level adjustments at this stage. This ensures that the ‘Justification principle’ has been applied in accordance with The Planning System and Flood Risk Management Guidelines Sequential Approach.
- Although considered beyond the extent of the subject site and scope of this flood risk assessment, the inclusion of flood defences might be considered to retain waters within undeveloped areas to reduce the risk of flooding of the road for the majority of extreme scenarios. Any flood defences will require a detailed assessment and a flood management plan to be undertaken. The construction form of the flood defences must be robust and resilient requiring limited maintenance and will ensure that the ‘Mitigation principle’ has been applied in accordance with The Planning System and Flood Risk Management Guidelines Sequential Approach.
- It is also noted that fluvial flooding associated with events in excess of the 1 in 100-year events open up other flood paths (along the R125) which pose a risk to the scheme and potentially to residential and commercial premises in the area. Consideration should be given to additional flood defences following a full detailed assessment and flood modelling. This is beyond the scope of this report.
- The design life of the scheme has been assumed as 40 years. A re-assessment of the flood risk at the site is recommended to be undertaken in 20 years.

- A possible source of flood risk from the surcharging or blockage of the development's drainage system has been identified. This risk shall be mitigated by suitable design of the drainage network, regular maintenance and inspection of the network and establishment of exceedance overland flow routes.
- The outfalls of the existing surface water drainage networks require investigations to be undertaken to confirm condition and extents. The receiving watercourse of the surface water networks, that is the Greenfields stream and the drainage ditch adjacent to the R132 also require investigations to trace the route of the runoff to the Swords Estuary to ensure that no flood risk is created upstream of the discharge points due to possible malfunctioning of the system.
- A further detailed Site-Specific Flood Risk Assessment is not considered necessary.

Appendix A – Topographical Surveys













Zone 1
Zone 2

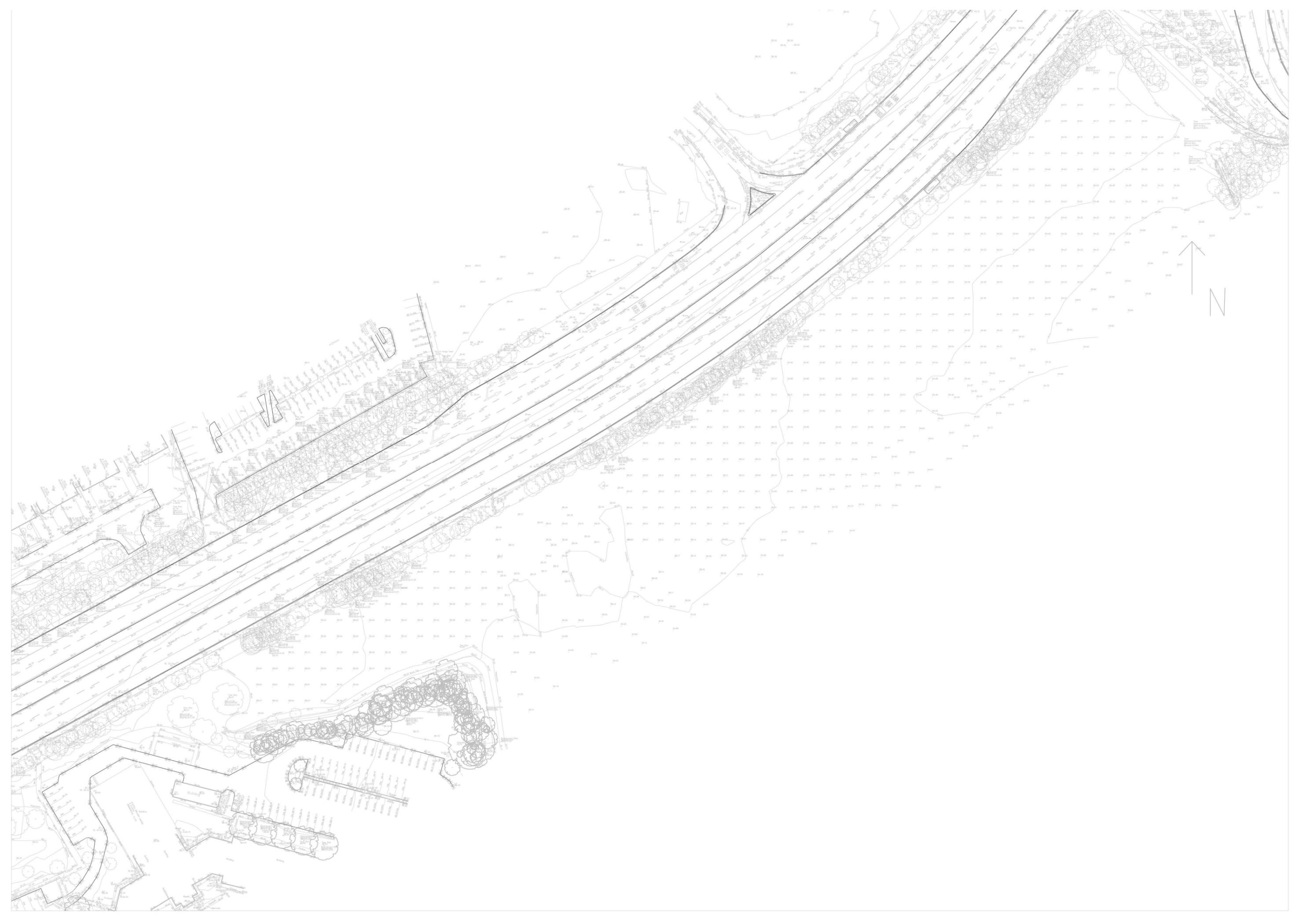


Zone 1
Zone 2



Zone 1
Zone 2

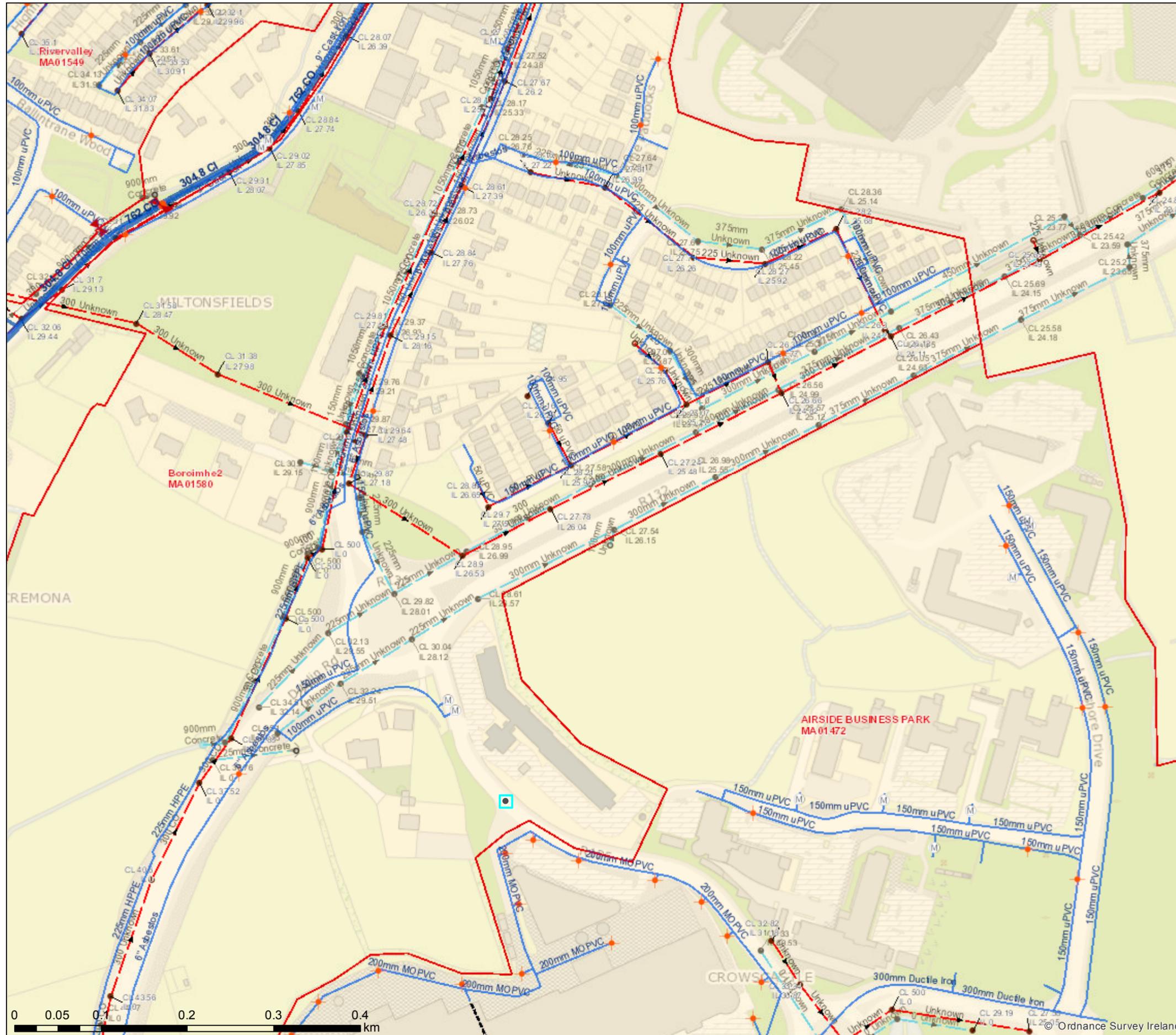






Appendix B – Drainage Records

Irish Water R132 between pinnockhill and seatown park 1



UISCE
EIREANN : IRISH
WATER

Print Date: 12/03/2020

Printed by: Irish Water

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

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

© Copyright Irish Water

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

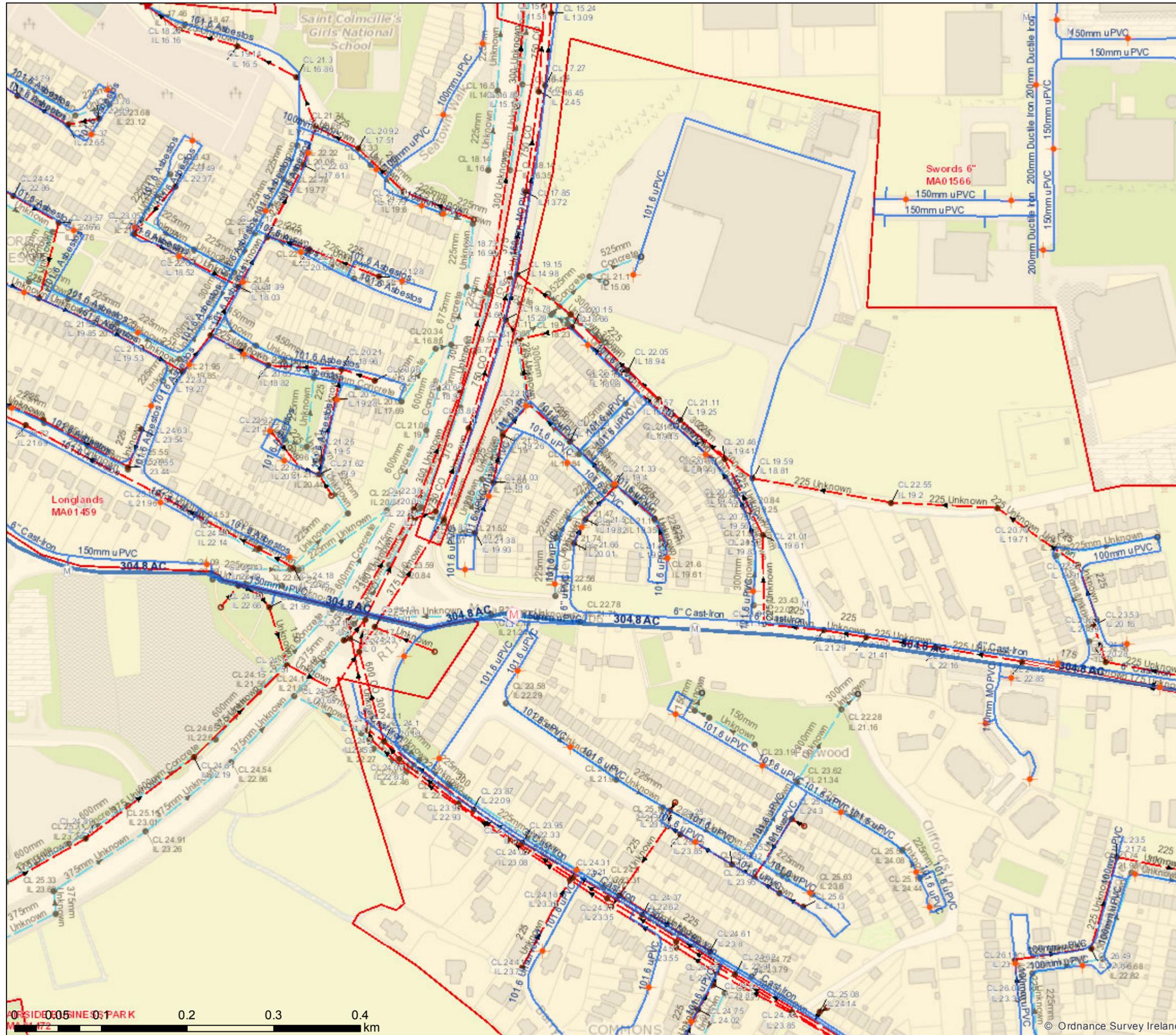
"Gas Networks Ireland (GNI), their affiliates and assigns, accept no responsibility for any information contained in this document concerning location and technical designation of the gas distribution and transmission network ("the Information"). Any representations and warranties express or implied, are excluded to the fullest extent permitted by law. No liability shall be accepted for any loss or damage including, without limitation, direct, indirect, special, incidental, punitive or consequential loss including loss of profits, arising out of or in connection with the use of the information (including maps or mapping data).

NOTE: DIAL BEFORE YOU DIG Phone: 1850 427 747 or e-mail dig@gasnetworks.ie - The actual position of the gas/electricity distribution and transmission network must be verified on site before any mechanical excavating takes place. If any mechanical excavation is proposed, hard copy maps must be requested from GNI re gas. All work in the vicinity of gas distribution and transmission network must be completed in accordance with the current edition of the Health & Safety Authority publication, 'Code of Practice For Avoiding Danger From Underground Services' which is available from the Health and Safety Authority (1890 28 93 89) or can be downloaded free of charge at www.hsa.ie."

Water Distribution Network	Sewer Foul Combined Network	Storm Water Network
Water Treatment Plant	Waste Water Treatment Plant	Surface Water Mains
Water Pump Station	Waste Water Pump Station	Surface Gravity Mains
Storage Cell/Tower		Surface Gravity Mains Private
Dosing Cell		Surface Water Pressurised Mains
Meter Station		Surface Water Pressurised Mains Private
Abstraction Point		Inlet Type
Telemetry Kiosk		Gully
Reservoir		Standard
Potable		Other: Unknown
Raw Water		Storm Manholes
Water Distribution Mains		Standard
Trunk Water Mains		Backdrop
Water Lateral Lines		Cascade
Water Casings		Catchpit
Water Abandoned Lines		Bifurcation
Boundary Meter		Hatchbox
Bulk/Check Meter		Lampole
Group Scheme		Hydrobrake
Source Meter		Other: Unknown
Waste Meter		Storm Culverts
Unknown Meter; Other Meter		Storm Clean Outs
Non-Return		Stormwater Chambers
PRV		Discharge Type
PSV		Outfall
Sluice Line Valve Open/Closed		Overflow
Butterfly Line Valve Open/Closed		Soakaway
Sluice Boundary Valve Open/Closed		Cascade
Butterfly Boundary Valve Open/Closed		Other; Unknown
Scour Valves		Gas Networks Ireland
Single Air Control Valve		Transmission High Pressure Gasline
Double Air Control Valve		Distribution Medium Pressure Gasline
Water Stop Valves		Distribution Low Pressure Gasline
Water Service Connections		ESB Networks
Water Distribution Chambers		ESB HV Lines
Pressure Monitoring Point		HV Underground
Fire Hydrant		HV Overhead
Fire Hydrant/Washout		HV Abandoned
Water Fittings		ESB MVLV Lines
Cap		MV Overhead Three Phase
Reducer		MV Overhead Single Phase
Tap		LV Overhead Three Phase
Other Fittings		LV Overhead Single Phase
		Abandoned
		Cleanout Type
		Rodding Eye
		Flushing Structure
		Other: Unknown
		Sewer Inlets
		Catchpit
		Gully
		Standard
		Other: Unknown
		Water Non Service Assets
		Water Point Feature
		Water Pipe
		Water Structure
		Waste Non Service Assets
		Waste Point Feature
		Sewer
		Waste Structure



Irish Water R132 between pinnockhill and seatown park 2



UISCE
EIREANN : IRISH
WATER

Print Date: 12/03/2020

Printed by: Irish Water

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

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

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

*Gas Networks Ireland (GNI), their affiliates and assigns, accept no responsibility for any information contained in this document concerning location and technical designation of the gas distribution and transmission network ("the Information"). Any representations and warranties express or implied, are excluded to the fullest extent permitted by law. No liability shall be accepted for any loss or damage including, without limitation, direct, indirect, special, incidental, punitive or consequential loss including loss of profits, arising out of or in connection with the use of the information (including maps or mapping data).
NOTE: DIAL BEFORE YOU DIG Phone: 1850 427 747 or e-mail dig@gasnetworks.ie - The actual position of the gas/electricity distribution and transmission network must be verified on site before any mechanical excavating takes place. If any mechanical excavation is proposed, hard copy maps must be requested from GNI re gas. All work in the vicinity of gas distribution and transmission network must be completed in accordance with the current edition of the Health & Safety Authority publication, 'Code of Practice For Avoiding Danger From Underground Services' which is available from the Health and Safety Authority (1890 28 93 89) or can be downloaded free of charge at www.hsa.ie."

Water Distribution Network	Sewer Foul Combined Network	Storm Water Network
Water Treatment Plant	Waste Water Treatment Plant	Surface Water Mains
Water Pump Station	Waste Water Pump station	Surface Gravity Mains
Storage Cell/Tower	Sewer Mains Irish Water	Surface Gravity Mains Private
Dosing Point	Gravity - Combined	Surface Water Pressurised Mains
Meter Station	Gravity - Foul	Surface Water Pressurised Mains Private
Abstraction Point	Gravity - Unknown	Inlet Type
Telemetry Kiosk	Pumping - Combined	Gully
Reservoir	Pumping - Foul	Standard
Potable	Pumping - Unknown	Other Unknown
Raw Water	Syphon - Combined	Storm Manholes
Water Distribution Mains	Syphon - Foul	Standard
Trunk Water Mains	Overflow	Backdrop
Water Lateral Lines	Sewer Mains Private	Cascade
Water Casings	Gravity - Combined	Catchpit
Water Abandoned Lines	Gravity - Foul	Biturcation
Boundary Meter	Gravity - Unknown	Hatchbox
Bulk/Check Meter	Pumping - Combined	Lampole
Group Meter	Pumping - Foul	Hydrobrake
Source Meter	Pumping - Unknown	Other Unknown
Water Stop Valves	Syphon - Combined	Storm Culverts
Water Service Connections	Syphon - Foul	Stormwater Chambers
Water Distribution Chambers	Overflow	Discharge Type
Water Network Junctions	Sewer Lateral Lines	Standard
Pressure Monitoring Point	Sewer Casings	Overflow
Fire Hydrant	Sewer Manholes	Soakaway
Fire Hydrant/Washout	Standard	Other; Unknown
Water Fittings	Backdrop	Gas Networks Ireland
Cap	Waste Meter	Transmission High Pressure Gasline
Reducer	Unknown Meter; Other Meter	Distribution Medium Pressure Gasline
Tap	Non-Return	Distribution Low Pressure Gasline
Other Fittings	PRV	ESB Networks
	PSV	ESB HV Lines
	Sluice Line Valve Open/Closed	HV Underground
	Butterfly Line Valve Open/Closed	HV Overhead
	Sluice Boundary Valve Open/Closed	HV Abandoned
	Butterfly Boundary Valve Open/Closed	ESB MVLV Lines
	Scour Valves	MV Overhead Three Phase
	Single Air Control Valve	MV Overhead Single Phase
	Double Air Control Valve	LV Overhead Three Phase
	Water Stop Valves	LV Overhead Single Phase
	Water Service Connections	Abandoned
	Water Distribution Chambers	Non Service Categories
	Water Network Junctions	Proposed
	Pressure Monitoring Point	Under Construction
	Fire Hydrant	Out of Service
	Fire Hydrant/Washout	Decommissioned
	Water Fittings	Water Non Service Assets
	Cap	Water Point Feature
	Reducer	Water Pipe
	Tap	Water Structure
	Other Fittings	Waste Non Service Assets
		Waste Point Feature
		Sewer
		Waste Structure



© Ordnance Survey Ireland

Irish Water R132 between pinnockhill and seatown park 4



UISCE
EIREANN : IRISH
WATER

Print Date: 12/03/2020

Printed by: Irish Water

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

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

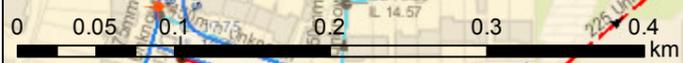
© Copyright Irish Water

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

"Gas Networks Ireland (GNI), their affiliates and assigns, accept no responsibility for any information contained in this document concerning location and technical designation of the gas distribution and transmission network ("the Information"). Any representations and warranties express or implied, are excluded to the fullest extent permitted by law. No liability shall be accepted for any loss or damage including, without limitation, direct, indirect, special, incidental, punitive or consequential loss including loss of profits, arising out of or in connection with the use of the information (including maps or mapping data).

NOTE: DIAL BEFORE YOU DIG Phone: 1850 427 747 or e-mail dig@gasnetworks.ie - The actual position of the gas/electricity distribution and transmission network must be verified on site before any mechanical excavating takes place. If any mechanical excavation is proposed, hard copy maps must be requested from GNI re gas. All work in the vicinity of gas distribution and transmission network must be completed in accordance with the current edition of the Health & Safety Authority publication, 'Code of Practice For Avoiding Danger From Underground Services' which is available from the Health and Safety Authority (1890 28 93 89) or can be downloaded free of charge at www.hsa.ie."

<p>Water Distribution Network</p> <ul style="list-style-type: none"> Water Treatment Plant Water Pump Station Storage Cell/Tower Dosing Point Meter Station Abstraction Point Telemetry Kiosk <p>Reservoir</p> <ul style="list-style-type: none"> Potable Raw Water <p>Water Distribution Mains</p> <ul style="list-style-type: none"> Irish Water Private <p>Trunk Water Mains</p> <ul style="list-style-type: none"> Irish Water Private <p>Water Lateral Lines</p> <ul style="list-style-type: none"> Irish Water Non IW Water Casings Water Abandoned Lines <p>Boundary Meter</p> <ul style="list-style-type: none"> Bulk/Check Meter Group Scheme Source Meter Waste Meter Unknown Meter ; Other Meter Non-Return PRV PSV <p>Sluice Line Valve Open/Closed</p> <ul style="list-style-type: none"> Butterfly Line Valve Open/Closed Sluice Boundary Valve Open/Closed Butterfly Boundary Valve Open/Closed <p>Scour Valves</p> <ul style="list-style-type: none"> Single Air Control Valve Double Air Control Valve <p>Water Stop Valves</p> <ul style="list-style-type: none"> Water Service Connections Water Distribution Chambers Water Network Junctions Pressure Monitoring Point <p>Fire Hydrant</p> <ul style="list-style-type: none"> Fire Hydrant/Washout <p>Water Fittings</p> <ul style="list-style-type: none"> Cap Reducer Tap Other Fittings 	<p>Sewer Foul Combined Network</p> <ul style="list-style-type: none"> Waste Water Treatment Plant Waste Water Pump station <p>Sewer Mains Irish Water</p> <ul style="list-style-type: none"> Gravity - Combined Gravity - Foul Gravity - Unknown Pumping - Combined Pumping - Foul Pumping - Unknown Syphon - Combined Syphon - Foul Overflow <p>Sewer Mains Private</p> <ul style="list-style-type: none"> Gravity - Combined Gravity - Foul Gravity - Unknown Pumping - Combined Pumping - Foul Pumping - Unknown Syphon - Combined Syphon - Foul Overflow <p>Sewer Lateral Lines</p> <ul style="list-style-type: none"> Sewer Casings <p>Sewer Manholes</p> <ul style="list-style-type: none"> Standard Backdrop Cascade Catchpit Non-Return Hatchbox Lampole Hydrobrake Other, Unknown <p>Discharge Type</p> <ul style="list-style-type: none"> Overflow Soakaway Standard Outlet Other, Unknown <p>Cleanout Type</p> <ul style="list-style-type: none"> Flushing Structure Other, Unknown <p>Sewer Inlets</p> <ul style="list-style-type: none"> Catchpit Gully Standard Other, Unknown Vent/Col Other, Unknown 	<p>Storm Water Network</p> <p>Surface Water Mains</p> <ul style="list-style-type: none"> Surface Gravity Mains Surface Gravity Mains Private Surface Water Pressurised Mains Surface Water Pressurised Mains Private <p>Inlet Type</p> <ul style="list-style-type: none"> Gully Standard Other, Unknown <p>Storm Manholes</p> <ul style="list-style-type: none"> Standard Backdrop Cascade Catchpit Bifurcation Hatchbox Lampole Hydrobrake Other, Unknown Storm Culverts Storm Clean Outs Stormwater Chambers <p>Discharge Type</p> <ul style="list-style-type: none"> Outfall Overflow Soakaway Other, Unknown <p>Gas Networks Ireland</p> <ul style="list-style-type: none"> Transmission High Pressure Gasline Distribution Medium Pressure Gasline Distribution Low Pressure Gasline <p>ESB Networks</p> <p>ESB HV Lines</p> <ul style="list-style-type: none"> HV Underground HV Overhead HV Abandoned <p>ESB MV/LV Lines</p> <ul style="list-style-type: none"> MV Overhead Three Phase MV Overhead Single Phase LV Overhead Three Phase LV Overhead Single Phase MV/LV Underground Abandoned <p>Non Service Categories</p> <ul style="list-style-type: none"> Proposed Under Construction Out of Service Decommissioned <p>Water Non Service Assets</p> <ul style="list-style-type: none"> Water Point Feature Water Pipe Water Structure <p>Sewer Non Service Assets</p> <ul style="list-style-type: none"> Waste Point Feature Sewer Waste Structure
---	--	---



Irish Water R132 between pinnockhill and seatown park 5



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

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

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

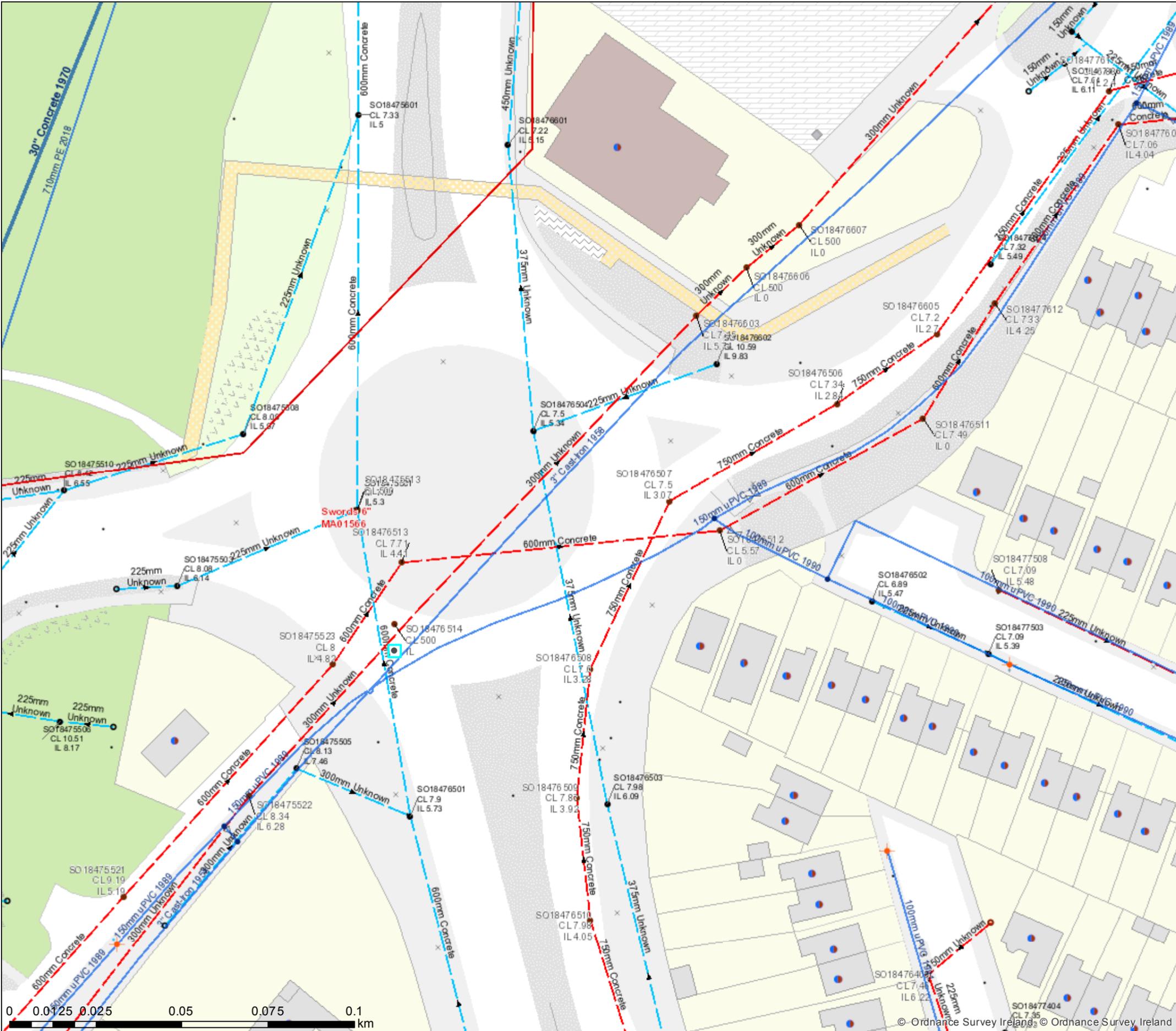
Gas Networks Ireland (GNI), their affiliates and assigns, accept no responsibility for any information contained in this document concerning location and technical designation of the gas distribution and transmission network ("the Information"). Any representations and warranties express or implied, are excluded to the fullest extent permitted by law. No liability shall be accepted for any loss or damage including, without limitation, direct, indirect, special, incidental, punitive or consequential loss including loss of profits, arising out of or in connection with the use of the information (including maps or mapping data).
 NOTE: DIAL BEFORE YOU DIG Phone: 1850 427 747 or e-mail dig@gasnetworks.ie - The actual position of the gas/electricity distribution and transmission network must be verified on site before any mechanical excavating takes place. If any mechanical excavation is proposed, hard copy maps must be requested from GNI re gas. All work in the vicinity of gas distribution and transmission network must be completed in accordance with the current edition of the Health & Safety Authority publication, 'Code of Practice For Avoiding Danger From Underground Services' which is available from the Health and Safety Authority (1890 28 93 89) or can be downloaded free of charge at www.hsa.ie."

Water Distribution Network	Sewer Foul Combined Network	Storm Water Network
Water Treatment Plant	Waste Water Treatment Plant	Surface Gravity Mains
Water Pump Station	Waste Water Pump station	Surface Gravity Mains Private
Storage Cell/Tower		Surface Water Pressurised Mains
Dosing Plant		Surface Water Pressurised Mains Private
Meter Station		Inlet Type
Abstraction Point		Gully
Telemetry Kiosk		Standard
Reservoir		Other, Unknown
Potable		Storm Manholes
Raw Water		Standard
Water Distribution Mains		Backdrop
Irish Water		Cascade
Private		Catchpit
Trunk Water Mains		Bifurcation
Irish Water		Hatchbox
Private		Lampole
Water Lateral Lines		Hydrobrake
Irish Water		Other, Unknown
Non IW		Storm Culverts
Water Casings		Storm Clean Outs
Water Abandoned Lines		Stormwater Chambers
Boundary Meter		Discharge Type
Bulk/Check Meter		Outfall
Group Scheme		Overflow
Source Meter		Soakaway
Waste Meter		Other, Unknown
Unknown Meter; Other Meter		Gas Networks Ireland
Non-Return		Transmission High Pressure Gasline
PRV		Distribution Medium Pressure Gasline
PSV		Distribution Low Pressure Gasline
Sluice Line Valve Open/Closed		ESB Networks
Butterfly Line Valve Open/Closed		ESB HV Lines
Sluice Boundary Valve Open/Closed		HV Underground
Butterfly Boundary Valve Open/Closed		HV Overhead
Scour Valves		HV Abandoned
Single Air Control Valve		ESB MVLV Lines
Double Air Control Valve		MV Overhead Three Phase
Water Stop Valves		MV Overhead Single Phase
Water Service Connections		LV Overhead Three Phase
Water Distribution Chambers		LV Overhead Single Phase
Water Network Junctions		MVLV Underground
Pressure Monitoring Point		Abandoned
Fire Hydrant		Non Service Categories
Fire Hydrant/Washout		Proposed
Water Fittings		Under Construction
Cap		Out of Service
Reducer		Decommissioned
Tap		Water Non Service Assets
Other Fittings		Water Point Feature
		Water Pipe
		Water Structure
		Waste Non Service Assets
		Waste Point Feature
		Sewer
		Waste Structure

Irish Water Intersection Estuary



Print Date: 02/04/2020
Printed by: Irish Water



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

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

© Copyright Irish Water

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

*Gas Networks Ireland (GNI), their affiliates and assigns, accept no responsibility for any information contained in this document concerning location and technical designation of the gas distribution and transmission network ("the Information"). Any representations and warranties express or implied, are excluded to the fullest extent permitted by law. No liability shall be accepted for any loss or damage including, without limitation, direct, indirect, special, incidental, punitive or consequential loss including loss of profits, arising out of or in connection with the use of the information (including maps or mapping data).

NOTE: DIAL BEFORE YOU DIG Phone: 1850 427 747 or e-mail dig@gasnetworks.ie - The actual position of the gas/electricity distribution and transmission network must be verified on site before any mechanical excavating takes place. If any mechanical excavation is proposed, hard copy maps must be requested from GNI re gas. All work in the vicinity of gas distribution and transmission network must be completed in accordance with the current edition of the Health & Safety Authority publication, 'Code of Practice For Avoiding Danger From Underground Services' which is available from the Health and Safety Authority (1890 28 93 89) or can be downloaded free of charge at www.hsa.ie."

Water Distribution Network Water Treatment Plant Water Pump Station Storage Cell/Tower Dosing Point Meter Station Abstraction Point Telemetry Kiosk Reservoir Potable Raw Water Water Distribution Mains Irish Water Private Trunk Water Mains Irish Water Private Water Lateral Lines Irish Water Non IW Water Casings Water Abandoned Lines Boundary Meter Bulk/Check Meter Group Scheme Source Meter Waste Meter Unknown Meter; Other Meter Non-Return PRV PSV Sluice Line Valve Open/Closed Butterfly Line Valve Open/Closed Sluice Boundary Valve Open/Closed Butterfly Boundary Valve Open/Closed Scour Valves Single Air Control Valve Double Air Control Valve Water Stop Valves Water Service Connections Water Distribution Chambers Water Network Junctions Pressure Monitoring Point Fire Hydrant Fire Hydrant/Washout Water Fittings Cap Reducer Tap Other Fittings	Sewer Foul Combined Network Waste Water Treatment Plant Waste Water Pump station Sewer Mains Irish Water Gravity - Combined Gravity - Foul Gravity - Unknown Pumping - Combined Pumping - Foul Pumping - Unknown Syphon - Combined Syphon - Foul Syphon - Unknown Overflow Sewer Mains Private Gravity - Combined Gravity - Foul Gravity - Unknown Pumping - Combined Pumping - Foul Pumping - Unknown Syphon - Combined Syphon - Foul Syphon - Unknown Overflow Sewer Lateral Lines Sewer Casings Sewer Manholes Standard Backdrop Cascade Catchpit Bifurcation Hatchbox Lamphole Hydrobrake Other; Unknown Discharge Type Outfall Overflow Soakaway Other; Unknown Gas Networks Ireland Transmission High Pressure Gasline Distribution Medium Pressure Gasline Distribution Low Pressure Gasline ESB Networks ESB HV Lines HV Underground HV Overhead HV Abandoned ESB MV/LV Lines MV Overhead Three Phase MV Overhead Single Phase LV Overhead Three Phase LV Overhead Single Phase MVLV Underground Abandoned Non Service Categories Proposed Under Construction Out of Service Decommissioned Water Non Service Assets Water Point Feature Water Pipe Water Structure Waste Non Service Assets Waste Point Feature Sewer Waste Structure
---	--

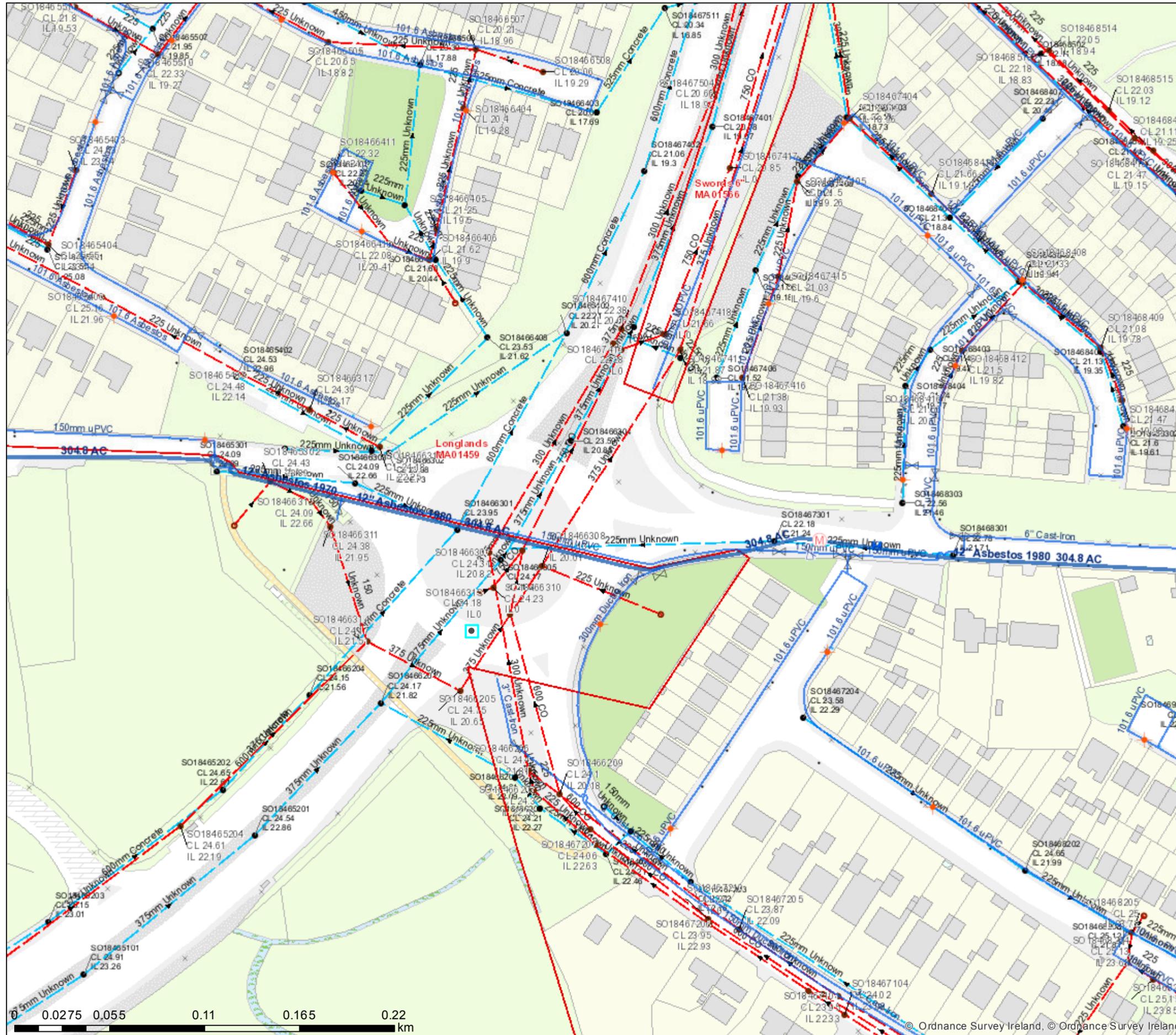


Irish Water Intersection Malahide Rd



Print Date: 02/04/2020

Printed by: Irish Water



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

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

© Copyright Irish Water

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

Gas Networks Ireland (GNI), their affiliates and assigns, accept no responsibility for any information contained in this document concerning location and technical designation of the gas distribution and transmission network ("the Information"). Any representations and warranties express or implied, are excluded to the fullest extent permitted by law. No liability shall be accepted for any loss or damage including, without limitation, direct, indirect, special, incidental, punitive or consequential loss including loss of profits, arising out of or in connection with the use of the information (including maps or mapping data).

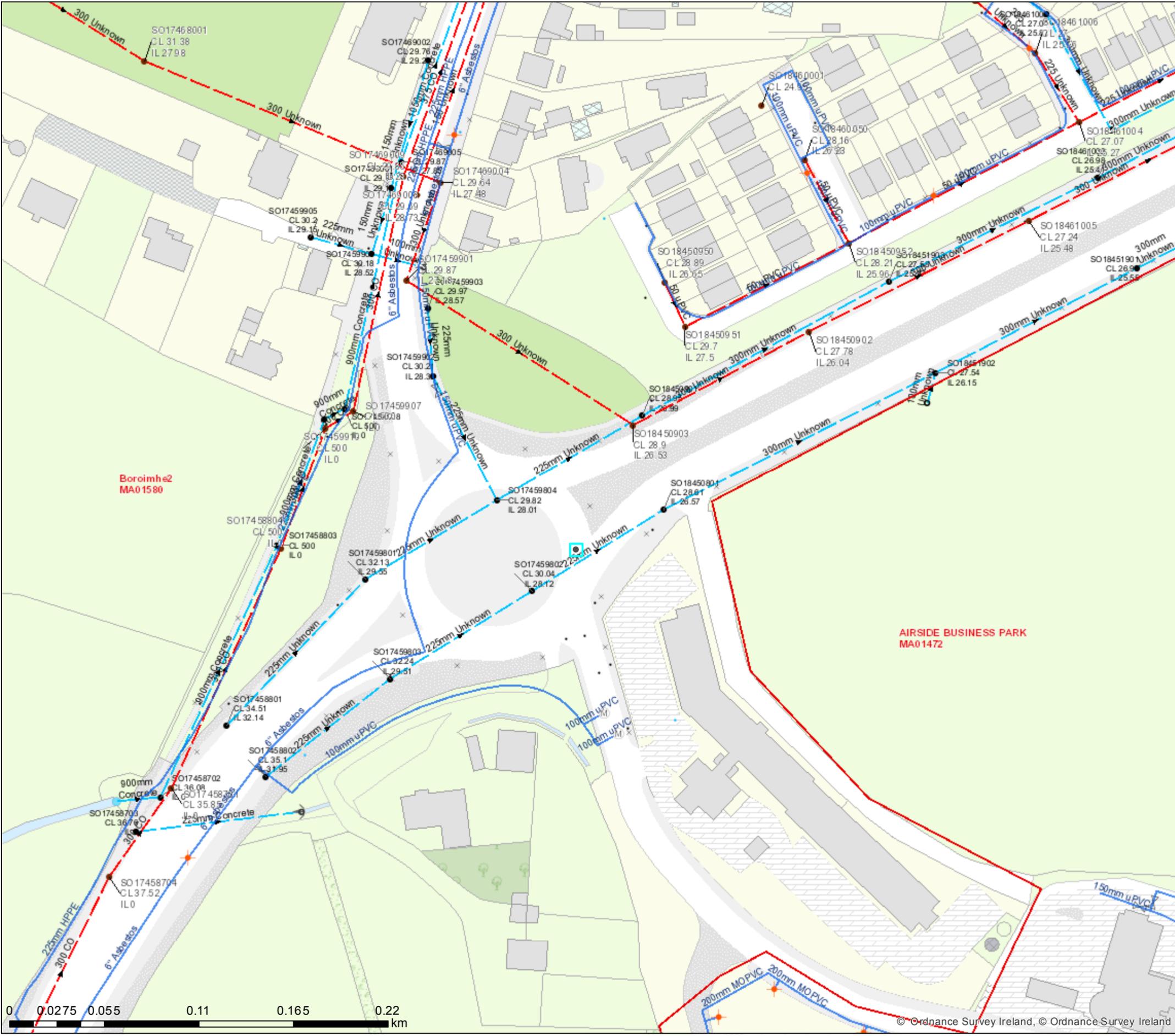
NOTE: DIAL BEFORE YOU DIG Phone: 1850 427 747 or e-mail dig@gasnetworks.ie - The actual position of the gas/electricity distribution and transmission network must be verified on site before any mechanical excavating takes place. If any mechanical excavation is proposed, hard copy maps must be requested from GNI re gas. All work in the vicinity of gas distribution and transmission network must be completed in accordance with the current edition of the Health & Safety Authority publication, 'Code of Practice For Avoiding Danger From Underground Services' which is available from the Health and Safety Authority (1890 28 93 89) or can be downloaded free of charge at www.hsa.ie."

Water Distribution Network	Sewer Foul Combined Network	Storm Water Network
Water Treatment Plant	Waste Water Treatment Plant	Surface Water Mains
Water Pump Station	Waste Water Pump station	Surface Gravity Mains
Storage Cell/Tower		Surface Gravity Mains Private
Dosing Point		Surface Water Pressurised Mains
Meter Station		Surface Water Pressurised Mains Private
Abstraction Point		Inlet Type
Telemetry Kiosk		Gully
Reservoir		Standard
Potable		Other Unknown
Raw Water		Storm Manholes
Water Distribution Mains		Standard
Irish Water		Backdrop
Private		Cascade
Trunk Water Mains		Catchpit
Irish Water		Bifurcation
Private		Hatchbox
Water Lateral Lines		Lampole
Irish Water		Hydrobrake
Non IW		Other Unknown
Water Casings		Storm Culverts
Water Abandoned Lines		Storm Clean Outs
Boundary Meter		Stormwater Chambers
Bulk/Check Meter		Discharge Type
Group Scheme		Outfall
Source Meter		Overflow
Waste Meter		Soakaway
Unknown Meter; Other Meter		Other; Unknown
Non-Return		Gas Networks Ireland
PRV		Transmission High Pressure Gasline
PSV		Distribution Medium Pressure Gasline
Sluice Line Valve Open/Closed		Distribution Low Pressure Gasline
Butterfly Line Valve Open/Closed		ESB Networks
Sluice Boundary Valve Open/Closed		ESB HV Lines
Butterfly Boundary Valve Open/Closed		HV Underground
Scour Valves		HV Overhead
Single Air Control Valve		HV Abandoned
Double Air Control Valve		ESB MVLV Lines
Water Stop Valves		MV Overhead Three Phase
Water Service Connections		MV Overhead Single Phase
Water Distribution Chambers		LV Overhead Three Phase
Water Network Junctions		LV Overhead Single Phase
Pressure Monitoring Point		MVLV Underground
Fire Hydrant		Abandoned
Fire Hydrant/Washout		Non Service Categories
Water Fittings		Proposed
Cap		Under Construction
Reducer		Out of Service
Tap		Decommissioned
Other Fittings		Water Non Service Assets
		Water Point Feature
		Water Pipe
		Water Structure
		Waste Non Service Assets
		Waste Point Feature
		Waste Structure
		Sewer
		Other

Irish Water Intersection Pinnock Hill



Print Date: 02/04/2020
Printed by: Irish Water



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

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

© Copyright Irish Water

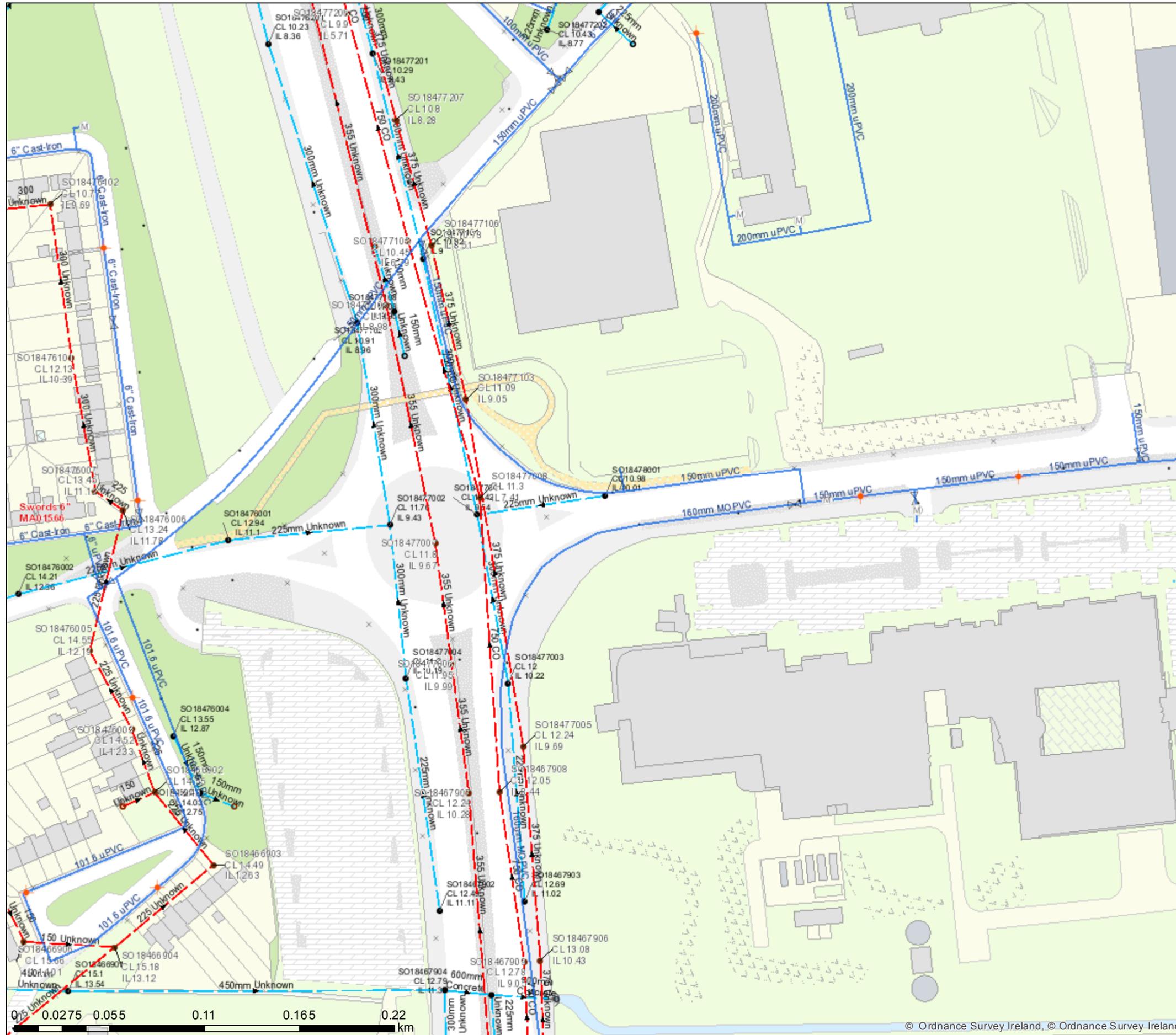
Reproduced from the Ordnance Survey Of Ireland by Permission of the Government.
License No. 3-3-34

"Gas Networks Ireland (GNI), their affiliates and assigns, accept no responsibility for any information contained in this document concerning location and technical designation of the gas distribution and transmission network ("the Information"). Any representations and warranties express or implied, are excluded to the fullest extent permitted by law. No liability shall be accepted for any loss or damage including, without limitation, direct, indirect, special, incidental, punitive or consequential loss including loss of profits, arising out of or in connection with the use of the information (including maps or mapping data).

NOTE: DIAL BEFORE YOU DIG Phone: 1850 427 747 or e-mail dig@gasnetworks.ie - The actual position of the gas/electricity distribution and transmission network must be verified on site before any mechanical excavating takes place. If any mechanical excavation is proposed, hard copy maps must be requested from GNI re gas. All work in the vicinity of gas distribution and transmission network must be completed in accordance with the current edition of the Health & Safety Authority publication, 'Code of Practice For Avoiding Danger From Underground Services' which is available from the Health and Safety Authority (1890 28 93 89) or can be downloaded free of charge at www.hsa.ie."

Water Distribution Network	Sewer Foul Combined Network	Storm Water Network
Water Treatment Plant	Waste Water Treatment Plant	Surface Gravity Mains
Water Pump Station	Waste Water Pump Station	Surface Gravity Mains Private
Storage Cell/Tower		Surface Water Pressurised Mains
Dosing Plant		Surface Water Pressurised Mains Private
Meter Station		Inlet Type
Abstraction Point		Gully
Telemetry Kiosk		Standard
Reservoir		Other Unknown
Potable		Storm Manholes
Raw Water		Standard
Water Distribution Mains		Backdrop
Irish Water		Cascade
Private		Catchpit
Trunk Water Mains		Bifurcation
Irish Water		Hatchbox
Private		Lampole
Water Lateral Lines		Hydrobrake
Irish Water		Other Unknown
Non IW		Storm Culverts
Water Casings		Storm Clean Outs
Water Abandoned Lines		Stormwater Chambers
Boundary Meter		Discharge Type
Bulk/Check Meter		Outfall
Group Scheme		Overflow
Source Meter		Soakaway
Waste Meter		Other; Unknown
Unknown Meter; Other Meter		Gas Networks Ireland
Non-Return		Transmission High Pressure Gasline
PRV		Distribution Medium Pressure Gasline
PSV		Distribution Low Pressure Gasline
Sluice Line Valve Open/Closed		ESB Networks
Butterfly Line Valve Open/Closed		ESB HV Lines
Sluice Boundary Valve Open/Closed		HV Underground
Butterfly Boundary Valve Open/Closed		HV Overhead
Scour Valves		HV Abandoned
Single Air Control Valve		ESB MVLV Lines
Double Air Control Valve		MV Overhead Three Phase
Water Stop Valves		MV Overhead Single Phase
Water Service Connections		LV Overhead Three Phase
Water Distribution Chambers		LV Overhead Single Phase
Water Network Junctions		MVLV Underground
Pressure Monitoring Point		Abandoned
Fire Hydrant		Non Service Categories
Fire Hydrant/Washout		Proposed
Water Fittings		Under Construction
Cap		Out of Service
Reducer		Decommissioned
Tap		Water Non Service Assets
Other Fittings		Water Point Feature
		Water Pipe
		Water Structure
		Waste Non Service Assets
		Waste Point Feature
		Sewer
		Waste Structure

Irish Water Intersection Seatown 2



UISCE
EIREANN : IRISH
WATER

Print Date: 09/04/2020

Printed by: Irish Water

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

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

© Copyright Irish Water

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

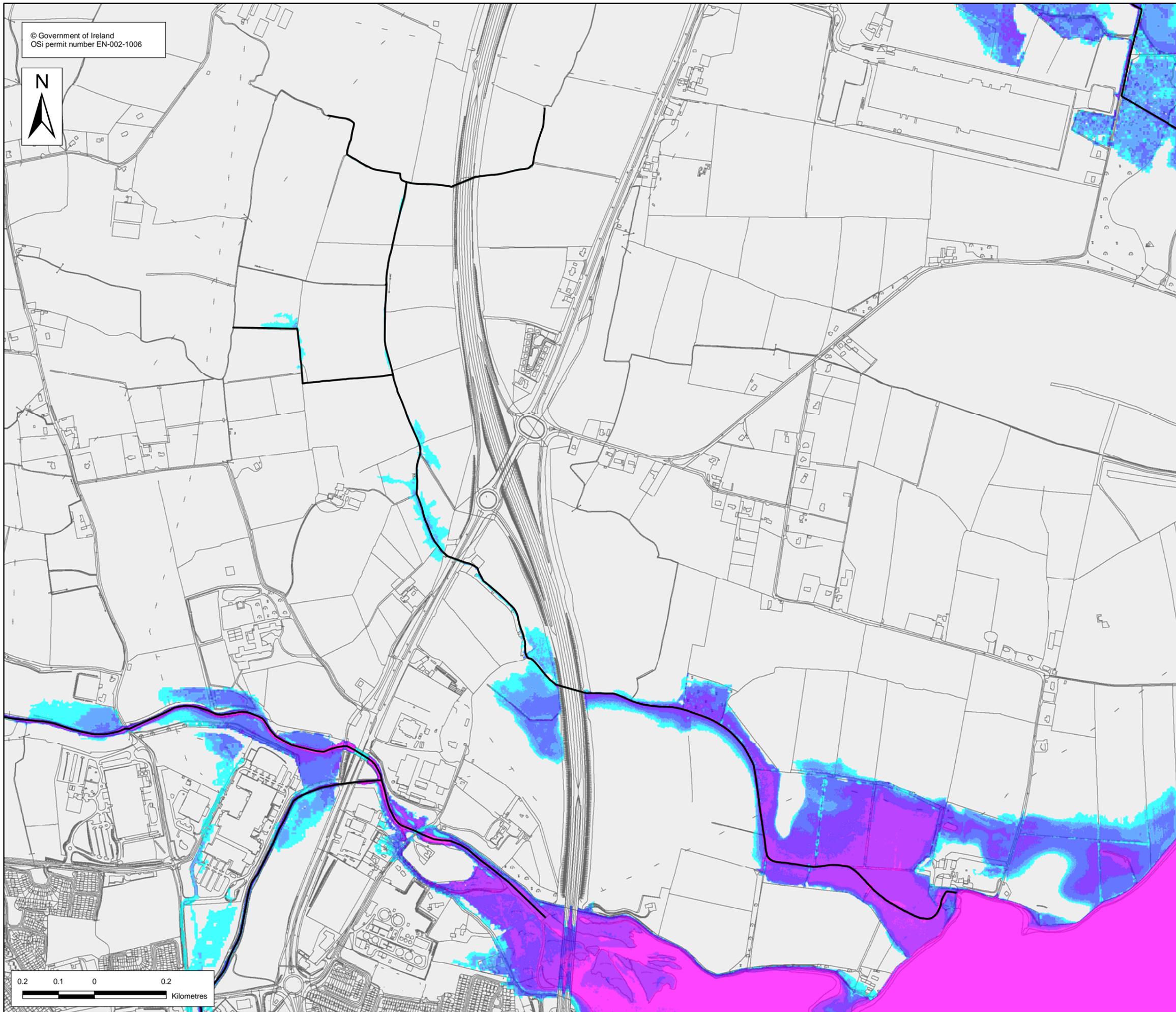
*Gas Networks Ireland (GNI), their affiliates and assigns, accept no responsibility for any information contained in this document concerning location and technical designation of the gas distribution and transmission network ("the Information"). Any representations and warranties express or implied, are excluded to the fullest extent permitted by law. No liability shall be accepted for any loss or damage including, without limitation, direct, indirect, special, incidental, punitive or consequential loss including loss of profits, arising out of or in connection with the use of the information (including maps or mapping data).

NOTE: DIAL BEFORE YOU DIG Phone: 1850 427 747 or e-mail dig@gasnetworks.ie - The actual position of the gas/electricity distribution and transmission network must be verified on site before any mechanical excavating takes place. If any mechanical excavation is proposed, hard copy maps must be requested from GNI re gas. All work in the vicinity of gas distribution and transmission network must be completed in accordance with the current edition of the Health & Safety Authority publication, 'Code of Practice For Avoiding Danger From Underground Services' which is available from the Health and Safety Authority (1890 28 93 89) or can be downloaded free of charge at www.hsa.ie.

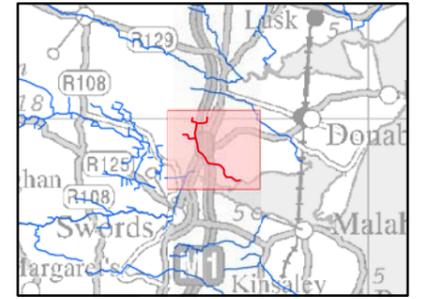
<p>Water Distribution Network</p> <ul style="list-style-type: none"> Water Treatment Plant Water Pump Station Storage Cell/Tower Dosing Point Meter Station Abstraction Point Telemetry Kiosk <p>Reservoir</p> <ul style="list-style-type: none"> Potable Raw Water <p>Water Distribution Mains</p> <ul style="list-style-type: none"> Irish Water Private <p>Trunk Water Mains</p> <ul style="list-style-type: none"> Irish Water Private <p>Water Lateral Lines</p> <ul style="list-style-type: none"> Irish Water Non IW Water Casings Water Abandoned Lines <p>Boundary Meter</p> <ul style="list-style-type: none"> Group Scheme Source Meter Waste Meter Unknown Meter ; Other Meter Non-Return PRV PSV <p>Sluice Line Valve Open/Closed</p> <ul style="list-style-type: none"> Butterfly Line Valve Open/Closed Sluice Boundary Valve Open/Closed Butterfly Boundary Valve Open/Closed <p>Scour Valves</p> <ul style="list-style-type: none"> Single Air Control Valve Double Air Control Valve Water Stop Valves <p>Water Service Connections</p> <ul style="list-style-type: none"> Water Network Junctions Pressure Monitoring Point Fire Hydrant Fire Hydrant/Washout <p>Water Fittings</p> <ul style="list-style-type: none"> Cap Reducer Tap Other Fittings 	<p>Sewer Foul Combined Network</p> <ul style="list-style-type: none"> Waste Water Treatment Plant Waste Water Pump station <p>Sewer Mains Irish Water</p> <ul style="list-style-type: none"> Gravity - Combined Gravity - Foul Gravity - Unknown Pumping - Combined Pumping - Foul Syphon - Combined Syphon - Foul Overflow <p>Sewer Mains Private</p> <ul style="list-style-type: none"> Gravity - Combined Gravity - Foul Gravity - Unknown Pumping - Combined Pumping - Foul Syphon - Unknown Syphon - Combined Syphon - Foul Overflow <p>Sewer Lateral Lines</p> <ul style="list-style-type: none"> Sewer Lateral Lines Sewer Casings <p>Sewer Manholes</p> <ul style="list-style-type: none"> Standard Backdrop Cascade Unknown Meter ; Other Meter Non-Return PRV Lampole Hydrobrake Other, Unknown <p>Discharge Type</p> <ul style="list-style-type: none"> Overflow Soakaway Other, Unknown <p>Cleanout Type</p> <ul style="list-style-type: none"> Rodding Eye Flushing Structure Other, Unknown <p>Sewer Inlets</p> <ul style="list-style-type: none"> Catchpit Gully Standard Other, Unknown Vent/Col Other, Unknown 	<p>Storm Water Network</p> <p>Surface Water Mains</p> <ul style="list-style-type: none"> Surface Gravity Mains Surface Gravity Mains Private Surface Water Pressurised Mains Surface Water Pressurised Mains Private <p>Inlet Type</p> <ul style="list-style-type: none"> Gully Standard Other, Unknown <p>Storm Manholes</p> <ul style="list-style-type: none"> Standard Backdrop Cascade Catchpit Bifurcation Hatchbox Lampole Hydrobrake Other, Unknown Storm Culverts Storm Clean Outs Stormwater Chambers <p>Discharge Type</p> <ul style="list-style-type: none"> Outfall Overflow Soakaway Other, Unknown <p>Gas Networks Ireland</p> <ul style="list-style-type: none"> Transmission High Pressure Gasline Distribution Medium Pressure Gasline Distribution Low Pressure Gasline <p>ESB Networks</p> <p>ESB HV Lines</p> <ul style="list-style-type: none"> HV Underground HV Overhead HV Abandoned <p>ESB MV/LV Lines</p> <ul style="list-style-type: none"> MV Overhead Three Phase MV Overhead Single Phase LV Overhead Three Phase LV Overhead Single Phase MVLV Underground Abandoned <p>Non Service Categories</p> <ul style="list-style-type: none"> Proposed Under Construction Out of Service Decommissioned <p>Water Non Service Assets</p> <ul style="list-style-type: none"> Water Point Feature Water Pipe Water Structure <p>Waste Non Service Assets</p> <ul style="list-style-type: none"> Waste Point Feature Sewer Waste Structure
--	---	--

Appendix C – Eastern CFRAM Flood Maps

© Government of Ireland
OSi permit number EN-002-1006



Location Plan :



DEPTH MAP 0.1% AEP

Legend Depth Grid:

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

USER NOTE:

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



Tramway House
32 Dartry Road
Dublin 6
Tel: +353-1-4975716

Clients :



Project :

FEM FRAMS

Map :

LISSENHALL MODEL DEPTH MAP

Map Type : DEPTH

Return Period : 0.1% AEP EVENT

Source : TIDAL FLOODING

Map area : HIGH PRIORITY WATERCOURSE

Scenario : CURRENT

Figure By : Mara Ruiz Date : 19 January 2011

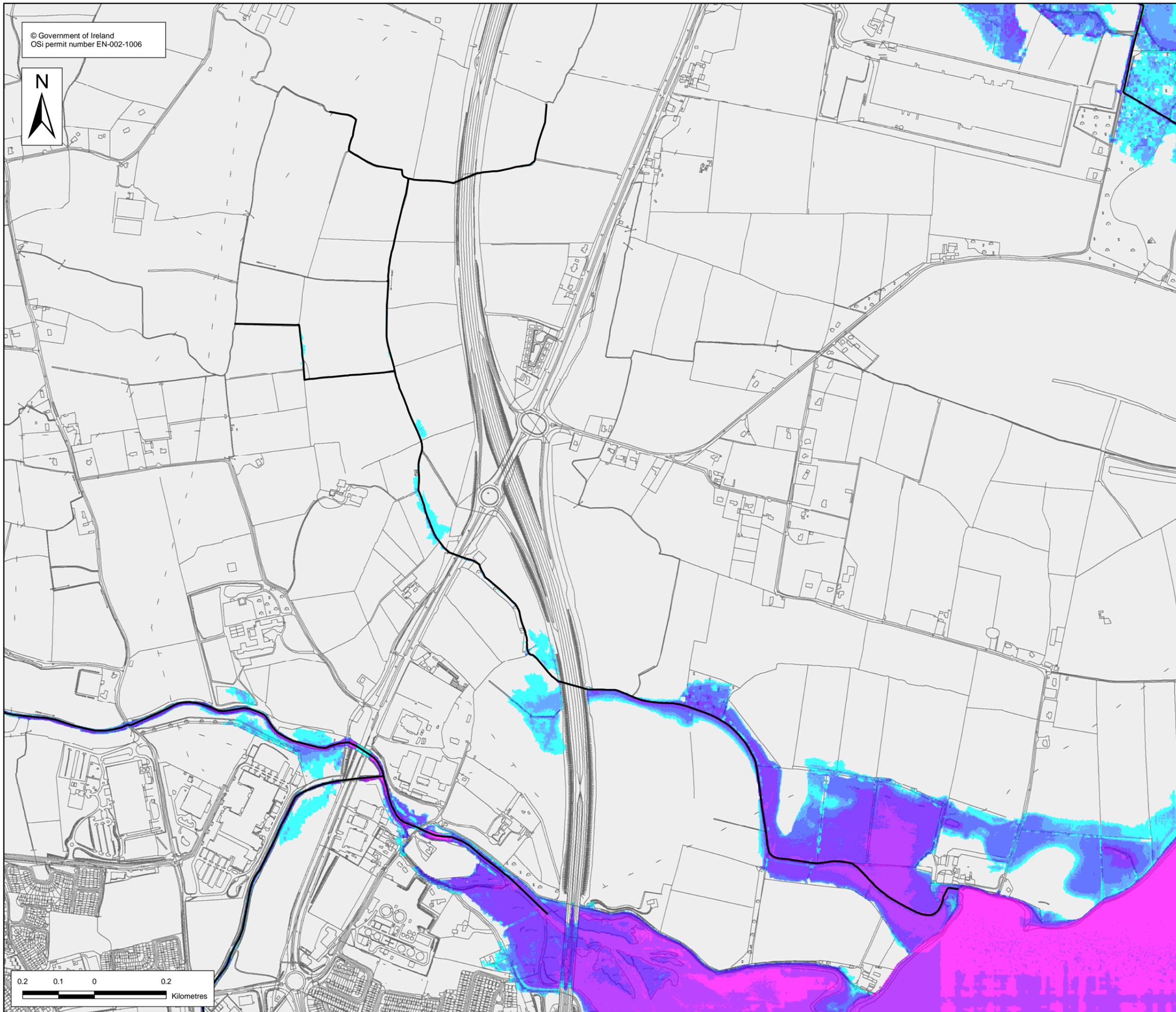
Checked By : Sergio Herbón Date : 19 January 2011

Approved By : Clare Dewar Date : 19 January 2011

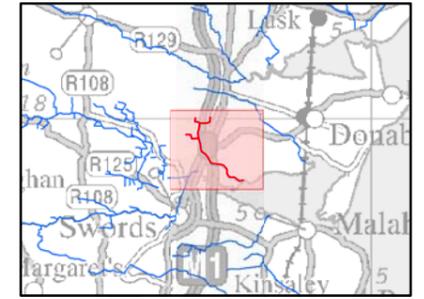
Figure No. : LIS/HPW/DEP/1000/T/001 Revision : 1

Drawing Scale : 1:10,000 Plot Scale : 1:1 @ A3

© Government of Ireland
OSi permit number EN-002-1006



Location Plan :



DEPTH MAP 0.5% AEP

Legend Depth Grid:

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

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



Tramway House
32 Dartry Road
Dublin 6
Tel: +353-1-4975716

Clients :



Project :
FEM FRAMS

Map :
LISSENHALL MODEL DEPTH MAP

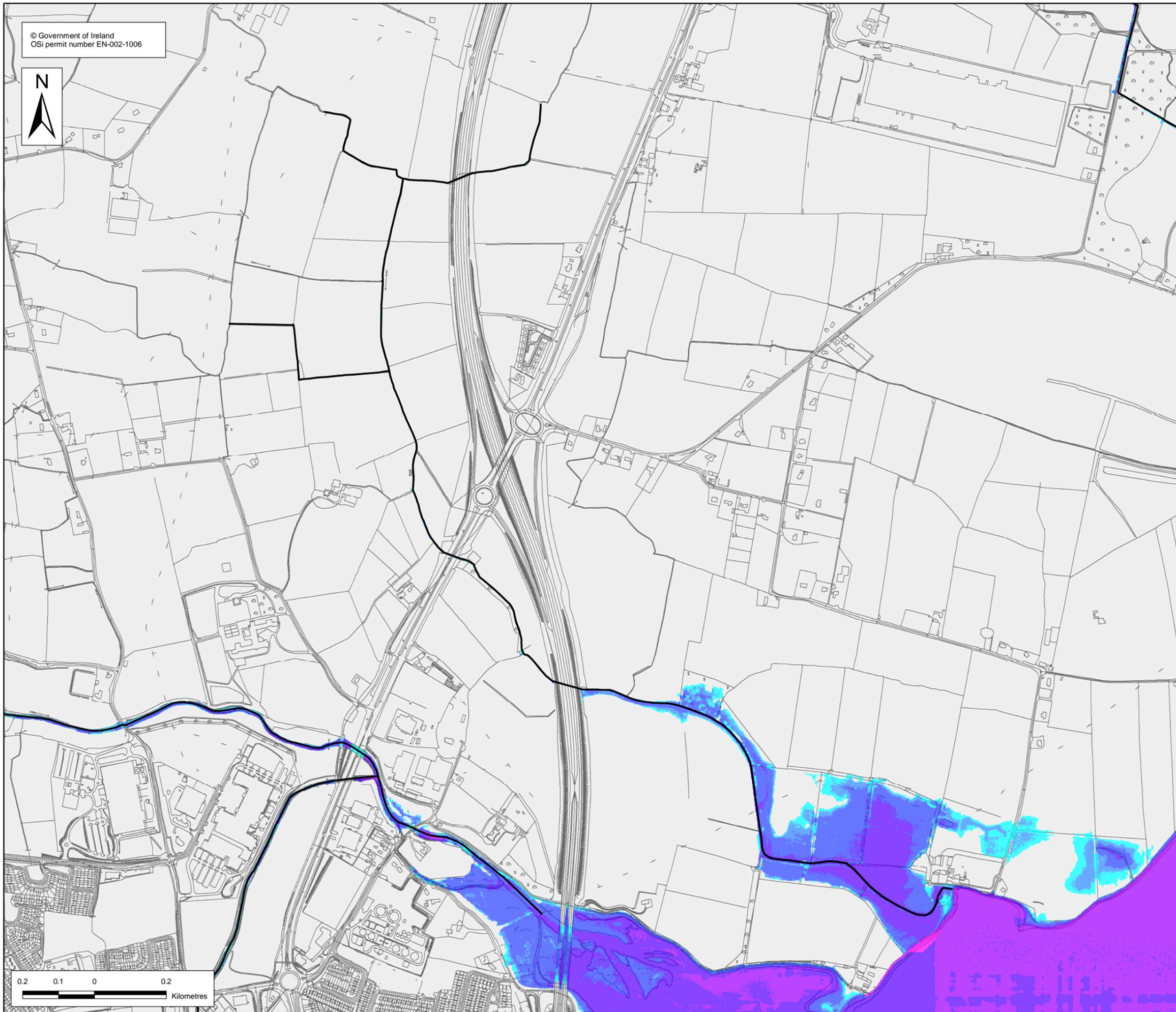
Map Type : DEPTH
Return Period : 0.5% AEP EVENT
Source : TIDAL FLOODING
Map area : HIGH PRIORITY WATERCOURSE
Scenario : CURRENT

Figure By : Mara Ruiz Date : 19 January 2011
Checked By : Sergio Herbón Date : 19 January 2011
Approved By : Clare Dewar Date : 19 January 2011

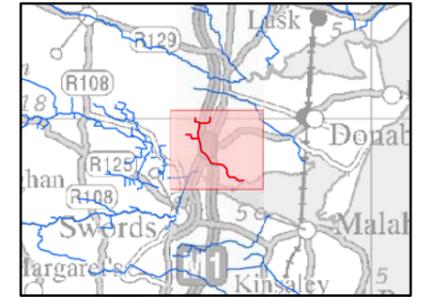
Figure No. : LIS/HPW/DEP/200/T/001 Revision : 1

Drawing Scale : 1:10,000 Plot Scale : 1:1 @ A3

© Government of Ireland
OSi permit number EN-002-1006



Location Plan :



DEPTH MAP 10% AEP

Legend Depth Grid:

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

USER NOTE:

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



Tramway House
32 Dartry Road
Dublin 6
Tel: +353-1-4975716

Clients :



Project :

FEM FRAMS

Map :

LISSENHALL MODEL DEPTH MAP

Map Type : DEPTH

Return Period : 10% AEP EVENT

Source : TIDAL FLOODING

Map area : HIGH PRIORITY WATERCOURSE

Scenario : CURRENT

Figure By : Mara Ruiz Date : 19 January 2011

Checked By : Sergio Herbón Date : 19 January 2011

Approved By : Clare Dewar Date : 19 January 2011

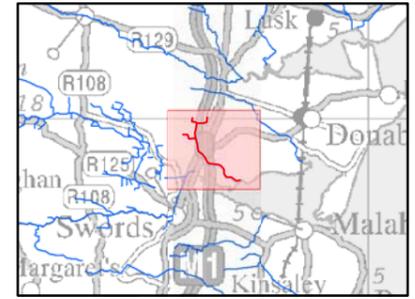
Figure No. : LIS/HPW/DEP/10/T/001
Revision : 1

Drawing Scale : 1:10,000 Plot Scale : 1:1 @ A3



Fluvial flooding may also occur within the area shown on this map. Please refer to the fluvial flood extent map. Figure No. LIS/HPW/EXT/CURS/001

Location Plan :



EXTENT MAP

Legend:

- 10 % AEP Flood Extent (1 in 10 chance in any given year)
 - 0.5 % AEP Flood Extent (1 in 200 chance in any given year)
 - 0.1 % AEP Flood Extent (1 in 1000 chance in any given year)
 - Defended area
 - High Confidence (<20m) (10% AEP)
 - Medium Confidence (<40m) (10% AEP)
 - Low Confidence (> 40m) (10% and 0.1% AEP)
 - High Confidence (<20m) (0.5% AEP)
 - Medium Confidence (<40m) (0.5% AEP)
 - Low Confidence (>40m) (0.5% AEP)
 - Modelled River Centreline
 - Node Point
 - Node label with level data (refer to table)
 - Node level with flow & level data (refer to table)
- High confidence

Medium confidence

Low confidence

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.



Tramway House
32 Dartry Road
Dublin 6
Tel: +353-1-4975716

Clients :



Project :

FEM FRAMS

Map :

LISSENHALL MODEL FLOOD EXTENT MAP

Map Type : FLOOD EXTENT

Source : TIDAL FLOODING

Map area : HIGH PRIORITY WATERCOURSE

Scenario : CURRENT

Figure By : Mara Ruiz Date : 17 January 2011

Checked By : Sergio Herbón Date : 17 January 2011

Approved By : Clare Dewar Date : 17 January 2011

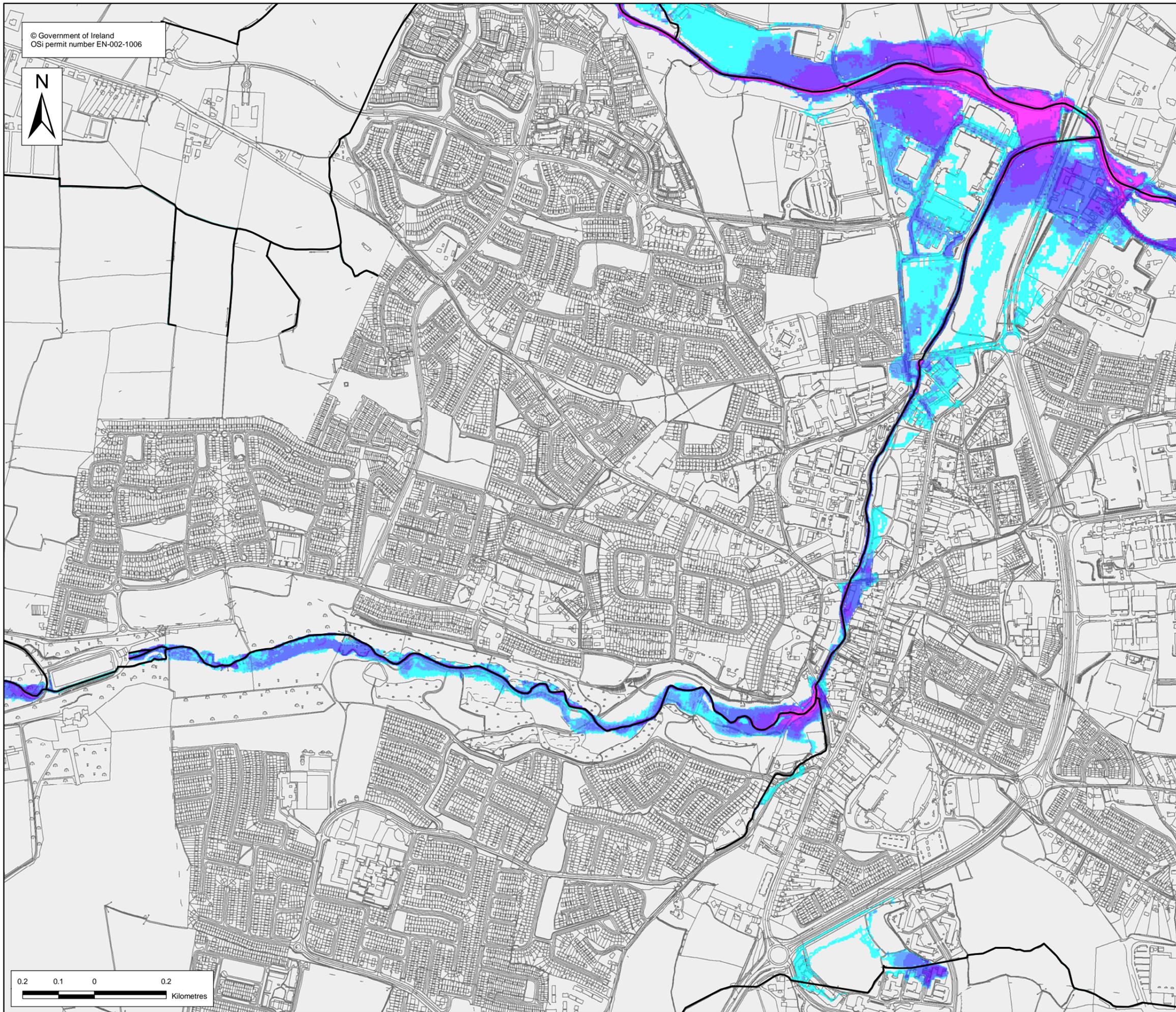
Figure No. : LIS/HPW/EXT/CURS/T/001 Revision 1

Drawing Scale : 1:10,000 Plot Scale : 1:1 @ A3

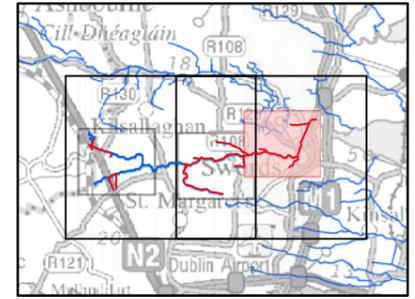
Node Label	10% AEP Event		0.5% AEP Event		0.1% AEP Event	
	Water Level (mOD)	Flow (m3/s)	Water Level (mOD)	Flow (m3/s)	Water Level (mOD)	Flow (m3/s)
5La3357	6.08	0.19	6.21	0.35	6.34	0.56
5La2993	5.39		5.67		5.92	
5La2641	4.92		5.13		5.28	
5La2004	4.04	0.60	4.22	1.16	4.43	1.87
5La1727	3.12	0.63	3.27	1.21	3.42	1.96
5La1395	2.67	0.82	3.11	-1.76	3.34	-3.12
5La1018	2.67		3.10		3.34	
5La490	2.65		3.10		3.34	
5La20U	2.65		3.10		3.33	
5Laa580	5.86	0.19	6.20	0.36	6.25	0.59
5Laa230	5.12		5.20		5.27	
5Lab529D	10.89	0.08	10.97	0.15	11.06	0.24
057	2.60		3.09		3.39	
058	2.60		3.09		3.39	



© Government of Ireland
OSi permit number EN-002-1006



Location Plan :



DEPTH MAP 0.1% AEP

- Legend Depth Grid:
-  0 - 0.25 m
 -  0.25 - 0.50 m
 -  0.50 - 1.00 m
 -  1.00 - 1.50 m
 -  1.50 - 2.00 m
 -  > 2.00 m
 -  Modelled River Centreline

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



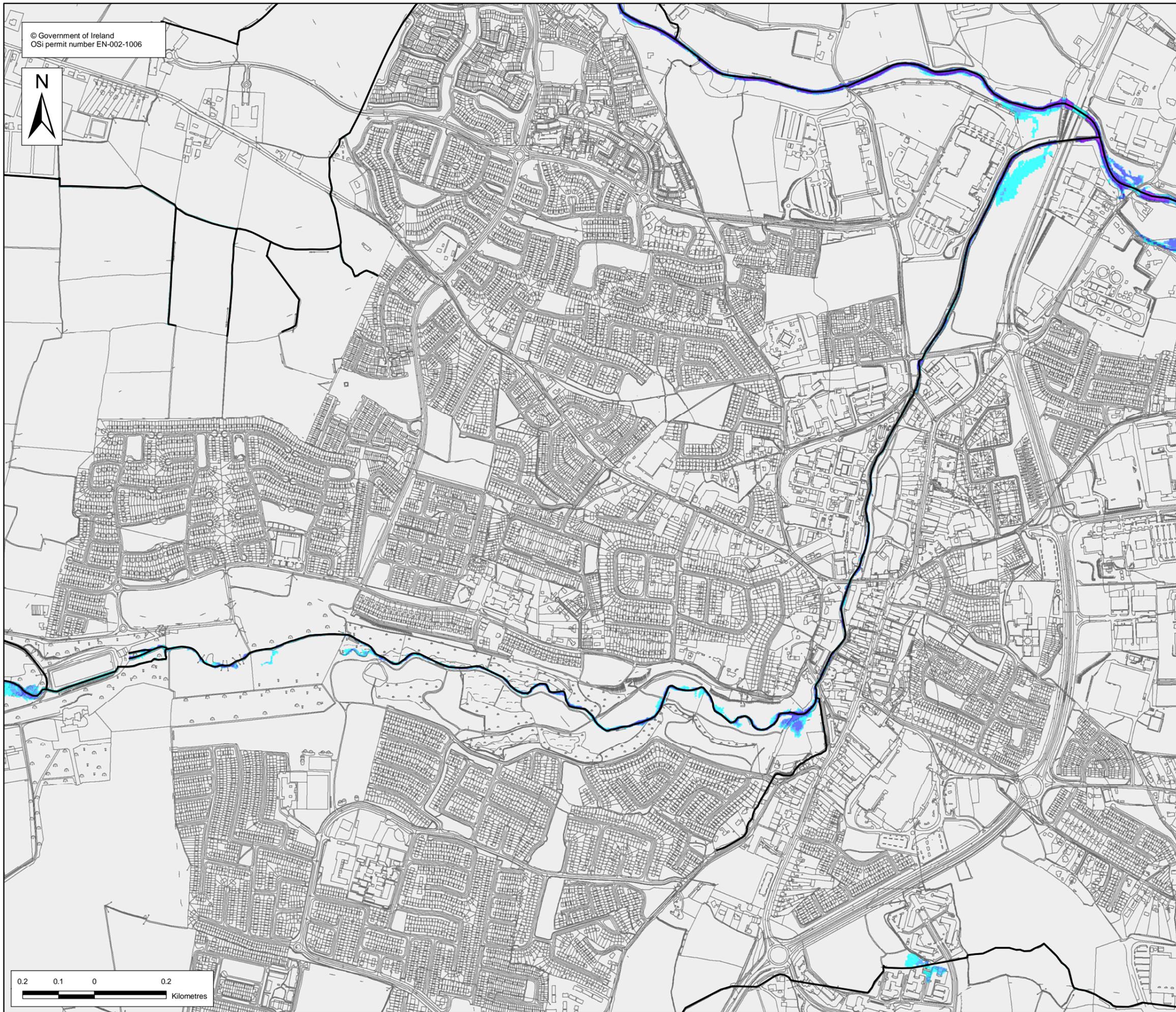
Tramway House
32 Dartry Road
Dublin 6
Tel: +353-1-4975716

Clients :



Project :	
FEM FRAMS	
Map :	
WARD MODEL DEPTH MAP	
Map Type : DEPTH	
Return Period : 0.1% AEP EVENT	
Source : FLUVIAL FLOODING	
Map area : HIGH PRIORITY WATERCOURSE	
Scenario : CURRENT	
Figure By : Mara Ruiz	Date : 17 September 2010
Checked By : Sergio Herbón	Date : 17 September 2010
Approved By : Clare Dewar	Date : 17 September 2010
Figure No. :	Revision
WAR/HPW/DEP/1000/003	0
Drawing Scale : 1:10,000	Plot Scale : 1:1 @ A3

© Government of Ireland
OSi permit number EN-002-1006



Location Plan :



DEPTH MAP 10% AEP

Legend Depth Grid:

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

USER NOTE:

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



Tramway House
32 Dartry Road
Dublin 6
Tel: +353-1-4975716

Clients :



Project :

FEM FRAMS

Map :

WARD MODEL DEPTH MAP

Map Type : DEPTH

Return Period : 10% AEP EVENT

Source : FLUVIAL FLOODING

Map area : HIGH PRIORITY WATERCOURSE

Scenario : CURRENT

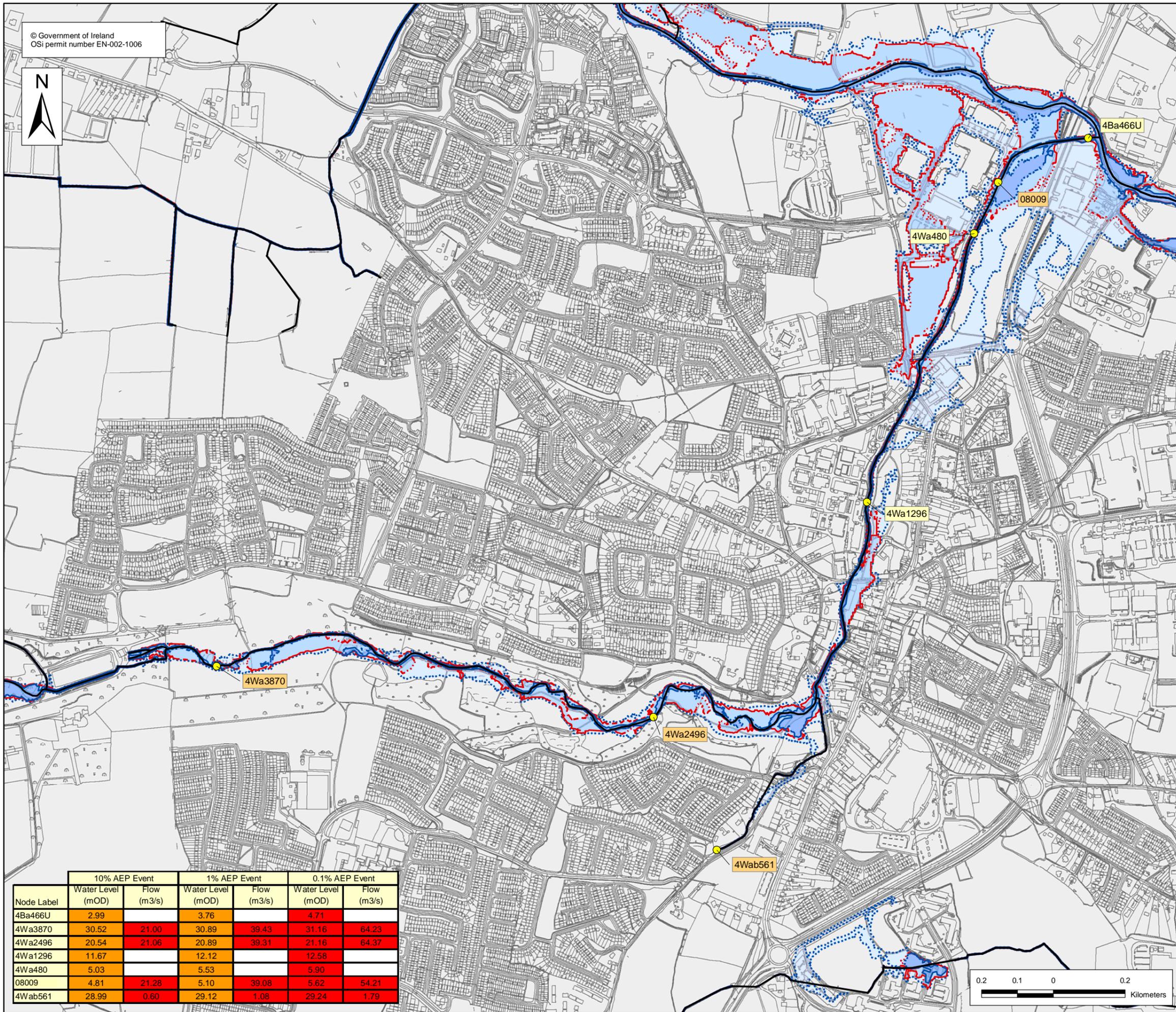
Figure By : Mara Ruiz Date : 17 September 2010

Checked By : Sergio Herbón Date : 17 September 2010

Approved By : Clare Dewar Date : 17 September 2010

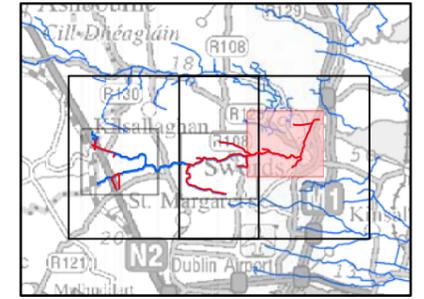
Figure No. : WAR/HPW/DEP/10/003
Revision : 0

Drawing Scale : 1:10,000 Plot Scale : 1:1 @ A3



Node Label	10% AEP Event		1% AEP Event		0.1% AEP Event	
	Water Level (mOD)	Flow (m3/s)	Water Level (mOD)	Flow (m3/s)	Water Level (mOD)	Flow (m3/s)
4Ba466U	2.99		3.76		4.71	
4Wa3870	30.52	21.00	30.89	39.43	31.16	64.23
4Wa2496	20.54	21.06	20.89	39.31	21.16	64.37
4Wa1296	11.67		12.12		12.58	
4Wa480	5.03		5.53		5.90	
08009	4.81	21.28	5.10	39.08	5.62	54.21
4Wab561	28.99	0.60	29.12	1.08	29.24	1.79

Location Plan :



EXTENT MAP

Legend:

- 10 % AEP Flood Extent (1 in 10 chance in any given year)
 - 1 % AEP Flood Extent (1 in 100 chance in any given year)
 - 0.1 % AEP Flood Extent (1 in 1000 chance in any given year)
 - Defended area
 - High Confidence (<20m) (10% AEP)
 - Medium Confidence (<40m) (10% AEP)
 - Low Confidence (>40m) (10% and 0.1% AEP)
 - High Confidence (<20m) (1% AEP)
 - Medium Confidence (<40m) (1% AEP)
 - Low Confidence (>40m) (1% AEP)
 - Modelled River Centreline
 - Node Point
 - Node label with level data (refer to table)
 - Node level with flow & level data (refer to table)
- High confidence

Medium confidence

Low confidence 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.



Tramway House
32 Darty Road
Dublin 6
Tel: +353-1-4975716

Clients :



Project :

Map :
WARD MODEL FLOOD EXTENT MAP

Map Type : FLOOD EXTENT
Source : FLUVIAL FLOODING
Map area : HIGH PRIORITY WATERCOURSE
Scenario : CURRENT

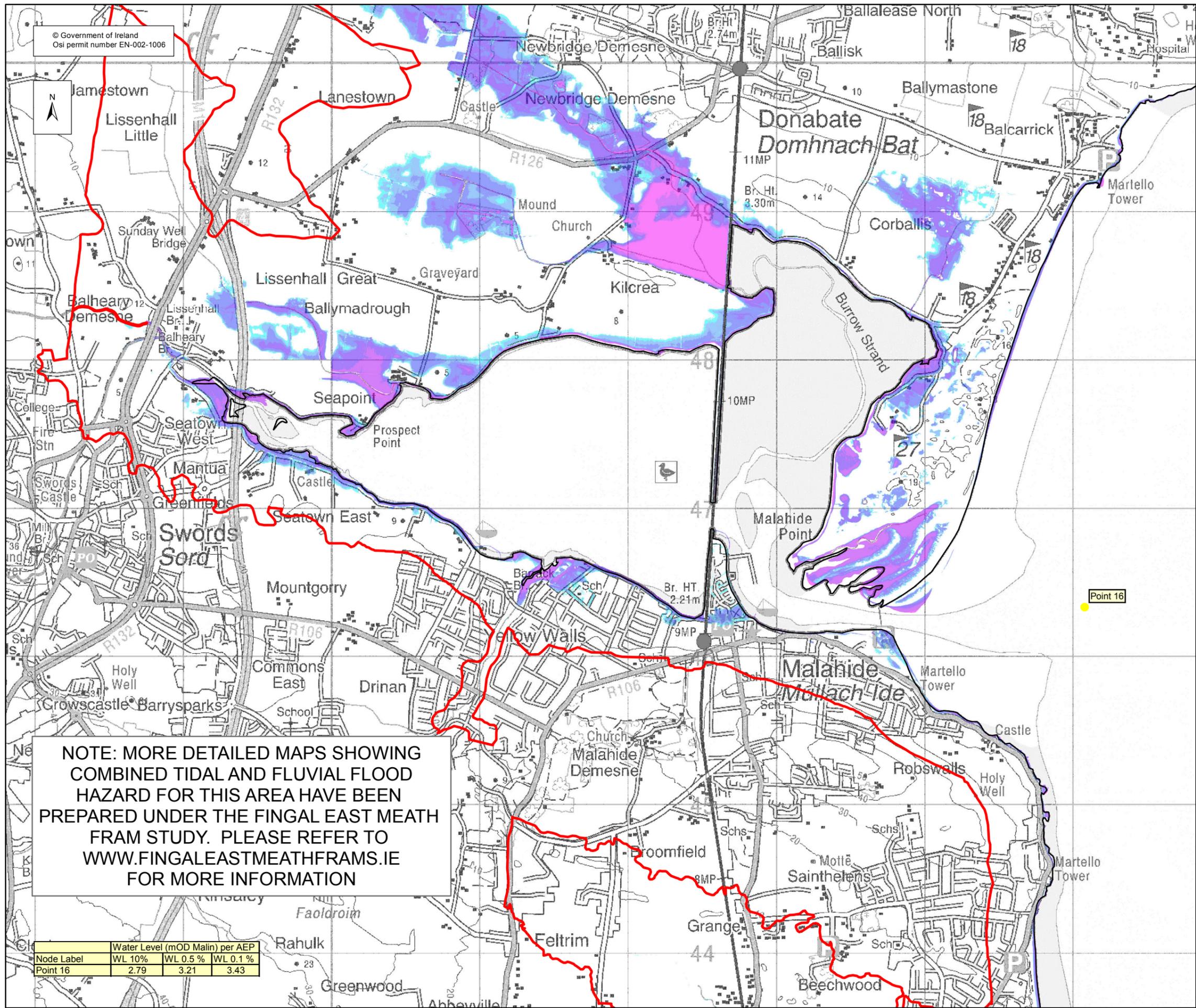
Figure By : Mara Ruiz Date : 8 August 2010
Checked By : Sergio Herbón Date : 8 August 2010
Approved By : Clare Dewar Date : 8 August 2010

Figure No. : WAR/HPW/EXT/CURS/003 Revision : 0

Drawing Scale : 1:10,000 Plot Scale : 1:1 @ A3

Appendix D – ICPSS Flood Maps

© Government of Ireland
Osi permit number EN-002-1006



DEPTH MAP 0.5%AEP

- Legend:
- Depth Grid**
- 0 - 0.25 m
 - 0.25 - 0.50 m
 - 0.50 - 1 m
 - 1.00 - 1.50 m
 - 1.50 - 2.00 m
 - > 2.00 m
- Inland DTM Extent
 - 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.

Elmwood House
74 Boucher Road
Belfast
BT 12 6RZ
Northern Ireland

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

NOTE: MORE DETAILED MAPS SHOWING COMBINED TIDAL AND FLUVIAL FLOOD HAZARD FOR THIS AREA HAVE BEEN PREPARED UNDER THE FINGAL EAST MEATH FRAM STUDY. PLEASE REFER TO WWW.FINGALEASTMEATHFRAMS.IE FOR MORE INFORMATION

Node Label	Water Level (mOD Malin) per AEP		
	WL 10%	WL 0.5%	WL 0.1%
Point 16	2.79	3.21	3.43



Project : IRISH COASTAL PROTECTION STRATEGY STUDY - PHASE III

Map : NORTH EAST COAST FLOOD DEPTH MAP

Map Type : DEPTH

Return Period : 0.5% AEP EVENT

Source : TIDAL FLOODING

Map area : RURAL AREA

Scenario : CURRENT

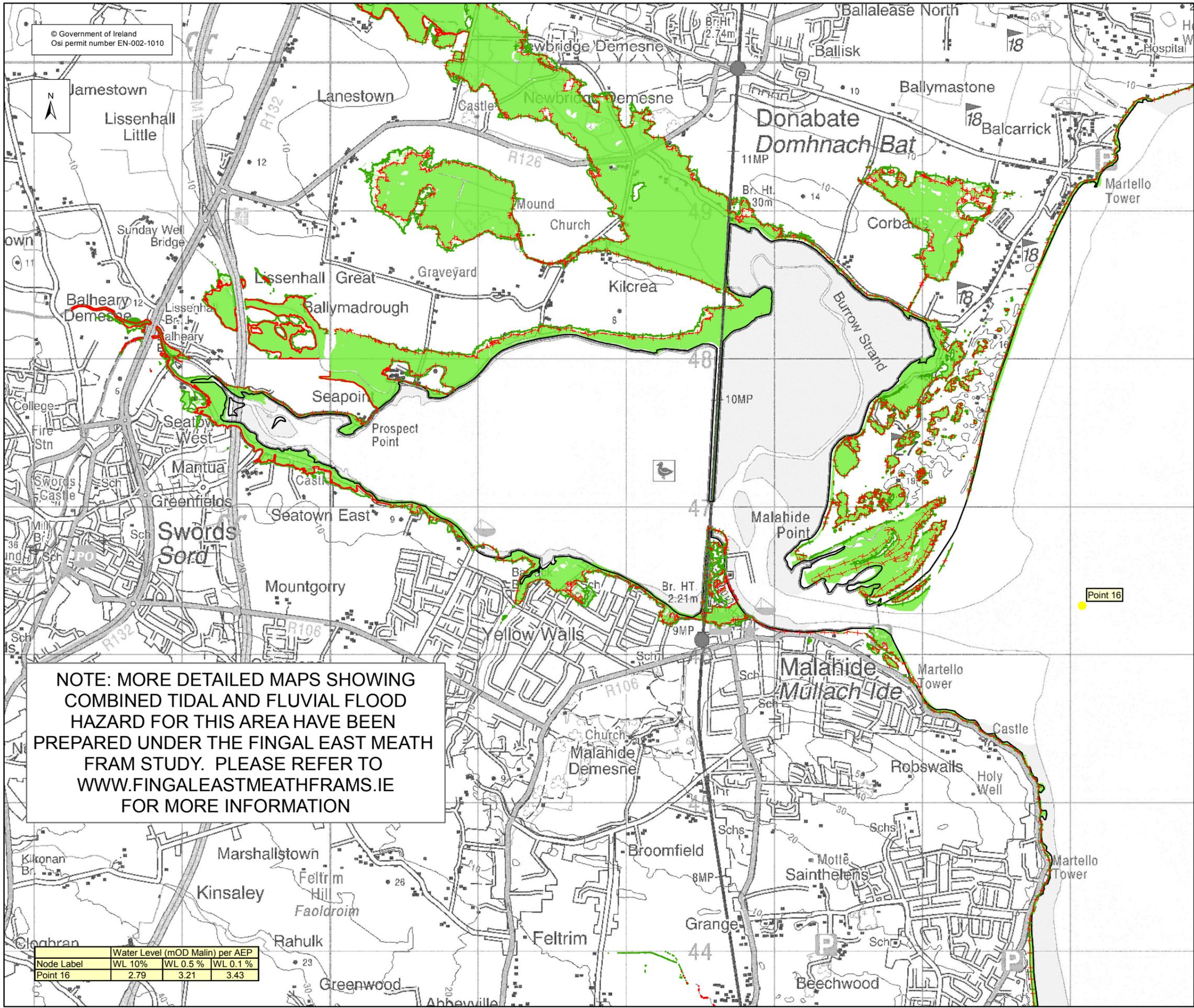
Figure By : PJW Date : Aug 2009

Checked By : JMC Date : Aug 2009

Figure No. : NE / RA / DEP / 16 Revision : 1

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

© Government of Ireland
Osi permit number EN-002-1010



NOTE: MORE DETAILED MAPS SHOWING COMBINED TIDAL AND FLUVIAL FLOOD HAZARD FOR THIS AREA HAVE BEEN PREPARED UNDER THE FINGAL EAST MEATH FRAM STUDY. PLEASE REFER TO WWW.FINGALEASTMEATHFRAMS.IE FOR MORE INFORMATION

Node Label	Water Level (mOD Malin) per AEP		
	WL 10%	WL 0.5%	WL 0.1%
Point 16	2.79	3.21	3.43



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)
- Very High Confidence (0.1% AEP)
- High Confidence (0.1% AEP)
- Medium Confidence (0.1% AEP)
- Low Confidence (0.1% AEP)
- Very Low Confidence (0.1% AEP)
- Very High Confidence (0.5% AEP)
- High Confidence (0.5% AEP)
- Medium Confidence (0.5% AEP)
- Low Confidence (0.5% AEP)
- Very Low Confidence (0.5% AEP)
- 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.



Elmwood House
74 Boucher Road
Belfast
BT 12 6RZ
Northern Ireland



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

Project:
IRISH COASTAL PROTECTION STRATEGY STUDY - PHASE III

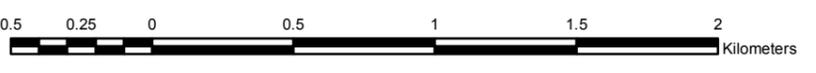
Map:
NORTH EAST COAST FLOOD EXTENT MAP

Map Type: FLOOD EXTENT
Source: TIDAL FLOODING
Map area: RURAL AREA
Scenario: CURRENT

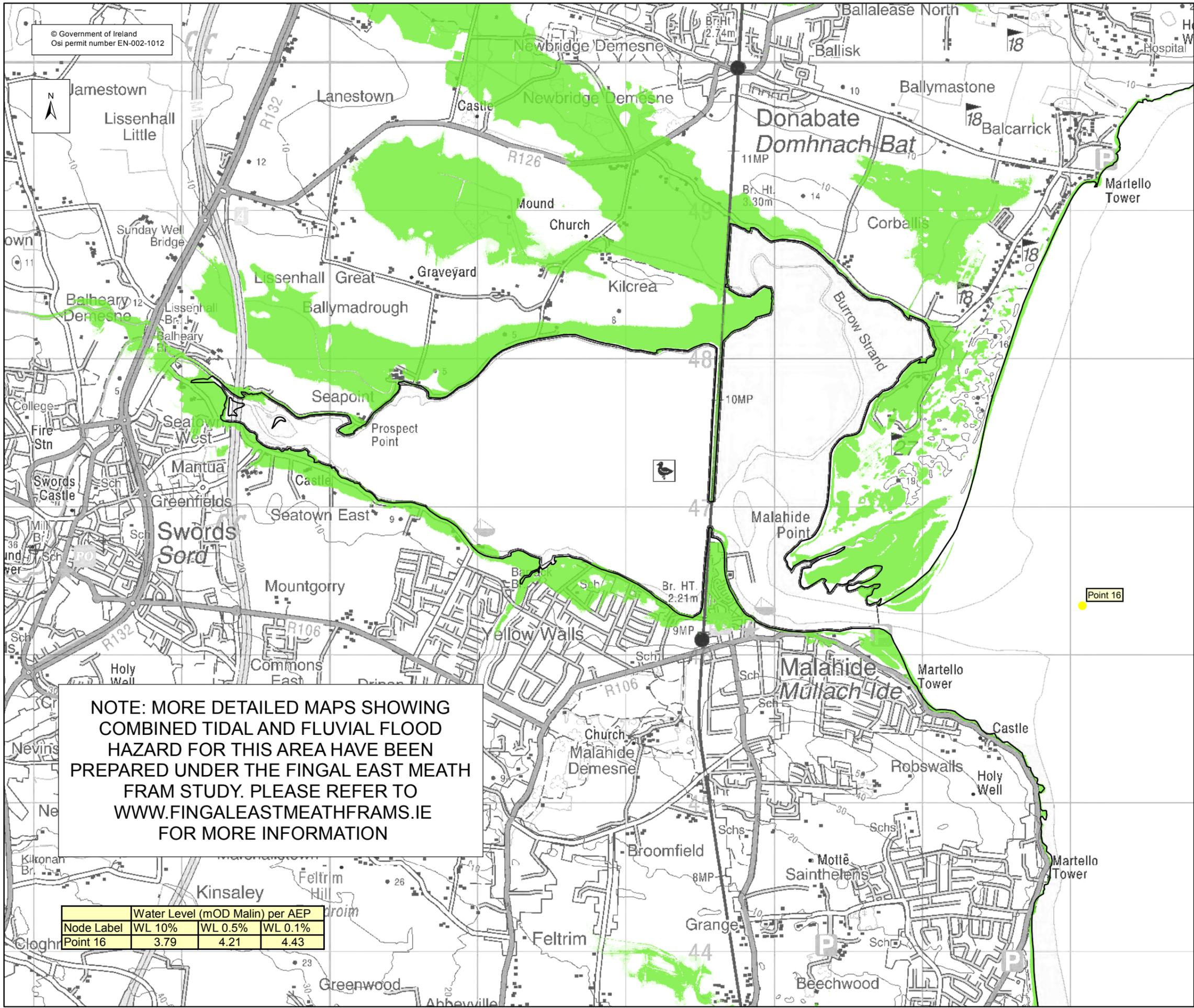
Figure By: PJW Date: Jan 2010
Checked By: JMC Date: Jan 2010

Figure No.: **NE / RA / EXT / 16** Revision: **1**

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



© Government of Ireland
Osi permit number EN-002-1012



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.

Elmwood House
74 Boucher Road
Belfast
BT 12 6RZ
Northern Ireland

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

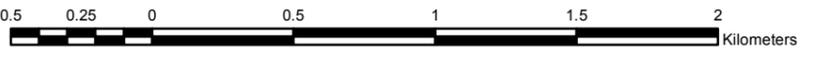
Figure By: PJW Date: Sept 2012
Checked By: JMC & JR Date: Sept 2012

Figure No.: **NE / RA / EXT / HEFS / 16** Revision: **0**

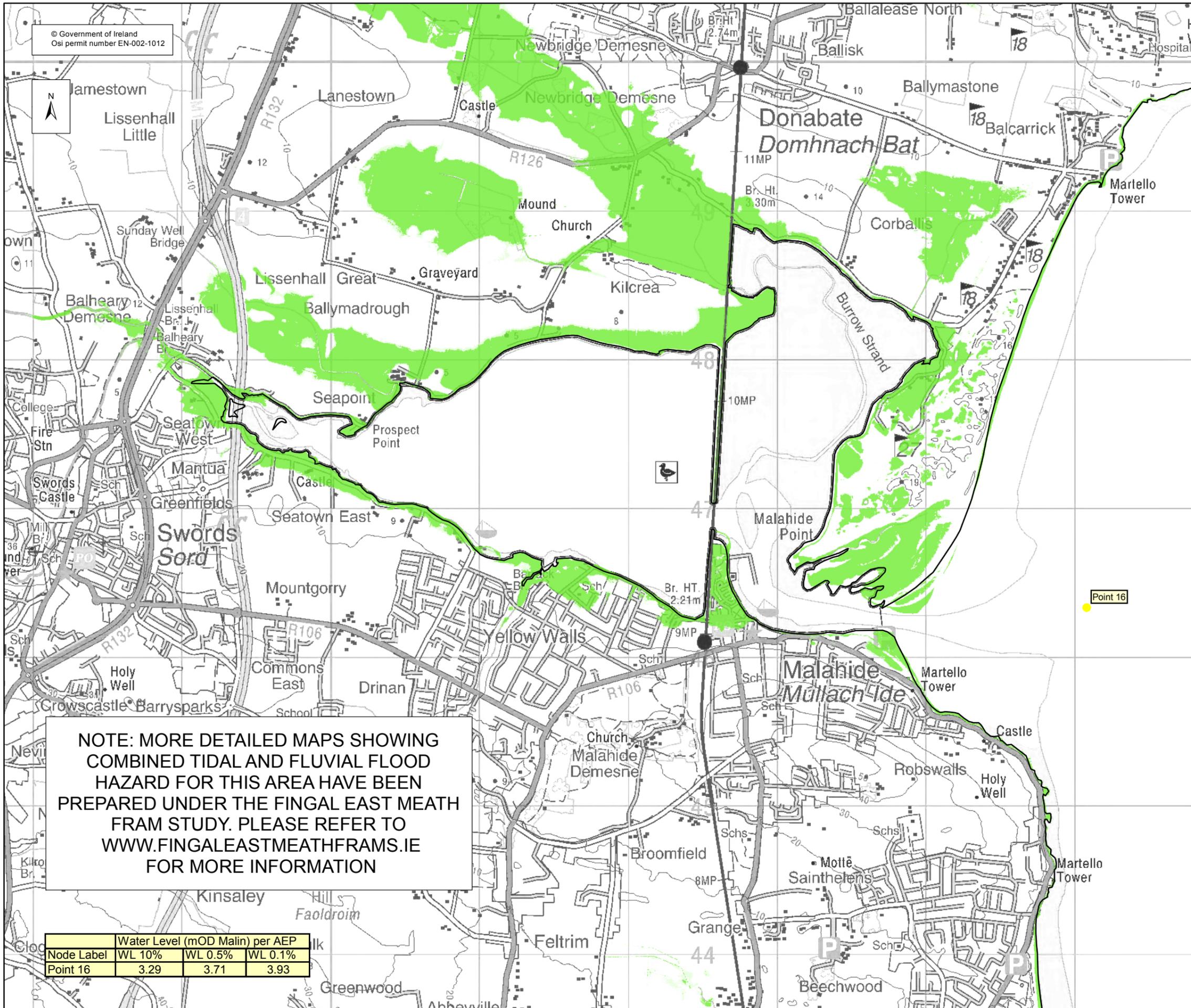
Drawing Scale: 1:25,000 Plot Scale: 1:1 @ A3

NOTE: MORE DETAILED MAPS SHOWING COMBINED TIDAL AND FLUVIAL FLOOD HAZARD FOR THIS AREA HAVE BEEN PREPARED UNDER THE FINGAL EAST MEATH FRAM STUDY. PLEASE REFER TO WWW.FINGALEASTMEATHFRAMS.IE FOR MORE INFORMATION

Node Label	Water Level (mOD Malin) per AEP		
	WL 10%	WL 0.5%	WL 0.1%
Point 16	3.79	4.21	4.43



© Government of Ireland
Osi permit number EN-002-1012



Location Plan :



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.



Elmwood House
74 Boucher Road
Belfast
BT 12 6RZ
Northern Ireland



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 : MID RANGE FUTURE SCENARIO
Figure By : PJW Date : June 2012
Checked By : JMC & JR Date : June 2012

Figure No. :
NE / RA / EXT / MRFS / 16 Revision
1

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

**NOTE: MORE DETAILED MAPS SHOWING
COMBINED TIDAL AND FLUVIAL FLOOD
HAZARD FOR THIS AREA HAVE BEEN
PREPARED UNDER THE FINGAL EAST MEATH
FRAM STUDY. PLEASE REFER TO
WWW.FINGALEASTMEATHFRAMS.IE
FOR MORE INFORMATION**

Node Label	Water Level (mOD Malin) per AEP		
	WL 10%	WL 0.5%	WL 0.1%
Point 16	3.29	3.71	3.93



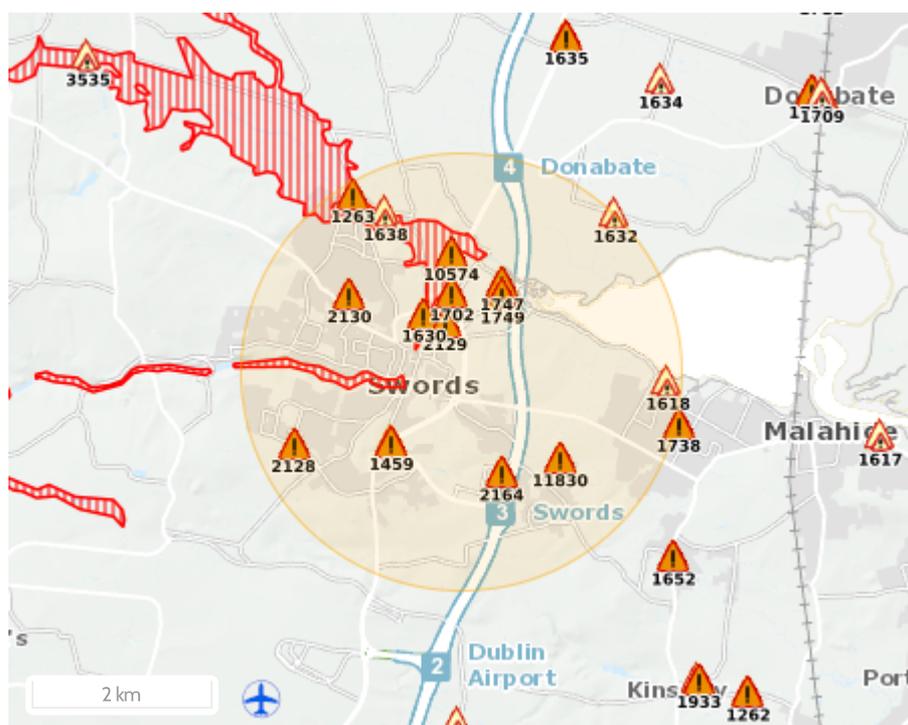
Appendix E – OPW Flood Hazard Report



Report Produced: 20/1/2021 15:22

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

16 Results

Name (Flood_ID)	Start Date	Event Location
1. Broadmeadow Swords August 1986 (ID-1263) Additional Information: Reports (1) Press Archive (0)	25/08/1986	Approximate Point
2. Pinnock Hill Swords Recurring (ID-1459) Additional Information: Reports (7) Press Archive (0)	n/a	Exact Point
3. Bisset Strand and Estuary Road Malahide Recurring (ID-1618) Additional Information: Reports (4) Press Archive (0)	n/a	Exact Point
4. Ward North Street Swords Nov 2002 (ID-1630) Additional Information: Reports (4) Press Archive (3)	13/11/2002	Exact Point
5. Balheary Road Swords Recurring (ID-1638) Additional Information: Reports (2) Press Archive (0)	n/a	Exact Point
6. N1 at Roundabout at Fingallions Nov 2002 (ID-1702) Additional Information: Reports (1) Press Archive (0)	13/11/2002	Exact Point

Name (Flood_ID)	Start Date	Event Location
7.  Estuary Road Swords Feb 2002 (ID-1747) Additional Information: Reports (1) Press Archive (0)	01/02/2002	Approximate Point
8.  Gartan Court Swords Feb 2002 (ID-1749) Additional Information: Reports (1) Press Archive (0)	01/02/2002	Exact Point
9.  Rathingle Swords Nov 1982 (ID-2128) Additional Information: Reports (1) Press Archive (0)	05/11/1982	Exact Point
10.  Seatown Villas Swords Nov 1982 (ID-2129) Additional Information: Reports (1) Press Archive (0)	05/11/1982	Exact Point
11.  Pine Grove Park Swords Nov 1982 (ID-2130) Additional Information: Reports (1) Press Archive (0)	05/11/1982	Exact Point
12.  Melrose Park Oct 2002 (ID-2164) Additional Information: Reports (1) Press Archive (0)	20/10/2002	Exact Point
13.  Pinnock Hill Nov 2002 (ID-2191) Additional Information: Reports (1) Press Archive (0)	14/11/2002	Exact Point
14.  Ward Swords Co.Dublin August 2008 (ID-10574) Additional Information: Reports (1) Press Archive (0)	09/08/2008	Approximate Point
15.  Flooding at Kinsealy Court, Swords, Co. Dublin (ID-11830) Additional Information: Reports (1) Press Archive (0)	24/11/2011	Approximate Point
16.  Pinnock Hill October 2002 (ID-1468) Additional Information: Reports (4) Press Archive (0)	20/10/2002	Exact Point