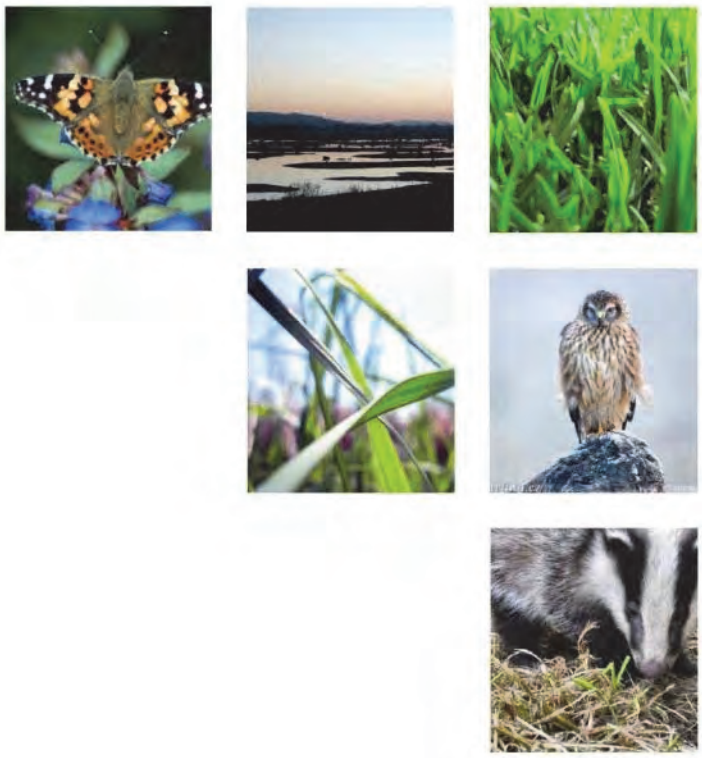

APPENDIX 13.1

FLOOD RISK ASSESSMENT

FLOOD RISK ASSESSMENT FOR A PROPOSED AVIATION FUEL PIPELINE FROM DUBLIN PORT TO DUBLIN AIRPORT

STAGE 1 – FLOOD RISK IDENTIFICATION

MARCH 2015

FEHILY TIMONEY & COMPANY

FLOOD RISK ASSESSMENT FOR A PROPOSED AVIATION FUEL PIPELINE FROM DUBLIN PORT TO DUBLIN AIRPORT

STAGE 1 – FLOOD RISK IDENTIFICATION

User is Responsible for Checking the Revision Status of This Document

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1	Final Issue	MC/MT	ME	COD	16.03.2015

Client: Fingleton White & Company Ltd.

Keywords: Flood Risk Assessment, stage 1, flood risk, flood risk mapping

Abstract: Fehily Timoney & Company was commissioned by Fingleton White & Company Ltd. to prepare a Stage 1 flood risk assessment for the proposed aviation fuel pipeline from Dublin Port to Dublin Airport in support of the Environmental Impact Statement (EIS) and planning application for this project. The Stage 1 flood risk assessment was prepared in accordance with the guidelines produced by the Department of the Environment, Heritage and Local Government (DoEHLG) - *The Planning System and Flood Risk Management Guidelines for Planning Authorities, November 2009*.

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1 INTRODUCTION

1.1 Background

Fehily Timoney & Company was commissioned by Fingleton White (FW) to prepare a flood risk assessment for the proposed aviation fuel pipeline from Dublin Port to Dublin Airport in support of the Environmental Impact Statement (EIS) and planning application for this development.

This report contains the first stage of the flood risk assessment, the flood risk identification.

The flood risk identification Stage 1 report was prepared in accordance with the guidelines produced by the Department of the Environment, Heritage and Local Government (DoEHLG) - *The Planning System and Flood Risk Management Guidelines for Planning Authorities, November 2009*.

1.2 Scope

The geographical scope of the flood risk assessment for the proposed development comprises any watercourse and floodplain that is intersected by the proposed scheme alignment and/or situated within a corridor of 25 m either side of the proposed pipeline corridor, which includes the public road, footway and verges within the boundary lines between public and private property. As the proposed pipeline is to be constructed generally in an urban setting and will be limited to within the proposed pipeline corridor, the receptors will be generally located within 10-25 m of the construction activities.

The flood risk assessment also examined the wider catchment influences on these watercourses. The assessment took cognisance of any environmentally protected areas along these hydrological pathways.

The proposed development comprises a 200 mm nominal bore (NB) pipeline to transport aviation fuel from a inlet station at Dublin Port to a reception station at Dublin Airport. The pipeline will be 14.4 km in length located predominantly within the road carriageway along the route. At the northern extent of the scheme, at Dublin Airport, the pipeline corridor will pass through the DAA Long Term Car Park (Red). A short section of the pipeline will traverse Athletic Union League (AUL) Sports Complex at Clonshaugh. The pipeline will also cross over the Dublin Port tunnel. It is proposed to cross seven river/stream crossings, five of which are culverted at the location of the crossing. Above Ground Stations will be required at both Dublin Port and Dublin Airport. These installations will be designed to pump and receive fuel and to control and monitor the quality and quantity of fuel being transported. The inlet station at Dublin Port and the reception station at Dublin Airport are existing facilities which will be modified to accommodate the proposed pipeline.

Detailed strip mapping at a scale of 1:1000 was available for the entire pipeline corridor of 14.4 km. This strip mapping was examined along each section to determine the likely potential flood risk to and from the proposed development.

The pipeline passes through two local authority functional areas namely, Dublin City Council (DCC) (from Dublin Port to Clonshaugh) and Fingal County Council (FCC) (from Clonshaugh to Dublin Airport). Figure 3.1 shows the proposed route of the pipeline.

The catchments crossed by the proposed development are in Hydrometric Area HA09 passing through the Mayne and Santry River catchments and the coastal catchments of the Tolka and Mayne Rivers. There are seven watercourse crossings in all along the pipeline route. Five of these crossings are culverted at the location of the proposed crossing points. These rivers are under the responsibility of the Eastern River Basin District and Inland Fisheries Ireland.

In the EIS, Chapter 13 Hydrology and Water Quality, the location of known existing foul, combined and stormwater collection systems and watermains was identified in Figure 13.5 and Figure 13.6. Cognisance was taken in this flood risk assessment of the potential flood risk where there are clashes with these networks in the jurisdictions of DCC and FCC. The layout of proposed sewerage schemes and watermain schemes was also examined.
There is a network of stormwater gullies and manholes servicing the area where the pipeline corridor will pass through the DAA Long Term Car Park (Red). The developer will liaise with DAA to confirm the location of services in this area before construction commences. In addition, the location of services will be proofed using slit trenches and scanning equipment where necessary.

Underground infrastructure could be impacted by the proposed pipeline affecting the integrity of the structure and providing a new passage for flood waters into vulnerable areas. Two principal examples will be considered in this flood risk assessment as follows:

- Dublin Port Tunnel
- The documented assumed location of basements at Donnycarney

The purpose of this report is to identify the flood risk posed by the scheme, both during the construction and operational phase, to assess the runoff characteristics of the site and the consequent effects on any sensitive receptors downstream and to also identify any flood risk to the proposed scheme from any hydrological features in areas liable to flooding.

1.3 Methodology

The flood risk assessment was prepared by a specialist water engineer in Fehily Timoney & Company in accordance with the guidelines produced by the DoEHLG - *The Planning System and Flood Risk Management Guidelines for Planning Authorities, November 2009*.

1.3.1 Stage 1 - Flood Risk Identification

The flood risk identification involved a desk-based study to identify whether there may be any flooding or surface water management issues related to the proposed development site that may warrant further investigation.

The methodology used to prepare the flood risk identification (Stage 1) is outlined as follows:

- Development plans, policies and recent planning applications were studied
- Responses from statutory bodies during the consultation process were examined, with particular reference to concerns relating to flood risk.
- The nature and location of the area in the vicinity of the proposed development was described in terms of the existing hydrological environment
- The existing site geology and hydrogeology was examined in terms of how it relates to the flooding history
- All existing historical information on previous events, studies and surveys, was examined as made available from the Office of Public Works (OPW) flood hazard mapping website www.floodmaps.ie and their catchment flood risk assessment and management website www.cfram.ie.
- The River Tolka study, *Phase 1 Initial Planning Study, Tolka NDDS Drainage Area (Catchment Ref. S2008a), August 2006* from the Greater Dublin Strategic Drainage Study (GDSDS) was examined along with the information provided on storm sewers and culverted watercourses in that study.
- The available results from the River Tolka Flooding Study and the EU Interreg IVB FloodResilienCity Project, Dublin City Report, January 2012, Interim Review and recommendations following the Dublin flood event of 24th October 2011 were examined. Mapping showing flooding from all sources is available as part of this latter study. These studies are available to view on the Dublin City Council (DCC) website at:
    - www.dublincity.ie/WATERWASTEENVIRONMENT/WASTEWATER/Pages/Flooding.aspx
- The risk of flooding from groundwater sources was examined
- The pluvial and fluvial flood risk was examined
- The mapping produced in the Eastern Catchment Flood Risk Assessment and Management Study (EASTCFRAMS) was examined
- Pluvial mapping from the Fingal-East Meath Flood Risk Assessment and Management Study (FEM FRAMS) was studied. The FEM FRAMS was undertaken by FCC in association with Meath County Council and the OPW, in the summer of 2008 to address the issue of existing flood risk in the Fingal East Meath area
- Tidal influences on the Tolka and Mayne Estuaries and at North Bull Island were examined.
- Results of the Dublin Coastal Flooding Protection Project (DCFPP) were examined
- Emergency response capabilities were examined as outlined in the SAFER Project and in the Strategic Development Zone North Lotts and Grand Canal Dock Flood Risk Assessment included in the North Lotts & Grand Canal Dock Planning Scheme Strategic Environmental Assessment (SEA) Environmental Report, November 2013
- The flood risk was examined for the proposed aviation fuel pipeline from Dublin Port to Dublin Airport.

2 DEVELOPMENT PLANS AND POLICIES

2.1 National, Regional and Local Spatial Plans

A number of planning and policy documents were reviewed with respect to their flood protection policies. This flood risk assessment addresses the following policies with regard to flood risk management for the affected areas:

- National Development Plan 2007–2013
- Dublin City Development Plan (DCDP) 2011–2017
- Fingal County Development Plan (FDP) 2011–2017
- Dublin Airport Local Area Plan

Other documents examined in the course of the flood risk assessment were as follows:

- Sustainable Development: A Strategy for Ireland, Department of the Environment, 1997
- Regional Planning Guidelines for the Greater Dublin Area 2004–2016, Dublin Regional Authority and Mid-East Regional Authority
- Greater Dublin Strategic Drainage Study (GDSDS)
- Eastern River Basin District (ERBD) River Basin Management Plan 2009–2015
- The Dublin City Council Water Services Strategic Plan 2009

2.1.1 National Development Plan 2007–2013

The National Development Plan sets out the priorities of the State in terms of economic, social and infrastructural investment over the course of the plan. The proposed scheme falls under the Airport's and the Port's sub-programmes which are part of the plan's Economic Infrastructure Priority. The relevant key objectives under this priority are:

- *To improve the infrastructure of the 3 State Airports and provide support for investment in the regional airports;*
- *To better equip the ports sector to meet national and regional capacity and service needs;*

2.1.2 Dublin City Development Plan (DCDP) 2011 - 2017

The Dublin City Development Plan 2011 -2017 recognises challenges as outlined below:

It is crucial to respond to the issue of climate change and the impact of increased flood risk due to extremes of weather by flood risk management. Given the onset of climate change and increased flood risk from extreme events, flood risk assessment and management is required in relation to all aspects of the development plan, including the areas of urban design, flood resilient construction materials and individual developments. In this matter the development plan and all developments will have regard to the Guidelines for Planning Authorities on Flood Risk Management Guidelines (2009) issued by the Department of the Environment Heritage and Local Government.

Possible exceptions to restriction of development due to potential flood risks are provided for through the use of a Justification Test, whereby the overriding planning need and the sustainable management of flood risk to an acceptable level can be demonstrated.

The flood risk policies from the 2011–2017 development plan are as follows:

SI47
To assist the Office of Public Works in developing catchment-based Flood Risk Management Plans for rivers in the Dublin City Area and have regard to their provisions/recommendations

SI48
To carry out flood risk assessment and introduce Flood Risk Management in all areas which have been flooded in recent years recognising that areas of the City are at risk of flooding

SI49
To have regard to the Guidelines for Planning Authorities on the Planning System and Flood Risk Management, November 2009, published by the Department of the Environment, Heritage and Local Government when assessing planning applications and in the preparation of plans both statutory and non-statutory

SI50
To put in place adequate measures to protect the integrity of the existing Flood Defence Infrastructure identified in Appendix 17 (of the Development Plan) and to ensure that the new developments do not have the effect of reducing the effectiveness or integrity of existing and new flood defence infrastructure and that flood defence infrastructure provision has regard also to nature conservation and amenity issues.

Dublin City Council has the following objective with regard to flood risk*:*

SIO77
To require all applicants, where appropriate, to carry out a Flood Risk Assessment in accordance with the Departmental Guidelines on Flood Risk Management. The flood risk assessment shall accompany the planning application and should be sufficiently detailed to quantify the risks and the effects of any necessary mitigation/adaptation, together with the measures needed to manage residual risks. Local Area Plans or other land use plans or policies drawn up by Dublin City Council under the Development Plan are also subject to a flood risk assessment as appropriate in accordance with the Guidelines

The following are policies of Dublin City Council in relation to Dublin Bay:

GC23 *To cooperate with Dublin Bay Task Force (DBTF) to work towards developing a framework for Coastal Zone Management Plan for Dublin Bay, developing a detailed masterplan, and identifying new opportunities for enhancing Dublin Bay as a resource*

GC24 *To seek the continued improvement of water quality, bathing facilities and other recreational opportunities in the coastal, estuarine and surface waters in the city and to protect the ecology and wildlife of Dublin Bay.*

Requirements for development proposals adjoining rivers and canals are as follows:

Where a proposed development adjoins a river or canal bank, the area adjacent to the waterway should be retained as a linear park or walkway, with linkages into the wider open space network. The width of the linear park will take into account the existing layout and amenity potential with due allowance for riparian corridors and flood risk. In all case, any existing blockages to permeability, such as boundaries or redundant buildings, should be resolved where possible.

In terms of flood management, it is recognised that the risk of flooding has increased due to climate change and sea level rise.

There are three types of flooding events which can arise separately or in combination:

1) Coastal Flooding arising from the sea or estuary
2) Fluvial Flooding arising from Rivers or streams
3) Pluvial Flooding arising from extreme rainfall

The Dublin City Council Water Services Strategic Plan 2009 is the current strategic plan in place for Dublin City and sets out a number of objectives in relation to flood risk management including an objective to meet the requirements of the Floods Directive. Dublin City Council has been working in cooperation with the OPW to put in place appropriate studies and policies to address this issue (See also Appendix 17 of the Development Plan on Flood Defence Infrastructure and relevant extract from the listed flood defence infrastructure outlined below). The three types of flooding above have been addressed by various measures and policies including:

- Coastal Flooding – the 2005 Report on the Dublin Coastal Flood Protection Project
- Fluvial Flooding – The preparation of Catchment Flood Risk Assessment Models (CFRAMS)
- Pluvial Flooding – the implementation of the SAFER Project and the Flood Resilient Cities Project
- General – the Guidelines issued by the DEHLG on *The Planning System and Flood Risk Management Guidelines for Planning Authorities* (November 2009)

The flood defence infrastructure which is relevant to the proposed scheme is described in Appendix 17 of the Development Plan as follows

> **APPENDIX 17 – FLOOD DEFENCE INFRASTRUCTURE**
> ***Tolka River:*** *the River Tolka Flooding Study is used to calculate the 100 river flow and 200 year tidal events. A summary of upgrade work along the length of the river Tolka are as follows:*
> *1. East Point Business Park Bridge to John McCormack Bridge: 200-year tidal flood contained by embankment on the north side and joint bank and retaining wall defence on south side.*

The proposed Clontarf Flood Defence project comprises a series of flood bunds and walls along Clontarf Promenade between Alfie Byrne Road and the Bull Wall to protect nearby roads and properties from coastal flooding. The total length is circa 3 km. Due to the synergies and common location of the proposed North City Arterial Watermain and the proposed Clontarf Flood Defences it was decided to combine the two projects. This project received planning in July 2008, however construction is on hold due to local objections.

The proposed aviation fuel pipeline will be underground and therefore will not interfere with the amenity potential of river banks with due allowance for riparian corridors and flood risk. Any access manholes proposed will not interfere with the walkways. Temporary diversions may be required for walkways during the construction of the pipeline.

2.1.2.1 Planning Applications to DCC

The planning application database for DCC was examined with particular attention paid to applications adjacent to the watercourses within the study area dated post November 2009. The search was undertaken with a view to determining any conditions set down by the local authorities expressing concerns relating to flood risk following the publication of the guidelines produced by the DoEHLG - *The Planning System and Flood Risk Management Guidelines for Planning Authorities* (November 2009).

DCC has set down a number of conditions in several applications relating to surface water drainage. These are outlined as follows:

- The developer shall limit surface water discharge from site in accordance with the requirements of the Drainage Division as set out in the Greater Dublin Strategic Drainage Study's, Technical Document on New Development
- The developer shall ensure that an appropriate flood risk impact assessment is carried out for the proposed development.

2.1.3 Fingal County Development Plan (FDP) 2011–2017

The Fingal Development Plan 2011–2017 cites a number of key environmental challenges which can be identified for Fingal. Amongst these are the "Management of the coastline including the management of flood risk and dune conservation and the measures will be increasingly important in response to the impacts of predicted climate change and increased population pressure" and the "Management of flood risk along the County's watercourses taking account of climate change predictions".

In the plan it is stated that the strategic policy will deliver on the main aims by seeking to:

Item 2. "*Minimise the County's contribution to climate change, and adapt to the effects of climate change, with particular reference to the areas of land use, energy, transport, water resources, flooding, waste management and biodiversity".*

Item 18. "*Avoid building on areas liable to flooding or which would be liable to exacerbate flooding".*

Included amongst the objectives in the draft plan is the following:

'Support the construction of an oil pipeline from Dublin Port to provide fuel service to Dublin Airport'.

2.1.3.1 Planning Applications to FCC

The planning application database for FCC was examined with particular attention to applications adjacent to the watercourses within the study area dated post November 2009. The search was undertaken with a view to determining any conditions set down by the local authorities expressing concerns relating to flood risk following the publication of the guidelines produced by the DoEHLG - *The Planning System and Flood Risk Management Guidelines for Planning Authorities* (November 2009).

FCC has not set down any particular conditions relating to flooding in the vicinity of Stockhole, Cuckoo Stream or the Mayne River.

FCC has set down a condition in several applications relating to surface water drainage. This is outlined as follows:

- That the water supply and drainage arrangements, including the disposal of surface water, be in accordance with the requirements of the County Council. In particular, the following requirements of the Water & Drainage Department shall be complied with in full prior to the commencement of development: Surface Water: a) No surface water/ rainwater is to discharge into the foul sewer system under any circumstances. b) The surface water drainage must be in compliance with the 'Regional Code of Practice for Drainage Works Version 6.0' FCC April 2006. c) Soakways must comply with BRE Digest 365 and be at least 5m from the proposed dwelling.

2.1.4 Dublin Airport Local Area Plan 2006

The Dublin Airport Local Area Plan was developed in the context of the FDP 2005–2011 and was adopted by the Council on 23rd June 2006. The surface water objectives with respect to flood risk are as follows:

SW4
To develop and implement a storm water management system following the principle of Sustainable Urban Drainage and in compliance with the recommendations of the Greater Dublin Strategic Drainage Study in respect of new development and re-development of "brownfield" sites, to interalia attenuate runoff to pre-development green field rates.

SW5
*To implement, in respect of existing developments where practicable, recommendations arising from flood impact assessments under Objective WDO34 of the Fingal Development Plan 2005–2011, within the lifetime of this Masterplan (**Objective WDO34** To develop flood impact assessments for the minor rivers of Fingal including the Matt (Balbriggan), Ward (Swords), Sluice (Kinsealy & Baldoyle) and Mayne (Baldoyle) and for the Donabate Peninsula).*

2.2 Consultations with Statutory Bodies

Consultations were undertaken by FW with a number of statutory bodies during the EIA process. Details of the consultations relating to the Flood Risk Assessment are outlined in the following sections.

Dublin City Council

In its response by email on 24 April 2014, DCC stated that the newly formed body 'Irish Water' are the statutory agency now responsible for foul/combined drainage systems while Dublin City Council retains responsibility for surface water pipelines and flooding. The Drainage Division effectively acts for Irish Water under the terms of the Service Level Agreement between both organisations.

DCC Drainage Division commented in relation to flood risk as follows:

- *A Flood Risk Assessment should take cognisance of the impact of any diversions/severances during the construction phase. (eg: temporary removal of road gullies to facilitate construction).*

The potential clashes between the proposed pipeline corridor and storm sewer networks from drawings provided by FCC and DCC, together with identified locations of culverted and open watercourses were considered in this Flood Risk Assessment.

Irish Water

In its letter received on 25 April 2014, Irish Water encouraged FTC to engage with both Local Authorities to address the potential conflicts and crossings of water and sewerage services and to ensure appropriate mitigation. Irish Water requested to be consulted if particular risks were identified to Irish Water assets in the EIS.

Health Services Executive (HSE)

In its response by letter, received on 16 May 2014, HSE raised the following concerns relating to flood risk:

- *Detailed mitigation measures should be identified during the EIA including visual leak detection in relevant and vulnerable areas of water bodies/courses and pipeline equipment.*
- *It is recommended that extra physical protection of pipes be provided at all river and stream crossings including the Tolka, Santry, Mayne, Wad, Naniken Rivers and the Cuckoo and Kilbarrack Streams which will require specialised construction techniques.*
- *The impacts from the submergence of the pipeline by floodwaters at the Tolka and Santry Rivers during the operation of the pipeline should be assessed during the EIA.*

A separate report has been prepared by AMEC Environment and Infrastructure UK Ltd., to investigate the potential for leaks in the pipeline and to examine the leak detection systems proposed. This report is included in Appendix 2.1 of the EIS and it has been examined regarding its findings in relation to flood risk, which are discussed in Section 3.5 of this flood risk assessment.

National Roads Authority (NRA)

In its letter of 09 May 2014, the NRA requested that trenchless technology be used under roads between M1 junctions 1 and 2 (See Section 3.4 of the EIS, identified as 'M1 Crossing –FAI Grounds to DAA Long Term Car Park (Red)') and the Southern Portal of Dublin Port Tunnel (See Section 3.4 of the EIS, identified as 'Dublin Port Tunnel Crossing – Alfie Byrne Road'). The concern expressed for the latter location was in relation to the shallow depth available over the tunnel and the potential for disturbance to the integrity of the tunnel and subsequent leakage. It is noted however that the clearance of the Port Tunnel at the proposed crossing is adequate to take the proposed 200 mm pipeline with a separation distance of 1.4 m from the crown of the tunnel. The tunnel is circa 2.9 m below ground. It is also proposed to lay the pipe over the Port Tunnel using open cut trench technology.

Health and Safety Authority (HSA)

In its letter of 01 May 2014, The Health and Safety Authority looked for the applicant to demonstrate that the proposed pipeline would not increase the risk of a major accident at the COMAH establishments. The only COMAH site identified along the route is discussed in Chapter 7 of the EIS and it is located at Dublin Port.

3 EXISTING HYDROLOGICAL ENVIRONMENT

3.1 General Description of the Catchments Crossed

The catchments crossed by the proposed development are in Hydrometric Area HA09 passing through the Mayne and Santry River catchments and the coastal catchments of the Tolka and Mayne Rivers. There are seven watercourse crossings in all, along the pipeline route. Five of these crossings are culverted at the proposed crossing point locations. These rivers are under the responsibility of the Eastern River Basin District and Inland Fisheries Ireland.

Situated in a predominantly urban setting, the pipeline will be laid within a route corridor in close proximity to and crossing existing services, including culverted watercourses, storm water sewers, foul sewers, combined sewers and watermains. There are also other proposed schemes in the vicinity of the proposed pipeline as follows:

- Proposed Cloghran Sewerage Scheme on Clonshaugh Road
- North Fringe Water Supply Scheme on Clontarf Road

These existing and proposed services are discussed in Section 3.2.

A description of each of the watercourses crossed by the proposed scheme (from north to South) is given below (refer to Figure 3.1):

Cuckoo Stream - The proposed pipeline corridor crosses the Cuckoo Stream, a tributary of the Mayne River, at Clonshagh, approximately 2.5 km downstream of where this stream rises, just south of Dublin Airport. The stream is culverted in two culverts at the point of the crossing, one 700 mm x 900 mm stone culvert and a second concrete culvert, 1830 mm x 1130 mm. The Cuckoo Stream is not a major watercourse and joins the Mayne River approximately 3 km downstream in the Balgriffin area. The details of the stream crossing are outlined in Table 3.1.

Mayne River - The proposed pipeline corridor crosses the Mayne River on the R139 at the roundabout, at the junction with the Clonshaugh Road, approximately 2 km downstream of where this river rises in Dardistown. The river is culverted at the point of the crossing. The Mayne River flows into Baldoyle Bay at Maynetown, which is a cSAC and pNHA, some 5 km downstream of the crossing. The environmentally designated areas are discussed further in Chapter 11 Flora and Fauna of the EIS. The details of the stream crossing are outlined in Table 3.1.

Kilbarrack Stream – The proposed pipeline corridor crosses the Kilbarrack Stream on the R107 Malahide Road at Newtown. The stream is culverted at the point of the crossing. The Kilbarrack Stream is part of a coastal waterbody that drains into the Mayne Estuary. From the point where it is crossed by the proposed scheme, it continues in an easterly direction for 5 km, through Kilbarrack Lower and turning north through Baldoyle to join the Mayne River at Maynetown just before the Mayne River flows into Baldoyle Bay, which is a cSAC and pNHA. The environmentally designated areas are discussed further in Chapter 11 Flora and Fauna of the EIS. The details of the stream crossing are outlined in Table 3.1.

Santry River - The proposed pipeline corridor crosses the Santry River at Coolock, just downstream of Coolock Bridge. The location of the proposed crossing is an open channel section of the Santry River, which has been channelized in concrete. It is proposed, for the pipeline development, to cross under the Santry River using trenchless construction methods. The Santry River rises in the semi-rural areas of Harristown and Dubber in County Dublin. The river flows south along the boundary of Dublin Airport, close to the new Dublin Bus Harristown Depot. From there, it flows in an easterly direction through Silloge Public Golf Course, crossing the M50 at Ballymun and crossing Santry Demesne (pNHA). It crosses the M1 at Santry and the proposed scheme crosses the Santry River some 2.5 km east of the M1. The Santry River reaches the sea, a further 2.5 km downstream of the proposed crossing, discharging at Raheny Strand, with the mouth of the river forming part of the western lagoon behind North Bull Island (SPA). Raheny Strand is within Dublin Bay cSAC and pNHA. The environmentally designated areas are discussed further in Chapter 11 Flora and Fauna of the EIS. The details of the stream crossing are outlined in Table 3.1.

Naniken River – The proposed pipeline corridor crosses the Naniken River on the Malahide Road in Artane. The Naniken River rises to the east at Beaumont. The stream is culverted at the point of the proposed crossing. The Naniken River is part of a coastal waterbody that drains into the Tolka Estuary.

From the point where it is crossed by the proposed scheme, it continues in an easterly direction for 3.75 km, through Killester and St. Annes Park before flowing into the Tolka Estuary. The Tolka Estuary is within Dublin Bay cSAC and pNHA. The environmentally designated areas are discussed further in Chapter 11 Flora and Fauna of the EIS. The details of the stream crossing are outlined in Table 3.1.

Wad River – The proposed pipeline corridor crosses the Wad River on the Malahide Road, just north of Collins Avenue junction at Donnycarney Bridge. The Wad River rises to the east at Poppintree Park, 4.5 km upstream of the proposed crossing. The stream is culverted at the point of the proposed crossing. The Wad River is part of a coastal waterbody that drains into the Tolka Estuary. From the point where it is crossed by the proposed scheme, it continues in an easterly direction for approximately 2 km, through Killester, where it turns south and crosses the Howth Road and the Clontarf Road at a location just to the east of Alfie Byrne Road and then flows into the Tolka Estuary. The Tolka Estuary is within the South Dublin Bay and River Tolka Estuary SPA and the South Dublin Bay cSAC and pNHA, however the point at which the proposed pipeline crosses the Tolka River is not within any designated site. The environmentally designated areas are discussed further in Chapter 11 Flora and Fauna of the EIS. The details of the stream crossing are outlined in Table 3.1.

Tolka River - The proposed pipeline corridor crosses the channel of the Tolka River at the mouth of the Tolka River Estuary to the north of the East Wall Road and just to the east of John McCormack Bridge, as shown in Figure 3.1. It is proposed to cross under the Tolka River using trenchless construction methods in this location. The location of the proposed launch pit for the trenchless crossing can be seen in the foreground in Appendix 3.5 of the EIS. The Tolka River rises near Culmullin in County Meath and flows for 33.3 km to discharge into the Tolka Estuary. The catchment of this river is generally divided into three parts, namely the upper, middle and lower catchments. The lower catchment flows into the transitional coastal waterbody that flows into the Tolka Estuary. The proposed pipeline will cross the Tolka River at the mouth of the Tolka Estuary. The Tolka Estuary is within the South Dublin Bay and River Tolka Estuary SPA and the South Dublin Bay cSAC and pNHA, however the point at which the proposed pipeline crosses the Tolka River is not within any designated site. The environmentally designated areas are discussed further in Chapter 11 Flora and Fauna of the EIS. The details of the stream crossing are outlined in Table 3.1.

As it is proposed to cross each of the above water bodies using trenchless technology such as thrust bore/pipe jack techniques, it is not anticipated that there will be any significant impacts associated with the work as there will be no disturbance to the bed of the river or flow within the channel itself.

The Tolka River and the Santry River are classified as heavily modified water bodies by the Eastern River Basin Management Plan due to the flood defences constructed. A heavily modified water body is an existing body of water that has had its original appearance significantly changed to suit a specific purpose. In this case, these bodies of water have undergone re-alignment where flood defences have been constructed.

The pipeline route also crosses culverted sections of tributaries of the Tolka River and storm water drainage sewers amongst other utility crossings, which are discussed in Section 3.2.

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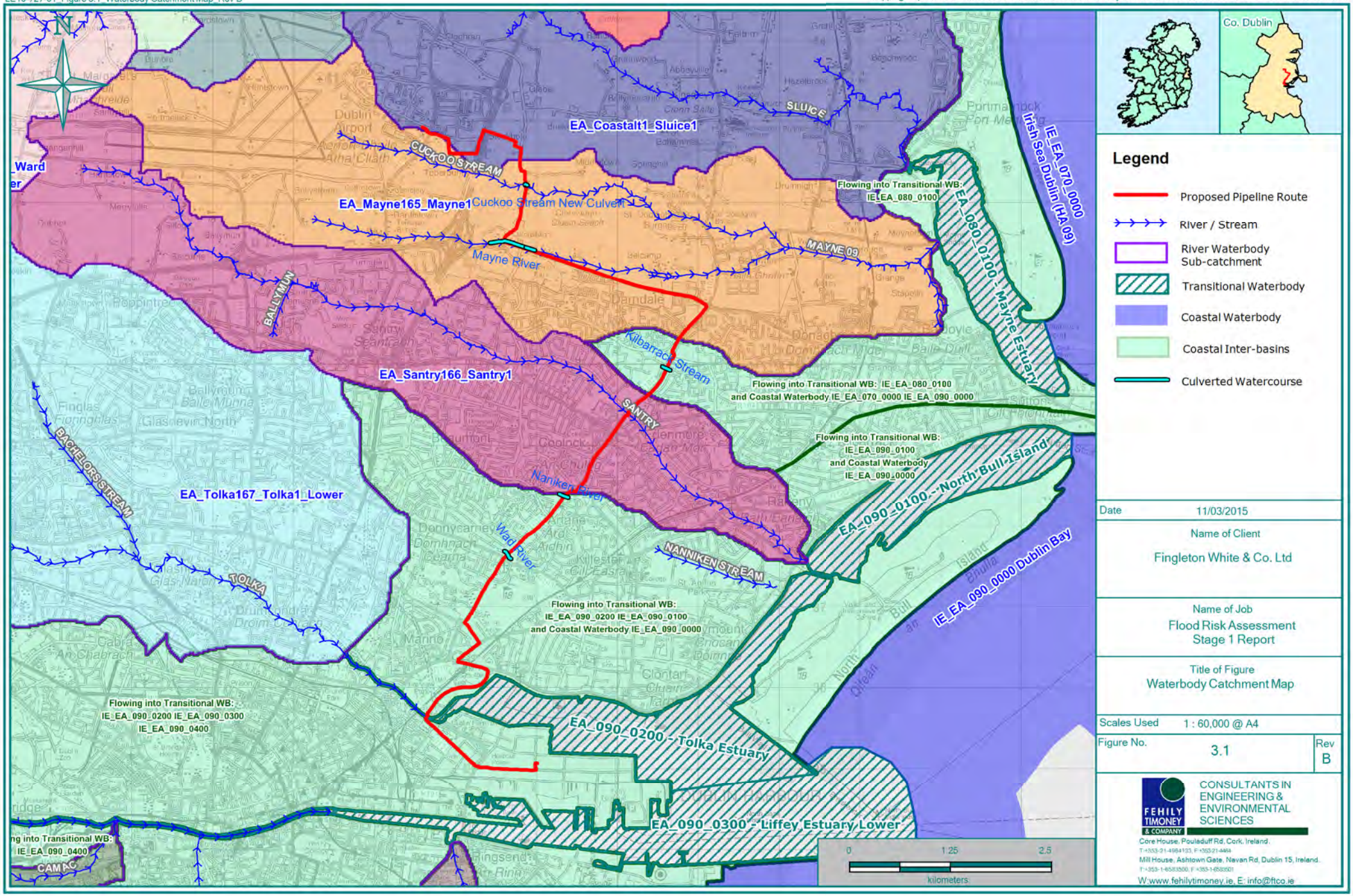
LE10-727-01_Figure 3.1_Waterbody Catchment Map_Rev B



Legend

- Proposed Pipeline Route
- River / Stream
- River Waterbody Sub-catchment
- Transitional Waterbody
- Coastal Waterbody
- Coastal Inter-basins
- Culverted Watercourse

Date	11/03/2015
Name of Client	Fingleton White & Co. Ltd
Name of Job	Flood Risk Assessment Stage 1 Report
Title of Figure	Waterbody Catchment Map
Scales Used	1 : 60,000 @ A4
Figure No.	3.1
Rev	B

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Table 3.1: Pipeline Crossing Details at Streams and Rivers

	Culvert 1		Culvert 2		Clearance under Culvert 1/Channel Bed	Clearance Culvert 2	Fuel Pipeline Crossing Method Proposed
Stream	Width (mm)	Height (mm)	Width (mm)	Height (mm)	m	m	
Cuckoo Stream	900	700	1830	1100	0.6 m min.	0.82 m min.	Trenchless crossing under culverts
Mayne River		800			0.6 m min.		Trenchless crossing under culverts
Kilbarrack Stream		1350			1.0 m min.		Trenchless crossing under culverts
Santry River	Approx. 3 m Wide Channel	Approx. channel depth = 1.43 m			1.2 m min.		Trenchless crossing under bed of river channel
Naniken River	1250	1020			1.0 m min.		Trenchless crossing under culverts
Wad River	1490	1240			1.0 m min.		Trenchless crossing under culverts
Tolka River	25.6 m Wide Channel	Approx. channel depth = 4.16 m			2.0 m min.		Trenchless crossing under bed of river channel
Source: Fingal County Council and Trial Pits undertaken by Fingleton White							

3.2 Existing and Proposed Drainage and Water Supply Systems

In Dublin, the existing drainage system for foul drainage is a mixture of separate and combined systems with overflows to watercourses. The study area lies within the North Dublin Drainage Scheme and North Fringe Sewer catchments, with a minor part of the study area within the City Centre/Dockland catchment. These catchments are mainly served by a combined sewerage system (i.e. a system which accepts both foul and surface water) that drains to the Ringsend Sewage Treatment Works. The sewerage network in the city centre is very complex with many overflows and with bifurcations (i.e. where the piping splits into two parts) resulting in looped systems. Surface water systems tend to be limited to small areas within the catchment and mostly the catchment is served by the foul/combined system.

The location of known existing foul, combined and stormwater collection systems and watermains was identified in Figure 13.5 and Figure 13.6 of the EIS in Chapter 13 Hydrology and Water Quality. It is evident from these figures that there will be numerous clashes with sewers and watermains along the proposed pipeline corridor. The developer will liaise with DCC and FCC in advance of construction to check for updates on the progress of any new sewers or watermains along each section of the proposed pipeline corridor. In particular the Cloghran Sewerage Scheme and the North Fringe Water Supply Scheme, which are proposed at the time of preparation of this FRA, will be of relevance. It is proposed that two phases of the installation of the pipeline will run concurrently, commencing at each end of the proposed pipeline corridor. The pipeline will be laid in 24 m lengths as construction progresses. The 200 mm diameter pipe will be laid at a nominal depth of cover of 1.2 m. This depth will be increased where necessary to avoid clashing with sewers or watermains.

At the northern extent of the scheme, on approach to Dublin Airport, the pipeline corridor will pass through the DAA Long Term Car Park (Red). There is a network of stormwater gullies and manholes servicing this area. The developer will liaise with DAA to confirm the location of services in this area before construction commences. In addition, the location of services will be proofed using slit trenches and scanning equipment where necessary.

3.3 Existing Site Geology and Hydrogeology

The Geological Survey of Ireland (GSI) website provides information on its public online mapping service at www.GSI.ie on subsoils, as shown in Figure 12.1 in Chapter 12 Soils, Geology and Hydrogeology of the EIS. Subsoil mapping provides evidence of alluvium which can be an indicator of past flooding, where flood records are limited in the vicinity of watercourses. The GSI mapping also provides information on estuarine sediments as shown in Figure 12.1 of the EIS, which can be an indicator of past coastal flooding.

Alluvium is evident where the proposed pipeline corridor crosses the Mayne and Santry Rivers as well as along the southern side of the Clontarf Road and across the junction with the Alfie Byrne Road. There is no evidence of estuarine sediments (silts and clays) along the proposed pipeline corridor.

3.4 Existing Flood Records

The national flood hazard mapping website (www.floodmaps.ie) provides data on historical flood locations throughout the country. The website indicates a history of flooding in a small number of locations adjacent to the pipeline route. These flood locations are shown in Figure 3.2 Flood Zones Overview Map and further detail is included in the set of detailed sub-maps in Appendix 2 of this FRA, Figures A 2.1 – A 2.9. The flood history is summarised in Table 3.2 Historical Flood Incidents.

Table 3.2: Historical Flood Incidents

Flood ID	OPW ID	Flood Location	Year of Flood	Source and Cause of Flooding
OPW 1	Flood ID No 1651	Stockhole Lane (near Airport)	2005	Fingal County Council, recorded in minutes of meeting identifying areas

Flood ID	OPW ID	Flood Location	Year of Flood	Source and Cause of Flooding
				subject to flooding - Fingal – Dublin. Road flooding - recurring.
OPW 2		Naniken River Artane	December 1954 & May 1955	Dublin City Council. Correspondence connected to flooding in Artane (Naniken) in north Dublin. Flooding occurred following severe and continued rainfall. Flooding occurred along the line of the Naniken River, flooding the Malahide Road by 3 ft. The culvert was inadequately sized to take the flows and has since been upsized & extended*
OPW 3		Clanmoyle Road, Donnycarney	July 2009	OPW Trim. Rainfall information, description of flooding damage and photograph. A number of properties on Clanmoyle Road, Donnycarney had to be evacuated due to flooding in July 2009.
OPW 4		Wad River Donnycarney	August 2008 & July 2009	Dublin City Council. Wad River Flooding. River Tolka, Wad River Sub-Catchment Pluvial Flood Modelling Study, Donnycarney Area Interim Report. In August 2008 and July 2009 flooding occurred at the Malahide Road, north of Collins Avenue, flowed to Collins Avenue East and along it to Clanmoyle Road following the historic floodplain of the Wad River. Flooding occurred at a number of properties. Additional gullies were provided along with minor flood relief works and recommendations for upgrading of the culvert at Clontarf Golf Club and provision of overflow facility.*
OPW 5		Clanmoyle Road, Donnycarney	October 2011	OPW Trim - Report of flooding at Clanmoyle Road, Donnycarney, Dublin 5 on 24th Oct 2011. Data gathered under the Eastern CFRAM Study. The source of the flood waters was the Wad River. Water from the

Flood ID	OPW ID	Flood Location	Year of Flood	Source and Cause of Flooding
				river ran into Collins Avenue and then Clanmoyle Road and ponded around the houses. Max. Flood depth 1 m with damage to properties and road flooding.
OPW 6		Clontarf Rd Seaview Avenue	August 2004 & Tidal Flood Event October 2004	Dublin City Council document. Schedule of locations affected by flooding on 23 Aug 2004. List and map of properties flooded during heavy rainfall (Estimated 1 in 30 yr event) provided. Account of Tidal flooding, 2.62 m OD Malin Head Flood Level recorded together with waves of 1.5 m to 1.8 m high in October 2004 from the Docklands Engineer to ESBI*

*Flood Defence assets have since been put in place

No flood incidents were recorded in the Cuckoo Stream, Mayne River, Kilbarrack Stream or Santry River in the vicinity of the pipeline corridor.

Flood extents mapping available from the OPW website for the Tolka River indicates historical flooding in the vicinity of the proposed crossing point. The outline of the area subject to flooding in the Tolka River is shown on the flood map in Figure 3.2. A more detailed map is shown in Appendix 2 of this FRA, Figure A 2.9.

The OPW has produced indicative flood mapping to assist in a preliminary flood risk assessment (PFRA) on its website www.cframs.ie. These maps were produced by the OPW from a number of sources and they illustrate flood zones.

Flood zones are geographical areas within which the likelihood of flooding is in a particular range and they are a key tool in flood risk management within the planning process as well as in flood warning and emergency planning. There are three types or levels of flood zones defined in accordance with “The Planning System and Flood Risk Management Guidelines” as follows:

Flood Zone A – *where the probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding):*

Flood Zone B – *where the probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 year and 0.5% or 1 in 200 for coastal flooding); and*

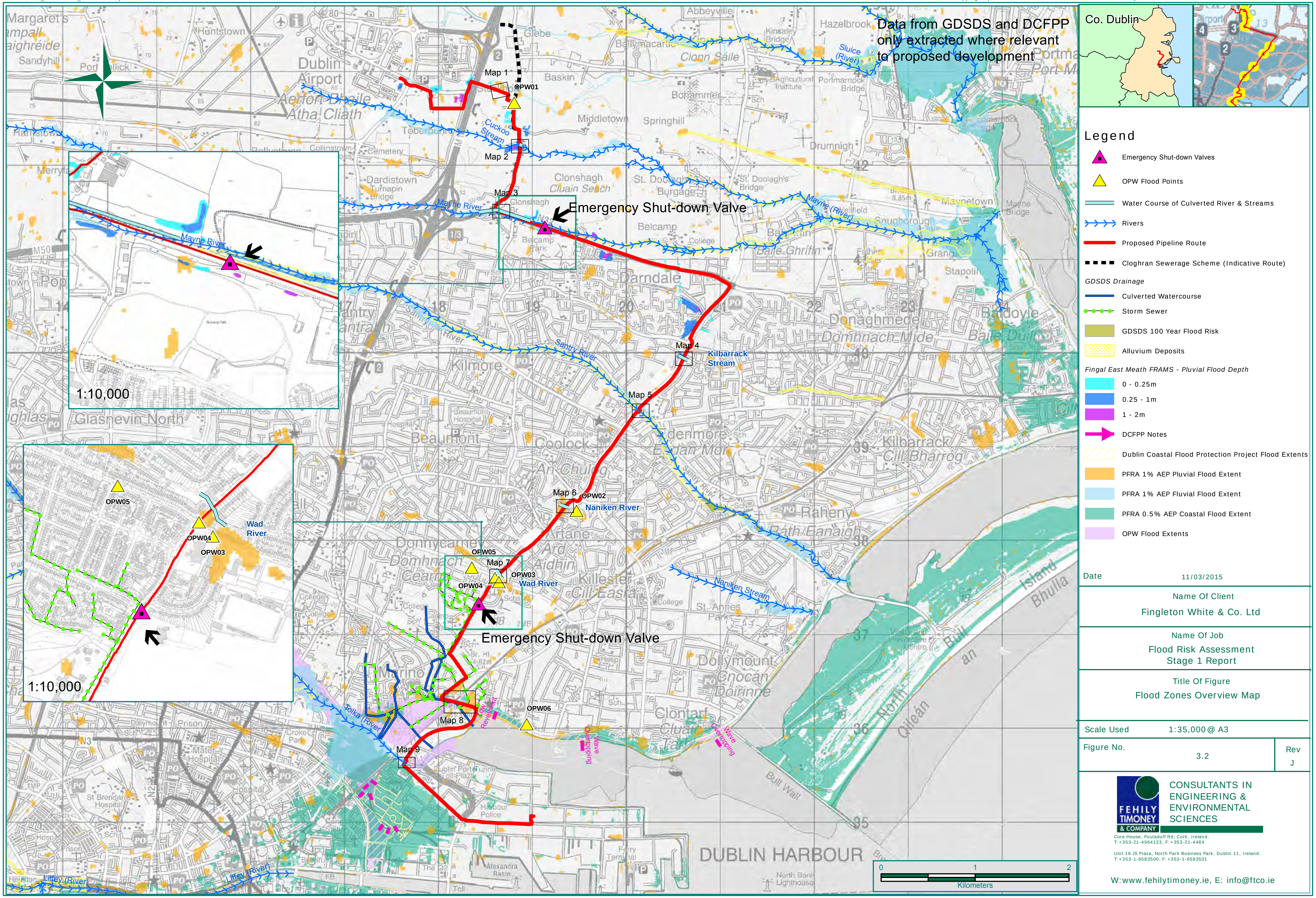
Flood Zone C – *where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.*

It can be seen in Figure A 2.9 in Appendix 2, that the launch and reception areas for the proposed crossing of the Tolka River are outside of the OPW flood extents outline but within a 'Flood Zone A' area i.e. an area with a probability of flooding in a 1 in 100 year flood or 1% AEP (Annual Exceedance Probability).

There is some ambiguity in the flood mapping here at the mouth of the Tolka Estuary. A survey was carried out at this location as part of this Flood Risk Assessment – Stage 1 to assist in the interpretation of the flood mapping at this location. The results of the flood risk assessment are discussed later in Section 4.1.3. The proposed launch and reception areas (for the trenchless crossings) and the access to same are proposed to be mostly located at ground levels above those associated with the flood area identified in the OPW mapping and mitigation is provided during construction where this is not the case.

Areas that could be subject to pluvial flooding are also shown on the PFRA mapping. The process for developing the pluvial flood extent maps was based on 'dropping' various depths and intensities of rainfall over a range of durations, and modelling how that rainfall would flow over the land and, in particular, pond in low-lying areas. A number of pluvial features are shown in the vicinity of Stockhole, at the proposed crossing locations of the Naniken and Wad Rivers, on the Clontarf Road and just to the north of the Clontarf Road, on the Malahide Road (R107). These low-lying areas correspond with some of the historic flood incidents listed in Table 3.2.

R:\Map Production\2010\LE10\727\01\Workspace\FRA\
LE1072701_FloodZones_Overview Map 3.2



Legend

- Emergency Shut-down Valves
- OPW Flood Points
- Water Course of Culverted River & Streams
- Rivers
- Proposed Pipeline Route
- Cloghran Sewerage Scheme (Indicative Route)

GDSDS Drainage

- Culverted Watercourse
- Storm Sewer
- GDSDS 100 Year Flood Risk
- Alluvium Deposits

Fingal East Meath FRAMS - Pluvial Flood Depth

- 0 - 0.25m
- 0.25 - 1m
- 1 - 2m
- DCFPP Notes
- Dublin Coastal Flood Protection Project Flood Extents
- PFRA 1% AEP Pluvial Flood Extent
- PFRA 1% AEP Fluvial Flood Extent
- PFRA 0.5% AEP Coastal Flood Extent
- OPW Flood Extents

Date 11/03/2015

Name Of Client
Fingleton White & Co. Ltd

Name Of Job
Flood Risk Assessment
Stage 1 Report

Title Of Figure
Flood Zones Overview Map

Scale Used 1:35,000 @ A3

Figure No. 3.2

Rev J

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3.5 Existing Flood Studies and Surveys

Greater Dublin Strategic Drainage Study (GDSDS)

The GDSDS was commissioned by Dublin Corporation (now Dublin City Council) in 2001 to identify policies, strategies and works leading to the development of a sustainable drainage system for the Greater Dublin Area. As part of this study drainage models were produced for a number of foul and stormwater catchments including the Tolka River and the Santry River. 100-year flood extent maps were prepared for each of the catchments as part of the studies. These maps were examined in the preparation of this section of the EIS and the information has been included in Figure 3.2 Flood Zones Overview Map.

The GDSDS recommended designing for a predicted flood level at Dublin Port of 3.4m OD (Malin) and that this should be raised to 4.0m OD (Malin) for strategic very long term Dublin area planning in highly sensitive areas.

Tolka River Flooding Study

The River Tolka Flooding Study was commissioned by DCC in association with FCC, Meath County Council and the OPW in 2002 to address concerns of increasing flood risk to properties along the river. The objective of the study was to establish a flood risk profile for the river and to design a scheme to provide a realistic level of protection from a 1 in 100 year flood risk. GDSDS stormwater catchments were divided into S1, S2 and S3 groupings in order of importance. S1 = rivers, S2 = large piped stormwater catchments, and S3 = smaller piped stormwater catchments. The Tolka River came under the category S2 and was not therefore assessed for a 100 year Average Recurrence Interval (ARI) flood level. The OPW predictive flood extent area as shown on the OPW website was therefore indicated on the flood risk mapping in Figure 3.2 Flood Information Map.

The study reports that the Tolka River is subject to occasional significant floods, generally in winter months.

From the River Tolka Flooding Study it can be seen that the pipeline corridor will cross culverted sections of tributaries of the Tolka River and storm water drainage sewers amongst other utility services. Relevant detail from the study is shown in Figure 3.2.

As part of the GDSDS Tolka Study – Storm Level 2 the location of known and assumed basements were mapped as important hydraulic considerations. The closest location of basements shown on available mapping from this study, to the proposed pipeline corridor is at the junction of Donnycarney Road and the Malahide Road. These were marked as 'assumed' location of basements. It is proposed to lay the pipeline at the opposite side of the road at this location (Ref. Strip Map Nos. 15 and 16).

Dublin Coastal Flooding Protection Project (DCFPP)

This project was designed to reduce the risks to life and property caused by coastal flooding. The project aim is to propose solutions and an enhanced early warning system for the region.

In addition to the flood extent shown for the Tolka River as outlined above, the OPW flood mapping website www.floodmaps.ie includes information from the Dublin Coastal Flooding Protection Project on the extreme tidal flooding experienced in the Tolka River and Estuary in February 2002. This flood extent mapping is included in the flood zone mapping in Figure 3.2.

An area upstream of the Railway Bridge which is upstream of John McCormack Bridge on the Tolka River and an area along the Clontarf Road were included in the areas identified as having flooded during this event.

The areas known to have flooded on 1st Feb 2002 in locations relevant to the proposed scheme are shown in the Consultants Map, available on the OPW website, Drawing (Fig C1.4) which has been reproduced in **Error! Reference source not found.** and Drawing (Fig C1.5) which has been reproduced in **Error! Reference source not found.**. The source of the flood extent mapping is in GIS. It was developed using reports prepared by Dublin City Council/ Fingal County Council and subsequent discussions with these stakeholders. The Local Authority that provided this Flood Information item wishes to point out that a number of defence assets were put in place since one or more of the flood events described by this item.

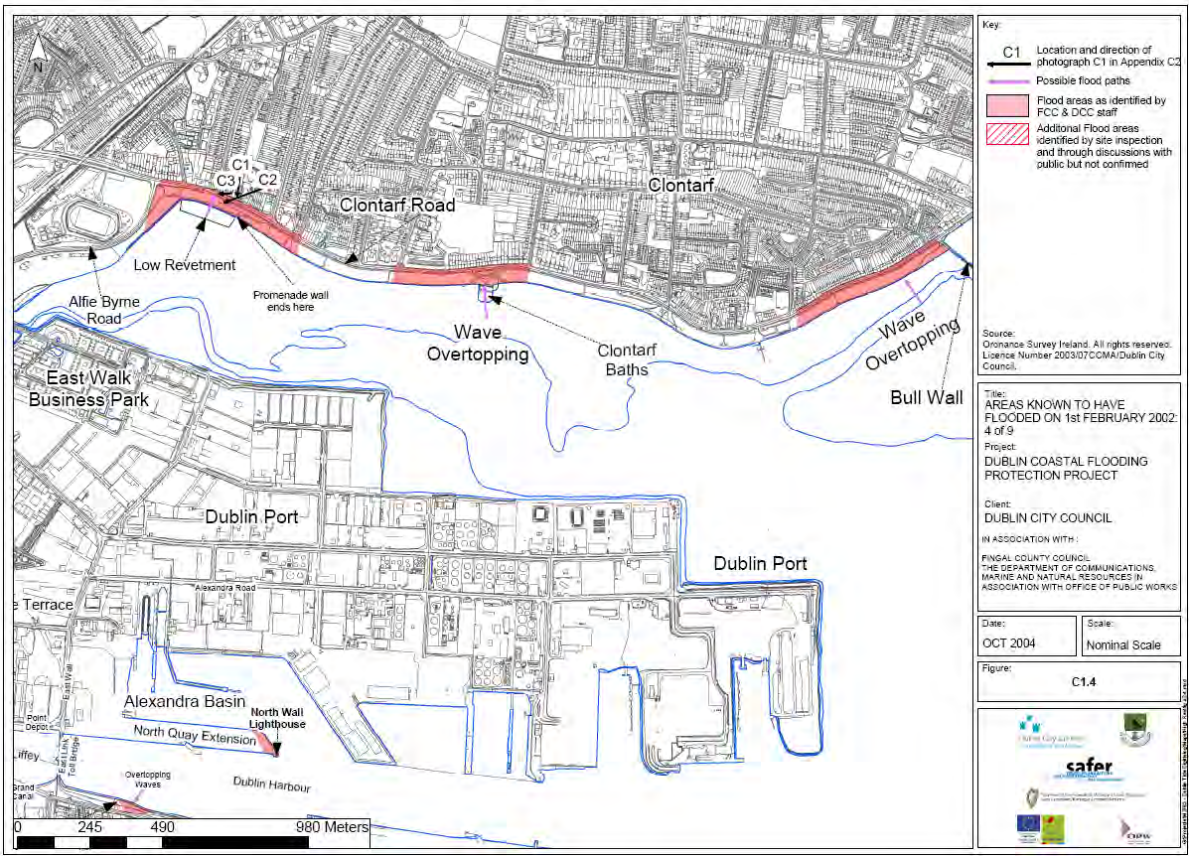


Figure 3.3: DCFPP Project Map C1.4

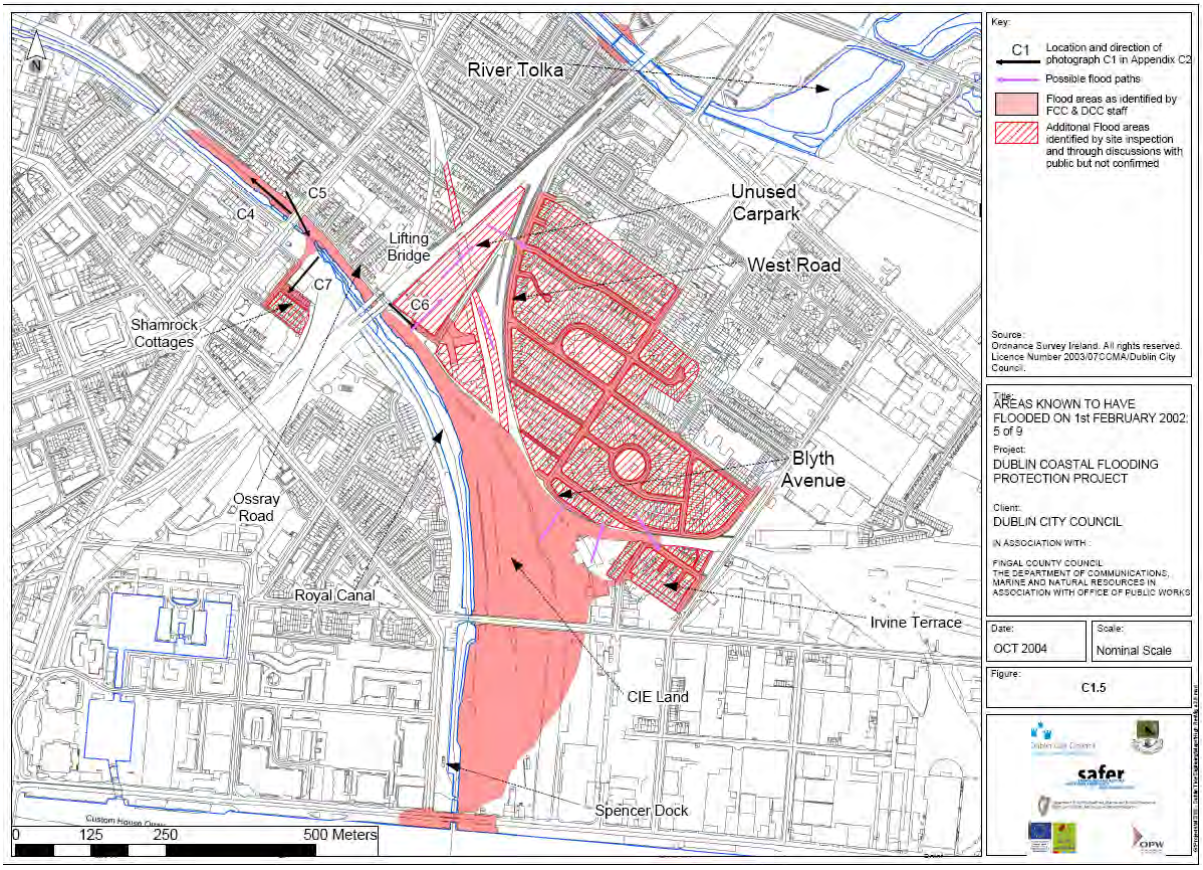


Figure 3.4: DCFPP Project Map C1.5

It can be seen that the pipeline route will not encroach on any of the flood risk areas identified in the mapping. The proposed pipeline corridor does cross the River Tolka downstream of a flood area as identified by DCC staff and it also borders a flood risk area on the Alfie Byrne Road on approach to the junction with the Clontarf Road.

Dublin City Council produced an Interim Assessment Report on 'Flood 2002', which reported a high tide level of 2.95 m OD (Malin) on 1st February 2002. Rainfall is reported as not being a significant factor in this event. The report includes photographs taken during the flood event.

SAFER Project

The SAFER project will use emergency response management to provide the very best level of flood protection. The SAFER Project is part of a €10m EU funded INTERREG project involving Dublin City, Germany, Scotland and Switzerland.

EU Interreg IVB Flood ResilienCity Project, Dublin City Report, January 2012

The Interim Review and recommendations following the Dublin flood event of 24 October 2011 were examined as part of the Flood ResilienCity Project. Mapping showing flooding from all sources is available as part of this study and the relevant map to the proposed pipeline corridor (Figure 1.2 (North Central) from the FloodReslienCity Project) is included in Appendix 1 of this FRA.

It can be seen from this map that flooding from a number of different sources occurred in the vicinity of the proposed pipeline corridor during the event of 24 October 2011. The relevant events are listed below:

- Pluvial events were recorded close to the proposed pipeline corridor in the vicinity of the Kilbarrack Stream, between Coolock and Darndale.
- At Coolock, flooding from a sewer source was recorded in the vicinity of the proposed pipeline corridor. The location of the foul and storm sewer network at this location can be seen in Figure 13.7 of the EIS.
- At Donnycarney, a number of fluvial events were recorded in the vicinity of the Wad River, close to the proposed pipeline corridor.
- Flooding from a pluvial and sewer source were recorded at Marino, in the vicinity of the proposed pipeline corridor where there are a number of culverted watercourses, storm sewers and a storm water overflow, as can be seen in Figure 13.7 of the EIS.
- Flooding from a sewer source was recorded to the east of Alfie Byrne Road, in the vicinity of the proposed pipeline corridor. The location of storm sewers here, can be seen in Figure 13.7 of the EIS.
- A number of flooding types labelled 'Unknown Flood Type' were noted to have occurred at four different locations along the proposed pipeline corridor. There are no streams or rivers at the locations indicated. Foul and Combined Sewers, Storm Sewers and Watermains are all in the vicinity of these flood events recorded. The location of these services can be seen in Figure 13.7 and Figure 13.8 of the EIS.

Flooding events in the North Central area were summarised in the Interim Review of January 2012 as follows:

Flooding in the North Central area in general appears to have resulted from a combination of pluvial and fluvial flooding associated with the Rivers Naniken (not in the vicinity of the proposed pipeline corridor) *and Wad. A number of known areas flooded along the course of the Naniken and Wad. Flooding occurred of both properties and roads.*

In the north west of this district flooding has been attributed to some known foul drainage problems where flooding has occurred in the last three years. Pluvial impacts were associated with highway drainage and open parkland around the Kilbarrack area.

Other sporadic instances of sewer flooding and pluvial flooding were identified throughout this district.

Disruptions in this district included property flooding/damage, traffic issues, and flooded car parks.

It is noted that no flood event was recorded at the Santry River, Naniken River or the Tolka River, in the vicinity of the proposed pipeline corridor, during the event of 24 October 2011. It would appear that this is also the case for the Mayne River, however the Administrative Boundary is located at the Mayne River and it is not clear if flooding was noted in this area. The project did not extend to the Cuckoo Stream, therefore no flood events were noted at that location.

No flooding occurred from fluvial or coastal sources along the Alfie Byrne Road or the Clontarf Road, in the vicinity of the proposed pipeline corridor, during this event. Fluvial flooding occurred further to the east of the proposed pipeline corridor on the Clontarf Road.

Eastern Catchment Flood Risk Assessment and Management Study (EASTCFRAMS)

The Eastern Catchment Flood Risk Assessment and Management Study was completed in November 2011. The mapping produced from this study was incorporated into the PFRA mapping and has been included in Figure 3.6.

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

FCC in association with Meath County Council and the OPW engaged a consultant to undertake the FEM FRAMS in the summer of 2008 to address the issue of existing flood risk in the Fingal East Meath area.

A number of high priority watercourses were studied as part of the FEM FRAMS and the resulting pluvial maps were examined in the context of the proposed pipeline corridor. The relevant mapping examined from the FEM FRAMS is included on Figure 3.2 and the information has been derived from the following map from that study:

- Pluvial Flood Depth Map Figure No. M9/PLUV/CURS/005, Fingal East Meath Flood Risk Assessment and Management Study (FEM FRAMS)

The pluvial flood depth map does not report any excessive depths at the location of the proposed pipeline corridor, with the exception of the crossing of the Cuckoo Stream, where flood depths of up to 2 m were observed at the location of the crossing and just after the crossing of the M1 Motorway, as the pipeline corridor turns southward around the DAA Long Term Car Park (Red) where flood depths of up to 2 m were observed.

The fluvial mapping from FEMFRAMS was considered to be more detailed than that produced for the EASTCFRAMS within the FEMFRAMS study area and thus was adopted in the PFRA mapping. This has been included in Figure 3.2.

AMEC Environment and Infrastructure UK Ltd.: Safety and Environmental Impact Evaluation Report, October 2014

The Safety and Environmental Impact Evaluation Report prepared by AMEC, investigated the pipeline hazards and protective measures proposed. The AMEC report was examined in the context of potential flood risk to identify measures that are proposed to avoid, substitute, justify or mitigate any potential flood risk and subsequent risks to the receiving environment.

If a leak occurs the fuel would float on any free water surface. If leaks migrated to underground unvented voids (cellars, basements, sewers etc.) then there is the potential for build-up of vapours and potential explosion if ignited. Corrosion or third party damage from excavations are the major risks for leaks. Leaks may also result from a mechanical failure due to construction faults or material defects and hazards such as the presence of other underground services. The proposed protective measures were outlined in the AMEC report, along with an assessment of these, which are summarised as follows:

- Depth of cover 1.2 m
- Pipe wall thickness of 12.7 mm
- Trench backfilled with 700 mm of lean mix concrete providing protection from third party (external) interference
- External leak detection at the Tolka River. This will comprise a slotted duct installed in the pipeline trench with a sensing cable installed in the duct. The duct will have 0.5mm wide slots to prevent it filling with silt. Other river crossings on the route are in culverts or in a concrete open channel (Santry River crossing)
- Marker tape installed in the lean mix concrete – to indicate the presence of the utility
- Cathodic protection system to prevent external corrosion
- Leak detection using instrumentation to monitor: pressure; flow; mass balance and static pressure together with automatic and manual emergency shut-down capability
- Leak detection by visual inspection which includes a fortnightly walkover of the route by operators

- Isolation valves at the beginning and end of the pipeline with two emergency shutdown valves positioned along the pipeline, one on the Malahide Road and one on the R139. The emergency shutdown valves are strategically located to limit the drain down of the pipeline taking into account topography of the route
- Protection for valves and fittings

Disturbance of the fibre optic communications cable laid above the pipe will automatically initiate an emergency shutdown of the pumps and closure of the section isolation valves.

The conclusion in the AMEC report is that the above measures give a very high reliability of detection of pipe rupture and minimisation of the volume spilled.

4 FLOOD RISK IDENTIFICATION

Flood Zone Map

In the absence of a catchment flood risk assessment and management study (CFRAM) for the watercourses crossed by the proposed scheme, information on flood risk was obtained from a number of different sources as outlined previously. This information culminated in the production of a flood information map, indicating flood zones, refer to Figure 3.6 and the sub-maps Figured 3.6.1, 3.6.2, 3.6.3, 3.6.4, 3.6.5, 3.6.6, 3.6.7, 3.6.8 and 3.6.9.

Where a wide floodplain extent has been indicated in the OPW flood map or GDSDS sources it should be noted, the floodplain may have been constricted by an old structure which has since been upgraded. The routing of the pipeline under the existing structure or the river bed may be all that is proposed at these locations. Further, existing flood defences may give a different picture of the extent of the floodplain on the ground as often times these are not considered in flood extent models. The details at the various flood zones identified are assessed further in the Stage 1 Flood Risk Assessment which is included in Sections 4.1.2, 4.1.3 and 4.1.4.

Underground infrastructure could be impacted by the proposed pipeline affecting the integrity of the structure and providing a new passage for flood waters into vulnerable areas. Two principal examples will be considered in this flood risk assessment as follows:

- Dublin Port Tunnel
- The documented assumed location of basements at Donnycarney

The principal findings of the flood risk assessment together with the survey commissioned to support the FRA are summarised in Section 4.1:

The developer will ensure that the final location of all inspection chambers, emergency shutdown valves and any automated equipment will be outside any flood zones as identified in Figure 3.2.

4.1 Vulnerability of Development

The proposed aviation fuel pipeline is categorised as a highly vulnerable development in accordance with the guidelines produced by the DoEHLG - *The Planning System and Flood Risk Management Guidelines for Planning Authorities, November 2009*. The proposed development comes under the category of essential infrastructure. The flood risk from different sources was examined under the following headings:

- Risk of flooding from groundwater sources
- Pluvial flood risk
- Fluvial flood risk
- Tidal flood risk

4.1.1 Risk of flooding from Groundwater Sources

A perched aquifer may exist within the glacial till, however due to the low permeability of the strata, groundwater inflow was often not observed during site investigations. This is discussed further in Chapter 12 Soils, Geology and Hydrogeology of the accompanying EIS. Flooding as a result of groundwater is not anticipated.

4.1.2 Pluvial Flood Risk

The route corridor of the proposed pipeline does not involve any appreciable increase in the existing hard standing area and therefore will not contribute to an increased pluvial flood risk.

A number of pluvial features are shown in the vicinity of Stockhole, at the proposed crossing locations of the Naniken and Wad Rivers, on the Clontarf Road and just to the north of the Clontarf Road, on the Malahide Road. These low-lying areas correspond with some of the historic flood incidents listed in Table 3.2. As can be seen in Figure A2.1, the pipeline corridor avoids the pluvial feature identified at Stockhole.

The pipeline will be installed along the opposite side of the road, where the pipeline corridor turns southward around the DAA Long Term Car Park (Red), to avoid the area which was identified in the pluvial flood depth mapping indicating flood depths of up to 2 m in the FEM FRAMS mapping. Thus, any flood risk will be avoided through the design of the pipeline route.

Pluvial incidents following the Dublin flood event of 24 October 2011 were examined as part of the EU Interreg IVB Flood ResilienCity Project, Dublin City Report, January 2012, which is discussed in Section 3.5. Pluvial events were recorded close to the proposed pipeline corridor in the vicinity of the Kilbarrack Stream, between Coolock and Darndale and at Marino where there are a number of culverted watercourses, storm sewers and a storm water overflow, as can be seen in Figure 13.7 of the EIS. Pluvial impacts were found to be associated with highway drainage and open parkland around the Kilbarrack area.

The design of the pipeline provides for mitigation as listed in Section 3.5 under the heading *AMEC Environment and Infrastructure UK Ltd.: Safety and Environmental Impact Evaluation Report*. Given the systems put in place to ensure the integrity of the pipeline, it is not anticipated that there will be any pluvial risk to or from the pipeline. Pluvial flooding by its nature involves the ponding of water in localised low lying areas. In the unlikely event of a spillage from the proposed pipeline, the spill would be contained in the ponded area.

4.1.3 Fluvial Flood Risk

The route corridor of the proposed pipeline does not involve any appreciable increase in the existing hard standing area and therefore will not contribute to an increased fluvial flood risk.

Fluvial incidents following the Dublin flood event of 24 October 2011 were examined as part of the EU Interreg IVB Flood ResilienCity Project, Dublin City Report, January 2012, which is discussed in Section 3.5. At Donnycarney, a number of fluvial events were recorded in the vicinity of the Wad River, close to the proposed pipeline corridor. It is noted that no fluvial flood event was recorded at the Santry River, Naniken River or the Tolka River, in the vicinity of the proposed pipeline corridor, during the event of 24 October 2011. It would appear that this is also the case for the Mayne River, however the Administrative Boundary is located at the Mayne River and it is not clear if flooding was noted in this area. The project did not extend to the Cuckoo Stream, therefore no flood events were noted at that location. No flooding occurred from fluvial or coastal sources along the Alfie Byrne Road or the Clontarf Road, in the vicinity of the proposed pipeline corridor, during this event. Fluvial flooding occurred further to the east of the proposed pipeline corridor on the Clontarf Road.

The fluvial flood risk associated with each of the watercourses in the study area, as interpreted from the remaining sources in Sections 3.4 and 3.5, together with a ground survey undertaken for this proposed development is set out below:

Cuckoo Stream - The proposed pipeline corridor crosses the Cuckoo Stream, a tributary of the Mayne River, at Clonshagh. The stream is culverted in two culverts at the point of the crossing, one 700 mm x 900 mm stone culvert and a second concrete culvert 1,830 mm x 1,130 mm. It is proposed to cross under these culverts using trenchless technology as shown in Appendix 3.5 of the EIS. It can be seen in Figure A2.2 that the proposed launch pit just skirts the indicative fluvial floodplain and is in a local low point which experiences pluvial flooding. The proposed reception pit is outwith the indicative fluvial floodplain. Temporary mitigation measures, such as temporary berms, will be put in place to divert flood flows from an extreme event at the launch pit, thus ensuring the safety of personnel working in this location during the construction stage and to prevent inundation of the trench. This will also avoid flood flows coming into contact with bare soil in the excavations for the launch pit, thus reducing the risk of an increase in suspended solids in the run-off due to construction for the proposed development. Following construction the launch and reception pits will be infilled as per the trenches and the surface re-instated as previously.

Mayne River - The proposed scheme crosses the Mayne River on the R139 at the roundabout, at the junction with the Clonshaugh Road. The river is culverted in a circular 800 mm diameter pipe, at the point of the crossing. It is proposed to cross under the culvert using trenchless technology as shown in Appendix 3.5 of the EIS. It can be seen in Figure A2.3 that the proposed launch and reception pits are outwith the indicative fluvial floodplain, therefore no additional mitigation measures are necessary during construction at this crossing location. Following construction the launch and reception pits will be infilled as per the trenches and the surface re-instated as previously.

Kilbarrack Stream – The proposed scheme crosses the Kilbarrack Stream on the R107 Malahide Road at Newtown. The stream is culverted in a circular 1350 mm diameter pipe, at the point of the crossing. It is proposed to cross under this culvert using trenchless technology as shown in Appendix 3.5 of the EIS. It can be seen in Figure A2.4 that the proposed launch and reception pits, are within the indicative fluvial floodplain to the west of the proposed pipeline corridor. Temporary mitigation measures, such as temporary berms will be put in place to the west of the proposed pipeline corridor, to divert flood flows from an extreme event at the launch and reception pits, thus ensuring the safety of personnel working in this location during the construction stage and to prevent inundation of the trench. This will also avoid flood flows coming into contact with bare soil in the excavations for the Pits, thus reducing the risk of an increase in suspended solids in the run-off due to construction for the proposed development. Following construction the launch and reception pits will be infilled as per the trenches and the surface re-instated as previously.

Santry River - The proposed scheme crosses the Santry River at Coolock, just downstream of Coolock Bridge. The location of the proposed crossing is an open concrete channel section of the Santry River. The river channel is approximately 3 m wide and 1.43 m deep at the location of the proposed crossing. It is proposed to cross under the Santry River using trenchless construction methods, for the proposed aviation fuel pipeline, as shown in Appendix 3.5 of the EIS. It can be seen in Figure A2.5 that the location of the proposed launch pit and the proposed reception pit is within the indicative fluvial floodplain. Temporary mitigation measures, such as shuttering with ramps up to a raised ope at each end or temporary berms will be put in place to divert flood flows from an extreme event at the launch and reception pits, thus ensuring the safety of personnel working in this location during the construction stage and to prevent inundation of the trench. This will also avoid flood flows coming into contact with bare soil in the excavations for the launch and reception pits, thus reducing the risk of an increase in suspended solids in the run-off due to construction for the proposed development. A method statement will be prepared for the proposed works at this location at detailed design stage for this river crossing. Following construction the launch and reception pits will be infilled as per the trenches and the surface re-instated as previously.

Naniken River – The proposed scheme crosses the Naniken River on the Malahide Road in Artane. The stream is culverted in a 1,250 mm x 1,020 mm culvert at the point of the proposed crossing. It is proposed to cross under this culvert using trenchless technology as shown in Appendix 3.5 of the EIS. The flood record OPW2 in Table 3.2, describes a historic flood event along the line of the Naniken River, however the culvert was upsized and extended since this event occurred. It can be seen in Figure A2.6 that there is no indicative fluvial floodplain shown in the vicinity of the proposed launch and reception pits. The crossing location is however within a local low point which may experience pluvial flooding, according to the indicative mapping. Temporary mitigation measures, such as temporary berms will be put in place to divert pluvial flood flows from an extreme event at the launch and reception pits, thus ensuring the safety of personnel working in this location during the construction stage and to prevent inundation of the trench. This will also avoid flood flows coming into contact with bare soil in the excavations for the launch pit, thus reducing the risk of an increase in suspended solids in the run-off due to construction for the proposed development. Following construction the launch and reception pits will be infilled as per the trenches and the surface re-instated as previously.

Wad River – The proposed scheme crosses the Wad River on the Malahide Road, just north of Collins Avenue junction at Donnycarney Bridge. The stream is culverted in a 1490 mm x 1240 mm culvert at the point of the proposed crossing. It is proposed to cross under this culvert using trenchless technology as shown in Appendix 3.5 of the EIS. The flood records OPW3, OPW4 and OPW5 in Table 3.2, describe flood events from 2008, 2009 and 2011 along the historic path of the Wad River. Additional gullies were provided along with minor flood relief works after the flooding in 2009. Flooding occurred at a number of properties and on the road, up to a depth of 1 m at Clonmoyle Road in 2011, however none of these flood events impacted on the location of the proposed crossing of the pipeline. It can be seen in Figure A2.7 that there is no indicative fluvial or pluvial floodplain shown in the vicinity of the proposed launch and reception pits, therefore no additional mitigation measures are necessary during construction at this crossing location. Following construction the launch and reception pits will be infilled as per the trenches and the surface re-instated as previously.

Tolka River - The proposed scheme crosses the channel of the Tolka River at the mouth of the Tolka River Estuary to the north of the East Wall Road and just to the east of John McCormack Bridge, as shown in Figure 3.1. The river channel is approximately 25.6 m wide and 4.19 m deep at the location of the proposed crossing. It is proposed to cross under the Tolka River using trenchless construction methods, as shown in Appendix 3.5 of the EIS. It can be seen in Figure A2.9 that the location of the proposed launch pit and the proposed reception pit for the proposed crossing of the Tolka River are outside of the OPW flood extents outline but within an area marked as a 'Flood Zone A' area i.e. an area with a probability of flooding in a 1 in 100 year flood or 1% AEP (Annual Exceedance Probability). However a survey carried out at this location as part of this Flood Risk Assessment – Stage 1 confirmed that the latter indicative flooding outline could not be relied upon. At the flood extents outline shown, the surveyed level looking downstream, on the right hand side is 3.39 m OD and the surveyed level on the left hand side is 4.4 m OD i.e. 1 m difference. The river would not therefore find its flood level from overbank flow coinciding with the indicative outline shown in the PFRA mapping. It can also be observed that the banks of the Tolka River are considerably higher than the river channel at this location and overbank flooding would not be likely to occur at this location. For this reason the OPW Flood Extents mapping was considered to be more reliable as a flood indicator at this location. Further, the pipeline route will not encroach on any of the flood risk areas identified in the DCFPP mapping, upstream of the Railway Bridge, as shown in Figure 3.4, therefore no additional mitigation measures are deemed necessary during construction at this crossing location. Following construction the launch and reception pits will be infilled as per the trenches and the surface re-instated as previously.

As it is proposed to cross each of the above water bodies using trenchless technology such as thrust bore/pipe jack techniques, it is not anticipated that there will be any significant impacts associated with the work as there will be no disturbance to the bed of the river or flow within the channel itself.

The developer will liaise with DCC on the location of the culverted watercourses as identified from the GDSDS mapping on Alfie Byrne Road and shown in Figure 3.2. The 200 mm diameter pipe proposed for the Aviation Fuel Pipeline will be laid at a nominal depth of cover of 1.2 m. This depth will be increased where necessary to avoid any culverted watercourse. The separation distance from the top of the pipe to the bed of the Tolka River at the crossing will be a minimum of 2 m. The separation distance from the top of the pipe to the concrete channel of the Santry River will be 1.2 m. The separation distance from the top of the pipe to the Mayne River (culverted) will be 0.6 m. The separation distance from the top of the pipe to the Cuckoo Stream (culverted in two culverts) will be 0.6 m for the old culvert and 0.82 m for the new culvert. The separation distance from the top of the pipe to the Nanniken River, the Wad River and the Kilbarrack Stream (all three culverted) will be a minimum of 1.0 m.

4.1.4 Tidal Flood Risk

An assessment of the tidal flood risk associated with the Tolka Estuary is set out below:

The route of the proposed pipeline corridor passes along the Alfie Byrne Road and on to the Clontarf Road. It is proposed to lay the pipe using the 'Cut and Cover' method. This area is within the transitional area of the Tolka Estuary as described by the Water Framework Directive (WFD). These transitional areas are tidal. Following the extreme tide and flood event in Dublin City and Fingal in February 2002 (estimated as a 1 in 60 year return period event) a report was commissioned by DCC and FCC on the Dublin Coastal Flooding Protection Project (DCFPP). The report was prepared by Royal Haskoning and the final report was issued in April 2005. In this report the 200 year (AEP 0.5 %) predicted tide level at Dublin Port Lighthouse was taken as 3.25 m OD (Malin) (0.3 m higher than the extreme tidal event of February 2002 as reported in Dublin City Councils Interim Assessment Report on 'Flood 2002').

The tidal prediction study which is currently underway by the OPW for the Irish coast, the Irish Coastal Protection Strategy Study Phase III – North East Coast, June 2010, predicts a 1 in 200 year flood level of 3.06 m OD in this part of the Tolka Estuary. It can be seen in Figure A2.8 that the location of the proposed pipeline corridor along Clontarf Road is protected by a wall, with an average height of 3.13 m. The proposed pipeline corridor is outside the flood risk area identified in the DCFPP mapping, as shown in Figure 3.3 and Figure 3.4. The flood record OPW6 listed in Table 3.2, describes the flood event of August 2004 & the tidal flood event of October 2004, however these flood incidents occurred at Clontarf Rd Seaview Avenue, further to the east of the proposed pipeline corridor. In the flooding event of 23 Aug 2004, properties flooded during heavy rainfall (estimated 1 in 30 yr event). In the account of tidal flooding in October 2004, a flood level of 2.62 m OD (Malin) was recorded together with waves of 1.5 m to 1.8 m high. The road levels along the proposed pipeline corridor on Clontarf Road are greater than 2.62 m OD. It is expected that the low wall (approx.. level of 3.13 m) on the side of the road closest to the estuary will provide additional protection and serve to break any wave action that might occur along with an extreme event at this location.

In addition, it is proposed to lay the pipe along the inside of Alfie Byrne Road and thus away from the potential flood risk from overtopping waves. Construction will not take place during extreme events and it is proposed to lay the pipeline in 24 m lengths as construction progresses. Additional mitigation in the form of sand bagging will be provided along the coastal side of Alfie Byrne Road, where there are gaps in the wall, during construction of the pipeline along this section.
The sites for the location of the launch and reception pits at the Tolka River crossing are above the predicted tidal flood level of 3.06 m OD.

Reference is made in the River Tolka Flooding Study prepared as part of the GDSDS to tidal predictions in Dublin Bay. It is stated in the Study that these predicted levels would be superseded by those estimated in the Dublin Coastal Flooding Protection Project (DCFPP). In turn the DCFPP has recommended an integrated flood forecasting system to include fluvial as well as tidal forecasting.

Dublin City Council's current Major Emergency Plan (MEP) was prepared in 2008. In the MEP it outlines the procedure for forecasting coastal flooding: Using the data from the Meteorological service the Tide Watch section of the Council Drainage Division monitors the potential for coastal flooding and using predictive modelling can provide early warning of the potential risk to pre-identified vulnerable communities living beside the City coastline. The Triton and Tidewatch early warning systems, based on sensors in Dublin Bay provide continuous information on sea-level changes and send alarm messages to relevant personnel in the Council. The former provides a 1 day advance warning of high tides and the latter provides a 3 day advance warning of same. These early warning systems then provide the necessary information to inform the subsequent emergency response strategy. Tides are monitored 365/24/7 by DCC. Closing of tide gates in at risk areas is an integral part of DCC"s Emergency Plan.

The implementation by DCC of the following projects assures the ongoing learning process to improve flood defences by sharing the knowledge and experience of other European countries:

- **SAFER project** - This project will use emergency response management providing the very best level of flood protection. The SAFER Project is part of a €10m EU funded INTERREG project involving Dublin City, Germany, Scotland and Switzerland.

- **The Flood Resilien Cities Project** - This project is co-funded by the European Union INTERREG IVB programme. The purpose of the IVB programme is to make North-West Europe a more competitive, more environment-friendly and a more cohesive region. To achieve this ambition, the INTERREG IVB programme is designed to increase employment opportunities and the quality of the environment, improve mobility by devising intelligent transport solutions and make cities and countryside attractive and sustainable. This requires that the best possible use be made of existing territorial assets in order to yield optimal results with maximum leverage. Further information can be examined at the website www.floodresiliencity.eu/en/about/

The proposed pipeline will not contribute to an increase in the risk of coastal flooding as there will be no appreciable increase in hard standing areas as a result of the development of the scheme in these areas. In addition to the tidal flood defences provided, the road surface will be reinstated above the pipeline following installation and therefore the pipeline will not be at risk of flooding from an extreme tidal event. The pipe material (steel) and wall thickness provides the pipeline with negative buoyancy so it will not float even in a fully flooded open trench, empty of product. In the unlikely event that a leak should occur in the pipeline, the leak would be detected by the mass balance system and/or pressure system which would shut down the pumps and reduce pressures. If the fibre optic communication cable is interfered with by a third party, again, the pumps would shut down. The emergency shutdown valves would be activated and the leakage dealt with accordingly. It is not anticipated that any leakage would gravitate into the Tolka Estuary from the pipeline.

4.2 Overview of Flood Risk Identification

The Stage 1 flood risk assessment concludes that a further investigation, moving on to Stage 2 of the flood risk assessment process is not required. The different types of flood risk were identified and the results of the identification process are outlined below.

4.2.1 Risk of Flooding to the Development

The pipe material (steel) and wall thickness provides the pipeline with negative buoyancy so it will not float even in a fully flooded open trench, empty of product. The flood extent has been identified in detail at each crossing location in Section 4.1, in order to ensure that the location of any significant infrastructure associated with the pipeline will not be impacted by floodwaters during construction and during the operation of the pipeline.

4.2.2 Risk of Flooding from the Development

The relevant statutory bodies will be consulted in relation to all abstractions and discharges for hydro-testing. The integrity of the pipeline will be high with all joints radiographed. All storm water run-off generated during the operation of the Above Ground Installations (AGIs) will be managed by a surface water collection system which will feed into the existing drainage system at Dublin Port and Dublin Airport. The surface water collection system will accommodate extreme rainfall events with an allowance for climate change.

The Dublin Port Tunnel is circa 2.9 m below ground. The pipeline trench will be at a depth of 1.5 m, affording a 1.4 m separation distance between the two. There will be no risk of an ingress of floodwaters from the pipeline trench into the tunnel. This issue assessed further in the AMEC report included in Appendix 2.1 of the Volume 3 of the EIS.

As part of the GDSDS Tolka Study – Storm Level 2, the location of known and assumed basements were mapped as important hydraulic considerations. The closest location of basements shown on available mapping from this study, to the proposed pipeline corridor is at the junction of Donnycarney Road and the Malahide Road. These were marked as 'assumed' location of basements. It is proposed to lay the pipeline at the opposite side of the road at this location (Ref. Strip Map Nos. 15 and 16). This is considered to be adequate to avoid any breach in the integrity of the walls of any basements at this location.

4.2.3 Risk of Flooding from Groundwater Sources

A risk of flooding from groundwater sources is not anticipated. Any discharges from dewatering activities will be passed through a settlement pond before discharging to the surface water sewer network. Alternatively, discharges will be pumped to onsite bowsers where they will be removed off-site for treatment at an appropriate WWTP. There will be no direct pumping of contaminated water from the works to a watercourse at any time.

4.2.4 Pluvial Flood Risk

The proposed crossing locations at the Cuckoo Stream and the Naniken River are in low lying areas that may experience pluvial flooding, according to the indicative pluvial flood mapping prepared by OPW. Given the mitigation measures proposed during construction (as set out in Chapter 13 – Surface Water Quality & Drainage of Volume 2 of the EIS) together with the systems put in place to ensure the integrity of the pipeline, it is not anticipated that there will be any pluvial risk to or from the pipeline.

4.2.5 Fluvial Flood Risk

A temporary fluvial flood risk exists at the crossing of the Cuckoo Stream, Kilbarrack Stream and Santry River. Construction will not take place during extreme events. Temporary mitigation measures (as outlined in Section 4.3.1) to divert flood flows from an extreme event at the launch or reception pits where relevant, will be implemented, thus ensuring the safety of personnel working in the vicinity of the pits during the construction stage and preventing inundation of the trench. This will also avoid flood flows coming into contact with bare soil in the excavations for the pits, thus reducing the risk of an increase in suspended solids in the run-off due to construction for the proposed development. Following construction the launch and reception pits will be infilled as per the trenches and the surface re-instated as previously.

4.2.6 Tidal Flood Risk

It is not anticipated that there will be any tidal risk to the pipeline.

The matrix of vulnerability set out in Table 3.2 of the guidelines produced by the DoEHLG - *The Planning System and Flood Risk Management Guidelines for Planning Authorities, November 2009, indicates that a justification test is required where a highly vulnerable development is proposed to be located in a flood risk area of magnitude 'Flood Zone A'.*

The fluvial risk identified is temporary and can be managed through mitigation during construction. As the significance of the flood risk involved is considered to be very low, further studies are not deemed necessary to examine the flood risk in greater detail. A justification test has however been applied for the proposed development, which is outlined in Section 4.3 below.

4.3 Justification Test

The justification for the development of the proposed Aviation Fuel Pipeline is outlined as follows:

- A risk of flooding from groundwater sources is not anticipated
- There is no significant pluvial flood risk to the development
- The fluvial flood risk is temporary and can be managed through mitigation during construction
- The floodplain storage will not be reduced by the scheme
- The proposed development will not increase the flood risk in the catchments through which it traverses
- Existing flood defences on Clontarf Road will provide adequate protection to operatives during the installation of the pipeline along this road. In addition, construction will not take place during extreme events and only 24 m lengths of trenching will be open at any one time at any one location. The emergency procedures, managed by DCC would be in place in advance of an extreme tidal event. The 'Tide Watch' system which is monitored by DCC can provide extreme tide warnings, 3 days in advance of the event. This would give ample time to suspend the construction in areas perceived to be at risk
- Included amongst the objectives in the draft Fingal County Development Plan is the following: 'Support the construction of an oil pipeline from Dublin Port to provide fuel service to Dublin Airport'.
- In the unlikely event that a leak should occur in the pipeline, the leak would be detected by the mass balance system and/or pressure system which would shut down the pumps and reduce pressures. If the fibre optic communication cable is interfered with by a third party, again the pumps would shut down. The emergency shutdown valves would be activated and the leakage dealt with accordingly. It is not anticipated that any leakage would gravitate into the Tolka Estuary from the pipeline
- The pipe material (steel) and wall thickness provides the pipeline with negative buoyancy so it will not float even in a fully flooded open trench, empty of product.

4.3.1 Residual Risks

To avoid any residual risks, FCC, DCC and Irish Water will be consulted during the construction stage to ensure that there is adequate reconnaissance of all services in the vicinity of the proposed pipeline route. The developer will also liaise with the DAA prior to construction to identify the location of services at the DAA Long Term Car Park (Red) and to seek approval of the proposed construction methodology.

5 CONCLUSIONS AND RECOMMENDATIONS

This report sets out the Stage 1 flood risk identification study carried out as part of a flood risk assessment for the proposed scheme in accordance with the guidelines produced by the DoEHLG - *The Planning System and Flood Risk Management Guidelines for Planning Authorities, November 2009*. Flood risk identification maps were produced as a result of the Stage 1 process. The results of the flood risk identification process conclude that following the application of the justification test as outlined in Section 4.3 above, the preparation of a Stage 2 initial flood risk assessment in accordance with OPW Guidelines will not be necessary.

A sustainable management of flood risk can be applied to this scheme. An early warning system of extreme tides will suspend construction of the pipeline at Alfie Byrne Road and Clontarf Road, which could be perceived as 'at risk' areas and in an extreme emergency, where a warning may not issue in time, access and egress from the 'at risk' areas will be easily achievable.

The location of known existing services has been identified and slit trenching will be carried out in conjunction with pipe laying along the road sections in order to proof the location of the services. To avoid any residual risks, the developer will liaise on an ongoing basis with FCC, DCC, Irish Water and the DAA to ensure that there is adequate reconnaissance of all services in the vicinity of the proposed pipeline route.

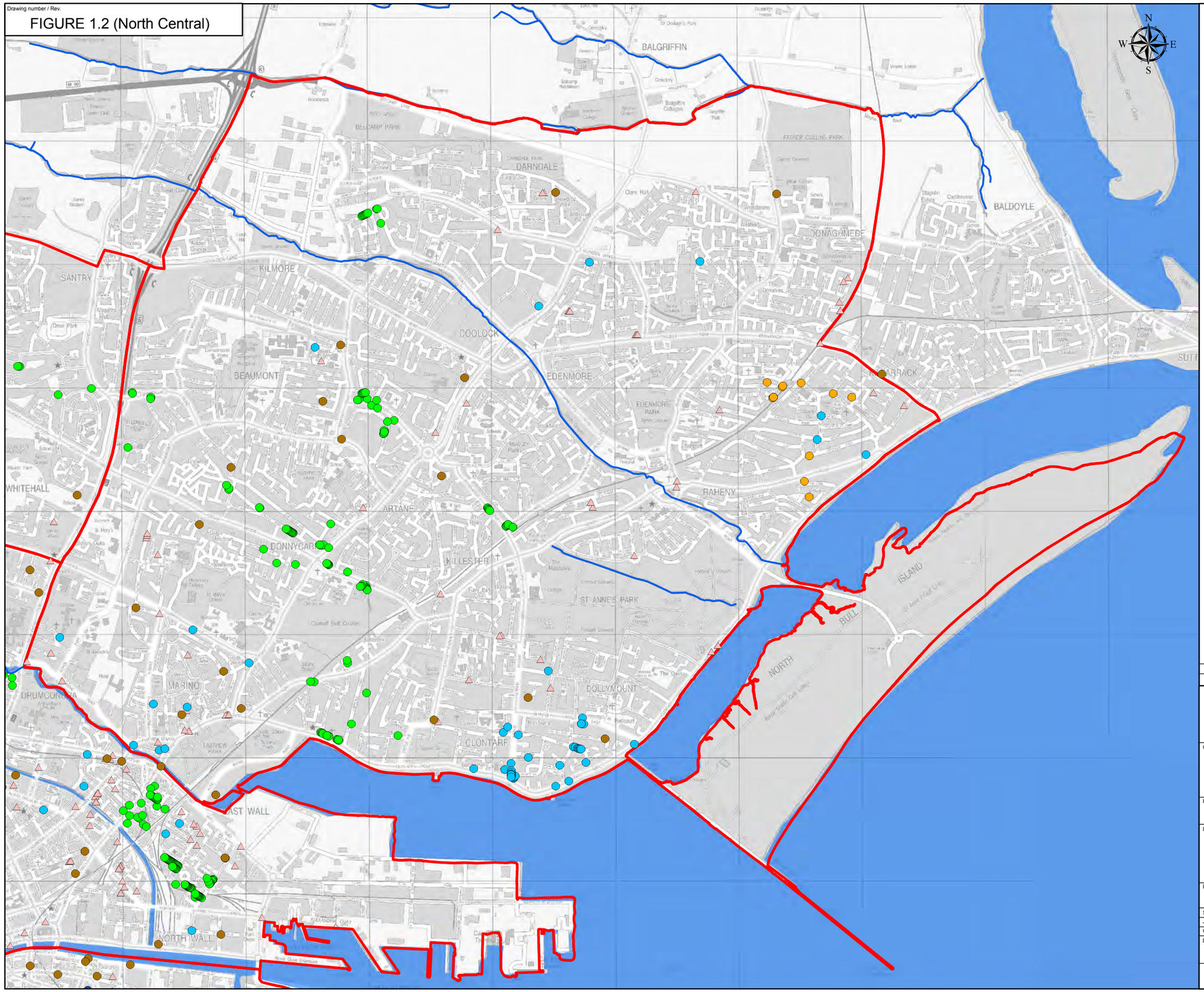
Appendix 1

Flood Risk Assessment Stage 1

Figure 1.2 (North Central) from the FloodReslienCity Project)

Drawing number / Rev.

FIGURE 1.2 (North Central)



LEGEND:

- Administration Boundaries
- Watercourse Routes

Flooding Location (24-25 Oct 2011)

Flooding Type:

- Fluvial
- Fluvial / Pluvial
- Foul Drainage
- Pluvial
- Pluvial / Sewer
- Sewer
- Unknown Flood Type

NOTES:

1. The flood incidents shown in these drawings are based on records as of 28th Nov 2011 and may not represent all flooded areas.

2. Not all watercourses are shown.

3. Watercourses that are shown include both culverted and open water sections.

Rev.	Rev. Date	Purpose of revision	Drawn	Checked	Approved
0	JAN 12	ISSUE	RJF	ST	KK

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Client

Project

FloodResilienCity Project

Drawing Title

IDENTIFIED FLOOD TYPE
AT REPORTED FLOOD LOCATIONS
(24-25th OCTOBER 2011 EVENT)

Drawing Status

INTERIM

Scale	NTS @ A3	DO NOT SCALE
Jacobs No.	32102500	
Client No.		

Drawing Number: FIGURE 1.2 (North Central) — Rev: 0

Appendix 2

Flood Risk Assessment Stage 1

Flood Risk Identification Mapping

Flood Zones Sub-Maps A2.1 – A2.9




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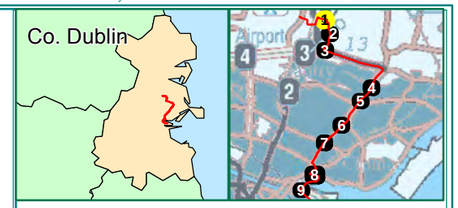
LE1072701_FloodZones_Detailed Map A.2.1-9

Data from GDSDS and DCFPP only extracted where relevant to proposed development



Legend

- OPW Flood Points
- Water Course of Culverted River & Streams
- Rivers
- Proposed Pipeline Route
- Cloghran Sewerage Scheme (Indicative Route)

GDSDS Drainage

- Culverted Watercourse
- Storm Sewer
- GDSDS 100 Year Flood Risk
- Alluvium Deposits

Fingal East Meath FRAMS - Pluvial Flood Depth

- 0 - 0.25m
- 0.25 - 1m
- 1 - 2m
- DCFPP Notes
- Dublin Coastal Flood Protection Project Flood Extents
- PFRA 1% AEP Pluvial Flood Extent
- PFRA 1% AEP Fluvial Flood Extent
- PFRA 0.5% AEP Coastal Flood Extent
- OPW Flood Extents
- Launch Pit
- Reception Pit
- Murphy's Survey Points
- Murphy's Survey Lines

Date 11/03/2015

Name Of Client
Fingleton White & Co. Ltd

Name Of Job
Flood Risk Assessment
Stage 1 Report

Title Of Figure
Flood Zones:
Detailed Map 1

Scale Used 1:650 @ A3

Figure No. A.2.1

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LE1072701_FloodZones_Detailed Map A.2.1-9

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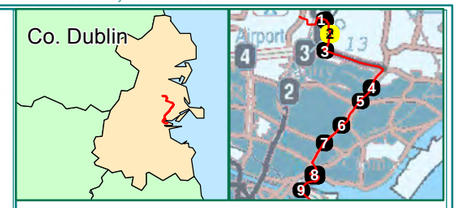

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Date 11/03/2015

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Flood Risk Assessment
Stage 1 Report

Title Of Figure
Flood Zones:
Detailed Map 2

Scale Used 1:650 @ A3

Figure No. A.2.2

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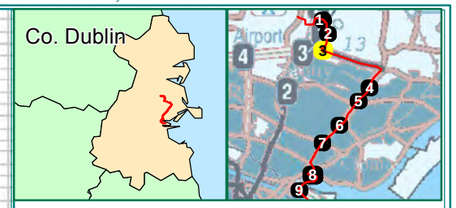
LE1072701_FloodZones_Detailed Map A.2.1-9

Data from GDSDS and DCFPP only extracted where relevant to proposed development



Legend

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- Murphy's Survey Lines

Date 11/03/2015

Name Of Client
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Name Of Job
Flood Risk Assessment
Stage 1 Report

Title Of Figure
Flood Zones:
Detailed Map 3

Scale Used 1:650 @ A3

Figure No. A.2.3

Rev B

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LE1072701_FloodZones_Detailed Map A.2.1-9

Data from GDSDS and DCFPP only extracted where relevant to proposed development

Legend

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Fingal East Meath FRAMS - Pluvial Flood Depth
- 0 - 0.25m
- 0.25 - 1m
- 1 - 2m
- DCFPP Notes
- Dublin Coastal Flood Protection Project Flood Extents
- PFRA 1% AEP Pluvial Flood Extent
- PFRA 1% AEP Fluvial Flood Extent
- PFRA 0.5% AEP Coastal Flood Extent
- OPW Flood Extents
- Launch Pit
- Reception Pit
- Murphy's Survey Points
- Murphy's Survey Lines

Date 11/03/2015

Name Of Client
Fingleton White & Co. Ltd

Name Of Job
Flood Risk Assessment
Stage 1 Report

Title Of Figure
Flood Zones:
Detailed Map 4

Scale Used 1:650 @ A3

Figure No. A.2.4

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LE1072701_FloodZones_Detailed Map A.2.1-9

Data from GDSDS and DCFPP only extracted where relevant to proposed development

Legend

- OPW Flood Points
- Water Course of Culverted River & Streams
- Rivers
- Proposed Pipeline Route
- Cloghran Sewerage Scheme (Indicative Route)

GDSDS Drainage

- Culverted Watercourse
- Storm Sewer
- GDSDS 100 Year Flood Risk
- Alluvium Deposits

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Date	11/03/2015
Name Of Client	Fingleton White & Co. Ltd
Name Of Job	Flood Risk Assessment Stage 1 Report
Title Of Figure	Flood Zones: Detailed Map 5
Scale Used	1:650 @ A3
Figure No.	A.2.5
Rev	B

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LE1072701_FloodZones_Detailed Map A.2.1-9

Data from GDSDS and DCFPP only extracted where relevant to proposed development

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Date 11/03/2015

Name Of Client
Fingleton White & Co. Ltd

Name Of Job
Flood Risk Assessment
Stage 1 Report

Title Of Figure
Flood Zones:
Detailed Map 6

Scale Used 1:650 @ A3

Figure No. A.2.6

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LE1072701_FloodZones_Detailed Map A.2.1-9

Data from GDSDS and DCFPP only extracted where relevant to proposed development

Wad River

OPW04

OPW03

Legend

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Date 11/03/2015

Name Of Client
Fingleton White & Co. Ltd

Name Of Job
Flood Risk Assessment
Stage 1 Report

Title Of Figure
Flood Zones:
Detailed Map 7

Scale Used 1:650 @ A3

Figure No. A.2.7

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LE1072701_FloodZones_Detailed Map A.2.1-9

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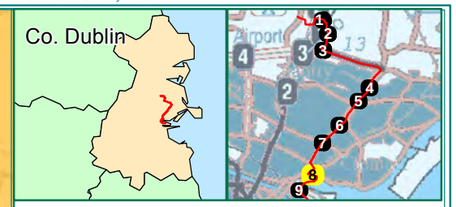

Legend

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Date 11/03/2015

Name Of Client
Fingleton White & Co. Ltd

Name Of Job
Flood Risk Assessment
Stage 1 Report

Title Of Figure
Flood Zones:
Detailed Map 8

Scale Used 1:650 @ A3

Figure No. A.2.8

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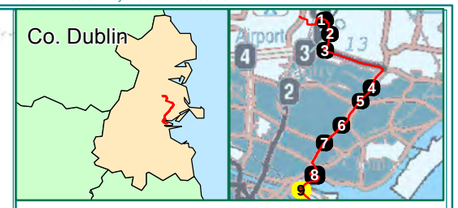
LE1072701_FloodZones_Detailed Map A.2.1-9

Data from GDSDS and DCFPP only extracted where relevant to proposed development



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Date	11/03/2015
Name Of Client	Fingleton White & Co. Ltd
Name Of Job	Flood Risk Assessment Stage 1 Report
Title Of Figure	Flood Zones: Detailed Map 9
Scale Used	1:650 @ A3
Figure No.	A.2.9
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