Active Travel Infrastructure- Ballyalbaney Bridge

Flood Risk Assessment

Monaghan County Council

June 2023

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This document has 21 pages including the cover.

Document history

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Client signoff

Client	Monaghan County Council
Project	Active Travel Infrastructure-Ballyalbaney Bridge
Job number	5213957
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Contents

Chapter		Page
1.	**Introduction**	**5**
1.1.	Relevant Guidance	5
1.2.	Flood Risk	5
1.3.	Causes of Flooding	5
1.4.	Floodplains	6
1.5.	Assessing of Flood Risk	6
2.	**Site Description**	**7**
2.1.	Site Location	7
2.2.	Topography	7
2.3.	Local Hydrology	8
3.	**Flood Risk Identification for the Site**	**9**
3.1.	Flood Risk Investigation	9
3.2.	Conclusion of Flood Risk Identification	12
3.3.	Recommendations	12
4.	**Initial Flood Risk Assessment**	**13**
4.1.	Assessment of Flood Levels	13
4.2.	Application of Flood Risk Management Guidelines	14
4.3.	Conclusion of Initial Flood Risk Assessment	15
5.	**Conclusion and Recommendation**	**16**
5.1.	Conclusion	16
5.2.	Recommendations	16

Appendices **17**

Appendix A. OPW Fluvial Map **18**

Appendix B. Ballyalbaney Bridge Preliminary Design **19**

Appendix C. Section 50 Application **20**

Tables

Table 1-1 - Flood Zones 6

Table 3-1 - Possible Flooding Mechanisms 9

Table 4-1 - Matrix of Development Vulnerability and Flood Zones 14

Figures

Figure 2-1 - Site Location 7

Figure 2-2 - Hydrological Features 8

Figure 3-1 - OSI 6 Inch Colour Map 10

Figure 3-2 - OSI 25 Inch Map 10

Figure 3-3 - Historical Flood Events 11

Figure 3-4 - GSI Soil Map 11

Figure 3-5 - Monaghan County SFRA Predicted Flood Map 12

Figure 4-1 - OPW Predicted Flood Level Nodes 13
Figure 4-2 - Vulnerability Classification 14

1. Introduction

Monaghan County Council appointed Atkins as the consultants to undertake Engineering Multi-disciplinary Consultancy and Design services of the new pedestrian footbridge within Monaghan Town.

This report presents the Flood Risk Assessment of the proposed development on Coolshannagh Road, Monaghan.

1.1. Relevant Guidance

This FRA has been undertaken in consideration with 'The Planning System and Flood Risk Management – Guidelines for Planning Authorities' DOEHLG November 2009, which is the latest guidance document. The guidance has been issued to ensure that flood risk is a key consideration for developers, planning & regional authorities, and the public in preparing and submitting development proposals. The principles of the guidance are as follows:

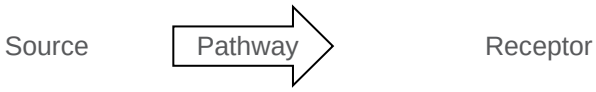
- Avoid the risk, where possible
- Substitute less vulnerable users, where avoidance is not possible, and
- Mitigate and manage the risk, where avoidance and substitution are not possible.

A staged approach is recommended within the guidance document in relation to identifying and assessing flood risk. The three stages of appraisal and assessment are as follows:

- Stage 1 Flood risk identification
- Stage 2 Initial flood risk assessment
- Stage 3 Detailed flood risk assessment

1.2. Flood Risk

Flood risk can be quantified by relating the probability of the flood event occurring to the consequence of the flood. Probability, in flood event terms, is gauged by potential annual occurrence/return period and flood consequence is dependent on the nature of the flood hazard and the vulnerability of the inundated area. The source-pathway-receptor model considers the components of flood risk.



The source is the hazard with the potential to cause harm through flooding (e.g., rainfall, high sea levels). The pathway is the mechanism by which the source can affect the receptor (e.g., inadequate drainage, overtopping of coastal defences) and finally, the receptor is anything which is affected by the flood event (e.g., people, infrastructure, property).

1.3. Causes of Flooding

The Planning System and Flood Risk Management Guidelines requires a FRA to consider all potential causes of flooding including the following:

- Coastal flooding
- Inland flooding
  - Overland flow
  - River flooding
  - Flooding from artificial drainage systems
  - Groundwater flooding
  - Estuarial flooding
  - Failure of infrastructure

1.4. Floodplains

A river flood plain is a low-lying area which receives excess flood water when the flow within the watercourse exceeds the capacity of the channel. A coastal flood plain is an area which, during high tide or increased sea levels, becomes inundated with sea water.

1.5. Assessing of Flood Risk

In the context of the 'Planning System and Flood Risk Management Guidelines, DOEHLG, 2009' three flood zones are designated in the consideration of flood risk to a particular site. The three flood zones are described in **Table 1-1** below.

Table 1-1 - Flood Zones

Flood Zone	Description
Flood 'Zone A'	where the probability of flooding from watercourses is the highest (greater than 1% or 1 in 100 year for watercourse flooding or 0.5% or 1 in 200 for coastal flooding).
Flood 'Zone B'	where the probability of flooding from watercourses is moderate (between 0.1% or 1 in 1000 year and 1% or 1 in 100 year for watercourse flooding, and between 0.1% or 1 in 1000 year and 0.5% or 1 in 200 for coastal flooding).
Flood 'Zone C'	where the probability of flooding from watercourses and the sea is low or negligible (less than 0.1% or 1 in 1000 year for both watercourse and coastal flooding). Flood Zone 'C' covers all areas which are not in Zones 'A' or 'B'.

The planning implications for each of the flood zones are:

Zone A - High probability of flooding. Most types of development would be considered inappropriate in this zone. Development in this zone should be avoided and/or only considered in exceptional circumstances, such as in city and town centres, or in the case of essential infrastructure that cannot be located elsewhere, and where the Justification Test has been applied. Only water-compatible development, such as docks and marinas, dockside activities that require a waterside location, amenity open space, outdoor sports and recreation, would be considered appropriate in this zone.

Zone B - Moderate probability of flooding. Highly vulnerable development, such as hospitals, residential care homes, Garda, fire and ambulance stations, dwelling houses and primary strategic transport and utilities infrastructure, would generally be considered inappropriate in this zone, unless the requirements of the Justification Test can be met. Less vulnerable development, such as retail, commercial and industrial uses, sites used for short-let for caravans and camping and secondary strategic transport and utilities infrastructure, and water-compatible development might be considered appropriate in this zone. In general, however, less vulnerable development should only be considered in this zone if adequate lands or sites are not available in Zone C and subject to a flood risk assessment to the appropriate level of detail to demonstrate that flood risk to and from the development can or will adequately be managed.

Zone C - Low probability of flooding. Development in this zone is appropriate from a flood risk perspective (subject to assessment of flood hazard from sources other than rivers and the coast) but would need to meet the normal range of other proper planning and sustainable development considerations.

2. Site Description

2.1. Site Location

The Ballybane bridge site (Circa 0.153 Ha) is located on the northeast side of Monaghan town centre, which carries Coolshannagh Road L5181 over the River Blackwater. The bridge is located in the townlands of Ballyalbaney. The southern side of the bridge features a 5.1-meter-wide roadway flanked by a sidewalk on its eastern side.

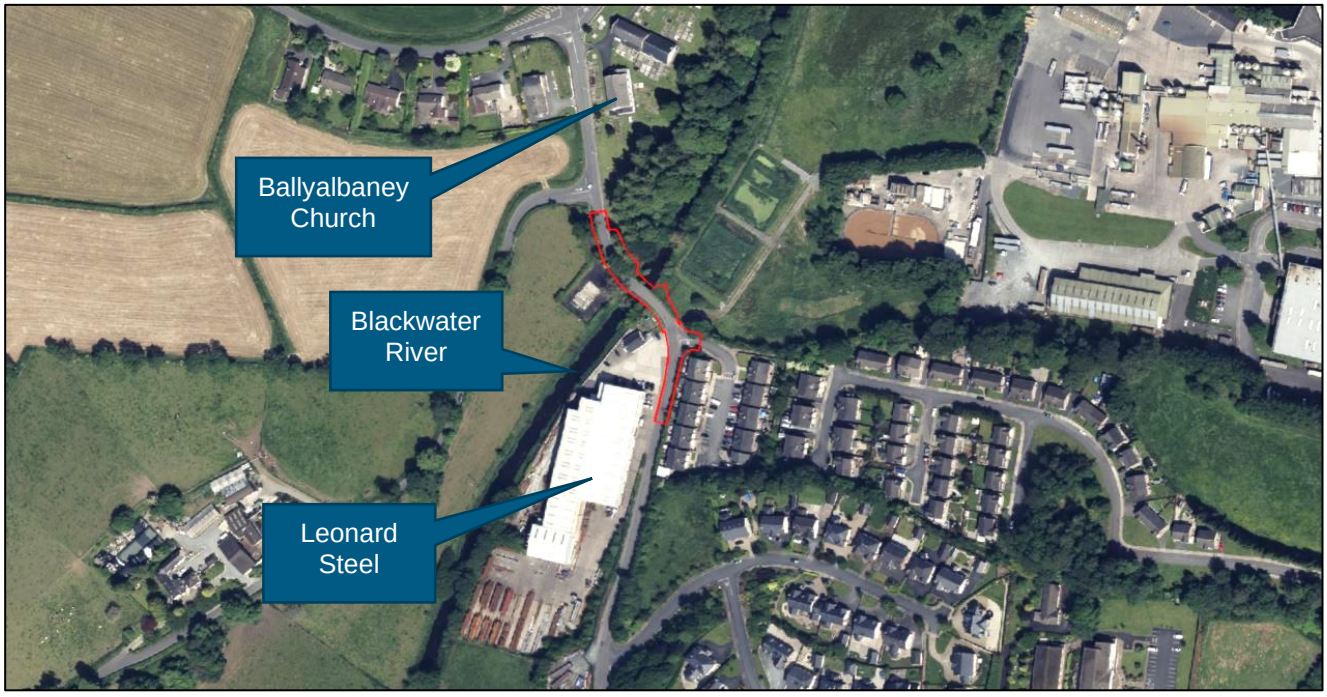


Figure 2-1 - Site Location

2.2. Topography

The proposed development is located on the southwest of the Ballyalbaney Church and north of Leonard Steel. The existing topographical levels of the proposed development and surrounding locations range from 49.86m OD to 54.70m OD. The surrounding area is flat in nature with a water treatment facility located west of the site and residential area to the southeast.

2.3. Local Hydrology

River Blackwater is the most immediate hydrological feature present at the site which flows from southwest to northeast under the existing bridge as shown in **Figure 2-2** below.

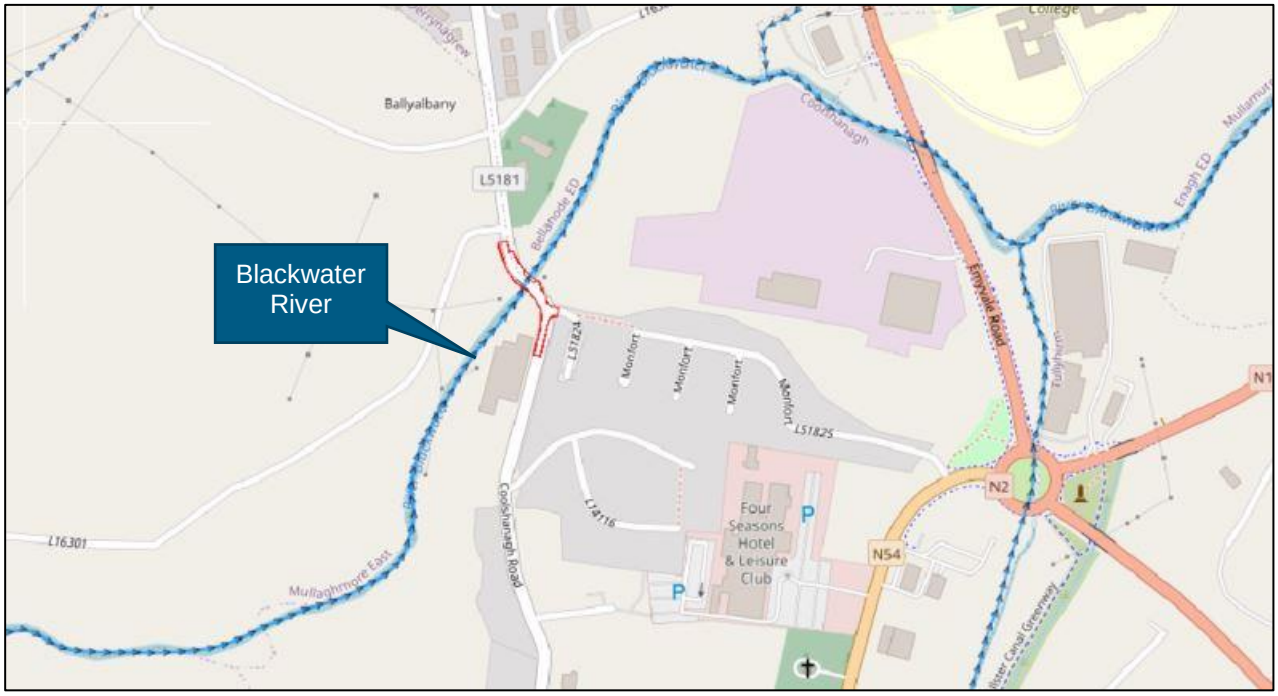


Figure 2-2 - Hydrological Features

This Blackwater River flows east and merges with Clontibret stream in United Kingdom (Northern Ireland).

3. Flood Risk Identification for the Site

In accordance with the planning guidelines, a *Stage 1 Flood risk identification* is required to be undertaken to identify if there are any flooding or surface water management issued related to the proposed development site that may warrant further investigation. Initially, the following possible flood mechanisms for the Proposed Ballyalbaney Bridge have been identified:

Table 3-1 - Possible Flooding Mechanisms

Source/Pathway	Significant?	Comment/Reason
Coastal flooding	No	The site is not at a coastal location.
Overland flow	No	The surrounding topography is relatively shallow.
River flooding	Possible	The proposed bridge spans over the river Blackwater.
Flooding from artificial drainage systems	No	There is no urban drainage infrastructure within the site and in the immediate vicinity of the site.
Groundwater flooding	No	There are no significant springs or groundwater discharges recorded in the immediate vicinity of the site.
Estuarial flooding	No	The site is not at an estuarial location.
Failure of infrastructure	Possible	Potential Blockages within the bridge structure or associated existing flood span.

Table 3-1 above demonstrates that the site is at risk of flooding, however the report will continue to confirm the initial assumptions detailed above.

3.1. Flood Risk Investigation

3.1.1. OPW Flood Maps

The Office of Public Works (OPW) interactive map viewer (http://www.floodinfo.ie/map/floodmaps/) displays the predicted flood extents for both rivers and coastal areas over various return periods. The viewer was consulted in relation to the Ballyalbaney Bridge and the map specific to the site (N06MGN_EXFCD_F0_03) has been included in **Appendix A** of this report.

From the review of the detailed map, it appears that the flood plain of the river Blackwater extends beyond the riverbanks. From the maps it is evident that the site is at a risk of fluvial flooding from the river Blackwater for events > and including the 1 in 10-year event (10% AEP)

3.1.2. Historical Flood Records

The OPW Flood Hazard Mapping Website (www.floodmaps.ie) was consulted in relation to available historical or anecdotal information on any flooding incidences or occurrences in vicinity of the site. The flood Hazard Mapping Report does not indicate any flood points within the vicinity of the site.

Figure 3-1 and **Figure 3-2** below illustrate the historic map of the site environs:

Figure 3-1 - OSI 6 Inch Colour Map

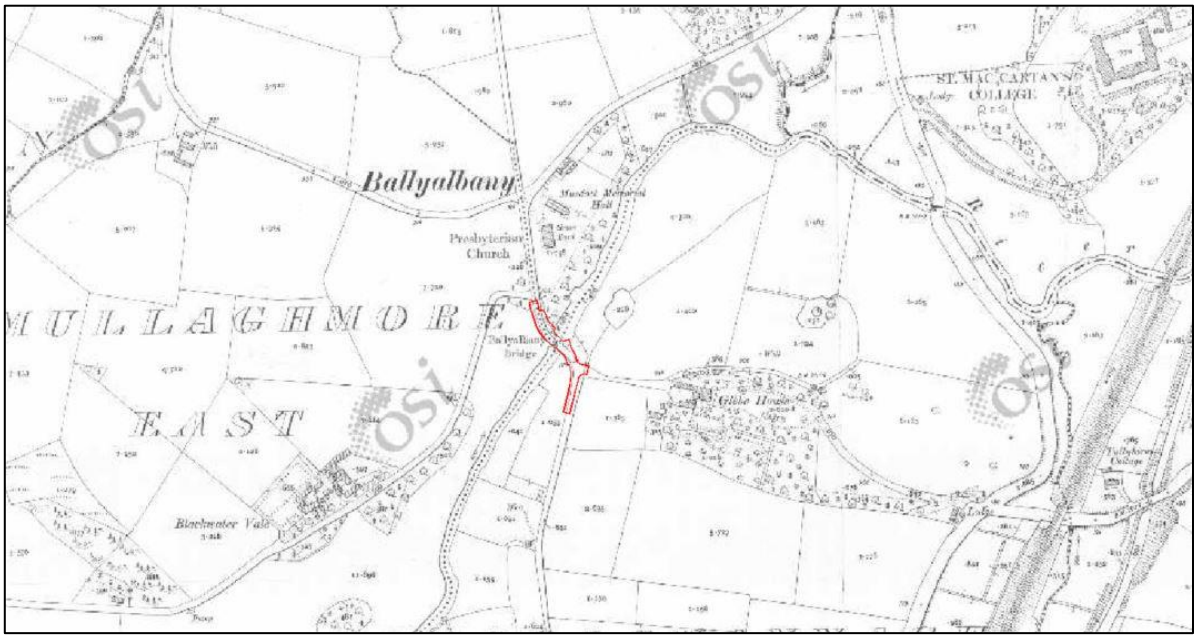


Figure 3-2 - OSI 25 Inch Map

With references to the pre-1900's historic maps and the flood maps layer, no indication of historic or anecdotal instances of flooding were observed within the environs of the site.

3.1.3. Historical Flooding

The Office of Public Works (OPW) interactive map viewer http://www.floodinfo.ie/map/floodmaps was consulted to view any historic flood events located within the proposed site. Various flood events indicate that the Blackwater River and its channels flood every year after a heavy rainfall. Refer to **Figure 3-3** for location of flood events.

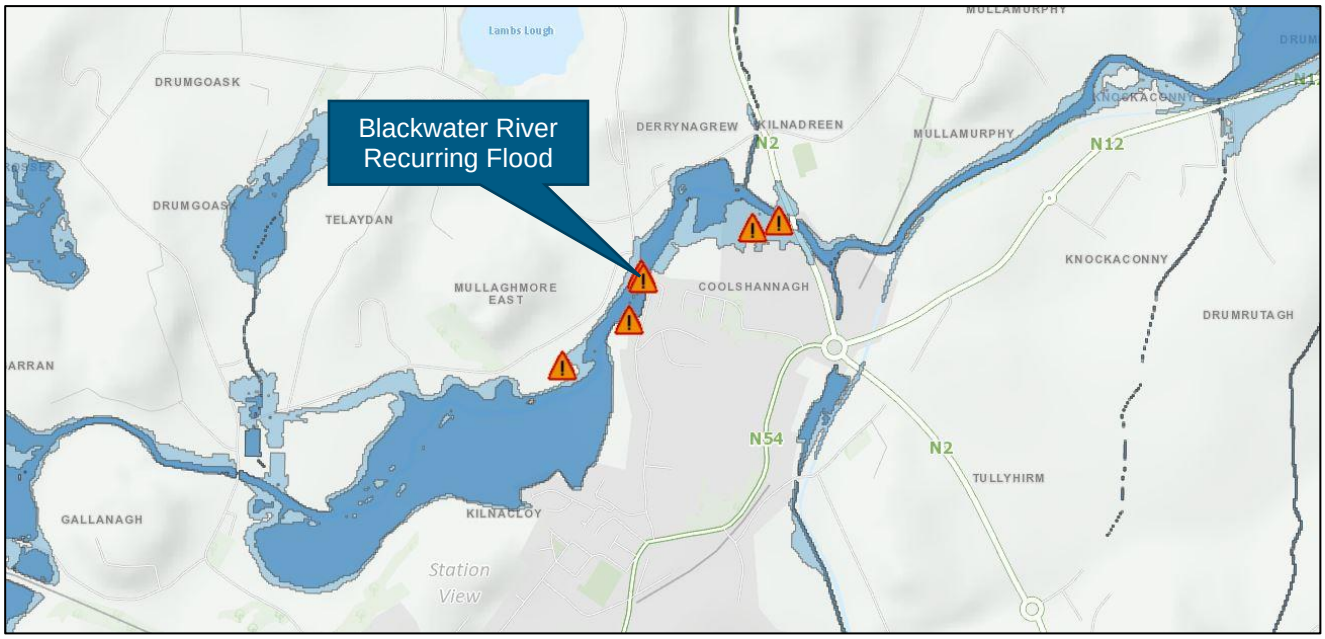


Figure 3-3 - Historical Flood Events

3.1.4. Geological Survey of Ireland Mapping

The soils maps of Geological Survey of Ireland (GSI) were consulted to determine the presence of alluvium deposits in the vicinity of the site. Deposition of alluvium deposits can be an indicator of areas which have flooded in the recent geological past.

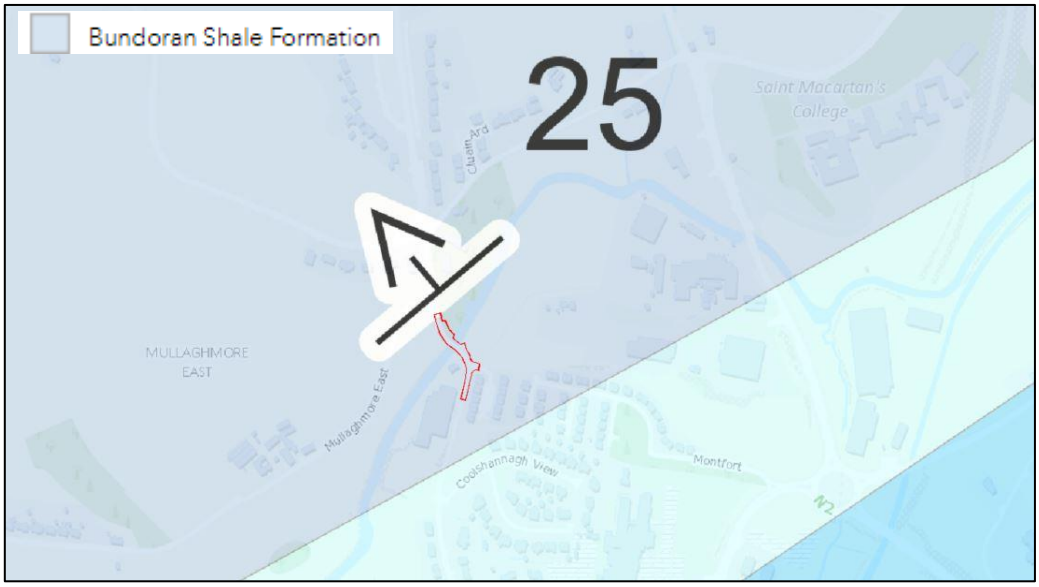


Figure 3-4 - GSI Soil Map

Figure 3-4 above shows the soils mapping for the proposed development site contains Bundoran Shale Formation, which does not indicate alluvium deposits within the proposed development site.

3.1.5. County Monaghan SFRA 2019-2025

The Strategic Flood Risk Assessment (SFRA) produced as part of the Development Plan of County Monaghan 2019-2025 includes Flood Zone Maps which covers the proposed development site. **Figure 3-5** Monaghan County SFRA Predicted Flood Map below indicates the proposed site to be inside Flood Zone A (1% Annual Exceedance probability) and Flood Zone B (0.1% Annual Exceedance Probability).

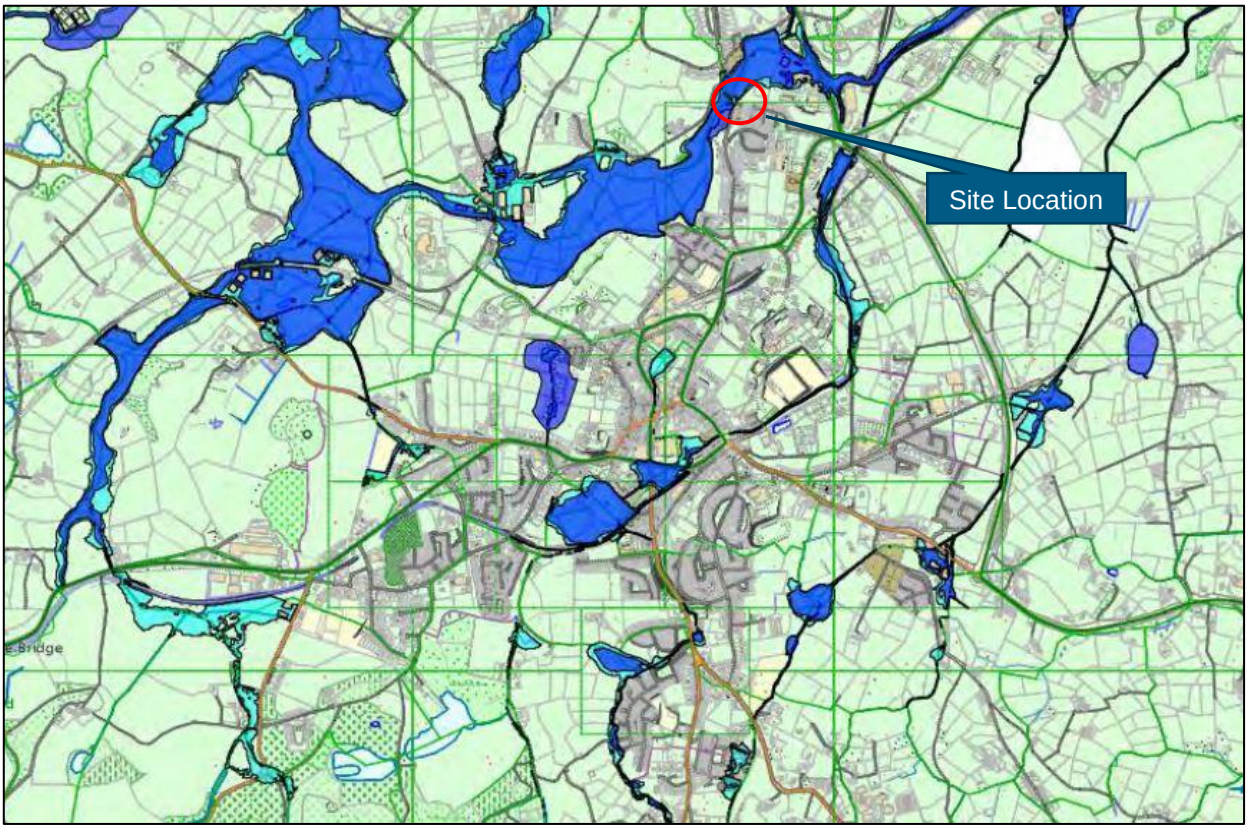


Figure 3-5 - Monaghan County SFRA Predicted Flood Map

3.1.6. Potential Receptors

A receptor of flooding can include people, their property, and the environment. The vulnerability of a potential receptor must be identified and reviewed for all sites which are at risk of flooding.

In accordance with the planning guidelines, it is deemed that the proposed active travel scheme should be classified as “water compatible”.

3.2. Conclusion of Flood Risk Identification

The purpose of the Stage 1 Flood Risk Identification process is to establish whether a flood risk issue currently exists or may exist in the future. If a potential flood risk issue is identified the risk will be investigated in further detail by undertaking a Stage 2 – Initial Flood Risk Assessment. However, if no potential flood risk is identified then the overall assessment can conclude at this point.

In relation to the proposed Active Travel Scheme-Ballyalbaney Bridge, the basis of this Stage 1-Flood Risk Identification findings discussed above in this report have identified that proposed site location is within Flood Zone A & B and risk from Fluvial Flooding.

3.3. Recommendations

While the proposed active travel scheme is deemed to be “water compatible”, the possible displacement of water due to the raised levels and associated embankments will require a Stage 2-Flood Risk Assessment to be carried out to determine any potential impact on the surrounding areas.

4. Initial Flood Risk Assessment

In accordance with the planning guidelines, a *Stage 2 - Initial Flood Risk Assessment* is required to be undertaken to confirm the sources of flooding to the development site, to review the adequacy of existing information and to estimate the extents of possible flooding. The potential source identified to the Ballyalbaney Bridge - Active Travel Scheme at the initial flood risk stage is fluvial flooding from the Blackwater River.

4.1. Assessment of Flood Levels

The maps from the Northwestern Neagh Bann Catchment Flood Risk Assessment and Management (CFRAM) have been examined further to ascertain the potential depth of flooding that may occur during a storm event. Figure 4-1 is an extract from the OPW Monaghan Fluvial Flood Map, attached in Appendix A.

Node Label	Water Level (OD) 10% AEP	Flow (m^3/s) 10% AEP	Water Level (OD) 1% AEP	Flow (m^3/s) 1% AEP	Water Level (OD) 0.1% AEP	Flow (m^3/s) 0.1% AEP
0635M01759	53.34	N/A	54.04	N/A	54.80	N/A
0635M01709	53.19	N/A	53.94	N/A	54.73	N/A
0635M01659	52.91	N/A	53.71	N/A	54.51	N/A
0635M01588	52.36	48.57	53.02	73.67	53.67	107.50
0635M01577	52.25	50.96	52.90	79.20	53.52	117.44
0639M00082	52.38	N/A	53.05	N/A	53.85	N/A
0639M00031I	52.31	2.60	52.98	4.00	53.69	8.27
0639M00008	52.29	2.63	52.96	4.08	53.63	8.30

Figure 4-1 - OPW Predicted Flood Level Nodes

The closest node 0635M01659 is located 95m upstream of the existing bridge. The water level for the 1% AEP event is indicated as 53.71mOD.

Further hydraulic modelling has been carried out as part of a section 50 application for this proposed development, refer to Appendix C. The modelling was completed using the HEC-RAS software which included detailed cross sections of the river channel and surrounding areas based on the topographic data provided.

The findings of the HEC-RAS model confirmed that the flood level for the 1% AEP event (including 20% climate change allowance) is 53.21mOD which is lower than the current levels indicated on the CFRAM mapping in Appendix A.

Based on the site topographical survey, the ground level across the site extents ranges from 49.86mOD to 54.70mOD. The level of the existing bridge carriageway ranges from 54.0mOD on the eastern extent to 53.9mOD to the western extent with a top of bridge level of 54.70mOD. As the finished level of the bridge structure will align with the existing bridge levels it is therefore concluded that the proposed works and the existing bridge are not at risk of flooding from the 1% AEP flood event.

Furthermore, there is no increase in flood risk to the existing bridge, Ballyalbaney Church & Graveyard, Lakeland Dairies, Leonard Steel, or any other properties in the neighbouring proximity.

4.2. Application of Flood Risk Management Guidelines

4.2.1. Classification of Proposed Development

The proposed development is used for transportation for vehicles, cyclist, and pedestrians. As a result, this development shall be categorised under navigation facilities which is classified as a 'water compatible development' as per the vulnerability classification in the planning guidelines in **Figure 4-2**.

Vulnerability class	Land uses and types of development which include*:
Highly vulnerable development (including essential infrastructure)	Garda, ambulance and fire stations and command centres required to be operational during flooding; Hospitals; Emergency access and egress points; Schools; Dwelling houses, student halls of residence and hostels; Residential institutions such as residential care homes, children's homes and social services homes; Caravans and mobile home parks; Dwelling houses designed, constructed or adapted for the elderly or, other people with impaired mobility; and Essential infrastructure, such as primary transport and utilities distribution, including electricity generating power stations and sub-stations, water and sewage treatment, and potential significant sources of pollution (SEVESO sites, IPPC sites, etc.) in the event of flooding.
Less vulnerable development	Buildings used for: retail, leisure, warehousing, commercial, industrial and non-residential institutions; Land and buildings used for holiday or short-let caravans and camping, subject to specific warning and evacuation plans; Land and buildings used for agriculture and forestry; Waste treatment (except landfill and hazardous waste); Mineral working and processing; and Local transport infrastructure.
Water-compatible development	Flood control infrastructure; Docks, marinas and wharves; Navigation facilities; Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location; Water-based recreation and tourism (excluding sleeping accommodation); Lifeguard and coastguard stations; Amenity open space, outdoor sports and recreation and essential facilities such as changing rooms; and Essential ancillary sleeping or residential accommodation for staff required by uses in this category (subject to a specific warning and evacuation plan).
*Uses not listed here should be considered on their own merits	

Figure 4-2 - Vulnerability Classification

Table 4-1 illustrates the types of development that would be appropriate to each flood zone and those that would be required to meet the justification test.

Table 4-1 - Matrix of Development Vulnerability and Flood Zones

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development	Justification Test	Justification Test	Appropriate
Less vulnerable development	Justification Test	Appropriate	Appropriate
Water-compatible development	Appropriate	Appropriate	Appropriate

4.3. Conclusion of Initial Flood Risk Assessment

In relation to the Blackwater River and the proposed active travel scheme, the proposed levels for the development were compared against the 1 in 100-year fluvial flood event and observed that the levels on the proposed development are higher.

Based on the Stage 2-*Initial Flood Risk Assessment* findings discussed above (section 4.2), as the proposed development fall under the category of amenity open space, it is classified as a water-compatible development under the vulnerability class, therefore the flood risk study shall not require a justification test as per Table 4-1.

5. Conclusion and Recommendation

5.1. Conclusion

Atkins were commissioned by Monaghan County Council to prepare a Flood Risk Assessment (FRA) as part of providing Engineering-led Multi-disciplinary Consultancy and Design services for the concept development and option selection, preliminary design and statutory processes of active travel provisions and associated works on the Ballyalbaney Bridge-Active Travel Scheme.

The Ballyalbaney Bridge-Active Travel Scheme is classified as a “water compatible development” as per the planning guidelines.

Based on the Stage 1-*Flood risk identification* findings, the proposed site was identified as being potentially at risk of fluvial flooding from the Blackwater River, and therefore a Stage 2-*Initial Flood Risk Assessment* was required.

In relation to the active travel scheme, the levels of the existing bridge and the proposed development are higher than the 1 in 100-year fluvial flood event (1% AEP including 20% climate change allowance) obtained from HEC-RAS model. Also, as the proposed development is a water compatible development, no justification test is required.

It is deemed that all criteria of the Stage 2 have been addressed and satisfied and therefore a Stage 3-Flood Risk Assessment is not required.

There is no increase in flood risk to the existing bridge, Ballyalbaney Church & Graveyard, Lakeland Dairies, Leonard Steel, or any other properties in the neighbouring proximity.

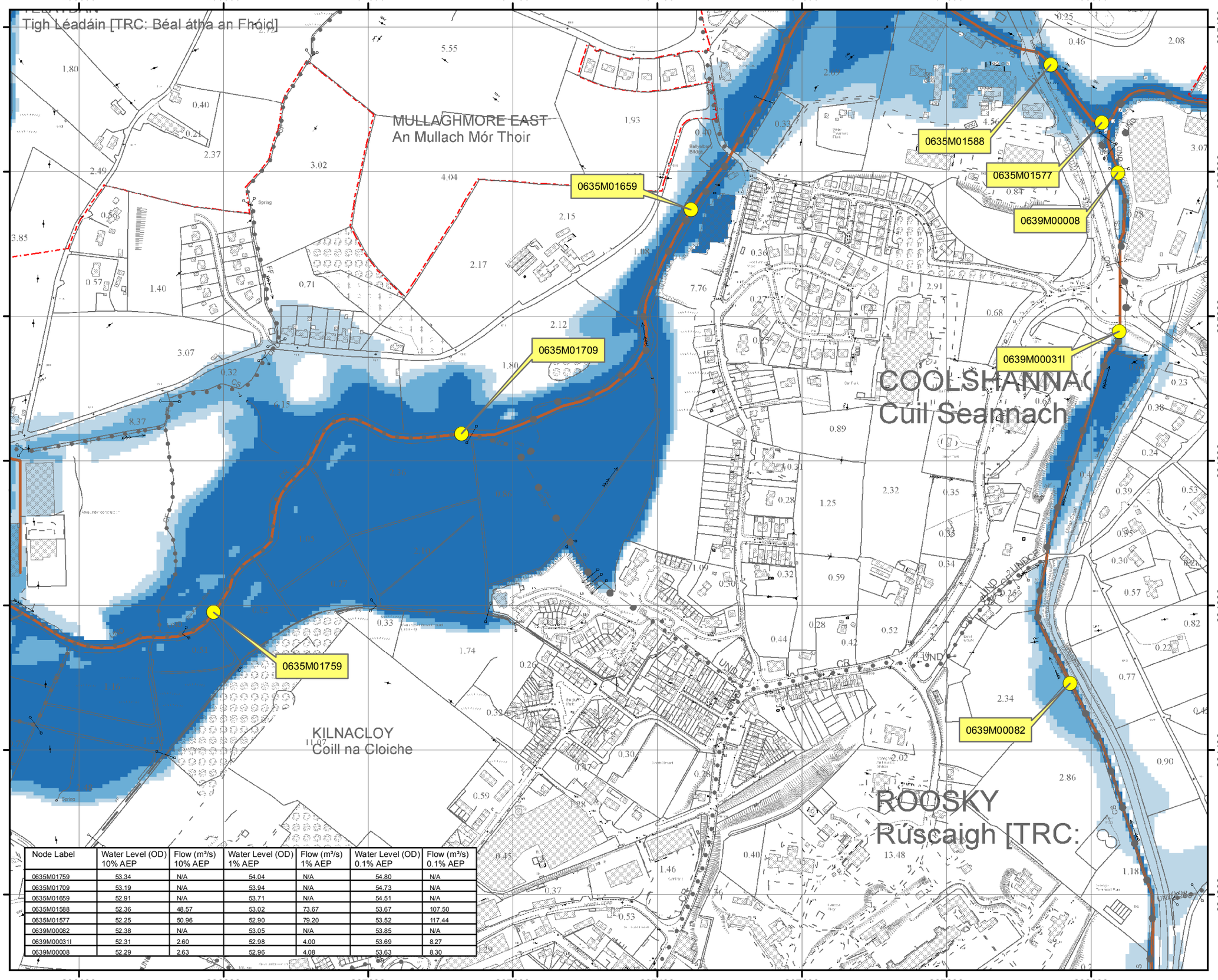
5.2. Recommendations

The following recommendations should be considered;

- The design for the proposed storm-water drainage is to take into consideration all other standards for drainage design, from the ‘*Greater Dublin Strategic Drainage Study Volume 2 – New Developments*.’
- Final detail design of the bridge structure is to ensure that the proposed soffit level remains as a minimum at the same level of the existing bridge soffit level.

Appendices

Appendix A. OPW Fluvial Map



Node Label	Water Level (OD) 10% AEP	Flow (m³/s) 10% AEP	Water Level (OD) 1% AEP	Flow (m³/s) 1% AEP	Water Level (OD) 0.1% AEP	Flow (m³/s) 0.1% AEP
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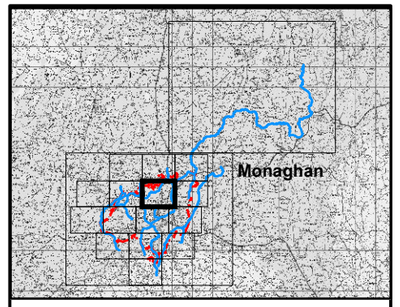


IMPORTANT USER NOTE:
THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.

Legend

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

FINAL

REV:	NOTE:	DATE:

NORTH WESTERN NEAGH BANN CFRAM STUDY
CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT

OPW Oifig na nOibreacha Poiblí The Office of Public Works
The Office of Public Works
Jonathan Swift Street
Trim
Co Meath

RPS
Elmwood House
74 Boucher Road
Belfast
BT12 6RZ
T +44(0) 28 90 667914
F +44(0) 28 90 668286
W www.rpsgroup.com
E ireland@rpsgroup.com

Map: Monaghan Fluvial Flood Extents

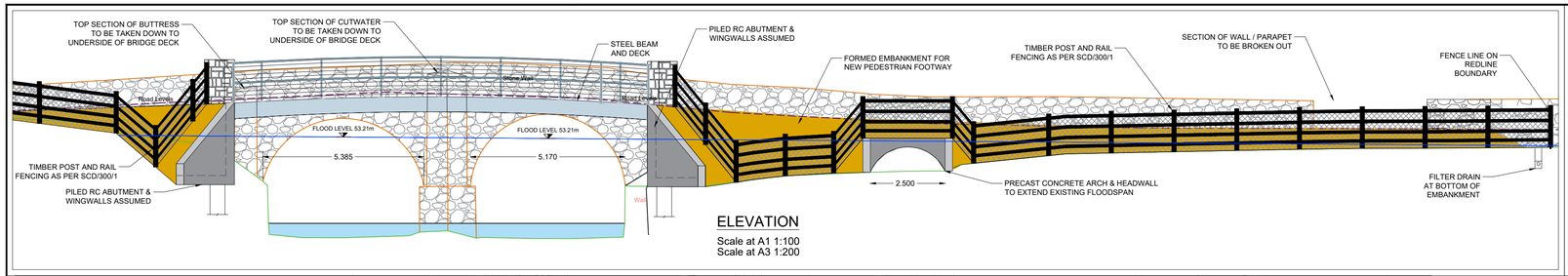
Map Type:	EXTENT
Source:	FLUVIAL
Map Area:	HPW
Scenario:	CURRENT
Drawn By : F.M.C.	Date : 15 July 2016
Checked By : E.H.	Date : 15 July 2016
Approved By : S.P.	Date : 15 July 2016
Drawing No. :	N06MGN_EXFCD_F0_03
Map Series :	Page 3 of 17
Drawing Scale : 1:5,000	@A3

Appendix B. Ballyalbaney Bridge Preliminary Design

DO NOT SCALE

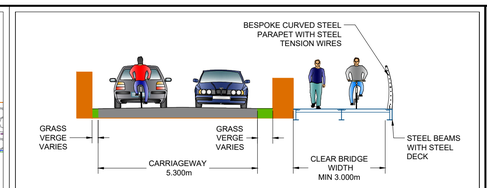
A1

100 0 10



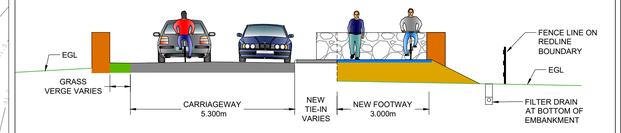
ELEVATION

Scale at A1 1:100
Scale at A3 1:200



CROSS SECTION A-A

Scale at A1 1:100
Scale at A3 1:200



CROSS SECTION B-B

Scale at A1 1:100
Scale at A3 1:200

GENERAL NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE
2. ONLY WRITTEN DIMENSIONS SHALL BE USED. NO DIMENSIONS SHALL BE SCALED FROM THE DRAWINGS
3. ALL LEVELS ARE IN METRES AND ARE TO MALIN HEAD DATUM
4. ALL COORDINATES ARE IN METRES AND ARE TO IRISH TRANSVERSE MERCATOR
5. DRAWINGS ARE TO BE READ IN CONJUNCTION WITH THE SPECIFICATION

LEGEND:

- EXISTING CARRIAGEWAY
- EXISTING FOOTPATH
- NEW FOOTPATH
- PROPOSED TACTILE PAVING (UNCONTROLLED)
- EXISTING GRASS VERGE
- PROPOSED GRASS VERGE
- EXISTING WALL / PARAPET
- PROPOSED BRIDGE
- PROPOSED FOOTWAY
- PROPOSED EMBANKMENT
- NEW OVER RIDE AREA
- NEW DROPPED KERB
- AREA OF LANDTAKE
- PROPOSED PARAPET / FENCE

Risk Level		
	X	Atkins Base Line - Low Risk
		Atkins Sensitive - Medium Risk
		Atkins Private - High Risk
		Client Critical - Already Marked

Comhairle Contae Mhuineacháin
Monaghan County Council

Rev	Description	By	Date	Chk'd	Rev'd	Auth
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ATKINS
Member of the SNC-Lavalin Group

Atkins House, 150-155 Airside Business Park, Swords, Co. Dublin
Tel (+353) 01 810 8000
Fax (+353) 01 810 8001

Unit 2B, 2200 Cork Airport Business Park, Cork
Tel (+353) 021 429 0300
Fax (+353) 021 429 0360

1st Floor Technology House Parkmore Technology Park, Galway
Tel (+353) 091 786 050
Fax (+353) 091 779 830

Client: MONAGHAN COUNTY COUNCIL

Project: ACTIVE TRAVEL INFRASTRUCTURE BALLYALBANEY & HORSESHOE BRIDGES

Purpose: FOR INFORMATION

Title: BALLYALBANEY BRIDGE PRELIMINARY DESIGN

Original Scale	Drawn	Checked	Reviewed	Authorised
1:250 at A1 1:500 at A3	GOH Date 04.11.22	GOH Date 04.11.22	RM Date 04.11.22	RM Date 04.11.22

Status	Drawing Number	Rev
I	5213957-ATK-01-ZZ-SK-C-900102	6

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Date: May 11, 2023 - 4:32pm Plotted by: aosullivan

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Appendix C. Section 50 Application

Ballyalbany Bridge, Co. Monaghan

OPW Section 50 Application

W.S. Atkins Ireland Ltd.

Prepared by:

SLR Environmental Consulting (Ireland) Ltd

7 Dundrum Business Park, Windy Arbour, Dublin, D14 N2Y7

SLR Project No.: 501.65044.001

9 May 2023

Revision: 2- Final

Making Sustainability Happen

Revision Record

Revision	Date	Prepared By	Checked By	Authorized By
1 - Draft	2 May 2023	KD	PG	PG
2- Final	9 May 2023	KD	PG	PG
	Click to enter a date.			
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	Click to enter a date.			

Basis of Report

This document has been prepared by SLR Environmental Consulting (Ireland) Ltd (SLR) with reasonable skill, care and diligence, and taking account of the manpower, timescales and resources devoted to it by agreement with W.S. Atkins Ireland Ltd. (the Client) as part or all of the services it has been appointed by the Client to carry out. It is subject to the terms and conditions of that appointment.

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Table of Contents

Basis of Report i
Acronyms and Abbreviations iii
1.0 Introduction 1
2.0 Hydrology Analysis 2
2.1 Flood Index 2
2.2 Growth Factors and Peak Runoff 3
3.0 Hydraulic Analysis 4
3.1 Existing Scenario 5
3.2 Post Development Scenario 6
3.3 Climate Change 8
4.0 Conclusion 10

Tables in Text

Table 1 Growth Factors and Peak Flow (m^3/s) 3
Table 2 Modelled Flood Levels - Existing and Post Development Scenario (1% AEP) 7
Table 3 Modelled Flood Levels – Pre Development and Post Development With Climate Change Allowance (1% AEP) 8
Table 4 Modelled Flood Levels – Pre Development With Climate Change and Post Development With Climate Change Allowance (1% AEP) 9

Figures in Text

Figure 1 Location of the Existing and Proposed Bridge 1
Figure 2 Catchment Area 2
Figure 3 OPW CFRAM Study Flood Map 3
Figure 4 1D Flood Model Schematization 4
Figure 5 Longitudinal Section – 1% AEP - Existing 5
Figure 6 Cross Section of Bridge – Upstream – Existing 5
Figure 7 Cross Section of Bridge – Downstream - Existing 5
Figure 8 Longitudinal Section – 1% AEP – Post Development 6
Figure 9 Cross Section of Bridge – Upstream – Post Development 6
Figure 10 Cross Section of Bridge – Downstream - Post Development 6

Appendices

Appendix A Preliminary Design Drawing
Appendix B Section 50 Application

Acronyms and Abbreviations

AEP	Annual Exceedance Probability
OPW	Office of Public Work
FSU	Flood Study Update
CFRAM Study	Catchment Flood Risk and Management Study
mOD	Meters above Ordnance Datum (Malin)

1.0 Introduction

SLR Consulting (SLR) has been appointed by W.S. Atkins Ireland Ltd to prepare a Section 50 Application, as required by the Office of Public Works (OPW), to install a new pedestrian bridge immediately downstream of an existing vehicle road bridge over the River Blackwater (Monaghan), in Monaghan Town. The Section 50 application includes a hydraulic report for the River Blackwater.

The existing road bridge is a two-span masonry arch structure. On the left bank of the river there is a dry/flood span through the bridge structure to accommodate out of bank flows across the river floodplain. This span through the bridge is fully blocked on the upstream side of the bridge.

The location of the existing and proposed bridge is shown on Figure 1.

The new pedestrian bridge will be a single span steel structure. Approach embankments will be constructed on either side to form new pedestrian links. It is also proposed to extend the existing dry span through the new embankment structure for the pedestrian bridge.

The Preliminary Design drawing for the proposed pedestrian bridge is attached in Appendix A.

Figure 1
Location of the Existing and Proposed Bridge

The installation of the new pedestrian bridge and associated embankments will have an impact on the river hydraulics. Therefore, it was necessary to developing a numerical hydraulic model for the river to determine the impact of the proposed development. This is discussed in Section 3.

According to the OPW Section 50 Guidelines, the proposed bridge must be capable of operating under the fluvial flood flow associated with the 1% Annual Exceedance Probability (AEP), while maintain a freeboard of at least 300 mm. The Guidelines also requires that any changes in the catchment's hydrological characteristics due to climate change are considered also.

Therefore, the proposed bridge will be also tested against the 1% AEP with 20% climate change allowance.

2.0 Hydrology Analysis

2.1 Flood Index

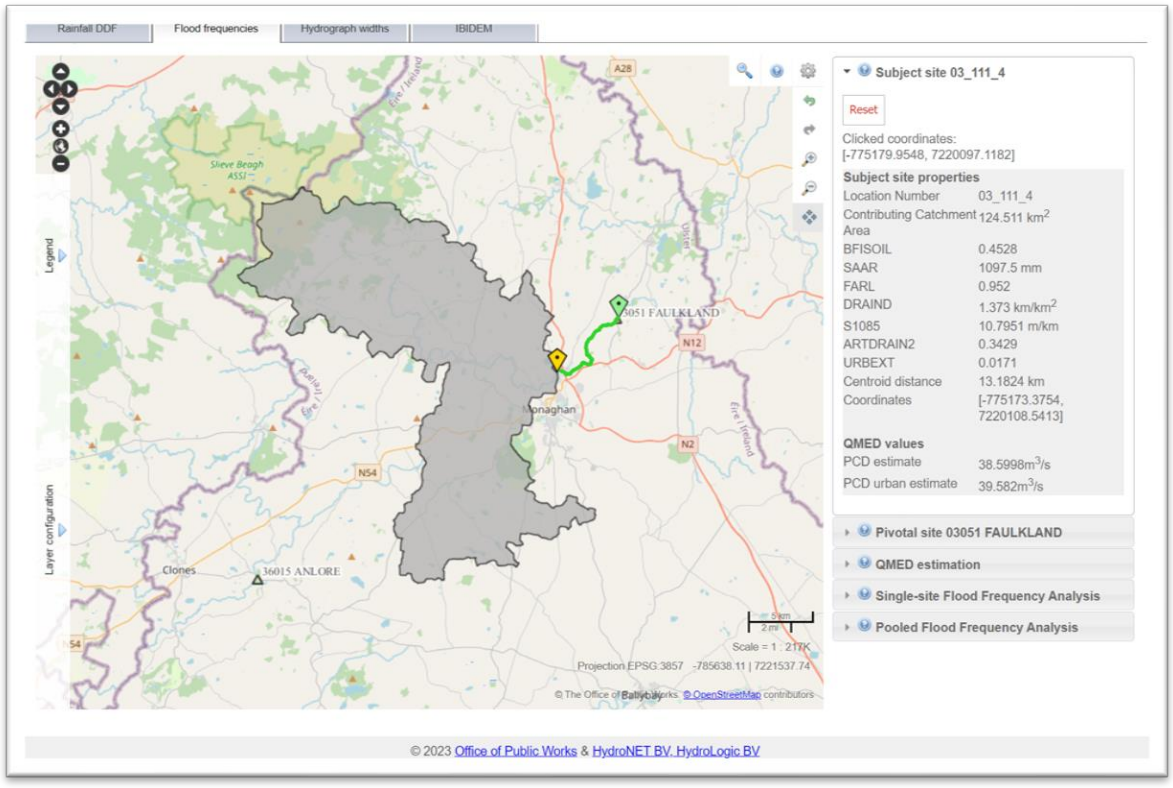
The estimation of the flood index has followed the OPW Flood Studies Update (FSU) methods and processes as set out in the FSU Web Portal (https://opw.hydronet.com/). As part of Work Package 5.3 of FSU, catchment descriptors were generated at 500 m intervals or less, on watercourses across the country. Hydrological estimation points (HEP, also known as FSU Nodes) are points at these intervals along a watercourse at which flow estimates are derived, based on catchment descriptors.

The principal flood estimation method set out in the FSU is a statistical method, using donor (pivotal) gauged sites and pooling groups of hydrologically similar catchments in order to estimate the peak flowrates of probabilistic events.

The proposed bridge is located approximately 3.4 km upstream of the hydrometric gauging station 3051 Faulkland which has been used as a donor site.

Figure 2 shows an extract from the OPW's Flood Studies Update (FSU) Portal which presents the catchment area and catchment characteristics of the FSU Node closest to the site, Node 03_111_4. The node is located 180 m downstream of the bridge. The total catchment area to this node is c. 125 km^2.

Figure 2
Catchment Area



The determined flood index is 35.37 m^3/s at the location just downstream of the subject location.

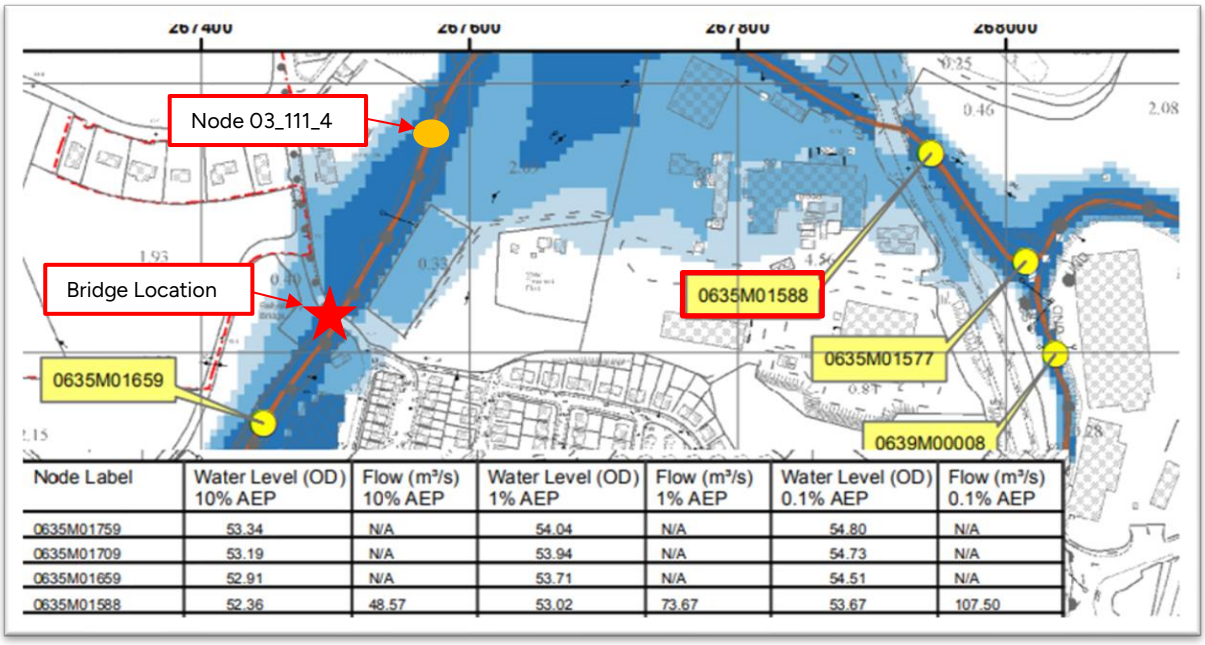
2.2 Growth Factors and Peak Runoff

It is recommended in the North Western Neagh Bann OPW CFRAM Study Hydrology Report that the growth curve factors at FSU Nodes with catchment size ranging from 10 to 200 km^2 should be estimated from the individual growth curve estimation process.

The growth factors have been determined through the FSU Web Portal using the pooling group method at FSU node Node 03_111_4, this node has been also used to determine the flood index in Section 2.1.

The pooling method resulted in c. 20 % lower flows compared to the flows determined as part of the CFRAM Study at Node 0635M01588, located 400 m downstream of Node 03_111_4. The extract from the OPW CFRAM Maps showing these locations is shown in Figure 3 below.

Figure 3
OPW CFRAM Study Flood Map



Node Label	Water Level (OD) 10% AEP	Flow (m³/s) 10% AEP	Water Level (OD) 1% AEP	Flow (m³/s) 1% AEP	Water Level (OD) 0.1% AEP	Flow (m³/s) 0.1% AEP
0635M01759	53.34	N/A	54.04	N/A	54.80	N/A
0635M01709	53.19	N/A	53.94	N/A	54.73	N/A
0635M01659	52.91	N/A	53.71	N/A	54.51	N/A
0635M01588	52.36	48.57	53.02	73.67	53.67	107.50

The growth factors and peak flows determined as part of the pooling method and the OPW CFRAM Study are presented in Table .

Table 1
Growth Factors and Peak Flow (m³/s)

Return Period / Probability	Pooling Method		OPW CFRAM Study	
	Growth Factor	Peak Runoff (m³/s)	Growth Factor	Peak Runoff (m³/s)
2 years / 50%	1.00	35.37	1.00	N/A
100 years / 1%	1.74	61.43	N/A	73.67

To preserve a conservative approach, flows calculated as part of the OPW CFRAM Study have been used for this exercise.

3.0 Hydraulic Analysis

Hydraulic modelling has been carried out in a software HEC-RAS 6.3.1. A 1D modelling approach has been used for this exercise. It is a common practice to use one-dimensional (1D) models for the analysis of bridge/culvert structures and determining water elevation along the analysed reach.

The topography data has been provided by the client.

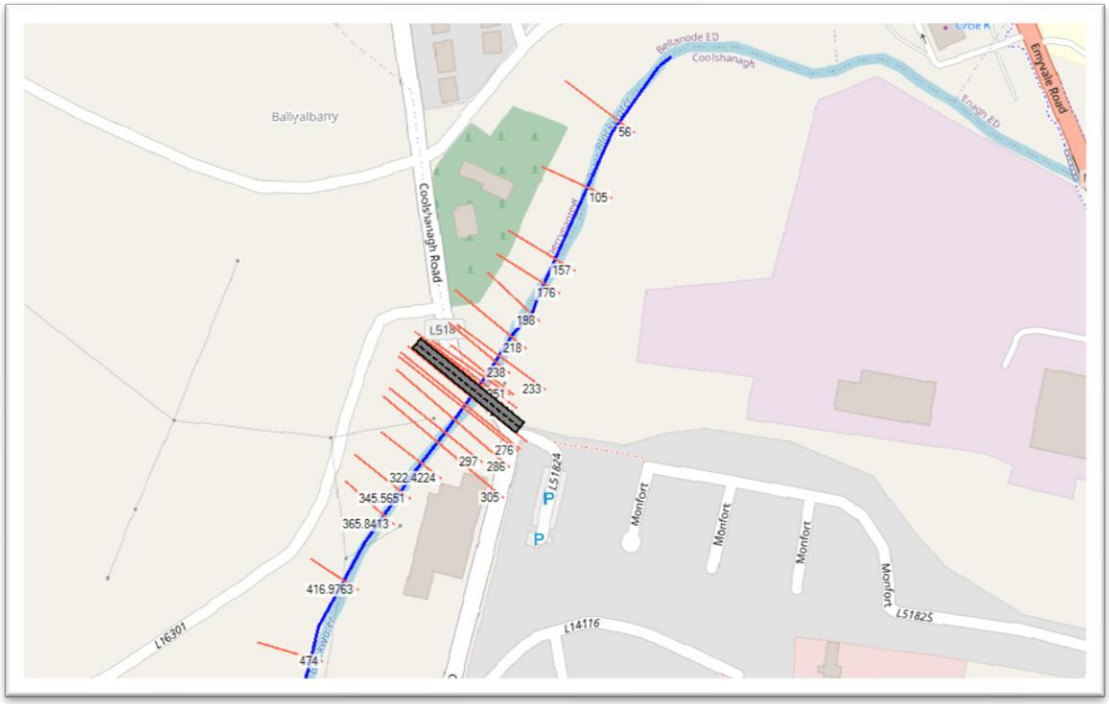
The hydraulic modelling has been carried out as 'Steady flow'. The modelled extend of the river is Stream is 418 m longs, and it is presented by 23 cross sections as shown on Figure 4 below.

The proposed pedestrian bridge will be a single span steel bridge. Approach embankments will be constructed on the downstream side of the existing bridge on either side to form new pedestrian links. A portion of the area just downstream of the bridge is ineffective when it comes to conveying flows. This happens when water cannot flow in the longitudinal direction along the overbank areas due to roadway fill. When this occurs, flow must contract to pass through the opening under the roadway, adding additional and often significant losses. A reasonable approach to determine in the hydraulic model the impact of the pedestrian bridge, is to present the proposed pedestrian bridge as an extension of the existing vehicle bridge.

According to the planning drawing, please refer to Appendix A, the soffit level of the pedestrian bridge will match the soffit level of the existing bridge. The proposed bridge will be 3.0 m wide.

The peak flow for the 1% AEP event has been used for upper external boundary condition. Downstream boundary condition has been defined as Normal depth, with value of 0.0018 m/m. The Manning's roughness coefficient was taken as n = 0.045 within the channel and 0.075 outside of the channel's banks.

Figure 4
1D Flood Model Schematization



3.1 Existing Scenario

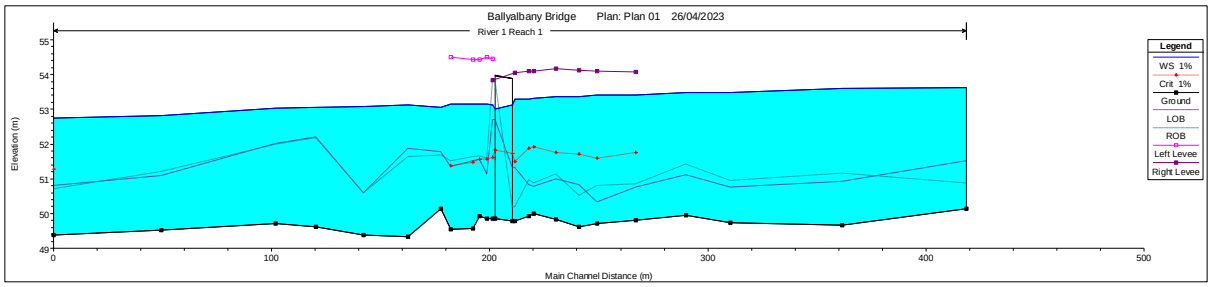
The longitudinal section with water levels for the 1% AEP for the existing scenario is shown on Figure 5. It can be observed that the water does not remains within the channel.

The invert level at the upstream end of the existing bridge is 49.78 mOD with the peak water level 53.13 mOD.

The invert level at the downstream end of the existing bridge is 49.87 mOD with the peak water level 53.00 mOD.

The soffit level of the arch is 53.82 mOD, which gives the freeboard level of 690 mm.

Figure 5
Longitudinal Section – 1% AEP - Existing



Cross sections showing upstream and downstream end of the culvert for the existing scenario are shown on Figure 6 and Figure 7 respectively.

Figure 6
Cross Section of Bridge – Upstream – Existing

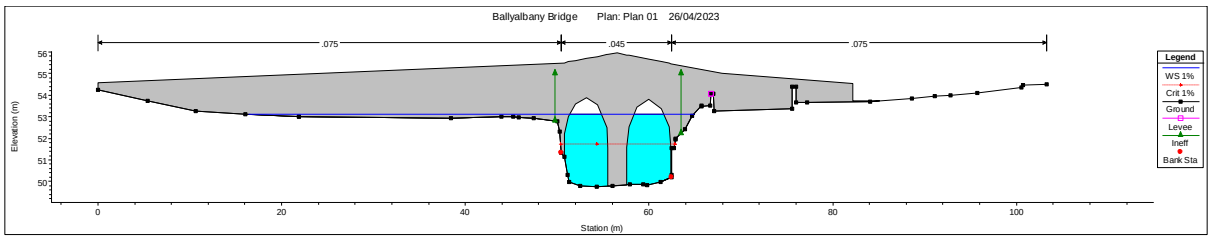
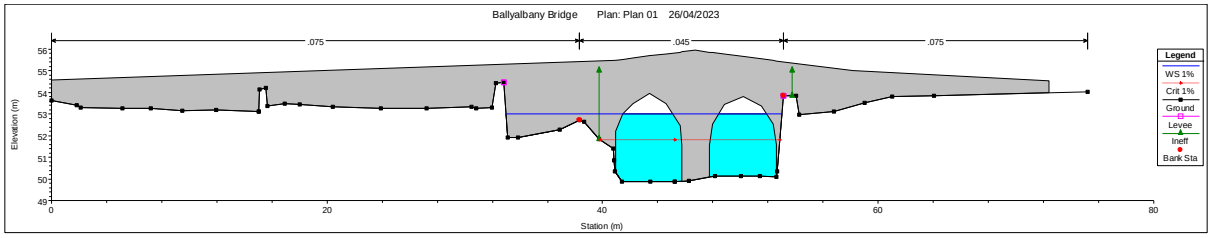


Figure 7
Cross Section of Bridge – Downstream - Existing



3.2 Post Development Scenario

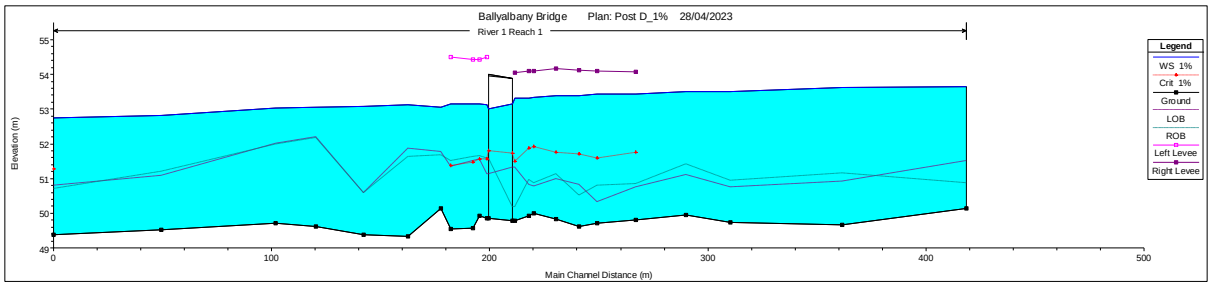
The longitudinal section with water levels for the 1% AEP are shown on Figure 8. It can be observed that the water does not remains within the channel.

The invert level at the upstream end of the existing bridge is 49.78 mOD with the peak water level 53.15 mOD.

The invert level at the downstream end of the existing bridge is 49.87 mOD with the peak water level 53.00 mOD.

The soffit level of the arch is 53.82 mOD, which gives the freeboard level of 670 mm.

Figure 8
Longitudinal Section – 1% AEP – Post Development



Cross sections showing upstream and downstream end of the culvert for the existing scenario are shown on Figure 9 and Figure 10 respectively.

Figure 9
Cross Section of Bridge – Upstream – Post Development

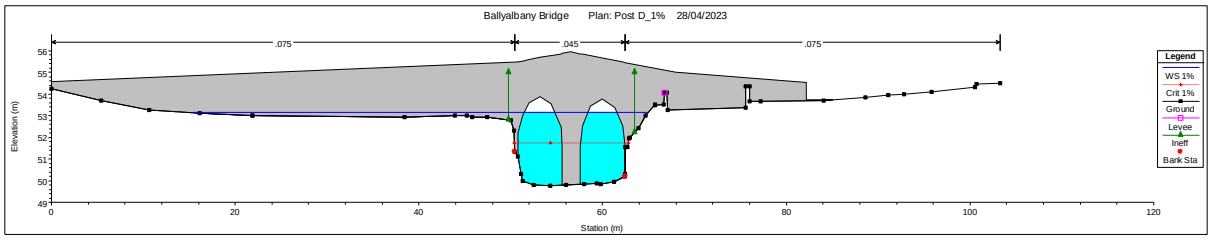
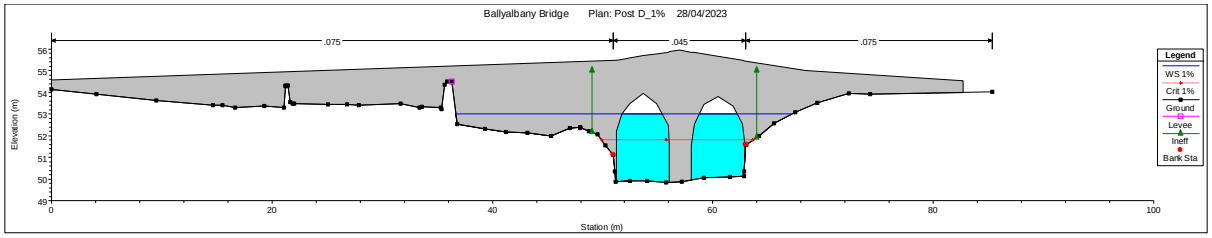


Figure 10
Cross Section of Bridge – Downstream - Post Development



Comparison of the flood levels for the existing and post development is present in Table 2.

Table 2
Modelled Flood Levels - Existing and Post Development Scenario (1% AEP)

	Pre Development		Post Development		Difference in Flood Level
Cross Section Chainage	Invert Level	Water Level	Invert Level	Water Level.	
	(mOD)	(mOD)	(mOD)	(mOD)	(m)
474	50.13	53.63	50.13	53.65	0.02
417	49.66	53.61	49.66	53.62	0.01
366	49.74	53.49	49.74	53.51	0.02
346	49.96	53.48	49.96	53.49	0.01
322	49.8	53.42	49.8	53.44	0.02
305	49.72	53.41	49.72	53.43	0.02
297	49.62	53.37	49.62	53.39	0.02
286	49.83	53.37	49.83	53.39	0.02
276	50.00	53.31	50.00	53.34	0.03
274	49.94	53.29	49.94	53.31	0.02
267	49.78	53.3	49.78	53.32	0.02
BRIDGE US	49.78	53.13	49.78	53.15	0.02
BRIDGE DS	49.87	53.00	49.87	53.00	0
257	49.86	53.12	N/A	N/A	N/A
254	49.85	53.15	49.85	53.12	-0.03
251	49.92	53.15	49.92	53.15	0
248	49.58	53.16	49.58	53.16	0
238	49.55	53.15	49.55	53.15	0
233	50.13	53.06	50.13	53.06	0
218	49.34	53.12	49.34	53.12	0
198	49.38	53.07	49.38	53.07	0
176	49.62	53.05	49.62	53.05	0
157	49.71	53.03	49.71	53.03	0
105	49.51	52.83	49.51	52.83	0
56	49.39	52.75	49.39	52.75	0

The installation of the pedestrian bridge will increase the modelled flood levels upstream of the bridge up to 30 mm upstream of the new pedestrian bridge. The new bridge does not result in a change in the modelled downstream flood levels.

3.3 Climate Change

The post development scenario has been tested against the climate change. The peak flow for the 1% AEP event has been increased for 20%. The flood levels showing pre-development and post development with climate change is provided in Table 3.

Table 3
Modelled Flood Levels – Pre Development and Post Development With Climate Change Allowance (1% AEP)

	Pre Development		Post Development With Climate Change		Difference in Flood Level
Cross Section Chainage	Invert Level	Water Level	Invert Level	Water Level.	
	(mOD)	(mOD)	(mOD)	(mOD)	(m)
474	50.13	53.63	50.13	54.01	0.38
417	49.66	53.61	49.66	53.97	0.36
366	49.74	53.49	49.74	53.85	0.36
346	49.96	53.48	49.96	53.83	0.35
322	49.8	53.42	49.8	53.78	0.36
305	49.72	53.41	49.72	53.78	0.37
297	49.62	53.37	49.62	53.74	0.37
286	49.83	53.37	49.83	53.75	0.38
276	50.00	53.31	50	53.72	0.41
274	49.94	53.29	49.94	53.7	0.41
267	49.78	53.3	49.78	53.65	0.35
BRIDGE US	49.78	53.13	49.78	53.41	0.28
BRIDGE DS	49.87	53.00	49.87	53.21	0.21
257	49.86	53.12	N/A	N/A	N/A
254	49.85	53.15	49.85	53.39	0.24
251	49.92	53.15	49.92	53.44	0.29
248	49.58	53.16	49.58	53.44	0.28
238	49.55	53.15	49.55	53.44	0.29
233	50.13	53.06	50.13	53.36	0.3
218	49.34	53.12	49.34	53.41	0.29
198	49.38	53.07	49.38	53.36	0.29
176	49.62	53.05	49.62	53.34	0.29
157	49.71	53.03	49.71	53.32	0.29
105	49.51	52.83	49.51	53.1	0.27
56	49.39	52.75	49.39	53.03	0.28

The freeboard level will decrease from the existing 690 mm to 410 mm due to the increased peak flow.

The post development scenario has been tested against the climate change. The peak flow for the 1% AEP event has been increased for 20%. The flood levels showing pre-development with climate change and post development with climate change is provided in Table 4.

Table 4
Modelled Flood Levels – Pre Development With Climate Change and Post Development With Climate Change Allowance (1% AEP)

	Pre Development with Climate Change		Post Development With Climate Change		Difference in Flood Level
Cross Section Chainage	Invert Level	Water Level	Invert Level	Water Level.	
	(mOD)	(mOD)	(mOD)	(mOD)	(m)
474	50.13	53.99	50.13	54.01	0.02
417	49.66	53.95	49.66	53.97	0.02
366	49.74	53.82	49.74	53.85	0.03
346	49.96	53.81	49.96	53.83	0.02
322	49.8	53.75	49.8	53.78	0.03
305	49.72	53.75	49.72	53.78	0.03
297	49.62	53.71	49.62	53.74	0.03
286	49.83	53.72	49.83	53.75	0.03
276	50.00	53.68	50	53.72	0.04
274	49.94	53.66	49.94	53.7	0.04
267	49.78	53.62	49.78	53.65	0.03
BRIDGE US	49.78	53.38	49.78	53.41	0.03
BRIDGE DS	49.87	53.22	49.87	53.21	-0.01
257	49.86	53.38	N/A	N/A	N/A
254	49.85	53.43	49.85	53.39	-0.04
251	49.92	53.44	49.92	53.44	0
248	49.58	53.44	49.58	53.44	0
238	49.55	53.44	49.55	53.44	0
233	50.13	53.36	50.13	53.36	0
218	49.34	53.41	49.34	53.41	0
198	49.38	53.36	49.38	53.36	0
176	49.62	53.34	49.62	53.34	0
157	49.71	53.32	49.71	53.32	0
105	49.51	53.10	49.51	53.10	0
56	49.39	53.03	49.39	53.03	0

The modelled water levels will increase by up to 0.04 m just upstream of the bridge.

4.0 Conclusion

The proposed pedestrian bridge will be installed immediately downstream of the existing road bridge over the River Blackwater (Monaghan). The impact on the flood levels due to the installation of the bridge has been determined with a hydraulic model.

The installation of the pedestrian bridge will increase the modelled flood levels upstream of the bridge up to 30 mm. Downstream the new bridge does not result in a change in the modelled flood levels.

The soffit level of the existing bridge will reduce from 690 mm to 670 mm for the 1% AEP flood event.

Appendix A Preliminary Design Drawing

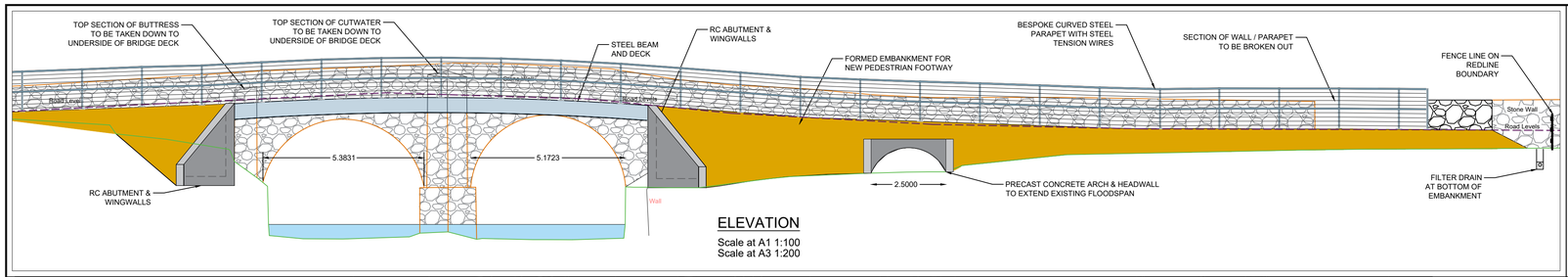
Ballyalbany Bridge, Co. Monaghan

OPW Section 50 Application

W.S. Atkins Ireland Ltd.

SLR Project No.: 501.65044.001

9 May 2023



ELEVATION

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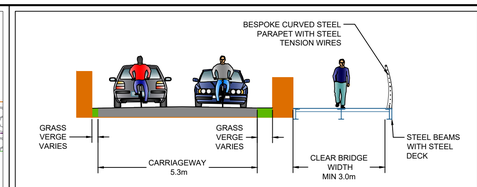
Scale at A3 1:200



CROSS SECTION A-A

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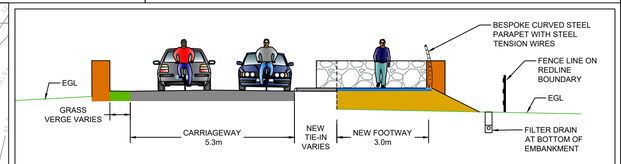


CROSS SECTION B-B

Scale at A1 1:100
Scale at A3 1:200

GENERAL NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE
2. ONLY WRITTEN DIMENSIONS SHALL BE USED. NO DIMENSIONS SHALL BE SCALED FROM THE DRAWINGS
3. ALL LEVELS ARE IN METRES AND ARE TO MALIN HEAD DATUM
4. ALL COORDINATES ARE IN METRES AND ARE TO IRISH TRANSVERSE MERCATOR
5. DRAWINGS ARE TO BE READ IN CONJUNCTION WITH THE SPECIFICATION

LEGEND:

- EXISTING CARRIAGEWAY
- EXISTING FOOTPATH
- NEW FOOTPATH
- PROPOSED TACTILE PAVING (UNCONTROLLED)
- EXISTING GRASS VERGE
- PROPOSED GRASS VERGE
- EXISTING WALL / PARAPET
- PROPOSED BRIDGE
- PROPOSED FOOTWAY
- PROPOSED EMBANKMENT
- AREA OF LANDTAKE
- PROPOSED PARAPET / FENCE

100 0 10

A1

DO NOT SCALE

File: 5213957-ATK-01-ZZ-SK-ST-900102.dwg
Date: Feb 22, 2023 - 9:15am Plotted by: gohare

Risk Level	X	
		Atkins Base Line - Low Risk
		Atkins Sensitive - Medium Risk
		Atkins Private - High Risk
		Client Critical - Already Marked

Comhairle Contae Mhuineacháin
Monaghan County Council

Rev	Description	By	Date	Chk'd	Rev'd	Auth
4	ISSUED FOR INFORMATION	GOH	21.02.23	GOH	RM	RM
3	ISSUED FOR INFORMATION	GOH	20.02.23	GOH	RM	RM
2	ISSUED FOR INFORMATION	GOH	17.02.23	GOH	RM	RM
1	ISSUED FOR INFORMATION	GOH	07.02.23	GOH	RM	RM
0	ISSUED FOR INFORMATION	GOH	04.11.22	GOH	RM	RM

ATKINS
Member of the SNC-Lavalin Group

Atkins House, 150-155 Airside Business Park, Swords, Co. Dublin
Tel (+353) 01 810 8000
Fax (+353) 01 810 8001

Unit 2B, 2200 Cork Airport Business Park, Cork
Tel (+353) 021 429 0300
Fax (+353) 021 429 0360

1st Floor Technology House Parkmore Technology Park, Galway
Tel (+353) 091 786 050
Fax (+353) 091 779 830

Client: MONAGHAN COUNTY COUNCIL

Project: ACTIVE TRAVEL INFRASTRUCTURE BALLYALBANEY & HORSESHOE BRIDGES

Purpose: FOR INFORMATION

Title: BALLYALBANEY BRIDGE OPTION 2 (STEEL BRIDGE & EMBANKMENTS)

Original Scale	Drawn	Checked	Reviewed	Authorised
1:250 at A1 1:500 at A3	GOH Date 04.11.22	GOH Date 04.11.22	RM Date 04.11.22	RM Date 04.11.22

Status	Drawing Number	Rev
I	5213957-ATK-01-ZZ-SK-C-900102	4

U:\5213957\6 Dwgs-Graphics\61 AutoCad\5213957-ATK-01-ZZ-SK-ST-900102.dwg

Appendix B Section 50 Application

Ballyalbany Bridge, Co. Monaghan

OPW Section 50 Application

W.S. Atkins Ireland Ltd.

SLR Project No.: 501.65044.001

9 May 2023

AF50 Rev1113

Construction, Replacement or Alteration of Bridges and Culverts

Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ballyalbany Pedestrian Bridge**	Structure Ref No.	**Pedestrian Bridge**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name:	**W.S. Atkins Ireland Ltd.**
Postal Address:	**Unit 150-155, Airside Business Park, Swords, Co. Dublin, K67 K5W4**
Contact Person:	**Robert Morgan (Project Manager)**
Phone:	**+353 1 8108165** Fax:
E-mail:	**robert.morgan@atkinsglobal.com**

Agent (Correspondence will issue to agent)	
Company or Organisation Name:	**SLR CONSULTING IRELAND**
Postal Address:	**D14 N2Y7**
Contact Person:	**Peter Glanville**
Phone:	**+353 1 296 4667** Fax:
E-mail:	**pglanville@slrconsulting.com**

Location and Parameters of crossing				
Watercourse:	**River Blackwater (Monaghan)**		Catchment:	**Lough Neagh and Lower Bann**
Address (Townland – County):		**Coolshannagh Road, Co. Monaghan**		
Grid Reference ITM	X:	**667444**	Y:	**835229**
Hydrometric Station(s) utilized (including reference number):		**03051 Faulkland**		
Area of Contributing Catchment:		**124.5** Km^2	Road Reference:	**Coolshannagh Road**
Design Flood Flow:	**73.67** m^3/s	Annual Exceedance Probability (AEP):		**1.0%**

Statement of Authenticity	
I hereby certify that the information contained in this application form, along with all appended supporting information, has been checked by me and that all statements are true and accurate.	
Name:	**Peter Glanville**
Company/Organisation:	**SLR CONSULTING IRELAND**
Signature:	**Peter Glanville**
Date:	**28/04/2023**

Application Check List	☐
COMPLETED APPLICATION FORM	☐
SUPPORTING HYDROLOGICAL AND HYDRAULIC INFORMATION	☐
PHOTOGRAPHS COVERING SITE OF ALL PROPOSED WORKS	☐
SCALED PLAN OF BRIDGE/CULVERT/APPROACH EARTHWORKS	☐
SCALED CROSS SECTION OF BRIDGE/CULVERT/APPROACH EARTHWORKS	☐
SCALED LONG SECTION OF CHANNEL THROUGH BRIDGE/CULVERT	☐
DETAILS OF RELEVANT EXISTING STRUCTURES	☐
COMPLETED STATEMENT OF AUTHENTICITY	☐
PLAN OF CATCHMENT AREA	☐
COPY OF NOTICE OF GRANT OF PLANNING PERMISSION WITH CONDITIONS *1	☐

For OPW use only	*Date of Receipt*				***Error! Not a valid bookmark self-reference.***			
OPW Drainage Maintenance Region	*East*	☒	*South East*	☐	*South West*	☐	*West*	☐
Correspondence Number	*OPW Register No:*							
	Consent Issued	☐						

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied			Factors Applied	
Method Used	Tick box if used or state other	Flow *2 (m^3/sec)	Type of Factor	Value Used
			Climate Change	1.2
6 – Variable Catchment characteristics			Irish Growth Curve	2.08
			Factor for Standard Error	N/A
3 – Variable Catchment Characteristics			Drained Channel	1
			Other	
IH 124	☐			
Gauged Flow	☐			
Unit Hydrograph	☐		Tidal ☐	
Other	☐		Comments	
Other	☐			

FSR ☐ FSU ☒ Other ☐

Comments:
Node 03_111_4, Qmed = 35.37 m^3/s

Hydraulic/Structure Details – **Pedestrian Bridge**

Description of Structure*3	**Single span steel structure, 3m wide, approach embankments will be constructed on either side to form new pedestrian links. Existing dry arch will be extended on floodplain**
Effective Conveyance Area *4	**32.49** m^2
Upstream Invert Level **49.90** mOD	Downstream Invert Level **49.90** mOD
Upstream Soffit Level **53.82** mOD	Downstream Soffit Level **53.82** mOD
Upstream Design Flood Level **53.15** mOD	Downstream Design Flood Level **53.00** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should

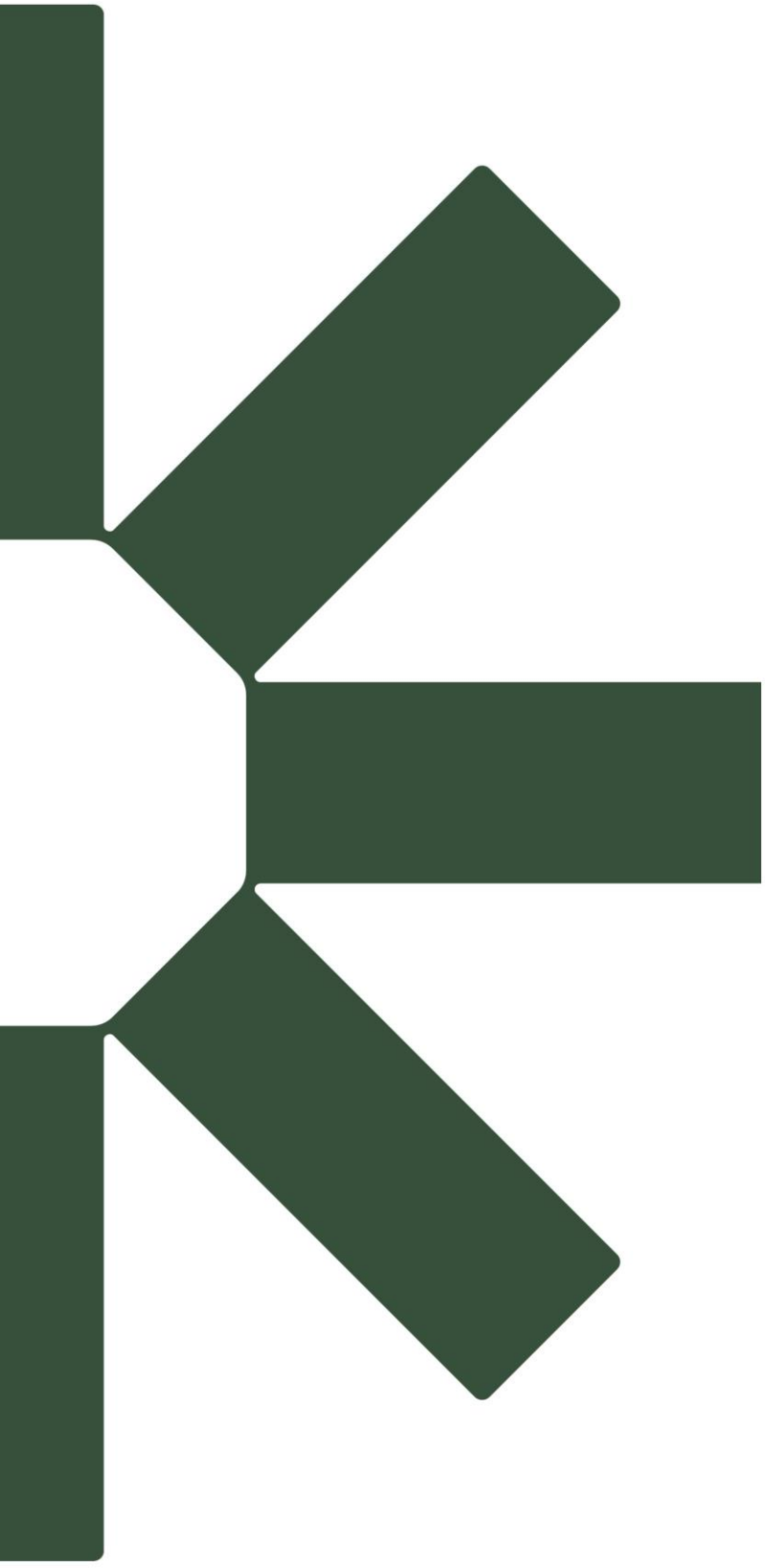
be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.

2.Flow is the estimated flow from the catchment, without any factors applied.

3.The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.

4. Effective conveyance area is from channel bed level to design flood level.

5.All levels must be given to Ordnance Datum, Malin Head.



Making Sustainability Happen

Atkins
WS Atkins Ireland Limited
Atkins House
150 Airside Business Park
Swords
Co. Dublin
K67 K5W4