



Glashaboy River

(Glanmire/Sallybrook) Drainage Scheme



Volume

1

(Main text)

Environmental Impact Statement

November 2016

Cork County Council and Office of
Public Works

**Glashaboy River
(Glanmire/Sallybrook) Drainage
Scheme**

Environmental Impact Statement

EIS

Issue | 11 November 2016

This report takes into account the particular
instructions and requirements of our client.

It is not intended for and should not be relied
upon by any third party and no responsibility
is undertaken to any third party.

Job number 234334-00




Ove Arup & Partners Ireland Ltd

Arup
One Albert Quay
Cork
T12 X8N6
Ireland
www.arup.com

ARUP

Document Verification

ARUP

		Glashaboy River (Glanmire/Sallybrook) Drainage Scheme		234334-00	
Document title		Environmental Impact Statement		File reference	
Document ref		EIS			
Revision	Date	Filename			
Issue	11 Nov 2016	Description	Issue 1		
			Prepared by	Checked by	Approved by
		Name	Fiona Patterson	Fiona Patterson	Clodagh O'Donovan
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
<div style="display: flex; justify-content: space-between;"> Issue Document Verification with Document <input checked="" type="checkbox"/> </div>					

	Page
Non-technical Summary	I
List of Figures	I
List of Appendices	IV
Glossary of Impacts	V
Preface	VII
List of Contributors	VIII

1	Introduction	1-1
	1.1 Project Overview	1-1
	1.2 Office of Public Works	1-4
	1.3 Cork County Council	1-4
	1.4 Environmental Impact Statement Methodology	1-4
	1.5 Difficulties encountered during the study	1-7
	1.6 Consultation	1-7
	1.7 References	1-8
2	Need for the Proposed Development and Alternatives Considered	2-1
	2.1 Introduction	2-1
	2.2 Need for proposed development	2-1
	2.3 Principal Design Process	2-3
	2.4 Constraints Study	2-3
	2.5 Options Assessment	2-4
3	Description of the Proposed Development	3-1
	3.1 Project Overview	3-1
	3.2 Main elements of the drainage scheme	3-1
	3.3 Drawing Index	3-2
	3.4 Sallybrook Industrial Estate	3-4
	3.5 Hazelwood	3-5
	3.6 Meadowbrook	3-8
	3.7 Butlerstown Stream	3-10
	3.8 Glenmore Stream	3-10
	3.9 O'Callaghan Park to Glanmire Bridge	3-12
	3.10 Downstream of Glanmire Bridge	3-13
	3.11 Future Channel Maintenance	3-13
4	Construction Activities	4-1

4.1	Introduction	4-1
4.2	Main elements of the drainage scheme	4-1
4.3	Outline Construction Methodology	4-2
4.4	Construction Site Layout	4-8
4.5	Duration, Phasing and Employment	4-10
4.6	In stream works	4-12
4.7	Environmental Construction Management	4-17
4.8	Materials Source and Transportation	4-22
4.9	Construction Safety	4-22
4.10	Construction Site Decommissioning	4-23
5	Planning and Policy	5-1
5.1	Introduction	5-1
5.2	EU Directives and Policy Guidance	5-1
5.3	Irish National Legislation, Policy and Guidance	5-2
5.4	Regional Policy Guidance	5-3
5.5	Local Policy Guidance	5-4
5.6	Conclusions	5-11
5.7	References	5-11
6	Biodiversity	6-1
6.1	Introduction	6-1
6.2	Ecological Baseline Surveys	6-3
6.3	Impact Assessment Methods	6-12
6.4	Receiving Environment	6-14
6.5	Evaluation of Ecological Receptors	6-61
6.6	Evaluation of Impacts	6-65
6.7	Impact Assessment	6-67
6.8	Mitigation Measures	6-80
6.9	Residual Impacts	6-91
6.10	References	6-91
7	Landscape and Visual	7-1
7.1	General Introduction	7-1
7.2	Methodology	7-1
7.3	Receiving Environment	7-4
7.4	Characteristics of the Proposed Development	7-12
7.5	Evaluation of Impacts	7-12
7.6	Cumulative Impacts	7-14
7.7	Mitigation Measures	7-14
7.8	Residual Impacts	7-16
7.9	References	7-17
8	Population and Human Health	8-1
8.1	Introduction	8-1

	8.2	Methodology	8-1
	8.3	Receiving Environment	8-1
	8.4	Characteristics of the Proposed Development	8-7
	8.5	Evaluation of Impacts	8-7
	8.6	Proposed Mitigation Measures	8-16
	8.7	Residual Impacts	8-17
	8.8	References	8-16
9		Noise and Vibration	9-1
	9.1	Introduction	9-1
	9.2	Methodology	9-1
	9.3	Receiving Environment	9-3
	9.4	Characteristics of the Proposed Development	9-3
	9.5	Evaluation of Impacts	9-5
	9.6	Proposed Mitigation Measures	9-6
	9.7	Residual Impacts	9-7
	9.8	References	9-7
10		Air Quality and Climate	10-1
	10.1	Introduction	10-1
	10.2	Methodology	10-1
	10.3	Receiving Environment	10-3
	10.4	Characteristics of the Proposed Development	10-4
	10.5	Evaluation of Impacts	10-4
	10.6	Proposed Mitigation Measures	10-6
	10.7	Residual Impacts	10-7
	10.8	References	10-7
11		Soils, Geology and Hydrogeology	11-1
	11.1	Introduction	11-1
	11.2	Methodology	11-1
	11.3	Receiving Environment	11-1
	11.4	Characteristics of the Proposed Development	11-7
	11.5	Evaluation of Impacts	11-9
	11.6	Proposed Mitigation Measures	11-11
	11.7	Residual Impacts	11-12
	11.8	References	11-12
12		Hydrology	12-1
	12.1	Introduction	12-1
	12.2	Methodology	12-1
	12.3	Receiving Environment	12-8
	12.4	Characteristics of the Proposed Development	12-9
	12.5	Evaluation of Impacts	12-9

	12.6	Mitigation Measures	12-12
	12.7	Residual Impacts	12-14
	12.8	References	12-14
13		Archaeology	13-1
	13.1	Introduction	13-1
	13.2	Methodology	13-2
	13.3	Receiving Environment	13-10
	13.4	Evaluation of Impacts	13-39
	13.5	Mitigation Measures	13-48
	13.6	Residual Impacts	13-50
	13.7	References	13-51
14		Roads and Traffic	14-1
	14.1	Introduction	14-1
	14.2	Methodology	14-1
	14.3	Receiving Environment	14-1
	14.4	Characteristics of the Proposed Development	14-4
	14.5	Evaluation of Impacts	14-5
	14.6	Mitigation Measures	14-9
	14.7	Residual Impacts	14-12
15		Material Assets	15-1
	15.1	Introduction	15-1
	15.2	Methodology	15-1
	15.3	Receiving Environment	15-2
	15.4	Characteristics of the Proposed Development	15-4
	15.5	Evaluation of Impacts	15-5
	15.6	Mitigation Measures	15-8
	15.7	Residual Impacts	15-9
	15.8	References	15-9
16		Cumulative Impacts	16-1
	16.1	Introduction	16-1
	16.2	Methodology	16-1
	16.3	Effects in Different Environmental Media	16-2
	16.4	Potential Interaction	16-4
	16.6	References	16-5
17		Summary of Impacts and Mitigation Measures	17-1
	17.1	Introduction	17-1

List of Figures

Figure 1.1	Site Location and Drainage Scheme Overview.
Figure 1.2	Site Location – Overview.
Figure 2.1	June 2012 Flood Event.
Figure 5.1	Glanmire Zoning Map from the Blarney Local Area Plan.
Figure 6.1	Natura 2000 Sites
Figure 6.2	Natura 2000 Sites and Proposed NHA (pNHAs) relevant to the Glashaboy Flood Scheme
Figure 6.3	Breeding bird surveys for Glashaboy including Terrestrial and Riparian Habitats
Figure 6.4:	Wintering bird surveys subsites Glashaboy 0L538 and Rathcoursey 0L483 (NPWS, 2014).
Figure 6.5:	Locations for electrofishing surveys in the upper Glashaboy Study Area.
Figure 6.7:	Fish species diversity recorded in the Glashaboy River and tributaries.
Figure 6.8	Otter Activity Signs
Figure 7.1	Entrance to Glanmire at Glashaboy River. Key vista from R639 across Glashaboy River at high tide, showing entrance to Glanmire and St Mary and All Saint's Church in background, and with existing stone wall boundary to river in foreground.
Figure 7.2:	Hazelwood Centre commercial complex at Riverstown, with trees and vegetation around a narrow section of the Glashaboy River corridor visible to the left of the photograph.
Figure 7.3:	Along Brooklodge Grove adjacent to Copper Valley Vue residential estate (behind trees to the right) with M8 overpass slightly visible in the back left.
Figure 7.1.0	Photomontage View Location Map (See Appendix 7.1)
Figure 7.1.1.1	View 1 from Hazelwood Centre, Riverstown (As Existing) (See Appendix 7.1)

Figure 7.1.1.2	View 1 from Hazelwood Centre, Riverstown (As Proposed) (See Appendix 7.1)
Figure 7.1.2.1	View 2 north of Hazelwood Centre near Basketball Court (As Existing) (See Appendix 7.1)
Figure 7.1.2.2	View 2 north of Hazelwood Centre near Basketball Court (As Proposed) (See Appendix 7.1)
Figure 7.1.3.1	View 3 from Meadowbrook Estate (As Existing) (See Appendix 7.1)
Figure 7.1.3.2	View 3 from Meadowbrook Estate (As Proposed) (See Appendix 7.1)
Figure 7.1.4.1	View 4 from L3010 approaching Riverstown Bridge (As Existing) (See Appendix 7.1)
Figure 7.1.4.2	View 4 from L3010 approaching Riverstown Bridge (As Proposed) (See Appendix 7.1)
Figure 7.1.5.1	View 5 from Brooklodge Grove (As Existing) (See Appendix 7.1)
Figure 7.1.5.2	View 5 from Brooklodge Grove (As Proposed) (See Appendix 7.1)
Figure 11.1	Bedrock geology of the Study Area. Source: Geological Society of Ireland
Figure 11.2	Aquifer classification of the Study Area. Source: Geological Society of Ireland
Figure 11.3	Aquifer vulnerability map. Source: Geological Survey of Ireland
Figure 11.4	Wells and boreholes with location accuracy. Source: Geological Survey of Ireland
Figure 12.1	Hydrological Features
Figure 12.3	Areas of proposed works
Figure 12.4	Envision Maps Risk Scores
Figure 12.5	Extract from the Glashaboy Drainage Scheme Fluvial Flood Map
Figure 12.6	Extract from the National Flood Hazard Mapping reports.
Figure 12.67	Extract from the Pluvial flood Map at Glanmire
Figure 13.1a	Archaeological sites included in the RMP and SMR database within the northern end of the study area
Figure 13.1b	Archaeological sites included in the RMP and SMR database within the southern end of the study area

- Figure 13.2: Extract from Grand Jury map of Cork (1811) showing the study area.
- Figure 13.3a: Extract from OS 6-inch map (1842) Glanmire
- Figure 13.3b: Extract from OS 6-inch map (1842) Poulacurry South.
- Figure 13.3c: Extract from OS 6-inch map (1842) Riverstown.
- Figure 13.3d: Extract from OS 6-inch map (1842) Sallybrook village.
- Figure 13.3e: Extract from OS 6-inch map (1842) Sallybrook Paper Mill.
- Figure 13.4a: Extract from OS 25-inch map (1902) Glanmire.
- Figure 13.4b: Extract from OS 25-inch map (1902) Riverstown.
- Figure 13.4c: Extract from OS 25-inch map (1902) Sallybrook village.
- Figure 13.4d: Extract from OS 25-inch map (1902) Sallybrook Mill.
- Figure 13.5a: Extract from OS 6-inch map (1934) Sallybrook village.
- Figure 13.5b: Extract from OS 6-inch map (1934) Sallybrook Mill.
- Figure 13.5c: Extract from OS 6-inch map (1934) Riverstown.
- Figure 14.1: Existing Road Network and Glashaboy River Route
- Figure 14.2: Existing Road Network and Glashaboy River Route.
- Figure 15.1: Possible location of Construction Compounds.

List of Appendices

- Appendix 3.1 Exhibition Drawings
- Appendix 3.2 Tree Removal Report
- Appendix 4.1 Outline Japanese Knotweed Management Strategy
- Appendix 6.1 Habitat Maps
- Appendix 6.2 Geomorphology Report
- Appendix 7.1 Photomontages (See Figures for Schedule of Figures)
- Appendix 7.2 Observations and Objectives from Cork Development Plan (2014) and Blarney Local Area Plan (2015)
- Appendix 13.1 Published information in Archaeological Inventory of Co Cork (Power 1994) and published files of the Archaeological Survey of Ireland
- Appendix 13.2 Wading and Metal Detection Survey at Glenmore Stream, Ballinglanna & Riverstown Unnamed channel at Sallybrook House, Riverstown and Bleach Hill Stream, Sarsfieldscourt, Glanmire, Co Cork
- Appendix 13.3 Dive Survey of the Glashaboy River
- Appendix 13.4 Glashaboy River Site Inspection – Plates 1-53

Glossary of Impacts

Reference is made in this report to environmental impacts of various qualities, significance, duration and types. These follow the relevant Environmental Protection Agency guidance on the subject.

Quality of Impacts

Positive Impact

A change which improves the quality of the environment (for example, by increasing species diversity; or the improving reproductive capacity of an eco-system, or removing nuisances or improving amenities).

Neutral Impact

A change which does not affect the quality of the environment.

Negative Impact

A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an eco-system; or damaging health *or* property by causing nuisance).

Significance of Impacts

Imperceptible Impact

An impact capable of measurement, but without noticeable consequences.

Slight Impact

An impact which causes noticeable changes in the character of the environment without affecting its sensitivities.

Moderate Impact

An impact that alters the character of the environment in a manner that is consistent with existing and emerging trends.

Significant Impact

An impact which, by its character, magnitude, duration or intensity, alters a sensitive aspect of the environment.

Profound Impact

An impact which obliterates sensitive characteristics.

Duration of Impacts

Temporary Impact

Impact lasting for one year or less.

Short-term Impact

Impact lasting one to seven years.

Medium-term Impact

Impact lasting seven to fifteen years.

Long-term Impact

Impact lasting fifteen to sixty years.

Permanent Impact

Impact lasting over sixty years.

Types of Impacts*Cumulative Impact*

The addition of many small impacts to create one larger, more significant, impact.

'Do Nothing' Impact

The environment as it would be in the future, should no development of any kind be carried out.

Indeterminable Impact

When the full consequences of a change in the environment cannot be described.

Irreversible Impact

When the character, distinctiveness, diversity or reproductive capacity of an environment is permanently lost.

Residual Impact

The degree of environmental change that will occur *after* the proposed mitigation measures have taken effect.

Synergistic Impact

Where the resultant impact is of greater significance than the sum of its constituents.

'Worst Case' Impact

The impacts arising from a development in the case where mitigation measures substantially fail.

Preface

This Environmental Impact Statement (EIS) for the purposed Glashaboy River (Glanmire/Sallybrook) Drainage Scheme consists of two volumes plus a Non-Technical Summary. A Natura Impact Statement is also provided:

Non-Technical Summary

Volume 1 – EIS (Main Text)

Volume 2 – Appendices

Volume 3 – Natura Impact Statement

List of Contributors

This Environmental Impact Statement (EIS) is based on an appraisal of the environmental effects of the proposed Glashaboy River (Glanmire/Sallybrook) Drainage Scheme undertaken by Arup and its sub-consultants. The Arup study team drew on in-house resources including environmental sciences, traffic engineering and graphics.

The following specialists, working in accordance with specifications prepared by Arup, supplemented these resources:

- Brady Shipman Martin – Landscape and Visual impact assessment, including preparation of the photomontages;
- Lane Purcell Archaeology – Archaeology, Architectural and Cultural Heritage assessment;
- JBA – Biodiversity and Natura Impact Statement, hydrological engineering and hydraulics

1 Introduction

1.1 Project Overview

1.1.1 Introduction

Cork County Council in conjunction with the Office of Public Works (OPW) intends to undertake engineering works along the Glashaboy River with the objective of minimising the risk of flooding in the Glanmire/Sallybrook area.

The proposed Glashaboy River (Glanmire/Sallybrook) Drainage Scheme will include the construction of direct flood defences, i.e. flood walls, and significant conveyance improvements including channel widening, channel deepening and the introduction of culverts. Numerous significant flood events have occurred in the Glanmire/Sallybrook area, necessitating the proposal to introduce flood defence works.

Flood defences and conveyance improvements are proposed at a number of locations in the Glanmire/Sallybrook area. The overall location of the proposed scheme is presented in **Figure 1.1** Site Location and Drainage Scheme Overview and **Figure 1.2** Site Location Overview. The details of the proposed scheme are presented in the Exhibition Drawings. Refer to **Drawings no GR101 – GR601**.

This chapter describes the methodology used to prepare this EIS and the consultation process that has been carried out to date. For ease of reference, the Glashaboy River (Glanmire/Sallybrook) Drainage Scheme is referred to as “proposed scheme” in this chapter and throughout the EIS.

This EIS will be put on public display in accordance with the Arterial Drainage Act (1945) and Amendment Act (1995), in Glanmire Public Library and in Cork County Council’s Regional office in Ballinglanna for a period of four weeks. A full copy of the EIS (including the Non-Technical Summary) and the scheme drawings will be available online on the scheme website (www.glashaboyfrs.ie). Copies of the EIS on CD will also be available to purchase from the OPW.

1.1.2 Study Area

The study area for the proposed scheme is located within the Glashaboy River Catchment. Specifically, the drainage scheme is proposed to be implemented along the Glashaboy River in Glanmire and Sallybrook, County Cork. Works will take place in six separate at-risk areas along the Glashaboy River. The northern boundary of the proposed site area is at Sallybrook Industrial Estate. The southern boundary extends as far as downstream of the Glanmire Bridge. Works will be required along a total of 4.76 km of the Glashaboy River. Works are also required along some of the tributaries of the Glashaboy, within the scheme area. Refer to **Drawing No GR_103 Channel Codes** which shows the extent of the proposed development along the Glashaboy River and its tributaries.

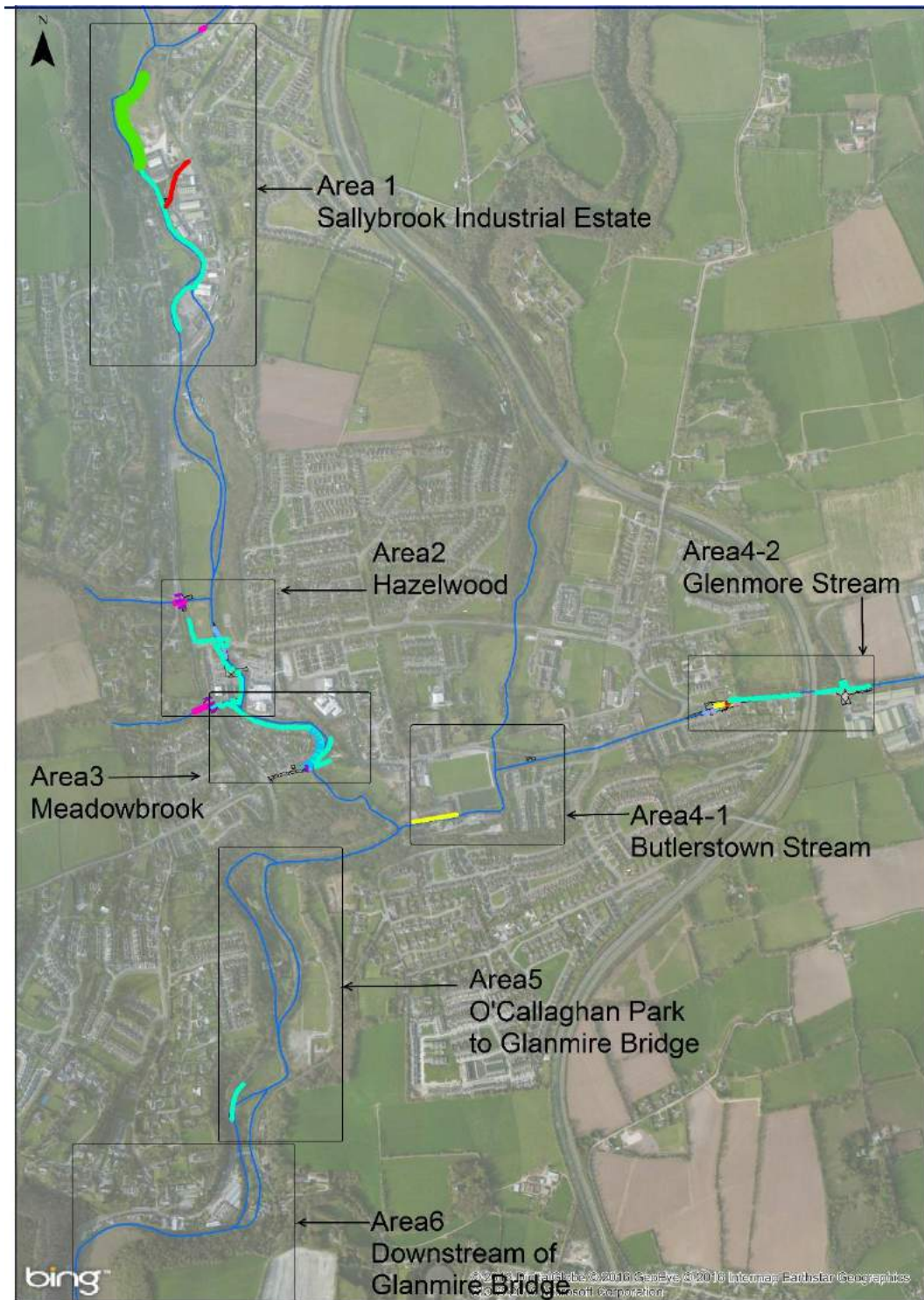


Figure 1.1: Site Location and Drainage Scheme Overview



1.2 Office of Public Works

The OPW is the lead agency for flood risk management in Ireland. Implementation of the EU Floods Directive and Government policy on the management of flood risk in Ireland, in conjunction with statutory obligations under the Arterial Drainage Acts 1945 - 1995, form one of the three core services of the OPW. Other services include Buildings and Architecture, and Heritage Services.

The OPW has statutory responsibility for the maintenance of completed arterial drainage schemes and completed flood relief schemes comprising over 11,500km of channel, 730km of embankments, some 18,500 bridges and 750 ancillary structures such as sluice gates, pumping stations and tidal barrages. Annually, approximately 2,000km of channels are maintained by the OPW, with circa 200 structures repaired.

The OPW in the South Region is working closely with Cork City and County Councils to bring forward measures to address the severe flooding that occurred in County Cork in November and December 2009, 2012 and more recently in the winter of 2015-2016.

1.3 Cork County Council

Cork County Council is acting as agents for the OPW to develop the drainage scheme. The scheme is located within the functional area of Cork County Council.

1.4 Environmental Impact Statement Methodology

1.4.1 Purpose and Screening

The prescribed classes of development and thresholds that trigger a mandatory Environmental Impact Assessment (EIA) are set out in Schedule 5 of the Planning and Development Regulations, 2001, as amended.

A review of the classes of development (requiring EIA) was carried out to determine whether the proposed development falls into any of the development classes contained therein.

The most relevant criterion is Class 10 of Part 2 of Schedule 5 which states:

10. *Infrastructure projects*

- (f) (ii) *Canalisation and flood relief works, where the immediate contributing sub-catchment of the proposed works (i.e. the difference between the contributing catchments at the upper and lower extent of the works) would exceed 1,000 hectares or where more than 20 hectares of wetland would be affected or where the length of river channel on which works are proposed would be greater than 2 kilometres.*

Section 10 f(ii) of the Planning and Development Regulations 2001, as amended, was subsequently amended by SI 454 of 2011 Planning and Development (Amendment) (No. 2) Regulations 2011.

(e) by the substitution of 100 for 1000 and 2 for 20 in 10(f)(ii),

Therefore an EIS is required if:

(f) (ii) Canalisation and flood relief works, where the immediate contributing sub-catchment of the proposed works (i.e. the difference between the contributing catchments at the upper and lower extent of the works) would exceed 100 hectares or where more than 2 hectares of wetland would be affected or where the length of river channel on which works are proposed would be greater than 2 kilometres.

In the case of the proposed Glashaboy River (Glanmire/Sallybrook) Drainage Scheme, the length of river channel on which works are proposed is greater than 2 kilometres and the contributing sub-catchment of the proposed works exceeds 100 hectares. An EIS of the proposed scheme is therefore required to be prepared and submitted to the competent authority to allow an EIA of the scheme to be undertaken.

1.4.2 Statutory Requirements for the Contents of an EIS

This EIS has been prepared in accordance with the relevant provisions set out in the Planning and Development Regulations 2001, as amended ('the Regulations'), and the provisions of the codified Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment. Annex IV to the EIA Directive and Schedule 6 to the Regulations specify the information to be contained in an EIS.

Thus, pursuant to the provisions of Article 5(1) of the EIA Directive, the information specified in Annex IV is to be provided, in as much as the information is relevant to a given stage of the consent procedure and to the specific characteristics of a particular project or type of project and of the environmental features likely to be affected, having regard to current knowledge and methods of assessment.

This EIS has been prepared in compliance with the requirements of Directive 2011/92/EU and the Regulations. Moreover, although the requirements of Directive 2014/52/EU have not yet been transposed into Irish law, this EIS has had regard to the provisions of Directive 2014/52/EU.

In addition, a Natura Impact Statement (NIS) has been prepared so as to enable the competent authority to carry out the Stage One and Stage Two assessments required pursuant to Article 6(3) of the Habitats Directive.

1.4.3 Structure of Environmental Impact Statement

This Environmental Impact Statement (EIS) has been prepared to provide information on the likely significant effects of the project on the environment and, in particular:

1. A description of the project comprising information on the site, design, size and other relevant features of the project;
2. A description of the features of the project and/or measures envisaged in order to avoid or reduce and, if possible, offset likely significant adverse effects on the environment;
3. The data required to identify and assess the main effects which the project is likely to have on the environment;
4. An outline of the main alternatives studied by the developer, which are relevant to the project and its specific characteristics, and an indication of the main reasons for the options chosen, taking into account the effects of the project on the environment; and
5. A non-technical summary of the information referred to in the above four points.

The EIS has been prepared on behalf of Cork County Council and the Office of Public Works by environmental specialists under the supervision of Arup.

The format used in the EIS is the grouped format, in which each topic is addressed in a separate section. This is designed to allow readers to access the issues of interest to them as easily as possible. However there is overlap of some topics. For example, effects on human beings are addressed in a number of chapters including Landscape and Visual Assessment, Air Quality and Climate Assessment, and Noise and Vibration, as well as Human Beings. Issues not directly addressed in individual chapters and interactions between environmental issues are described in **Chapter 17 Potential Cumulative & Other Impacts and Interactions** of this EIS.

The EIS comprises three main sections contained within one volume as follows:

- Non-Technical Summary;
- Environmental Impact Statement (Main Text); and
- Appendices.

1.4.4 EPA Guidelines and Other Guidelines

This EIS has been prepared with due regard to the guidelines on the preparation of environmental impact statements published by the EPA. These are contained in Advice Notes on Current Practice (in the preparation of Environmental Impact Statements) (2003), and Guidelines on the Information to be contained in Environmental Impact Statements (2002). Moreover, the EIS has been prepared having had due regard to:

- Revised Guidelines on the Information to be Contained in Environmental Impact Statements (Environmental Protection Agency, draft September 2015);
- Advice Notes for Preparing Environmental Impact Statements Draft September 2015;
- European Union (2013) Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment;
- European Commission (2012) Interpretation suggested by the Commission as regards the application of the EIA Directive to ancillary/associated works;
- European Commission (2006) Clarification of the application of Article 2(3) of the EIA Directive; and
- European Commission (1999) Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions.

1.5 Difficulties encountered during the study

No particular difficulties were encountered during the preparation of this EIS.

1.6 Consultation

A number of Public Information Days (PID) have been held for the proposed scheme where members of the public were invited to attend and make their views and comments known to the project's design team.

Advertisements were published each time in advance of these, both on the scheme website and in local newspapers and leaflet drops to local residents and businesses were carried out. The project team used a series of posters and other visual aids, to give an overview of the scheme, the planning history, and the legislative and policy context; and to demonstrate how the scheme is of benefit to the immediate and wider communities of Glanmire and Cork itself.

The first Public Information Day was held in Glanmire GAA Club on Tuesday 25th February 2014. The results of the environmental constraints study were presented at this PID. The second Public Information Day was held in Sarsfield GAA Hall on Friday 20th February 2015. The emerging preferred options were presented at this PID. All details of the PID information material can be downloaded from www.glashaboyfrs.ie

Presentations were made to elected members of Cork County Council which included the history of flooding in the Glanmire area, and the need for the scheme to be implemented. The programme for the scheme delivery was outlined, and the public was made aware of the key public consultation dates. Details of localised flooding issues were explained, as well as the emerging preferred options to address these. The project team remained available for all questions from the public for the duration of the consultation period.

The scheme website (www.glashaboyfrs.ie), is updated regularly to provide ongoing information relating to the project and its development.

The following groups and organisations were consulted in the preparation of this Environmental Impact Statement:

- Inland Fisheries Ireland;
- Cork County Council; and
- National Monuments Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.

On-site consultation was carried out by the design team at any opportunity which presented when visiting the catchment. Local residents were engaged in conversation to acquire any local knowledge that they might have and their experiences of flooding in the vicinity.

The residents/owners of a number of properties in the area were visited to discuss their experiences of flooding on their property and to outline the preferred option which is being pursued at their respective locations.

Meadowbrook residents have been consulted on a number of occasions with a presentation made to them on 6th of October 2016 to inform them of the proposed works which influence Meadowbrook estate. The residents provided useful feedback on their concerns regarding drainage connectivity.

1.7 References

Environmental Protection Agency (2003) Advice Notes on Current Practice in the Preparation of Environmental Impact Statements.

Environmental Protection Agency (2002) Guidelines on the Information to be contained in Environmental Impact Statements.

Revised Guidelines on the Information to be Contained in Environmental Impact Statements (Environmental Protection Agency, draft September 2015).

Advice Notes for Preparing Environmental Impact Statements Draft September 2015.

European Union (2013) Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment.

European Commission (2012) Interpretation suggested by the Commission as regards the application of the EIA Directive to ancillary/associated works.

European Commission (2006) Clarification of the application of Article 2(3) of the EIA Directive.

European Commission (1999) Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions.

2 Need for the Proposed Development and Alternatives Considered

2.1 Introduction

This chapter demonstrates the specific need for the proposed development. This chapter also addresses the main alternatives considered.

2.2 Need for the proposed development

The OPW in partnership with Cork City and Cork County Councils carried out a Catchment Flood Risk Assessment and Management (CFRAM) Study for the Lee Catchment. The Draft Catchment Flood Risk Management Plan (CFRAM) for the Lee Catchment was published in February 2010. The CFRAM included the following for the Glashaboy sub-catchment;

- Fluvial and tidal forecasting system, combined with a targeted public awareness and education campaign and individual property protection / flood proofing; and
- Permanent flood walls/embankments (to manage fluvial risk).

There is a history of flooding in the Glashaboy River catchment. In recent years, there was a significant flood event in June 2012 in the Glanmire/Sallybrook area which occurred following extremely heavy rainfall. The June 2012 flooding was the highest recorded flooding event. This significant flooding resulted in considerable damage to residential and commercial properties throughout the area. Refer to **Figure 2.1** below.

Flooding also recently occurred during the winter of 2015. The cumulative rainfall that fell in the Cork area in December 2015 was unprecedented, being circa three times the long term average and having an estimated return period of circa 1 in 200 years. This meant that the catchment was extremely saturated in advance of the flood event of 29th December 2015. This led to extremely high groundwater levels and a high rate of runoff from the surrounding lands. As a result there was a considerable amount of flooding experienced in the Glanmire/Sallybrook area and in particular in the Meadowbrook estate, The Grove, Copper Valley View and Hazelwood shopping centre. Like in 2012, this resulted in considerable damage to properties in the area.

Flood events are summarised in the following **Table 2.1**.

Table 2.1: Flood Events, Glashaboy River catchment

Flood Event	Mechanism
Dec 2015/Jan 2016	Fluvial/ pluvial and drainage system issues
June 2012	Fluvial
November 2009	Fluvial
October 2004	Tidal
November 2000	Fluvial
1968/1969	Fluvial
1961	Tidal

In the future, the risk of flooding may increase. Future changes which have the potential to affect the risk of flooding include:

- Climate change resulting in higher rainfall and higher tide levels;
- Geomorphological processes, such as sedimentation transport, which affects the area of conveyance of the river channel, and erosion;
- Development within the catchment of the Glashaboy River and its tributaries, which does not conform to the principles of sustainable drainage, and which adversely affects the response of the catchment to rainfall; and
- Changes in land use, including forestation and land drainage.

As a result of the findings of the CFRAM study and the recent flood events in the area, Cork County Council, acting as Agents for the OPW commissioned Arup in association with JBA Consulting to develop a Drainage Scheme for Glanmire/Sallybrook. The purpose of the scheme was to assess and develop a viable, cost effective and sustainable drainage scheme to alleviate flooding in the Glanmire and Sallybrook area. The drainage scheme design presented in this EIS is as a result of this detailed analysis.

The scheme will be designed to provide protection to properties in the study area from the 1 in 100 year fluvial / 1 in 200 year tidal flood events. The overall scheme will consist of:

- Flood alleviation measures in the form of hard defences along the Glashaboy River to provide the required standard of protection;
- Alterations to the geometry of existing bridge structure located along the Glashaboy River at Hazelwood shopping centre in order to prevent afflux at constricted areas within the channel; and
- Other measures to improve conveyance through the Glashaboy River and its tributaries.



Figure 2.1: June 2012 Flood Event

2.3 Scheme Design process

The development of the proposed scheme up to this stage was a process requiring an extensive assessment of different options for flood relief scheme design. The process included the assessment of the viability of all potential flood alleviation measures for each of the segments of the study area. In order to arrive at the final scheme design, a number of stages were followed. These required co-ordinated collaboration from the engineering and environmental teams. The design process required the following assessments:

- Constraints study;
- Hydrology study;
- Hydraulic Modelling;
- Site Investigations;
- Flood Risk Assessment Report;
- Options Assessment Report;
- Information required for Appropriate Assessment Screening and Natura Impact Statement; and
- Environmental Impact Statement.

Input was required from each of the preliminary reports in order to finalise the design for the scheme that is being considered as part of this EIS. A summary of the constraints study and options assessment is provided below as an overview in describing how alternatives were considered during the process.

2.4 Constraints Study

A constraints study was carried out during 2014 and 2015 in order to identify the main constraints that could either be affected by possible flood alleviation measures or issues that could constrain the viability or design of these measures. Constraints were documented under the following headings:

- Human Beings;
- Ecology (Aquatic and Terrestrial);
- Water;
- Soils and Geology;
- Archaeology, Architectural and Cultural Heritage;
- Landscape;
- Noise, Air Quality and Climate; and
- Material Assets.

Information for the constraints study was gathered with regard to the likely environmental impacts of the proposed scheme and statutory requirements for EIA. In addition, consultation was carried out with statutory and non-statutory consultees. A public information day was carried out during this period in order to gather information from the public about their experiences of flooding in the study area along with their thoughts on possible solutions to the flooding problem and their preferences in this regard.

The constraints study can be downloaded at www.glashaboyfrs.ie.

2.5 Options Assessment

2.5.1 Introduction

The process for the selection of the preferred flood relief options is outlined below:

- An initial screening of a long list of possible flood risk management measures against a predetermined set of criteria, was carried out to determine their potential viability;
- A technical assessment of potentially viable flood risk management measures was undertaken;
- Potential flood relief options were developed using combinations of flood risk management measures which were determined to be technically viable.

These flood relief options were then subjected to multi-criteria assessments, allowing a preferred flood relief option to be selected.

The options assessment report can be downloaded at www.glashaboyfrs.ie and a summary is provided below.

The initial screening of measures was assessed in terms of:

- Applicability to the study area (including technical feasibility, constructability, and Health and Safety);
- Economic viability;

- Environmental;
- Social; and
- Cultural.

2.5.2 Non-viable flood risk management measures

Further to the initial screening, a number of flood risk management measures were identified as being non-viable and were not carried forward for further technical assessment. This included:

- Do Nothing;
- Relocation;
- Non-structural Measures
 - SUDS;
 - Planning Control / Land Use Management;
 - Public Awareness.

The '**Do Nothing**' scenario is defined as the option involving no future expenditure on flood defences or maintenance of existing defences/channels etc. The implication is that the existing risk of flooding persists in the study area. This is not considered to be a sustainable option as it fails to meet the needs of the residents and business owners in Glanmire/Sallybrook and has therefore been ruled out at the initial screening stage.

Relocation involves moving the occupiers of properties at risk to new properties constructed outside of the area at risk. Due to the large number of properties at risk in the area, property relocation has been ruled out at the initial screening stage.

Non-structural measures, such as land use management within a catchment, affect the way in which rainfall is directed to watercourses. Hard surfaces reduce the amount of rainfall that can infiltrate to ground water, and intensive drainage schemes will increase the speed of runoff, giving rise to earlier and higher flood peaks. River restoration is about mitigating the negative impacts that past changes in catchment management practices, such as land drainage or deforestation, may have had on river systems. Modifications to land drainage systems within the catchment can reduce the rate at which rainfall is conveyed into the river channel and thus help to reduce peak flows. This option would take a long time to implement and would not reduce the flood risk to an acceptable level and therefore has not been carried forward for further technical assessment. The proposed scheme would not however, prevent such methods being implemented in the future.

2.5.3 Potentially viable flood risk management measures

Further to the initial screening, the following flood risk management measures were identified as potentially viable measures for the Glashaboy catchment and were taken forward for further technical assessment:

- Flood forecasting/flood warning;
- Upstream Storage;
- Direct Flood Defences;
- Sediment/Debris Control;
- Individual Property protection;
- Conveyance Improvements; and
- Pumping.

2.5.4 Development of shortlisted options

Following technical analysis of the flood risk management measures listed above, a number of options were carried forward for further development as follows (Refer to **Figure 1.1** for area locations).

Area 1: Sallybrook Industrial Estate

Option 1A – Direct defences with conveyance improvements on Bleach Hill Stream (only option considered)

Area 2: Hazelwood Shopping Centre

Option 2A – Direct defences (with conveyance improvements on Cois na Gleann Stream);

Option 2B – Conveyance Improvements (Dredging);

Option 2C – Combination of direct defences and conveyance improvements – Arrangement 1 - Raising and widening of Hazelwood Avenue Bridge and upgrade of the Cois na Gleann culvert;

Option 2D – Combination of direct defences and conveyance improvements – Arrangement 2 – New flood relief culvert at Hazelwood Avenue Bridge and upgrade of the Cois na Gleann culvert;

Option 2E – Combination of direct defences and conveyance improvements – Arrangement 3 – New flood relief culvert at Hazelwood Avenue Bridge, upgrade of the Cois na Gleann culvert and replacement of existing Hazelwood Shopping Centre road bridge with elevated footbridge; and

Option 2F – Combination of direct defences and conveyance improvements – Arrangement 4 – New flood relief culvert at Hazelwood Avenue Bridge, upgrade of the Cois na Gleann culvert and replacement of existing Hazelwood Shopping Centre road bridge with new raised bridge.

Area 3: Meadowbrook Housing Estate

Option 3A – Direct defences (with conveyance improvements on Springmount Stream) (only option considered).

Area 4: Butlerstown / Glenmore

Option 4.1A – Butlerstown Stream - Conveyance improvements.

Option 4.1B – Butlerstown Stream - Direct defences and conveyance improvements.

Option 4.2A – Glenmore - Overland flow management.

Option 4.2B – Glenmore - Culvert replacements and conveyance improvements.

Area 5: O’Callaghan Park to Glanmire Bridge

Option 5A – Direct defences and local property protection (only option considered).

Area 6: Downstream of Glanmire Bridge

Option 6A – Direct defences and local property protection (only option considered).

For the purposes of the initial development and assessment of options, a fixed freeboard of 500mm on all direct defences was assumed. This assumption was tested by undertaking a more detailed freeboard analysis on the preferred option once it is selected.

2.5.5 Multi-Criteria assessment of the shortlisted options

The effectiveness of each of the viable options can be measured in terms of how it achieves a set of flood risk management objectives. A detailed multi-criteria analysis (MCA) of the shortlisted options was carried out to evaluate the performance of each option in terms of predefined objectives. As part of this process, each objective was given a global and local weighting. Each option was then scored relative to the present day situation (baseline condition), based on how well they met the objectives. The output from this stage was a total weighted score for each option. The option with the highest score is deemed to be most desirable, subject to professional judgement exercised by the project’s designers/ steering group, as appropriate.

The determination of suitable local weightings and scorings for each of the criteria were determined through a workshop forum held with key representatives of OPW, Cork City Council, Cork County Council, Arup and JBA Consulting.

This ensured that the combined expertise and experience of all relevant specialists and disciplines were brought to bear in a transparent fashion in the scoring of each option.

The flood risk management objectives were categorised as follows:

- Technical;
- Economic;
- Social; and

- Environmental.

The categories were sub-divided into objectives. Each objective was weighted to reflect their importance and/or sensitivity, and to ensure that the objectives most relevant to the location under consideration were given priority in the decision-making process.

Following the MCA assessment, the preferred options were brought forward for further development.

Significant public consultation was carried out throughout the project and has been a vitally important part in the evolution of the proposed scheme and the ultimate decision on a preferred option. This consultation consisted of two public consultation days both at early Constraints Stage and at Emerging Preferred Options Stage as well as statutory consultation with all relevant stakeholders, extensive face to face landowner consultation and active and regular formal residents meetings. The feedback from this consultation process was carefully considered and taken on board in finalising the scheme, and it is noteworthy that this feedback resulted in some significant changes from the emerging preferred option initially exhibited in March 2015. Table 2.2 below shows some of the design changes that were made after this consultation process.

Table 2.2 below shows some of the design changes that were made after this consultation process.

Table 2.2: Examples of design changes made to the scheme through the consultation process as part of the Scheme

Location	Preferred Options Prior to Public Information Day	Preferred Options Post Consultation
Grandon's car sales at Sallybrook (Area 1, Figure 1.1)	Formalise existing embankment	Existing embankment to be replaced by flood walls.
Hazelwood Centre (Area 2, Figure 1.1)	Reconstruction of existing embankment.	Existing embankment to be removed and replaced with reinforced concrete flood defence wall.
Butlerstown Stream, north of Sarsfield GAA (Area 4-1, Figure 1.1)	Flood defence embankment	Removed from design.
Brooklodge Grove/Copper Valley, Glenmore Stream (Area 4-2, Figure 1.1)	New embankment on left bank, existing walls to be repaired, some walls to be replaced with railing	No embankments to be built, reinforced concrete flood defence wall, channel to be widened and deepened.

The options were also holistically reviewed by the project team as they were developed, and relevant issues were discussed with the Steering Group.

A final decision on the preferred option was made based on a holistic evaluation of the following key aspects:

- Findings of Cost Benefit Analysis;
- Findings of Multi-Criteria Analysis;
- Consideration of the key core messages which arose during the stakeholder consultation process;
- Consideration of Key Risks;
- Consideration of Climate Change Adaptability; and
- Combined professional judgement of the steering group members.

The preferred options were further developed during 2016.

The main aspects of the proposed drainage scheme comprise construction works entailing the following:

- Replacement of a number of existing culverts;
- Replacement of Hazelwood Shopping Centre bridge with a larger vehicular bridge;
- 1 new flood relief channel and culvert at Hazelwood Avenue;
- Replacement of existing flood defence walls and construction of new flood defence walls;
- Modification to an existing earthen flood defence embankment and construction of a new earthen flood defence embankment;
- New surface water pumping stations and foul pumping station;
- Localised in-channel conveyance improvements at culvert/bridge structures;
- Provision of civil works such as road/footpath regrading at a number of locations;
- Protecting drainage outlets along the line of flood defence works with non-return flap valves;
- Non – flood defence retaining walls; and
- Flow control structure on a millrace.

The final design is now presented in the exhibition drawings and is described in **Chapter 3 Description of the Proposed Development.**

3 Description of the Proposed Development

3.1 Project Overview

As discussed in **Chapter 1 Introduction**, Cork County Council in conjunction with the Office of Public Works (OPW) intends to undertake engineering works along the Glashaboy River with the objective of minimising the risk of flooding in the Glanmire/Sallybrook area.

The proposed Glashaboy River (Glanmire/Sallybrook) Drainage Scheme will include the construction of direct flood defences, i.e. flood walls, and significant conveyance improvements including channel widening, channel deepening and the introduction of culverts.

Flood defences and conveyance improvements are proposed at a number of locations in the Glanmire/Sallybrook area. The overall location of the proposed scheme is presented in **Figure 1.1 Site Location and Drainage Scheme Overview** and **Figure 1.2 Site Location Overview**. The details of the proposed scheme are presented in the Exhibition Drawings. Refer to **Drawings no GR101 – GR601**.

This chapter describes the main aspects of proposed development in detail.

3.2 Main elements of the drainage scheme

The main aspects of the drainage scheme comprise construction works entailing the following:

- Replacement of a number of existing culverts;
- Replacement of Hazelwood Shopping Centre bridge with a larger vehicular bridge;
- 1 new flood relief channel and culvert at Hazelwood Avenue;
- Replacement of existing flood defence walls and construction of new flood defence walls;
- Modification to an existing earthen flood defence embankment and construction of a new earthen flood defence embankment;
- New surface water pumping stations and foul pumping station;
- Localised in-channel conveyance improvements at culvert/bridge structures;
- Provision of civil works such as road/footpath re-grading at a number of locations;
- Protecting drainage outlets along the line of flood defence works with non-return flap valves;
- Non – flood defence retaining walls; and

- Flow control on a millrace.

These elements are described further below.

There will also be a number of trees and vegetation which will require removal to facilitate the works throughout the scheme area. The trees to be removed are shown in Drawing Series No 700, detailed in **Appendix 3.2** of this EIS.

It is also noted that many of the linear defences will require the temporary removal of boundary walls and fences to facilitate construction access (generally parallel with watercourses). These boundary walls/fences will be reinstated on completion in agreement with the landowners.

3.3 Drawing Index

The exhibition drawings are presented in **Appendix 3.1** of this EIS.

Refer to **GR_102 Index Sheet** which lists all of the Exhibition drawings.

Refer to **GR_103 Channel Codes** which shows the location of the Glashaboy River and the relevant tributaries where works are proposed and the corresponding Channel codes. The upstream extent of the drainage scheme is also shown on this drawing. The river and tributaries are listed as follows:

- C01 – Glashaboy River;
- C02 – Mill Race 1;
- C03 – Mill Race 2;
- C04 – Butlerstown Stream;
- C05 – Glenmore Stream;
- C06 – Springmount Stream;
- C07 – Cois na Gleann Stream;
- C08 - Mill Race 3;
- C09 – Bleach Hill Stream; and
- C10 – Sallybrook Stream.

Channel centreline, Channel Reference (C0X) and Chainage (XXX) is shown on each drawing.

Drawing No.'s GR_104 to GR_106 detail the existing flood extents and proposed flood benefit areas whilst **GR_107** lists the various flood defences (interferences) proposed for the drainage scheme.

The drainage scheme is described from north to south where possible. The plan layout is presented in **Series 2 (GR_201 to GR_216)** and is referred to throughout this chapter whilst the Sections are presented in **Series 3 (Drawing No.'s GR_301 to GR_308)**.

The proposed flood defence works finishes are presented in **Series 4 (Drawing No.'s GR_401 to 403)** whilst the proposed access routes and works areas during the construction phase are presented in **Series 5 (Drawing No.'s GR_501 to GR_503)**. Finally, **Series 6 (GR_601)** shows a detailed layout of the proposed revised car parking for the Hazelwood Shopping Centre area following the bridge replacement. **Series 7 (Drawing No.'s GR_701 to GR_704)** present the trees to be removed throughout the scheme.

As presented on **Figure 1.1**, the scheme is geographically divided into a number of Areas as follows:

Area 1	Sallybrook Industrial Estate
Area 2	Hazelwood
Area 3	Meadowbrook
Area 4-1	Butlerstown Stream
Area 4-2	Glenmore Stream
Area 5	O'Callaghan Park to Glanmire Bridge
Area 6	Downstream of Glanmire Bridge

The proposed flood defences are described Area by Area in the sections below. The left and right banks are described as one looks downstream. Future channel maintenance is also described below. Flood defence levels, structure dimensions etc. are all shown on the relevant drawings.

A number of photomontages have been prepared so as to more fully illustrate the physical and visual nature of aspects of the proposed development. These have been prepared to convey a time period of c. 5-7 years including planting maturity. The Photomontages, which are included in **Appendix 7.1**, are from/of the following locations:

- View 1 – View of Hazelwood Centre commercial complex at Riverstown from adjoining car park (**Figure 7.1.1.1 and 7.1.1.2**);
- View 2 – View from within Multi Use Games Area (MUGA) site in Hazelbrook, facing south towards existing open channel (**Figure 7.1.2.1 and 7.1.2.2**);
- View 3 – View from within Meadowbrook residential estate, south of the Hazelwood Centre (**Figure 7.1.3.1 and 7.1.3.2**);
- View 4 – View of Riverstown Bridge and adjacent entrance area to Meadowbrook residential estate (**Figure 7.1.4.1 and 7.1.4.2**); and
- View 5 – View east along Brooklodge Grove adjacent to Copper Valley Vue residential estate (**Figure 7.1.5.1 and 7.1.5.2**).

3.4 Area 1 - Sallybrook Industrial Estate

Flood defences proposed in Area 1 are described as follows:

3.4.1 Bleach Hill Stream

Refer to Drawing No **GR_201**.

There are existing twin 0.9m diameter culverts located beneath the access road into the Cúil Chluthair residential estate. It is proposed to replace these culverts by a new 2.6m wide by 2.4m high rectangular culvert. Refer to Interference No. **C09_B01** on drawing no **GR_201**. Refer also to **Drg No. GR_301** which shows the cross section of the proposed culvert (**C09.1**).

3.4.2 Glashaboy River

Refer to Drawing No.'s **GR_201, GR_202, GR_203** and **GR_204**.

There is an existing embankment along the left bank of the Glashaboy River. The existing embankment will be enhanced by the addition of a new flood defence embankment. The embankment will be constructed to the east of the existing to preserve the existing treeline growing on the "wet" side of the existing embankment. The proposed embankment will be approximately 270m in length. Refer to Interference No. **C01_E01** on drawing No.'s **GR_201** and **GR_202**. Refer also to **Drg No. GR_301** which shows the cross section of the proposed embankment (**C01.1**).

A proposed reinforced concrete flood defence wall will be constructed which will tie into the proposed flood defence embankment at the upstream end. Refer to Interference No. **C01_L01** on drawing No.'s **GR_202** to **GR_204**. The proposed flood defence wall will be approximately 530m in length. All drainage outfalls will be fitted with non-return valves. The flood defence wall will have a concrete fair finish on both sides. Refer also to **Drg No. GR_302** which shows the cross section of the proposed embankment (**C01.2**). Some trees will require removal to facilitate the construction of the flood defence wall. These are shown on Drawing No. **GR 701** in **Appendix 3.2**.

It is proposed that there will be a local surface water pumping station, collector drain, manhole and rising main to be installed for operation during a flood event at Chainage **C01_5285**. All outlets will be fitted with non-return valves. Refer to Interference No. **C01_P01** on drawing No. **GR_203**.

There will be a proposed flow control structure constructed, to restrict peak flows in the Mill Race. A base line flow will be maintained in the millrace at all times. Refer to Interference No. **C08_S01** on drawing No. **GR_203**. Refer also to **Drg No. GR_302** which shows the cross section of the proposed structure (**C08.1**).

3.4.3 Sallybrook Stream

Refer to Drawing No.'s **GR_202** and **GR_203**.

The Sallybrook stream (Channel C10) is located in the Sallybrook Industrial Estate. It consists of an open channel approximately 50m in length at the downstream end where it meets the Glashaboy River. The open channel section is referred to as **C10_C01** in the drawings. The stream is then culverted further upstream for a distance of approximately 100m. The culverted section is referred to as **C10_C02**. There is then a short reach of open channel referred to as **C10_C03** in the drawings, which connects into a culverted reach (**C10_C04**). This culvert ties into another culvert near the R639 at the upstream end of **C10_C04**. A row of mature trees line the existing open channel and also the culverted section. During flood events, water from the Glashaboy River backs up the Sallybrook Stream and overflows the channel.

It is proposed that the Sallybrook stream channel C10 will be realigned and culverted **C10.1_B01** to minimise flooding in the area. The purpose of the new alignment is to minimise tree removal along the existing channel alignment. It is proposed that the existing stretch of open channels (**C10_C01 & C10_C03**) will be extinguished, and backfilled. Flow will be diverted through the new culvert **C10.1_B01**. The existing culverts (**C10_C02 & C10_C04**) will also be extinguished and flow will also be diverted through **C10.1_B01**. Refer to Interference No. **C10_C01 through to C10_C04** on drawing no. **GR_202 & G203**. The new concrete culvert will be 900mm in diameter and will be approximately 159m in length. It will tie into the upstream end of **C10_C04** culvert which crosses under the R639. All drainage outfalls discharging to the culvert will be fitted with a flap valve. Refer also to **Drg No. GR_301** which shows the cross section of the proposed culvert (**C10.1**). Some trees will require removal to facilitate construction. These are shown on Drawing No. **GR 701** in **Appendix 3.2**.

A 130m long boundary fence will be provided around Sallybrook House. The proposed fence is shown as **C01_F01** on the drawings. Existing pedestrian access and vehicular access will be maintained. The fence will be 1.2m above ground level and will tie in with the flood defence wall at the western end. Refer also to **Drg No. GR_301** which shows the cross section of the proposed fence (**C10.1**).

3.5 Area 2 – Hazelwood

Flood defences proposed in Area 2 are described as follows:

Refer also to the photomontages, which are included in **Appendix 7.1** from/of the following locations:

- View 1 – View of Hazelwood Centre commercial complex from adjoining centre car park (Figure 7.1.1.1 and 7.1.1.2);
- View 2 – View from within Multi Use Games Area (MUGA) site in Hazelwood, facing south towards existing open channel (Figure 7.1.2.1 and 7.1.2.2);

3.5.1 Cois na Gleann Stream

Refer to Drawing No. **GR_206**.

The Cois na Gleann Stream is currently culverted beneath the R615 and R639 with an open section in between. There is a trash screen just upstream of the culvert on the R615. Refer to Drawing No. **GR_206**.

It is proposed that the two culverts are replaced with a single 26m long culvert (**C07_B01**). The new culvert will be a 2.75m wide by 0.9m high rectangular culvert. The trash screen upstream will be removed from the culvert. Refer also to **Drg No. GR_302** which shows the cross section of the proposed culvert (**C07.1**).

There will be a new retaining wall (**C07_L01**) constructed adjacent to the R639 approximately 0.8m above existing R639 road levels. The proposed retaining wall will be approximately 49m in length.

It is also proposed to regrade the R639 road (**C07_R01**) to facilitate the construction of the replacement Cois Na Gleann Stream culvert under the R639 road. The proposed road regrading will be approximately 49m in length.

3.5.2 Glashaboy River – Hazelwood Avenue

Refer to Drawing No. **GR_207**.

It is proposed that a reinforced concrete flood defence wall (**C01_L02**) will be constructed to 13.49mOD flood defence level (the wall will be constructed to a height of approximately 1.2m above existing road levels). The proposed flood defence wall will be constructed (in the field) parallel to the R639 and will curve eastwards into Hazelwood Avenue. It will cross over the Glashaboy River on the north side of Hazelwood Avenue bridge. The wall will be approximately 159m in length. The flood defence wall will have a sandstone finish on the dry side only. All drainage outfalls will be fitted with non-return valves. Some trees will require removal to facilitate construction. These are shown on Drawing No. **GR 702** in **Appendix 3.2**.

It is proposed that a flood relief channel 5.5m wide will be constructed with engineered grassed slopes parallel to the Glashaboy River on the north side (**C01_R01**) of Hazelwood Avenue bridge and on the south side (**C01_R02**) of the bridge. The flood relief channel will facilitate the movement of water through the area during high flows. The channel will cross underneath Hazelwood Avenue via a proposed 5.5m wide by 1.75m high rectangular flood relief culvert (**C01_B02**). The total length of the new flood relief channel will be approximately 112m in length (56m on north side, 18m culvert and 38m on south side). Some trees will require removal to facilitate construction. These are shown on Drawing No. **GR 702** in **Appendix 3.2**.

Fencing will be provided around the open channel for safety/security both on the north side (**C01_F02**) (approximately 56m in length) and on the south side (**C01_F03**) (approximately 38m in length).

Refer also to **Drg No. GR_303** which shows the cross sections at Hazelwood Avenue bridge (**C01.3**, **C01.4** and **C01.5**). Refer also to photomontages, **Figure 7.1.1.1** and **7.1.1.2** in **Appendix 7.1**.

It is proposed that a new reinforced concrete flood defence wall (**C01_L03**) is constructed across the south side of Hazelwood Avenue bridge and extending along the right bank (looking downstream) of the Glashaboy River. The total length of the flood wall will be approximately 121m in length. The flood wall will be constructed to 12.7mOD flood defence level (typically 0.9m above existing ground levels). All drainage outfalls will be fitted with non-return valves. The flood defence wall will have a sandstone finish on the northern side of the wall along the Hazelwood Avenue bridge section. Along the right bank of the river, the flood defence wall will have a concrete fair finish on both sides, where visible and there will be a bridge parapet on the downstream end where it ties into the new Hazelwood shopping centre bridge. Closer to the new Hazelwood shopping centre bridge, there will be a sandstone finished wall which will extend above the flood defence wall (typically 0.5m) to provide a barrier along the side of the road ramp to access the bridge crossing. Some trees will require removal to facilitate construction. These are shown on Drawing No. **GR 702** in **Appendix 3.2**.

Refer also to **Drg No. GR_304** which shows the cross section of the flood wall (**C01.8**).

3.5.3 Glashaboy River – Hazelwood Shopping Centre

Refer to Drawing No. **GR_207**.

It is proposed to replace the existing Hazelwood shopping centre bridge with a new reinforced concrete bridge (**C01_B03**). The existing bridge connects the commercial centre (including Supervalu) on the east of the river to the commercial centre on the west of the river. Both the commercial centre on the east and west can both be accessed separately via Hazelwood Avenue to the north. The proposed new bridge will be 12m clear span. The proposed bridge soffit level will be 12.3mOD, (approximately 1.85m above existing bridge soffit). The existing surrounding ground will be regraded (**C01_R03**) to facilitate the construction of the proposed new bridge. The ground levels will tie into existing levels on either side of the proposed bridge. Some trees will require removal to facilitate construction. These are shown on Drawing No. **GR 702** in **Appendix 3.2**.

Refer to Drg No. **GR_601** for details of revised car parking in the area. Refer also to Drg No. **GR_304** which shows the cross sections at Hazelwood shopping centre bridge (**C01.6**, **C01.7** and **C01.8**). Refer also to the photomontages, **Figure 7.1.1.1** and **7.1.1.2** in **Appendix 7.1**.

It is proposed that a new reinforced concrete flood defence wall (**C01_L04**) is constructed along the right bank of the Glashaboy River just downstream of Hazelwood shopping centre bridge, constructed to a flood defence level of 12.2mOD (typically 1.5m above existing ground levels in the funeral home car park). The flood defence wall will tie into the proposed Hazelwood shopping centre bridge at the upstream end and high ground at the downstream end. All

drainage outfalls will be fitted with non-return valves. The flood defence wall will have a concrete fair finish on both sides. The total length of the wall will be approximately 108m. Some trees will require removal to facilitate construction. These are shown on Drawing No. **GR 702** in **Appendix 3.2**.

There will be a proposed local surface water pumping station (**C01_P02**), collector drain, manhole and rising main installed for operation during a flood event at C01_3804. All outlets will be fitted with non-return valves.

3.5.4 Springmount Stream

Refer to Drawing No. **GR_207**.

The Springmount Stream flows east into the Glashaboy River just south of Hazelwood commercial centre and north of Meadowbrook Estate.

The Springmount Stream is currently culverted (twin culverts) beneath the R639. It is proposed to replace the existing twin 0.4m diameter culverts with a new 35m long 1.75m wide by 0.9m high rectangular culvert (**C06_B01**). Refer also to **Drg No. GR_305** which shows the cross sections along the R639 at this location (**C06.1**).

Localised road regrading (**C06_R01**) will take place to facilitate the construction of the replacement Springmount Stream culvert across the R639 road.

A proposed reinforced concrete retaining wall (**C06_L02**) (approximately 48m in length) will also be constructed parallel to the R639 in the same area and it will be typically 0.85m above existing wall levels. The wall will have a concrete sandstone finish on the exposed side.

Modifications to a boundary wall and gate will be required due to localised road regrading in the vicinity (**C06_F01**).

It is proposed to construct a reinforced concrete flood defence wall (**C06_L01**) (approximately 80m in length) on the right bank of the Springmount stream before its confluence with the Glashaboy River. The proposed wall will be constructed to a flood defence level of 11.3mOD (typically 1.1m above existing ground levels). All drainage outfalls are to be fitted with non-return valves. The flood defence wall will have a concrete fair finish on both sides. Some trees will require removal to facilitate construction. These are shown on Drawing No. **GR 702** in **Appendix 3.2**.

3.6 Area 3 – Meadowbrook

Flood defences proposed in Area 3 are described as follows:

Refer to Drawing No. **GR_208**.

Refer also to the photomontages, which are included in **Appendix 7.1** from/of the following locations:

- View 4 – View from within Meadowbrook residential estate, south of the Hazelwood Centre (Figure 7.1.4.1 and 7.1.4.2); and
- View 5 – View of Riverstown Bridge and adjacent entrance area to Meadowbrook residential estate (Figure 7.1.5.1 and 7.1.5.2).

3.6.1 Meadowbrook Estate

It is proposed to construct a reinforced concrete flood defence wall (**C01_L05**) on the right bank of the Glashaboy River along the entire length of the Meadowbrook Estate. There is an existing wall along the same stretch of river. The proposed wall will be approximately 334m in length.

At either end of the proposed wall, the existing wall will be replaced with the new flood defence wall on the same alignment. Along the middle reach of the proposed new wall, the new wall will be constructed inside the existing wall, along the Meadowbrook estate side (“dry side”) in order to minimise tree removal in the area. All drainage outfalls will be fitted with non-return valves. The proposed flood defence wall will have a concrete fair finish on both sides, with tree cover on the dry side. The levels are shown on Drawing No. **GR_208**.

Refer also to Drg No. **GR_305** which shows the cross sections at Meadowbrook Estate (**C01.9** and **C01.10**). Refer also to the photomontage **Figure 7.1.3.1** and **7.1.3.2** in **Appendix 7.1**.

It is also proposed to construct a reinforced concrete flood defence wall (**C01_L06**) on the left bank of the Glashaboy River opposite Meadowbrook Estate, close to Riverstown Bridge. The wall will curve westwards onto the L3010 (near Riverstown Bridge). The proposed wall will be approximately 90m in length. All drainage outfalls will be fitted with non-return valves. In general, the proposed flood defence wall will have a concrete fair finish on both sides, where it runs in parallel with the river, with tree cover on the dry side. At Riverstown bridge, where the wall runs parallel with the L3010, the wall will have a concrete fair finish with tree cover on the northern side and a sandstone finish on the dry side. Some trees will require removal to facilitate construction. These are shown on Drawing No. **GR 702** in **Appendix 3.2**.

It is proposed to construct a local surface water pumping station (**C01_P03**), collector drain, manhole and rising main to be used for operation during a flood event at C01_3425 just at the entrance of the Meadowbrook Estate near Riverstown Bridge. All outlets will be fitted with non-return valves. In the same general area, a proposed foul water pumping station (**C01_P04**), with overflow, manhole and rising main will also be installed for operation when required to pump foul wastewater trapped in Meadowbrook Estate into the foul sewer network downstream of the estate. Some trees will require removal to facilitate construction. These are shown on Drawing No. **GR 702** in **Appendix 3.2**.

3.6.2 Riverstown Bridge

Refer to Drawing No. **GR_208**.

Refer also to the photomontage **Figure 7.1.4.1** and **7.1.4.2** in **Appendix 7.1**.

Refer also to Drg No. **GR_306** which shows the cross sections of Riverstown Bridge (**C01.11**) and at Meadowbrook Estate in the same area (**C01.12**).

It is proposed that the existing Riverstown Bridge parapet wall will be modified to provide protection to guarding height to pedestrians (**C01_F04**). Localised regrading of and footpath will take place in same area (**C01_R04**). Recambering of the road will also take place to divert surface water runoff during a flood event southwards into the Glashaboy River via O'Callaghan Park, downstream of Riverstown Bridge (**C01_R04**). Along the approach to Riverstown Bridge, from the west, a proposed reinforced concrete retaining wall will be constructed typically 0.5m above the existing footpath level to support the regrading of the footpath. The wall will have a sandstone finish on the exposed side (**C01_L07**). The wall will tie into the proposed flood defence wall (**C01_L06**).

At Riverstown Bridge on the left bank of the Glashaboy River, the existing bridge arch will be cleared by removing built up silt and vegetation (**C01_C01**). Similarly, on the right bank of the river, the existing Riverstown bridge arch will be cleared by removing built up silt and vegetation. The existing manhole in the bridge arch is to be removed and services diverted (**C01_C02**). Some trees will require removal to facilitate construction. These are shown on Drawing No. **GR 702** in **Appendix 3.2**.

3.7 Area 4-1 - Butlerstown Stream

Flood defences proposed in Area 4-1 are described as follows:

Refer to Drawing No. **GR_209**.

South of Sarsfield GAA Club, in the Lidl parking area, it is proposed to modify the existing boundary wall to allow overland flow to pass through it (**C04_F01**). The length of this proposed modification is approximately 111m.

3.8 Area 4-2 - Glenmore Stream

Flood defences proposed in Area 4-2 are described as follows:

Refer to Drawing No. **GR_210**.

It is proposed to carry out minimal landscaping and regrading of ground levels, to facilitate overland flow from the Butlerstown stream back into the Glenmore Stream (**C05_R04**).

Refer to Drawing No. **GR_211**.

Refer also to the photomontage, which are included in **Appendix 7.1** from/of the following location:

View 6 – View east along Brooklodge Grove adjacent to Copper Valley Vue residential estate (**Figure 7.1.5.1** and **7.1.5.2** in **Appendix 7.1**).

Refer also to Drg No. **GR_307** which shows the cross section (**C05.1**), (**C05.2**) and (**C05.3**).

The existing wall on the left bank of the Glenmore Stream along Brooklodge Grove will be strengthened for a distance of 165m (**C05_L01**). All drainage outfalls will be fitted with non-return valves. Sandstone cladding will be provided on the dry side only.

It is proposed to replace the existing culverts, (2.32m span arch, 2.95m wide by 0.68m high culvert and 2.90m wide by 0.67m high culvert) with a new 10m wide by 1.95m high rectangular culvert (**C05_B01**) along Brooklodge Grove.

It is proposed to deepen (**C05_C01**) the Glenmore stream channel by 0.25m at the inlet to facilitate the installation of the proposed replacement culvert at Brooklodge Grove. It is also proposed to re-grade Brooklodge Grove road to facilitate the construction of the proposed replacement culvert (**C05_R01**).

It is proposed to construct a local surface water pumping station (**C05_P01**), collector drain, manhole and rising main to be used for operation during a flood event

Upstream of the new culvert (**C05_B01**), it is proposed to construct a reinforced concrete flood defence wall (**C05_L01**) along the left and right bank of the Glenmore stream to a flood defence level of 15.33mOD (typically 1.2m above existing ground levels). All drainage outfalls will be fitted with non-return valves. Sandstone cladding will be provided on the dry side only.

Further downstream along the Glenmore stream, at the Copper Valley Vue entrance, the existing 3.73m wide by 1.57m high culvert will be replaced with a new 10m wide by 1.90m high rectangular culvert (**C05_B02**). The entrance to Copper Valley Vue will be regraded (**C05_R02** and **C05_R03**) to facilitate the construction of the proposed replacement culvert.

The Glenmore stream channel will be widened by 5m and deepened by approximately 0.3m (**C05_C02**) over a distance of 61m from the proposed culvert under the entrance to Copper Valley Vue (**C05_B02**) to the proposed culvert under Brooklodge Grove (**C05_B01**).

The Glenmore stream channel will be widened by an average of 3m and deepened (**C05_C03**) by 0.4m over a distance of 20m downstream of the proposed culvert replacement at Copper Valley Vue (**C05_B02**). Further downstream the Glenmore stream channel will be deepened by up to 0.4m for a distance of 40m downstream of Copper Valley Vue (**C05_C04**).

Some trees will require removal to facilitate construction in the Brooklodge area. These are shown on Drawing No. **GR 703** in **Appendix 3.2**.

Refer to Drawing No **GR_216**.

The Glenmore Stream flows westwards along Brooklodge Grove, through a culvert beneath the slip road to the M8 (referred to as the New Line) and beneath the M8 underbridge.

Between the M8 underbridge and the New Line, it is proposed to strengthen the existing wall on the left bank of the Glenmore stream (**C05_L02**) for a distance of approximately 81m. All drainage outfalls will be fitted with non-return valves. Sandstone cladding to the dry side only.

West of the New Line, it is proposed to construct a new reinforced concrete flood defence wall on the left bank of the Glenmore stream (**C05_L03**) for a distance of approximately 60m. These works will require the removal of some vegetation and trees to facilitate the wall construction. Refer to Drawing No **GR 703** in **Appendix 3.2**. All drainage outfalls to be fitted with non-return valves. Sandstone cladding to the dry side only.

It is also proposed to extend the reinforced concrete flood defence wall (**C05_L03**) along the New Line, where the stream is culverted (for a distance of approximately 27m. All drainage outfalls to be fitted with non-return valves. Sandstone cladding to the dry side only.

It is proposed to replace the existing culvert beneath the New Line with a new larger culvert (**C05_B03**).

Finally, it is also proposed that the New Line, Brooklodge Grove and the junction between the two roads will be regraded to facilitate the construction of the proposed replacement culvert (**C05_R05**).

3.9 Area 5 - O'Callaghan Park to Glanmire Bridge

Flood defences proposed in Area 5 are described as follows:

3.9.1 The Grove

Refer to Drawing No. **GR_214**.

The Grove is located along the R639. The Glashaboy River is located to the east of the Grove. There are residential properties located on the west side of the R639.

Along the east side of the R639 in this area, it is proposed to construct a reinforced concrete flood defence wall (**C01_L08**) to a flood defence level of 4.48mOD (typically 1.2m above existing ground levels). The length of the flood defence wall will be approximately 101m. All drainage outfalls will be fitted with non-return valves.

Some trees will require removal to facilitate construction. These are shown on Drawing No. **GR 704** in **Appendix 3.2**.

Refer also to Drg No. **GR_307** which shows the cross section in The Grove area (**C01.13**).

In this area, it is also proposed to regrade the ground to formalise an access track along the length of the Glashaboy River from chainage C01_2010 to chainage C01_2264. A right of way to be granted in favour of the occupier/owner of Plot A297 along the line of the access track.

It is also proposed that a local surface water pumping station (**C01_P05**), collector drain, manhole and rising main are to be installed for operation during a flood event. All outlets will be fitted with non-return valves.

3.10 Area 6 - Downstream of Glanmire Bridge

No construction works are proposed in this area. Channel Maintenance only proposed at this location. Refer to Drawing No. **GR_215**.

3.11 Future Channel Maintenance

Under Section 37 of the Arterial Drainage Act 1945, the Office of Public Works (OPW) is statutorily obliged to maintain all rivers, embankments and urban flood defences on which it has executed works since the 1945 Act, in “*proper repair and effective condition*”.

Channel and embankment maintenance operations can encompass a variety of activities, including silt and vegetation management, aquatic vegetation cutting, bank protection, bush cutting/branch trimming, tree cutting, mulching, mowing and structure maintenance (Ryan Hanley, 2014).

Channel maintenance operations are defined as follows by the OPW (2011): *‘channel maintenance normally involves removing the build-up of foreign or natural material that impedes the free flow of water. Predominately this consists of the removal of water-entrained silt and associated vegetation from the bed of the channel by suitably rigged hydraulic excavators. In most cases, no alterations to the bank are required and in some cases the channel is not disturbed at all if no build-up of material is present.’*

This is a responsibility of the Office of Public Works (OPW).

Future channel maintenance will apply to the Glashaboy River (Glanmire/Sallybrook) Drainage Scheme. The location of channel maintenance is shown as general interferences on the drawings from **GR_201** to **GR_216**.

A channel maintenance programme will be required throughout the reach of the watercourses impacted by the proposed works. The channel maintenance programme will pay particular attention to locations where silt, gravel and debris are likely to accumulate, such as at structures, sharp bends, culvert inlets, blockages from trees etc.

At this stage, the exact nature and scale of channel and embankment maintenance work likely to be required for the Glashaboy is unknown, however Inland Fisheries Ireland (IFI) has indicated that dredging is to be avoided in the Glashaboy.

All OPW maintenance work is undertaken in accordance with Environmental Management Protocols and Standard Operating Procedures (OPW, 2011) along with additional measures where the SOPs show deficiencies, to ensure adverse impacts on the environment are considered and minimised.

OPW drainage maintenance activities will also be subject to a separate Ecological and Appropriate Assessment process to ensure no adverse impacts arise.

The proposed pumping stations will require regular maintenance and it will be necessary to jet the surface water sewers to maintain the hydraulic capacity to drain flood waters.

Other measures will include regular inspections of flood walls and embankments, regular scheduled maintenance of the river channel and pruning of trees (including removal of tress where necessary), planning and control measures. The inspection regime will ensure that there is no deterioration in the structural integrity of the defences which may occur as a result of a vehicular collision for example. It is expected that the flood defences will otherwise be relatively maintenance free. In general, maintenance will typically consist of the following activities:

- The channels will be monitored by means of a walkover survey from the banks on a regular basis (likely quarterly, and also following a flood event). The walkover surveys would aim to identify issues with implications for flood risk (e.g. fallen trees, excessive vegetation build-up, overgrown trees, illegal dumping, accumulation of granular deposits, etc.). In-channel debris will typically be removed by a long reach excavator working from the banks. Excessive overhanging vegetation will typically be pruned back or removed by hand using a cherry picker, depending on access.
- The structures will be monitored by means of a walkover survey from the banks on a bi-annual basis. The walkover surveys would aim to identify issues with implications for flood risk (e.g. damage to structures, settlement of embankments, etc.).
- Culverts will be inspected by means of man-entry on an annual basis, or following a significant flood event. Any debris present in the culvert will be cleared by hand. A full CCTV survey and clearing of silt/sediment from the culvert is expected to take place approximately every five years. Removal of debris will be carried out as required.

Consultation will be required with the relevant stakeholders as necessary during the planning of these maintenance works including landowners, IFI, the National Monuments Service (NMS), Cork County Council (CCC) and National Parks and Wildlife Service (NPWS) to ensure that the works are carried out with minimal environmental impact.

In certain locations, where there is a possibility of excessive seepage of flood water underneath the flood defence foundations, either sheet piles or grouting techniques will be required to provide a cut-off barrier. The sheet piles may be metal or plastic and will be driven to the required depth using a piling hammer or similar.

4 Construction Activities

4.1 Introduction

This chapter describes the construction activities and sequencing for the proposed drainage scheme and outlines the general mitigation measures which will be implemented to ensure the potential impacts of the construction activities on the environment are avoided, prevented or reduced. Construction mitigation measures for specific issues such as biodiversity and ecology are detailed in the relevant chapters.

A construction environmental management plan (CEMP) will be prepared prior to construction commencing. The CEMP will comprise all of the construction mitigation measures, which are set out in this EIS, and any additional measures which are required by any conditions attached to the Minister for Public Expenditure's statutory confirmation of the Scheme under the Arterial Drainage Acts.

Implementation of the CEMP will ensure disruption and nuisance are kept to a minimum. The plan will have regard to the guidance contained in the handbook published by Construction Industry Research and Information Association (CIRIA) in the UK, Environmental Good Practice on Site Guide, 4th Edition (CIRIA 2015).

It is anticipated that, with the proper implementation, phasing and management of construction activities described in this chapter, the construction phase of the development will have no significant or long-term impact.

4.2 Main elements of the drainage scheme

The main aspects of the drainage scheme comprise construction works entailing the following:

- Replacement of a number of existing culverts;
- Replacement of Hazelwood Shopping Centre bridge with a larger vehicular bridge;
- 1 new flood relief channel and culvert at Hazelwood Avenue;
- Replacement of existing flood defence walls and construction of new flood defence walls;
- Modification to an existing earthen flood defence embankment and construction of a new earthen flood defence embankment;
- Five new surface water pumping stations and one foul pumping station;
- Localised in-channel conveyance improvements at culvert/bridge structures;

- Provision of civil works such as road/footpath re-grading at a number of locations;
- Protecting drainage outlets along the line of flood defence works with non-return flap valves;
- Non – flood defence retaining walls; and
- Flow control structure on a millrace.

There will also be a number of trees and vegetation which will require removal to facilitate the works throughout the scheme area. The trees to be removed are shown in Drawing Series No 700, detailed in **Appendix 3.2** of this EIS.

It is also noted that many of the linear defences will require the temporary removal of boundary walls and fences to facilitate construction access (generally parallel with watercourses). These boundary walls/fences will be reinstated on completion in agreement with the landowners.

An outline of the methodology to construct the major elements of the works is described below.

4.3 Outline Construction methodology

4.3.1 General environmental considerations

The construction of the drainage scheme will be undertaken using industry standard construction methodologies. The anticipated construction methodology for the major elements of the scheme is described hereunder.

Traffic management will be set up for the works as required. Temporary road diversions and closures are likely to be required. Alternative access routes will be agreed with Cork County Council and An Garda Síochána. Refer also to the relevant chapters for specific construction details such as construction traffic management (**Chapter 14 Roads and Traffic**).

In-stream works associated with the drainage scheme will be carried out under the supervision of a suitably qualified and experienced ecologist. All in-stream works will be designed and carried out in consultation with Inland Fisheries Ireland (IFI) and in accordance with the IFI 2016 *Guidelines on protection of fisheries during construction works in and adjacent to waters*.

Where possible, it is expected that the Contractor will primarily gain access from the river banks; however temporary working areas within the river channel may be required for certain works. It is expected that access to construct the proposed flood defences which are located away from the river's edge (e.g. embankments) will be from the landward side in order to avoid any impact to the river. Where in-stream works are proposed, machine movements in the river will be minimised.

Where access to the river channel is required, detailed method statements will be drawn up which deal specifically with the works proposed.

The method statements will be drawn up in consultation with the supervising ecologist and will be agreed with the NPWS and Inland Fisheries Ireland (IFI) prior to the commencement of works.

Detailed silt control methods will be required for all in-stream works. Any works will require effective control of silt and it is expected that a variety of methods may be required i.e. silt curtains, dewatering, silt sumps etc. Detailed measures for control of silt will need to be designed and agreed with the IFI and NPWS.

4.3.2 New culverts, culvert replacements and or extensions

The construction of new culverts, replacement of culverts and/or extensions to culverts will generally be undertaken by excavating and removing the existing culverts before craning in new precast culvert units in short lengths. Some isolated sections of in-situ culvert may be required at changes in direction.

The works area will be isolated and traffic management set up as required. In general, single lane traffic will be maintained where possible but temporary road closures and diversions may be required for short discrete periods, if it does not prove possible to maintain one lane of the existing road open at all times. Refer to **Chapter 14 Roads and Traffic** for further details on construction traffic and traffic management.

Temporary works will be put in place, including silt barrages, and flow diversions/ over pumping where in stream works are required. In general the culverts will be constructed on the footprint of the existing river channel or in some cases offline (e.g. in Sallybrook Industrial Estate). The foundations will be excavated down to formation level. Utilities and drainage pipes will be diverted as required. Excavated material will be transported off site to a licenced facility or stored for reuse on site, where appropriate. Blinding concrete will be poured. The precast concrete culverts will be placed in position and where in situ culverts are required, formwork will be prepared and reinforcement bars fixed, followed by the pouring of the concrete. Utilities and drainage pipes will be diverted into permanent positions as required. The excavations will then be backfilled and road surfaces reinstated.

In the case of culverts constructed under the public road, permanent reinstatement may be required approximately six months following reopening of the road.

4.3.3 Bridge Replacement along Glashaboy River at Hazelwood Shopping Centre

The bridge at Hazelwood shopping centre will be replaced in order to increase the conveyance of the Glashaboy river. The works area will be isolated and traffic management set up as required. During the bridge replacement, both vehicular and pedestrian access between the shopping centre and the commercial centre will be maintained via the existing access to the commercial centre along Hazelwood Avenue. It is expected that access via the Hazelwood shopping centre bridge will be restricted for approximately 12 to 16 weeks. Access will be fully restored on completion of the bridge replacement works.

Due to the potential in-stream works (including preparatory work) on a watercourse supporting salmonids, it is envisaged that this work will be undertaken in a window from July to September (inclusive) and in consultation with IFI to avoid accidental damage or siltation of spawning beds.

Temporary works will be put in place, including silt barrages.

It is envisaged that the existing bridge deck will initially be dismantled / deconstructed, which will likely involve some in-channel works, but these will be minimised and of short duration.

Following this, it is envisaged that a temporary cofferdam will be constructed around each of the existing bridge abutments, to allow for the existing abutments to be removed, and new abutments constructed in the dry, whilst maintaining the Glashaboy flow between the two cofferdams, and minimising pollution risk.

The new bridge will be constructed using reinforced concrete abutments placed in situ with a precast concrete deck.

Construction of the reinforced concrete bridge abutments would typically involve:

- Fixing of reinforcement for abutments and piers;
- Placing of formwork for abutments and piers;
- Placing of cast in-situ concrete for abutments and piers; and
- Stripping of formwork.

Once the abutments are in place, the temporary cofferdam will be removed, allowing the placing and fixing of a precast concrete bridge deck, followed by the following:

- Construction of bridge parapets;
- Excavated material will be transported off site to a licensed facility or stored for reuse on site. The excavation will be backfilled, the area reinstated, and the works area reopened; and
- Permanent reinstatement of road surfaces may be required approximately six months following reopening of the road.

Any utility diversions necessary to facilitate the construction of the bridge will be completed prior to and after its construction.

Refer to **Chapter 14 Roads and Traffic** for further details on construction traffic.

4.3.4 Flood relief channel and culvert parallel to Glashaboy River at Hazelwood Avenue

In relation to the flood relief culvert on Hazelwood Avenue, it is envisaged that this will be constructed in two halves, allowing a minimum of a single lane to remain open at all times, and for at least part of the duration, 2 lane traffic will be possible due to the generous width of the existing road.

As the flood relief culvert and approach channels at Hazelwood Avenue are offline from the main Glashaboy river channel, they can be constructed in the dry and are therefore not seasonally constrained. If feasible, the reinforced concrete, cast in situ, flood relief culvert will be constructed during a period of school holidays when traffic volumes will be reduced. A construction period of circa 4 to 8 weeks is envisaged.

The works will be constrained such that work on the Hazelwood Avenue flood relief culvert will not be allowed at the same time as works in the Shopping Centre/Commercial Centre, to minimise temporary traffic impacts.

It is likely that the flood relief culvert will be constructed in advance of regrading the flood relief channels at the upstream and downstream ends to ensure that the culvert can be placed in the dry.

A flood relief channel will then be constructed parallel to the Glashaboy River just east of Hazelwood Avenue bridge to facilitate high flows during a flood event.

The channel will consist of the excavation of the left bank of the river (looking downstream) both north and south of Hazelwood Avenue. Refer to the exhibition drawings for details.

Connection of the flood relief channel to the Glashaboy river (via removal of sections of the bank) will only be carried out once all of the other works to the flood relief channel have been completed.

The preliminary design has been agreed with Inland Fisheries Ireland (IFI) and consultation will continue during the detailed design and construction stages. The construction methodology for the culvert beneath Hazelwood Avenue will be similar to the methodology described above for the other culvert works.

4.3.5 Reinforced Concrete Flood Walls

Reinforced concrete flood walls will be constructed using industry standard techniques including excavation of foundations, fixing of steel reinforcement, pouring concrete and reinstatement of the works area. Any excavated material that cannot be reused in the works will be transported to a suitable licensed waste facility.

The construction of the reinforced concrete flood defence walls is likely to comprise the following activities:

- isolation of works area, including traffic management where the work area will overlap with a public road / pedestrianised area;
- temporary works including silt barrages where in stream works are required (the vast majority of new walls do not require any in-channel works);
- excavation for foundations;
- blinding of formation;
- fixing of reinforcement;

- placing of formwork; and
- placing of concrete.

The construction of the reinforced concrete walls will be undertaken from the bank of the river for the majority of the scheme. Any utility diversions required for the construction of the walls will be completed prior to excavating the foundations.

4.3.6 Modifications to existing embankment along Glashaboy River at Sallybrook

The proposed embankment at Sallybrook will be constructed on the land side of the existing embankment to allow for retention of the existing tree line along the river bank. It will be constructed by placing low permeability cohesive soils to the required flood defence level. Topsoil will be placed on top of the embankment and seeded. All material excavated during the construction will be reused where feasible. Any material that is not suitable for use elsewhere in the scheme will be disposed of off-site. It is likely that it will be necessary to import most of the cohesive soils required to construct the embankment as it is unlikely that sufficient quantities of suitable excavated soil will be available from elsewhere in the project. The construction of the embankment will be undertaken from the river bank with no in channel works required.

Any utility diversions necessary to facilitate the construction of the embankment will be completed prior to the construction of the embankment.

4.3.7 Pumping Stations

The footprint of the pumping stations will be set out. Where the proposed excavation is located in a paved area, the pavement will be saw cut. Where the proposed excavation is located in a grassed area, the topsoil will be removed and stored in close proximity to the excavation. The excavation will take place to the required depth. Sheet piling will likely be required in order to facilitate construction of deep excavations in an urban area. Excavated material unsuitable for use as backfill material will be disposed of to an approved waste management facility. Lean mix concrete blinding will be placed, followed by formwork and steel fixing. Once concrete has been poured and has cured, the formwork will be stripped and the area outside the pumping station will be backfilled. Excavations in grassed areas will be backfilled with suitable excavated material, following which the original topsoil will be replaced. Excavations in paved areas will be backfilled with granular material and reinstated to their original condition. Mechanical and electrical fit out of pumping stations will take place following backfilling.

4.3.8 Channel modifications of Glenmore Stream at Brooklodge Grove

Channel modifications will generally be undertaken from the bank of the watercourse using an excavator. Temporary works will be put in place, including silt barrages, and flow diversions/ over pumping where in stream works are required. Any material unsuitable for reuse in the project will be disposed at a licensed waste facility. Any utility diversions required to widen and deepen the watercourse will be completed prior to the widening and deepening works commencing.

4.3.9 Future Maintenance Regime

A channel maintenance programme will be required throughout the reach of the watercourses impacted by the proposed works. The channel maintenance programme will pay particular attention to locations where silt, gravel and debris are likely to accumulate, such as at structures, sharp bends, culvert inlets, blockages from trees etc.

The proposed pumping stations will require regular maintenance and it will be necessary to jet the surface water sewers to maintain the hydraulic capacity to drain flood waters.

Other measures will include regular inspections of flood walls and embankments, regular scheduled maintenance of the river channel and pruning of trees (including removal of tress where necessary), planning and control measures. The inspection regime will ensure that there is no deterioration in the structural integrity of the defences which may occur as a result of a collision for example. It is expected that the flood defences will otherwise be relatively maintenance free. In general, maintenance will typically consist of the following activities:

- The channels will be monitored by means of a walkover survey from the banks on a regular basis (likely quarterly, and also following a flood event). The walkover surveys would aim to identify issues with implications for flood risk (e.g. fallen trees, excessive vegetation build-up, overgrown trees, illegal dumping, accumulation of granular deposits, etc.). In-channel debris will typically be removed by a long reach excavator working from the banks. Excessive overhanging vegetation will typically be pruned back or removed by hand using a cherrypicker, depending on access.
- The structures will be monitored by means of a walkover survey from the banks on a bi-annual basis. The walkover surveys would aim to identify issues with implications for flood risk (e.g. damage to structures, settlement of embankments, etc.).
- Culverts will be inspected by means of man-entry on an annual basis, or following a significant flood event. Any debris present in the culvert will be cleared by hand. A full CCTV survey and clearing of silt/sediment from the culvert is expected to take place approximately every five years. Removal of debris will be carried out as required.

The relevant stakeholders will be consulted with as necessary during the planning of these maintenance works including landowners, IFI, the National Monuments Service (NMS), Cork County Council (CCC) and National Parks and Wildlife Service (NPWS) to ensure that the works are carried out with minimal environmental impact.

In certain locations, where there is a possibility of excessive seepage of flood water underneath the flood defence foundations, either sheet piles or grouting techniques will be required to provide a cut-off barrier. The sheet piles may be metal or plastic and will be driven to the required depth using a piling hammer or similar.

4.4 Construction Site Layout

4.4.1 Construction Access

Detailed of the proposed Works Areas and potential access routes are illustrated on Series 5 of the Scheme Exhibition Drawings.

It is noted that many of the linear defences will require the temporary removal of boundary walls and fences to facilitate construction access (generally parallel with watercourses). These boundary walls / fences will be reinstated on completion in agreement with the landowners.

4.4.2 Construction Compounds

A number of potential locations for the construction compounds, in the immediate vicinity of the works, have been considered and are shown on Series 5 of the Exhibition Drawings. The final selection of the compound(s) will be made by the Contractor appointed to construct the works in consultation with the Office of Public Works and the project ecologist. Due to the length of channel involved, the Contractor may choose to move the compound during the construction period, in which case the same selection process shall apply. Site compounds will be bound by the mitigation measures identified within this EIS.

4.4.3 Construction Site Drainage

The construction site drainage within the construction compounds will be designed in such a manner so as to minimise the risk of contamination of the surrounding soil, surface water and groundwater. Rainwater run-off from the contractor's compounds will be controlled via a temporary surface water control system comprising measures such as swales (ditches) and settlement ponds (or similar system) which will minimise the risk of pollution to soil, surface water or groundwater. The temporary surface water control system will be subject to a daily visual inspection as well as routine maintenance. The inspection frequency will be increased during periods of exceptional high rainfall. Written procedures will be maintained and a log recorded for the inspections.

The contractor facilities will contain toilets, canteen, construction containers and site office. A grease trap will also be installed at the canteen. The disposal of sanitary effluent during construction will be via tankers.

Storm water will be managed carefully during construction. Any areas which will involve the storage of fuel will be paved and bunded and hydrocarbon interceptors installed to ensure no spillages will get into the surface water or groundwater. Daily plant and machinery checks will be carried out as per contract requirements on all construction plant and machinery. Drip trays will be used both for refuelling and overnight parking and spill kits will be on hand at all times. Further details are provided below in **Section 4.7**.

4.5 Duration, Phasing and Employment

Construction works are expected to commence in Quarter 3 of 2017 and the proposed construction period is estimated at circa 18 months. The total 18 month construction period has been estimated to allow for poor weather over the winter months, mobilisation between sites and seasonal ecological restrictions. The estimated period for individual locations is presented in **Table 4.1** below.

Table 4.1: Estimated Duration of Construction Works. Refer also to Figure 1.1 for location of works areas

Area of Works	General Location	Overview of Works	Estimated construction period (weeks)
1	Sallybrook	Culvert replacement along Bleach Hill stream at Cuil Chluthair, direct defences (embankment & flood walls) along Glashaboy River, Infilling of existing ditch along unnamed watercourse and provision of culvert. Flow control structure at Mill race at Grandons Garage and pumping Station	16 – 20 weeks
2	Hazelwood	Culvert replacements at Cois na Gleann Stream (R615 & R639), flood wall along R639 and curving around onto Hazelwood Avenue, across Hazelwood Avenue Bridge. Flood relief channel parallel to river under Hazelwood Avenue, Bridge replacement at Hazelwood Shopping Centre and flood wall along Glashaboy River, Road re-grading and pumping stations	32 – 40 weeks
3	Meadowbrook	Flood Walls along Glashaboy River, culvert replacement and extension along Springmount stream (R639) and road re-grading works along Riverstown Bridge and approaches, removal of existing manhole from the bridge arch and pumping stations	16 – 20 weeks
4-2	Copper Valley Vue Brooklodge Grove	Culvert upgrades, road re-grading and grouting of existing walls, channel modification flood walls along Glenmore Stream, re-grading of small area of land adjacent to Glenmore stream to facilitate overland flow	12 – 16 weeks
4-3	Lidl	Modification to boundary wall along Butlerstown Stream to facilitate overland flow	2-3 weeks
5	The Grove	Access track and flood wall along Glashaboy River (parallel to R369)	4 – 6 weeks

Whilst the majority of geotechnical investigation work has been completed, some further minor infill geotechnical investigations may be required prior to construction. These would consist of a mixture of shell and augur boreholes, cable percussive boreholes, rotary drilled boreholes, trial pits and slit trenches at the locations of the proposed structures. As discussed above, the construction works themselves will last approximately eighteen months and will be subject to the following programme constraints:

- In-stream works (including preparatory work) on all watercourses supporting salmonids shall normally be undertaken between July and September (inclusive) and in consultation with IFI (except in exceptional circumstances and in agreement with IFI) to avoid accidental damage or siltation of spawning beds. The appropriate window for in-stream works can vary depending on the nature of the fishery resource concerned and the existence of other factors such as catchment or sub catchment specific Bye Laws and Regulations.
- To avoid impacting on bird nesting sites, the vegetation removal within the defined working area will not be carried out during the peak bird nesting season of March to August (inclusive) prior to the onset of works.
- To avoid impacts on otters, derogations may be required to carry out works in the vicinity of breeding holts. The timing of the works will be agreed with the NPWS.
- Christmas non-working time is from the beginning of the second week of December to the end of the second week of January to avoid impacts on residents/businesses in the vicinity.

The co-ordination of people and materials on site will be one of the key activities throughout the construction phase. In order to ensure that construction workers do not create undue disruption, there will be a requirement that the Contractor provide adequate site supervision to co-ordinate, monitor and implement site regulations.

Normal construction working hours will be observed. These are 08.00 – 19.00 Monday to Friday; 09.00 – 16.00 on Saturday. It may be necessary to work outside these hours, including at weekends and at night, at certain stages. Working outside normal hours may be necessitated through consideration of safety or weather and sub-contractor availability. Heavy or noisy construction activities will be avoided outside normal hours and the amount of work outside normal hours will be strictly controlled. Approval from Cork County Council will be obtained for works outside normal hours.

It is envisaged that the average number of construction personnel on site will be circa 30 personnel but this will vary depending on the construction activities required, seasonal constraints and will likely peak during the summer months when up to 50 construction personnel is envisaged.

4.6 In-stream works

- All concrete works will be carried out in dry conditions with no in-stream pouring of concrete. It may be necessary therefore to effectively sheet-pile or cofferdam sections of the river and pump out the river water during the construction of the proposed works. If required, fish populations which become isolated, will be salvaged via electrofishing under licence from the Department of Communications, Climate Action and Environment and in consultation with Inland Fisheries Ireland.
- It is expected that most of the equipment used will be standard construction plant for a project of this nature, e.g. mechanical excavators, dump trucks, dewatering pumps, ready mix concrete lorries, pile drivers, rock breakers etc. All machinery should be maintained in good condition to prevent leakage of hydrocarbons. Fuelling and lubrication of equipment must not be carried out within 30m of any watercourse.
- All contractors, sub-contractors and in particular machinery operators will be made aware of the provisions for protecting water quality as outlined in the method statements.
- Where possible excavated material should not be stockpiled long-term within 10m of a watercourse. Where this measure is not implementable, then specific silt control measures should be planned as part of the detailed method statement for site works in each specific area. Precautions will be taken to minimise the run off of soil into watercourses.
- All culverts and walls will be designed to minimise impacts on fish and macroinvertebrate populations. Where possible, gravel substrates and as natural a flow pattern as possible under low water/ low tide conditions will be provided in channels affected by site works. The structure and flow pattern with culverts on minor streams will be designed to allow fish to move through them. The slope of culverts will follow the existing gradient and trash screens are not currently envisaged as part of the Scheme.
- Input from a qualified fisheries/aquatic ecologist with experience in the design of in-stream structures is required into the design of culverts and the post works flow patterns and channel structure. The specialist in conjunction with the supervising ecologist will be required to visit the watercourses prior to the commencement of site works to assess the existing channel structure, fish holding features, substrate composition, flow patterns etc. Where feasible such structures will be incorporated into the channels following completion of work.

4.7 Environmental Construction Management

4.7.1 General

Every effort will be made to ensure that any detrimental environmental effects will be avoided, prevented or reduced during the construction phase of this project.

A construction environmental management plan (CEMP) will be prepared prior to construction commencing. The CEMP will comprise all of the construction mitigation measures, which are set out in this EIS, and any additional measures which are required by the statutory consent conditions. Implementation of the CEMP will ensure disruption and nuisance are kept to a minimum. The plan will have regard to the guidance contained in the handbook published by Construction Industry Research and Information Association (CIRIA) in the UK, *Environmental Good Practice on Site Guide*, 4th Edition (CIRIA 2015).

The Employer's Representative will have a construction management team on the project site for the duration of the construction phase. The team will supervise the construction of the scheme including monitoring the contractors' performance to ensure that the proposed construction phase mitigation measures are implemented and that construction impacts and nuisance are minimised. The construction management team will liaise with residents and the general community during the construction phase to ensure that any disturbance is kept to a minimum and to ensure that all anticipated nuisances are minimised and that the construction activity will have the lowest possible impacts on the residents and other properties.

It is also proposed that a Community Liaison Officer will be appointed who will coordinate communications and liaise with the local community during the construction phase.

4.7.2 Soil, Surface Water and Groundwater

The employment of good construction management practices will minimise the risk of pollution of soil, storm water run-off, adjacent watercourses and groundwater. The Construction Industry Research and Information Association (CIRIA) in the UK has issued a guidance note on the control and management of water pollution from construction sites, *Control of Water Pollution from Construction Sites, guidance for consultants and contractors* (Masters-Williams et al 2001). Additional guidance is provided in the CIRIA technical guidance on Control of Water Pollution from Linear Construction Projects (Murnane et al 2006).

The guides are written for project promoters, design engineers and site and construction managers. They address the main causes of pollution of soil, groundwater and surface waters from construction sites and describes the protection measures required to prevent pollution of groundwater and surface waters and the emergency response procedures to be put in place so that any pollution, which occurs, can be remedied.

The guides address developments on green field and potentially contaminated brownfield sites. The construction management of the site will take account of the recommendations of the CIRIA guidance to minimise as far as possible the risk of soil, groundwater and surface water contamination.

Site activities considered in the guidance include the following:

- Excavation;
- Earthmoving;
- concreting operations;
- spreading of topsoil;
- road surfacing;
- site drainage, and the control and discharge of surface water runoff from the site;
- oil and fuel delivery and storage; and
- plant maintenance.

Measures, as recommended in the guidance above, that will be implemented to minimise the risk of spills and contamination of soils and waters, include:

- Training of site managers, foremen and workforce, including all subcontractors, in pollution risks and preventative measures;
- Careful consideration will be given to the location of any fuel storage facilities. These will be designed in accordance with guidelines produced by CIRIA, and will be fully bunded;
- All vehicles and plant will be regularly inspected for fuel, oil and hydraulic fluid leaks. Suitable equipment to deal with spills will be maintained on site;
- Where feasible, soil excavation will be completed during dry periods and undertaken with excavators and dump trucks. Topsoil and subsoil will not be mixed together;
- Ensure that all areas where liquids are stored or cleaning is carried out are in a designated impermeable area that is isolated from the surrounding area, e.g. by a roll-over bund, raised kerb, ramps or stepped access;
- Use collection systems to prevent any contaminated drainage entering surface water drains, watercourses or groundwater, or draining onto the land;
- Wheel wash at site entrance to clean vehicles prior to exiting onto public road network;
- Minimise the use of cleaning chemicals;
- Use trigger-operated spray guns, with automatic water-supply cut-off;

- Use settlement lagoons or suitable absorbent material such as flocculent to remove suspended solids such as mud and silt; and
- Ensure that all staff are trained and follow vehicle cleaning procedures. Post details of the procedures in the work area for easy reference.

The implementation of the above measures will ensure that the risk of pollution of groundwater, soils and surface waters, resulting from the construction activities will be minimised.

Furthermore, appropriate mitigation measures will be implemented prior to the construction phase to ensure that water quality of the Glashaboy River and its tributaries are not adversely affected through pollution incidents and silt mobilisation. This mitigation will include:

- Appropriate sediment control measures will be employed.
- Any chemical, fuel and oil stores will be located on an impervious base within a secured bund with a storage capacity 110% of the stored volume.
- Biodegradable oils and fuels will be used where possible.
- Drip trays will be placed underneath any standing machinery to prevent pollution by oil/fuel leaks. Where practicable, refuelling of vehicles and machinery will be carried out on an impermeable surface in one designated area well away from any watercourse or drainage (at least 10m).
- Emergency spill kits will be available on site and staff trained in their use.
- Operators will check their vehicles on a daily basis before starting work to confirm the absence of leakages. Any leakages will be reported immediately.
- Daily checks will be carried out and records kept on a weekly basis and any items that have been repaired/replaced/rejected noted and recorded. Any items of plant machinery found to be defective will be removed from site immediately or positioned in a place of safety until such time that it can be removed. All items of plant will be checked prior to use before each shift for signs of wear/damage.
- All washing out of grout pumps will be carried out in designated areas away from the river, such as in the lined compound area. At no point will grout pumps be washed out at the worksite.
- Any structures installed within the channel, to allow working in dry conditions must be designed by a competent person, be constructed of appropriate materials and take account of site conditions (i.e. depth of water, available space, bed substrate, flow velocities, flow patterns, duration of works, and accessibility and potential ingress of water).
- During all works the weather forecast will be monitored and a contingency plan developed to prevent damage or pollution during extreme weather and high flow events.
- Containment measures and emergency procedures to deal with accidental spillages of fuel and lubricants from site machinery will be outlined in the Construction Management Plan which will be developed by the contractor in advance of construction works taking place on site.

- The potential pollution of surface water will be mitigated through the development of containment measures and emergency procedures to deal with accidental spillages in the Construction Management Plan. Fuel will be stored within containment bunds within the site to prevent release of contaminants into the ground. Where it is necessary to refuel machinery on site this will be done in a carefully managed manner at a minimum distance of 25 m away from watercourses. An emergency plan to deal with accidental spillages will be drafted and kept on site during the construction period. The pollution control methods will be outlined within the Construction Management Plan.
- To minimise any impact on the underlying subsurface strata from material spillages all oils, solvents and paints used during construction will be stored within temporary bunded areas. The design (volume and construction) of all bunds will conform to standard bunding specifications. The retention capacity of bunded areas will be as follows: 110% of the capacity of the largest tank or drum to be stored within the bunded area; and 25% of the total volume of substance which could be stored within the bunded area. Spill kits / absorbent pads and boom should be used in the event of a spillage.
- Spill kits will be retained on site, in particular at refuelling areas and other high risk areas, to ensure that any spillages or leakages are dealt with immediately. All dispensing of fuels and hazardous materials will occur over areas of concrete hardstanding or other impermeable surface with drainage directed to an oil / water interceptor or a suitably constructed bund. No refuelling will be permitted in or near soil or rock cuttings.
- All associated waste residuals will also be stored within temporary bunded storage areas prior to removal by an appropriate waste disposal contractor for off-site treatment/recycling/disposal. Any other building waste will be disposed of to on-site skips for removal by a licensed waste disposal contractor. An emergency plan to deal with accidental spillage will be drafted and kept on site during the construction period.

4.7.3 Emissions to Air

As construction activities are likely to generate some dust emissions, particularly during the site clearance and excavation phase, a dust minimisation plan will be prepared and implemented by the contractor during the construction phase of the project.

The following measures will be implemented as part of the dust minimisation plan:

- Limiting vehicle speeds on the construction site;
- During very dry periods, spraying surfaces with water will control dust emissions from heavily trafficked locations;
- All vehicles exiting the site will make use of wheel wash facilities prior to entering onto public roads, to ensure mud and other wastes are not tracked onto public roads. Public roads outside the site will be regularly inspected for cleanliness, and cleaned as necessary. Wheel-washing facilities will be located away from sensitive receptors;

- Topsoil and other dusty material being moved onsite will be transported in covered trucks, where the likelihood of emitting dust is high, and during dry weather conditions the area of removal will be sprayed with water from a mobile tanker on a regular basis to control dust emissions;
- Exhaust emissions from vehicles operating within the site, including trucks, excavators, diesel generators or other plant equipment, will be minimised through regular servicing; and
- Dust monitoring will be carried out at the site boundary throughout the construction phase.

4.7.4 Site Tidiness

The following are some of the measures that will be taken to ensure that the site and surroundings are maintained to a high standard of cleanliness:

- Daily site inspections will be undertaken to monitor site tidiness;
- A regular programme of site tidying will be established to ensure a safe and orderly site;
- Scaffolding will have debris netting attached to prevent materials and equipment being scattered by the wind;
- Food waste will be strictly controlled on all parts of the site.
- Mud spillages on roads and footpaths outside the site will be cleaned regularly and will not be allowed to accumulate;
- Wheel-wash facilities will be provided for vehicles exiting the site; and
- In the event of any fugitive solid waste escaping the site, it will be collected immediately and removed to storage on site, and subsequently disposed of in the normal manner.

4.7.5 Noise Emissions and Vibration

Construction noise will be kept to a minimum in accordance with BS 5228 (2009). The contract documents will specify that the contractor, undertaking the construction of the works, will be obliged to take specific noise abatement measures and will comply with the best practice outlined in British Standard BS 5228 – 1: 2009 +A1 2014: *Code of Practice for Noise and Vibration Control on Construction and Open Sites – Noise* and the NRA (now TII) guidelines *Good Practice Guideline for the Treatment of Noise during the planning of National Road Schemes* (NRA 2014). The following measures will also be employed:

- Selection of plant machinery with low inherent potential for generation of noise and/or vibration. All construction plant and equipment to be used at the site will be modern equipment and will comply with the relevant legislation and regulations
- Regular maintenance of plant will be carried out in order to minimise noise produced by on-site operations. The regular and effective maintenance of plant can play an important role in reducing noise emissions. In particular, attention will be paid to the lubrication of bearings and the integrity of silencers.

Silencers and engine covers will be maintained in good and effective working order.

- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the Contract.
- Any compressors used on-site will be of the “sound reduced” models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers.
- Machines, which are used intermittently, will be shut down or throttled back to a minimum during those periods when they are not in use.
- Any plant, such as generators or pumps, which are required to work outside of normal working hours, will be surrounded by an acoustic enclosure.
- Training of drivers to ensure smooth machinery operation/driving, and to minimise unnecessary noise generation.
- A maximum speed limit of 40 km / hr will be imposed for HGV’s and drivers will be instructed to maintain as far as possible the distances between vehicles.

In terms of minimising vibration levels, the Contractor will be required to select and utilise methods of working and items of plant so that the maximum measured ground vibrations do not exceed a peak particle velocity (PPV) of 8.5mm per second at any occupied property, with a lower PPV limit of 5mm per second applying to properties in poor condition or other sensitive receptors.

The Contractor will be required to monitor ground vibrations at selected locations to the approval of the Employer’s Representative during the progress of the works. Each vibrograph shall be certified as being in proper working order and shall unless otherwise approved, record vibrations in three directions simultaneously with print-out showing the amplitude and frequency of the vibrations.

Vibration measurements shall be taken at the base of buildings, on the side facing the source of vibration. Where feasible, the measurement should be taken on a hard surface on the ground outside the building.

A pre-condition survey will also be undertaken of all properties potentially affected by the works (likely within a 10m radius of works areas). Crack monitoring will be installed on such affected properties and monitored throughout the works.

Where sheet piling is required, low vibration rigs will be used.

4.7.6 Invasive Species

- The invasive alien species Himalayan balsam and Japanese knotweed were recorded within the proposed works areas and wider study area and these species could potentially be dispersed downstream by incorrect work practices. It is noted that the locations identified are indicative of the current distribution of the species within the works area but should not be considered definitive.

- Works may require access to areas outside the immediate works area (i.e. stockpiling material, storage of machinery etc.) and these areas could support this species. It is recommended therefore that any area potentially affected by site works is checked for the presence of invasive species by the supervising ecologist prior to the commencement of site works.
- The Contractor shall also take every precaution to prevent the spread of invasive species (Japanese Knotweed in particular) encountered during the works by ensuring that all plant and equipment that comes in contact with these species (and soil deemed contaminated with species) are regularly cleaned or disposed of in the appropriate manner. The contractor shall be obliged to comply with The European Communities (Birds and Natural Habitats) Regulations 2011 which contain important new provisions to address the problem of invasive species. Whilst Himalayan balsam can be treated in a relatively straight forward manner with herbicides, treatment of Japanese Knotweed may involve burial, bunding, herbicides or a combination of methods. Relevant guidance documents include:
 - *The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads* (2008), Kelly, J., Maguire, C.M. and Cosgrove, P.J.;
 - (2008) Best Practice Management Guidelines Japanese knotweed *Fallopia japonica* prepared for NIEA and NPWS as part of Invasive; and
 - Managing Japanese knotweed on development sites - The Knotweed Code of Practice (2006) UK Environmental Agency.

The treatment of knotweed infested soil and associated biosecurity measures to prevent the spread of knotweed is described in **Appendix 4.1**.

4.7.7 Construction Waste Management

Waste generated during the construction phase will be carefully managed according to the accepted waste hierarchy which gives precedence to prevention, minimisation, reuse and recycling over disposal with energy recovery and finally disposal to landfill.

This hierarchy will be implemented by identifying opportunities to firstly prevent waste from being produced, and secondly minimise the amount of waste produced. Where prevention and minimisation will not be feasible, ways to reuse or recycle waste will be sought, preferably on-site to avoid the impacts arising from transportation. If this is not feasible, opportunities to reuse or recycle the waste off-site will be investigated. If this is not feasible, then waste will be sent to an energy recovery facility, and only where there is no alternative, will waste be disposed of to landfill. To achieve this, existing waste management programmes and networks will be used such as the National Waste Prevention Programme, which is implemented by the Environmental Protection Agency.

All waste removed from the site will be collected only by contractors with valid waste collection permits, under the Waste Management (Collection Permit) Regulations.

All facilities to which waste will be taken will have appropriate waste licences or permits, under the Waste Management Act 1996, as amended, and the regulations thereunder, allowing them to accept the type of waste that is to be sent there. Hazardous waste generation will be minimised, and such waste will be recovered where feasible, and only disposed of if recovery is not feasible. Hazardous waste will be managed in accordance with the relevant legislation.

4.7.7.1 Waste Arising

In general, construction waste materials may include general construction debris, scrap timber and steel, machinery oils and chemical cleaning solutions. The practice of excessive purchase of materials and equipment to allow for anticipated wastage will be avoided.

It is anticipated that the majority of the excavated material, which is expected to be uncontaminated soil will be suitable for reuse onsite. In the unlikely event of any evidence of soil contamination being found during work on site, the appropriate remediation measures will be employed. The treatment of knotweed infested soil and associated biosecurity measures to prevent the spread of knotweed is described in **Appendix 4.1**.

Any work of this nature would be carried out in consultation with, and with the approval of the Environmental Department of Cork County Council, IFI, EPA and NPWS as necessary. The material would be transported to a permitted site via the national and regional road network.

Timber from trees, felled as part of the site preparation, will be sold to the timber industry.

4.7.7.2 Waste Management Plan

The contractor will be required to develop, implement and maintain a Waste Management Plan during the construction works. A senior manager will be responsible for the waste management plan. The manager will be competent in waste management, and will receive training, where necessary, such as the CIF Site Waste Management and Environmental Awareness course.

The key principles underlying the plan will be to minimise waste generation and to segregate waste at source. The measures to achieve these aims include:

- Ordering of appropriate quantities of materials, with a just-in-time philosophy;
- Immediate and careful storage of materials delivered to the site;
- Storing materials which are vulnerable to damage by rain under cover and raised above the ground;
- Careful handling of materials, using appropriate equipment, to avoid undue damage; and

- Designation of separate storage areas for different types of waste, in order to maximise the reuse and recycling potential of the waste.

The Waste Management Plan will outline how residual waste will be handled as follows:

- The identification of disposal sites;
- The identification of quantities to be excavated and disposed of and classification of this material;
- The identification of measures to prevent nuisance, etc.;
- The identification of the amounts intended to be stored temporarily on site and the location of such storage;
- The contractor's approach to waste management; and
- The names, roles, responsibilities, and authority of the key personnel involved in the waste management.

The Waste Management Plan will include documented procedures for dealing with waste management including liaison with third parties, statutory undertakers and other companies.

The Waste Management Plan will meet the requirements of the guidelines prepared by the National Construction and Demolition Waste Council (NCDWC), Best Practice Guidelines on the Preparation of Waste Management Plans for Construction & Demolition Projects, NCDWC 2006.

The following will also be considered as part of the Waste Management Plan:

- The identification of the amounts of materials intended to be stored temporarily on site and the location of such storage;
- Procedures for controlling sub contracts i.e. for checking waste procedures of subcontractors and ensuring sub-contractors fulfil design teams and contractors obligations in respect of waste management;
- Designation of separate storage areas for different types of waste materials in order to maximise their re-use and recycling potential;
- Procedure for record keeping for waste retained on site;
- Procedure for record keeping for hazardous waste, for example, C1 forms and trans-frontier shipment documents; and
- Details of authorised waste hauliers with appropriate and up-to-date Waste Collection Permits. Details of permitted or licensed recovery and/or disposal facilities where waste materials will be sent, including copies of permits and licenses.

4.7.7.3 Waste Minimisation

The main contractor will be required to minimise waste and to segregate waste at source. The possible measures used to achieve these aims will include:

- Ordering of appropriate quantities of materials, with a just-in-time philosophy.
- Immediate and careful storage of materials delivered to the site.
- Storing under cover and raised above ground materials, which are vulnerable to damage by rain.
- Careful handling of materials, using appropriate equipment, to avoid undue damage.
- Designating separate storage areas for different types of waste in order to maximise the re-use and recycling potential of the waste.

Anticipated wastes arising can be summarised as follows:

- Sanitary waste from toilet and washing facilities. These will be routed to the existing sanitary waste infrastructure and treated on site prior to discharge; and
- Construction Waste – e.g. packaging, pallets, and metal waste will be disposed off-site at suitably permitted waste facilities.

4.8 Materials Source and Transportation

In so far as is feasible, all construction materials will be sourced from local suppliers if these are available within the Cork area. The selection and specification of construction materials will be informed by local availability of these materials. Within the necessary constraints of performance, durability and cost, construction materials will be sourced from local suppliers and manufacturers, where possible. The coordination and logistics of construction traffic will be captured within the construction traffic management plan which will be agreed with CCC and An Garda Síochána.

4.9 Construction Safety

As required by the Safety, Health and Welfare at Work (Construction) Regulations 2013, a Health and Safety Plan will be prepared which will address health and safety issues from the design stages through to the completion of the construction and maintenance phases. This plan will be reviewed as the scheme progresses. The contents of the Health and Safety Plan will comply with the requirements of the Regulations.

The Regulations require the developer of a project to appoint a “Project Supervisor Design Process” and “Project Supervisor Construction Stage”. Cork County Council has appointed Arup as Project Supervisor Design Process in accordance with the current legislation.

The Project Supervisor Design Process will assemble the Safety File as the project progresses. The Safety File will be incorporated into the overall technical record system at the end of the project.

Safety on site will be of paramount importance. During the selection of the contractors and subcontractors, their safety records will be investigated. Only contractors with high safety standards will be selected.

Prior to working on site, each individual will receive a full safety induction and will be provided with all of the safety equipment relevant to the tasks the individual will be required to perform during employment on site.

Safety briefings will be held regularly and prior to any onerous or special task. 'Toolbox talks' will be held to ensure all workers are fully aware of the tasks to be undertaken and the parameters required to ensure the task will be successfully and safely completed.

All visitors will be required to wear appropriate personal protective equipment prior to going on to the site and will undergo a safety briefing by a member of the site safety team.

Regular site safety audits will be carried out throughout the construction and the complied with at all times.

At any time that a potentially unsafe practice is observed, the site safety manager will have the right as well as the responsibility to halt the work in question, until a safe system of working is again put in place.

4.10 Construction Site Decommissioning

On completion of construction, all construction facilities and equipment such as plant, materials, signage, contractors' offices and laydown areas, etc. will be removed from site. Temporary entrances will be removed, boundary walls, fences reinstated and all roads reinstated as necessary. Construction site fencing will be removed and landscaping/replanting will be completed.

5 Planning and Policy

5.1 Introduction

This chapter outlines the statutory land use development and planning policy in the context of the proposed Glashaboy Drainage Scheme. The scheme is examined in the context of policies and objectives of the documents below, which address policy guidance at European Union, national and local levels.

5.2 EU Directives and Policy Guidance

5.2.1 EU ‘Floods Directive’

The EU Directive on the Assessment and Management of Flood Risks (2007/60/EC) (the ‘Floods’ Directive) was transposed into Irish law by the EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010. The directive requires Member States to assess if all watercourses and coastlines are at risk from flooding, to map the flood extent and assets and humans at risk in these areas and to take adequate and co-ordinated measures to reduce this flood risk.

Implementation of the EU Floods Directive is being coordinated with the requirements of the EU Water Framework Directive and the current River Basin Management Plans.

The Office of Public Works (OPW) is the national authority for the implementation of the Directive.

‘Conformance of the Project to the EU ‘Floods Directive’

The development of the Catchment Flood Risk Assessment and Management (CFRAM) Programme is the direct response to the Floods Directive. The CFRAM identifies areas at risk of flooding and is a strategy for the reduction and management of flood risks in Ireland. The Glashaboy Drainage Scheme has been developed as a result of the CFRAM recommendations. See section 5.3.2 below for further details of the CFRAM. The design of this proposed drainage scheme is a direct and coordinated measure proposed in line with the requirements of the Floods Directive as transposed into Irish law as SI 122 of 2010.

5.2.2 EU Water Framework Directive

The EU has developed the Water Framework Directive (WFD) which establishes a legislative framework for the protection of all waters including rivers, lakes, estuaries, coastal waters and groundwater, and their dependent wildlife and habitats. Specifically, the WFD aims to:

- *“protect/enhance all waters (surface, ground and coastal waters);*
- *achieve ‘good status’ for all waters by December 2015;*
- *manage water bodies based on river basins (or catchments);*
- *involve the public; and*
- *streamline legislation”.*

Conformance of the Project to the EU Water Framework Directive

The proposed drainage scheme is consistent with the EU Water Framework Directive in several ways. Measures to protect/enhance all waters have been incorporated into the design of the scheme (see **Chapter 11 Soils, Geology and Hydrogeology**). By conforming to the requirements of the CFRAM, the proposed scheme conforms to the aim of managing water bodies based on river basins. In addition, public consultation was held in relation to the proposed scheme on a number of occasions since 2014. Refer to **Chapter 1 Introduction** for more details.

5.3 Irish National Legislation, Policy and Guidance

5.1.1 Arterial Drainage Act

The Glashaboy River (Glanmire/Sallybrook) Drainage Scheme is being carried out under the Arterial Drainage Act (1945) and Amendment Act (1995). Under the Arterial Drainage Acts, 1925, 1945 and 1995, the OPW is the current statutory authority and responsible authority in relation to arterial drainage and flood relief. These acts enables the OPW to undertake local flood relief work. The Arterial Drainage Amendment (1995) recognised the significant problem that urban flooding has become in Ireland. This amendment empowered the Commissioners to undertake flood relief works in localised areas without having to undertake work throughout the river basin as had previously been the approach.

Consent for the proposed drainage scheme will be obtained under the Arterial Drainage Acts 1945 and 1995.

5.3.1 National Flood Policy

In line with changing national and international patterns on how to manage flood risk most effectively and efficiently, a review of national flood policy was undertaken in 2003-2004. The adopted resulting policy was accompanied by many specific recommendations which led to the development and implementation of the National CFRAM Programme.

Conformance of the Project to National Flood Policy

The proposed development has been developed in line with the Irish National Flood Policy. The National Flood Policy designates the OPW as the lead agency in the coordination and management of flood risk in Ireland. It draws on content from the 'Floods' Directive by encouraging the use of both structural and non-structural flood relief measures, which have been incorporated into the design of this scheme. It also requires that flood risk management take place at the River Basin District (RBD) level. This Glashaboy River Catchment sits in the South Western River Basin District. The South Western RBD includes most of County Cork and parts of the counties of Limerick, Kerry, Tipperary and Waterford.

The objectives of the South Western River Basin District CFRAM Study are as follows:

- *“Promote the active participation of the public in addressing flood risk;*
 - *Create accurate flood maps for areas at significant risk from flooding; and*
- Develop plans to manage flood risk on a catchment wide scale*

5.3.2 The National CFRAM Programme

The main objective of the national Catchment-based Flood Risk Assessment and Management (CFRAM) Programme is to achieve the requirements of the EU 'Floods' Directive. CFRAM, which commenced in Ireland in 2011, is a strategy for the reduction and management of flood risk in Ireland. It delivers on core components of the National Flood Policy, adopted in 2004, and on the requirements of the EU 'Floods' Directive.

Conformance of the Project to the National CFRAM Programme

The proposed development has been developed in line with the Irish National Flood Policy. The project on the Glashaboy River shares the overall strategy of the Programme of reducing and managing the flood risk in Ireland.

5.4 Regional Policy Guidance

5.4.1 Southwest Regional Planning Guidelines 2010-2022

The Southwest Regional Authority is the statutory authority for the Southwest region of Ireland, covering Cork City and County and County Kerry. The Planning and Development Act, 2000, as amended requires Regional Authorities to make Regional Planning Guidelines in respect of their region and to review the Guidelines at intervals not exceeding six years. The Regional Planning Guidelines document is a strategic policy document designed to steer the future growth of the region over the medium to long term.

The Southwest Regional Planning Guidelines 2010-2022 recommend a clear and transparent assessment of flood risk at all stages in the planning process.

The Guidelines set out the regional flood risk appraisal and management policy recommendations that necessary to set a policy framework for development and local area plans at the local level.

The Guidelines state how important it is to highlight the need for developing policy and actions, and encourage co-operation across Councils and regions as the impact of flood and water movement in many places crosses Local Authority and Regional boundaries.

It is an objective of the Guidelines to promote the completion, by the local authorities in the region, of CFRAM Studies covering the Southwest by 2016, including a review of long term flood risk management options.

Conformance of the Project to the Southwest Regional Planning Guidelines 2010 – 2022

The proposed scheme is in conformance with the Southwest Regional Planning Guidelines because it addresses the need for a risk appraisal and management plan on a regional basis. Understanding that the impact of flooding and water movement is trans-boundary, the development objectives of Cork City and Cork County have been considered in the scheme design. Finally, by conforming to the CFRAM, the proposed scheme can be considered consistent with the Southwest Regional Planning Guidelines 2010-2022.

5.5 Local Policy Guidance

5.5.1 Cork County Development Plan 2014

The *Cork County Development Plan 2014* sets out the County strategy in relation to ‘Strategic Sub-areas’. These sub-areas include the County ‘Metropolitan Strategic Planning Area’ in which the Study Area is located.

The objectives of the County Development Plan seek to prioritise the sustainable development of the metropolitan towns (formerly satellite towns), including Glanmire, and to increase their capacity to attract new investment in employment, services and public transport.

County Development Plan Objective CS 3-1 states that the strategic aim for Glanmire is: *“Critical population growth, service and employment centres within the Cork “Gateway”, providing high levels of community facilities and amenities with infrastructure capacity, high quality and integrated public transport connections should be the location of choice for most people especially those with an urban employment focus.”*

Chapter 11 Water services, Surface water and Waste of the County Development Plan outlines the county objectives for the management of surface water. The Plan makes reference to Glanmire undergoing flood risk assessment and management studies at the time of the report being published. The chapter makes specific reference to flooding in the county.

Objective WS 5-2: River Channel Protection is to: *“Ensure that where practical, development is kept at 10m or other appropriate distance from stream and river banks and adequate protection measures put in place.”*

Objective WS 5-3: Surface Water Management is to *“Manage surface water catchments and the use and development of lands adjoining streams, watercourses and rivers in such a way as to minimise damage to property by instances of flooding and with regard to any conservation objectives of European sites within the relevant catchments and floodplains.”*

Conformance of the Project to the Cork County Development Plan 2014

Community facilities and infrastructural development in areas at risk of flooding require strategic flood risk assessments. Glanmire was identified in this Plan and is described in this EIS (see **Chapter 2 Need for the Development and Alternatives Considered** for a history of flooding in Glanmire) and in the 2014 Development Plan, Glanmire is an area prone to flooding. These flooding events can hamper the achievement of the development goals of the County Development Plan. As such it is considered appropriate that the flood alleviation measures proposed in this scheme will contribute to achieving the overall objectives of the County Development plan, as outlined above.

The proposed flood relief measures described in **Chapter 4 Construction Activities** comply with the objectives WS 5-2 and WS 5-3 of the Development Plan. Where there is existing development, relief works have been designed to defend existing structures from future flooding events while also minimising the impact on the habitats that can potentially be affected by the works.

5.5.2 Local Area Plans

Local Area Plans (LAP) set out land use zonings and other specific objectives for lands within the Electoral Areas.

The Study Area which is the area that contains all areas of the proposed works for the drainage scheme and which includes the settlement of Glanmire, is located within the boundary of the Blarney Electoral Area Local Area Plan 2011, the 2nd Edition of which was published in January 2015.

Blarney Electoral Area Local Area Plan, 2nd Edition January 2015

Glanmire is defined in the Blarney Electoral Area LAP as a main town in Metropolitan Cork. The vision for Glanmire 2020, as outlined in the LAP, is:

“to achieve moderate population growth in tandem with incremental retail growth, high quality social and community facilities and improved transport linkages while protecting its attractive woodland setting within Metropolitan Cork.”

Section 2.2.29 of the Blarney Electoral Area LAP states that

“An expanded town centre designation has been provided in Glanmire in an attempt to consolidate retail uses in the area. This new designation will extend from the existing Hazelwood Shopping Centre towards Riverstown.”

LAP Zoning for Glanmire

The following LAP zoned areas in Glanmire are indicated on the Blarney LAP Zoning Map:

- ‘Open Space/Sports’;
- ‘Residential’;
- ‘Town/Centre/Neighbourhood Centre’;
- ‘Community/Utility’;
- ‘Industry’;
- ‘Area Susceptible to Flooding - Zone A’;
- ‘Area Susceptible to Flooding – Zone B’; and
- X-01 Special Policy Area.

LAP Objectives and Policies for Glanmire

The Blarney LAP includes a number of general objectives relating to the Glanmire area, and also objectives relating to residential, industrial, town centre and community facilities, development. In addition objectives relating to open space, agriculture and utilities are outlined.

Objectives of the LAP include, but are not limited to, the following:

Objective DB-01 – “*..to secure the development of a minimum 1889 new dwellings in Glanmire between 2010 and 2020 in order to facilitate the sustainable growth of the town’s population from 8,385 to 10, 788.*” The LAP states that with regard to residential development, much of the residentially zoned land was clustered at Dunkettle and Ballinglanna and that a number of sites remain undeveloped to the north of the town. These sites continue to “*represent suitable locations for the continued growth of the town*”.

Objective DB-06 – “*All proposals for development with the areas identified as being at risk of flooding will need to comply with Objectives FD1-1 to FD 1-6 detailed in Section 1 of this Plan...*”. (Objectives FD1-1 – FD 1-6 relate to ‘Flood Risk – Overall Approach’, page 8 of the Plan).

Two sites zoned ‘Industry’ are located in the northern portion of Glanmire. Objectives for these sites are as follows:

Objective I-01 – “*Industrial estate development suitable for small to medium sized industrial units... (approx. 12.3Ha)*” and

Objective I-02 – “*(a) Industrial estate development suitable for small to medium sized industrial units (4.6 Ha). (b) Parts of this site are at risk of flooding....*”.

With regard to Glanmire town centre development, the Hazelwood centre is identified in the LAP as the focal point for retail provision in the Town. Specific town centre zoning objectives are as follows:

Objective T-01 – “*(a) It is an objective to consolidate the Hazelwood Shopping Centre and provide connectivity, both pedestrian and cycling, to the new Riverstown Town centre and town park. Particular attention to be given to public realm enhancements...*”.

Objective T-02 – *“(a) It is an objective to facilitate the expansion of Glanmire Town centre by encouraging retail and office development ...”(c) parts of this site are at risk of flooding... ”.*

With regard to development zone C-01 indicated on the Zoning Map for community facilities, the specific zoning objective is:

Objective C-01 - *“(a) Provision for community facilities and uses to support residential amenity and associated uses, with appropriate linkages to the Hazelwood Shopping centre. (b) “Parts of this site are at risk of flooding.... ”.*

With regard to open space, the LAP states that parts of a number of open space sites are affected by flooding. Specific open space/agriculture zoning objectives include:

Objective O-01 – *“This prominent slope makes a significant contribution to the setting of Riverstown. There is a presumption against development on these lands because of the importance of the hillside to the setting of the area”(41.8 ha).*

Objective O-02 – *“(a) Open Space, to include the provision of playing pitches and amenity walk (4.5 Ha). (b) Parts of this site are at risk of flooding....(4.5 ha)”.*

Objective O-03 – *“Open space with provision for amenity walk and protection of existing playing fields (10.7ha)”.*

Objective O-04 – *“Open space for informal recreation including the provision of an amenity walk. This space contains the Town Park, an important community amenity (16.3ha)”.*

Objective O-05 – *“(a) Riverstown House estate demesne garden, cottages and ornamental lake (3.6ha). (b) Parts of this site are at risk of flooding.... ”*

Objective O-06- *(a) This site contains a substantial sporting facility (2.8ha). (b) Parts of this site are at risk of flooding..... ”*

Objective O-07 – *Passive open space. This important hillside makes a significant contribution to the rural character of Glanmire and is a visually attractive entrance to the City. The entire area is sensitive due to its proximity to Glanmire Wood and Dunkettle Shore, which are both proposed Natural Heritage Areas. The existing land uses will remain unchanged and there is presumption against development.”*

Specific utilities and infrastructure objectives for Glanmire include the following:

Objective U-01- *“Complete and maintain pedestrian walk through scenic area and open space to Glanmire Community College.*

Objective U-02 – *“Develop and maintain pedestrian walk through existing open space and extend through proposed open space (O-04) along river bank”.*

Objective U-03 – *“Develop and maintain pedestrian walk through residential areas”.*

Objective U-04 – *“Develop Link Road”.*

Special Policy Area X-01 - The LAP contains a number of objectives for the Special Policy Area X-01 (Dunkettle and Ballinglanna) (75.6ha) (page 49 of the LAP) indicated on the Zoning Map. The LAP states that development of the site will be subject to the agreement of a masterplan (Section 3.4.26 of LAP). The LAP also states that development on the site will provide approximately 1200 units.

Table 2.8 of the Blarney LAP *‘Future Education Provision in the Blarney Electoral Area’* includes the following school requirements in Glanmire:

“1 new primary school to be provided as part of Ballinglanna X-01 development.”

Blarney LAP Planning Considerations for Surface Water/Flooding

Much of the Blarney LAP objectives for Glanmire refer to the flooding in relation to town development. The Glanmire Zoning Map illustrates the zoning objectives for the town, refer to **Figure 5.1**.

Objective DB-06 states that “[A]ll proposals for development within the areas identified as being at risk of flooding will need to comply with Objectives FD1-1 to FD 1-6 detailed in Section 1 of this Plan, as appropriate, and with the provisions of the Ministerial Guidelines – ‘The Planning System and Flood Risk Management’. In particular, a site-specific flood risk assessment will be required as described in objectives FD1-4, 1-5 and 1-6 of this plan.”

Objective I-02 (b) The Blarney LAP identifies potential areas in Glanmire for industrial estate development. The site labelled I-02 is located east of the M8 motorway and north of the Glenmore Stream. The Blarney LAP Objective I-02 (b) notes that “Parts of this site [I-02] are at risk of flooding. Any development proposals on this site will normally be accompanied by a flood risk assessment that complies with Chapter 5 of the Ministerial Guidelines ‘The Planning System and Flood Risk Management’ as described in objectives FD 1-4, 1-5 and 1-6 in Section 1 of this plan.”

Objective T-02(c) notes that for the town centre site labelled in T-02, “[P]arts of this site are at risk of flooding. Any development proposals on this site will normally be accompanied by a flood risk assessment that complies with Chapter 5 of the Ministerial Guidelines ‘The Planning System and Flood Risk Management’ as described in objectives FD 1-4, 1-5 and 1-6 in Section 1 of this plan.”

Conformance of the Project to the Blarney Electoral Area Local Area Plan 2011

Many of the areas identified for development, e.g. Hazelwood Shopping Centre and Riverstown Town Centre, are in areas at risk of flooding. Similarly, new residential and commercial/industrial development is planned for the area, and it is an objective to ensure that sites are suitable for this development, and not at high risk of flooding. The maintenance of riverside walkways, parks and other amenities (including sporting facilities and open space) at risk of flooding are to be protected and enhanced.

The development objectives specific to Glanmire reference the overall flooding objectives included in the LAP (Objectives FD1-1 to FD 1-6).

All proposals to develop, enhance and consolidate the settlements in zoned lands must be protected from flooding. Any such proposed developments on these lands must adhere to the overall LAP flooding objectives. The proposed drainage scheme will mitigate the flood risk to some of these zoned lands and thereby contribute to achieving some of the objectives of the LAP.

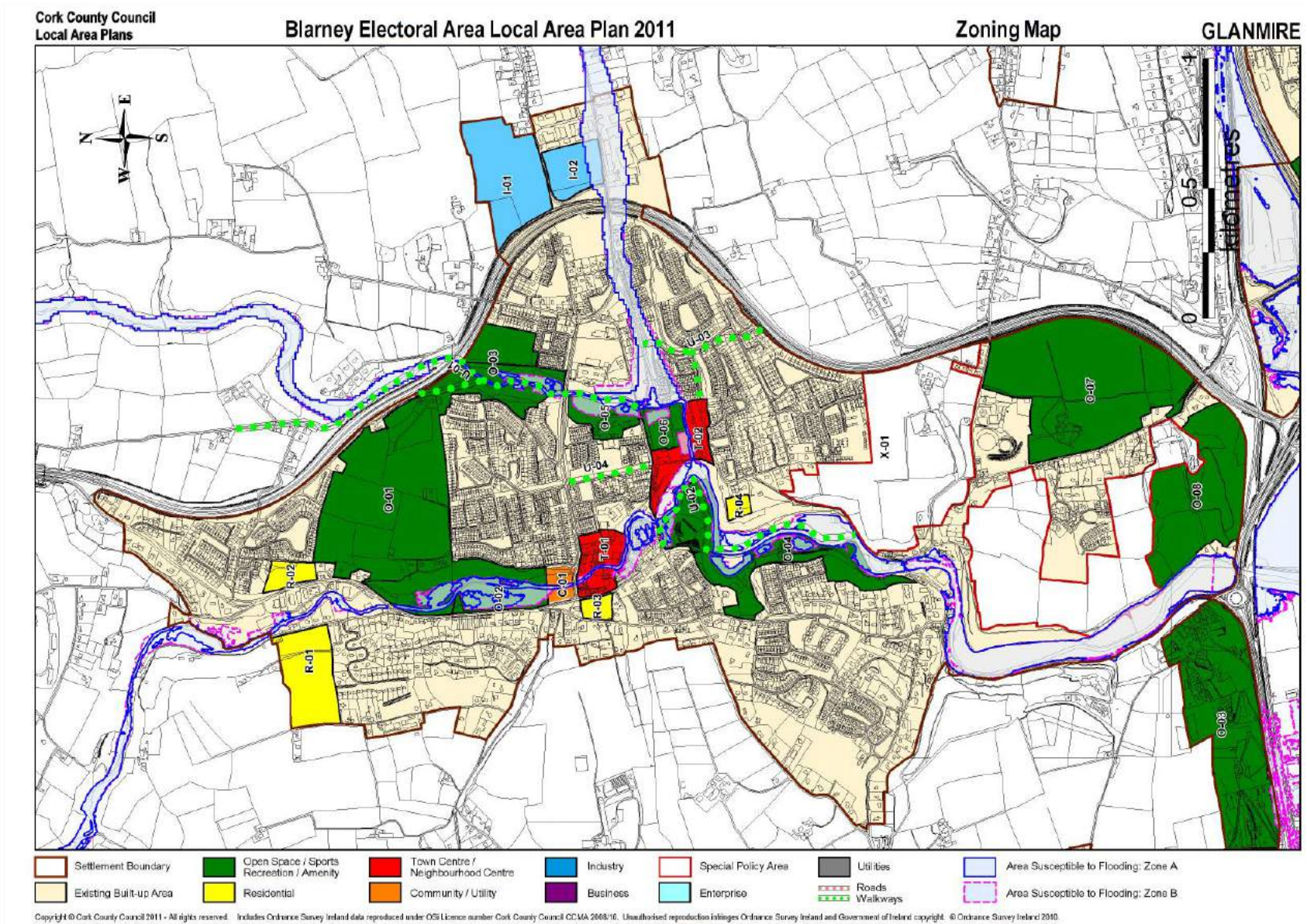


Figure 5.1: Glanmire Zoning Map from the Blarney Local Area Plan, 2nd Edition, 2015

5.6 Conclusions

This Chapter has dealt with the relevant planning and policy documents and guidelines, with the aim of demonstrating the conformance of the proposed scheme with these documents.

The Glashaboy River (Glanmire/Sallybrook) Drainage Scheme is being carried out under the Arterial Drainage Act (1945) and Amendment Act (1995).

European, national and local planning policies require that flood zones be properly identified, mapped, and that appropriate risk assessment and management plans be drawn up to reduce the risk of flooding. The policies and guidelines described in this chapter promote the improvement of local amenities, and the development of the Cork City environs to support economic growth. The reduction in the risk of flooding is considered a fundamental measure in achieving these objectives, which indicates the conformance of the proposed flood relief scheme with planning policy.

5.7 References

Central Statistics Office – online Censuses of Ireland 2006 and 2011, (www.cso.ie).

Cork County Council (2014) *Cork County Development Plan 2014*

Cork County Council (2015) *Blarney Electoral Area Local Area Plan 2011, Second Edition*.

Cork City and County Councils *Cork Area Strategic Plan 2001-2020*.

Indecon, RPOS and Savills HOK (2008) *The Cork Area Strategic Plan – Strategy for Additional Economic and Population Growth – An Update*.

Office of Public Works, *CFRAM Programme*.

South West Regional Authority *Regional Planning Guidelines 2010-2022*.

6 Biodiversity

6.1 Introduction

This chapter relates to the potential ecological impacts of the proposed Glashaboy River (Glanmire / Sallybrook) Drainage Scheme, considering designated sites, habitats, flora and protected/notable species. The aim of this chapter is to identify the key ecological receptors within the study area, determine their ecological value, assess the potential impacts of the scheme upon them and propose mitigation to offset any identified impacts.

Ecological receptors within the study area are strongly linked to the water environment and hydromorphological factors, and this chapter will give cognisance to the inter-relationships between these aspects, in particular.

6.1.1 Relevant Legislation and Policy Context

This assessment has had regard to the following policy documents and legislation:

6.1.1.1 National and International Legislation

- The Planning & Development Act 2000 & the Planning and Development (Amendment) Act, 2010 (as amended) hereafter referred to as the Planning Acts.
- The Wildlife Act 1976 as amended by the Wildlife (Amendment) Act, 2000 (as amended) hereafter referred to as the Wildlife Acts.
- European Communities (Environmental Impact Assessment) Regulations 1989 to 2001.
- European Commission (EC) Habitats Directive 92/43/EEC (as amended).
- EC Birds Directive 2009/147/EC.
- European Communities (Birds and Natural Habitats) Regulations 2011 (as amended) hereafter referred to as the Birds and Habitats Regulations.
- Flora (Protection) Order, 1999.
- Environment (Miscellaneous Provisions) Act 2011.
- The Fisheries (Consolidation) Act 1959.
- The Local Government (Water Pollution) Act, 1977 (as amended by Sections 3 and 24 of the 1990 Act).

6.1.1.2 Relevant Policies and Plans

- National Biodiversity Plan, 2011-2016.
- Ireland's National Strategy for Plant Conservation.
- Cork County Development Plan 2014.

- Blarney Electoral Area Local Area Plan 2015.
- Draft Cork Harbour Study 2010.
- County Cork Biodiversity Action Plan 2009-2014.
- Cork City Biodiversity Action Plan 2009 – 2014.

6.1.1.3 Relevant Guidance

- Invasive Species in Ireland (NPWS, 2004).
- Guidelines for Ecological Impact Assessment in the United Kingdom: Terrestrial, Freshwater and Coastal Environments (Institute of Ecology and Environmental Management, 2nd Edition 2016).
- Advice Notes on Current Practice (in preparation of Environmental Impact Statements) (Environmental Protection Agency, 2003).
- Advice Notes for Preparing Environmental Impact Statements (Draft) (EPA, 2015).
- Guidelines on the information to be contained in Environmental Impact Statements (EPA, 2002).
- Revised Guidelines on the information to be contained in Environmental Impact Statements (Draft) (EPA, 2015)
- Environmental Impact Assessment of National Road Schemes – A Practical Guide (NRA, 2008).
- Guidelines for Assessment of Ecological Impacts of National Road Schemes (NRA, 2009a).
- NRA Environmental Assessment and Construction Series Guidelines (NRA, 2006- 2009a).
- Bat Surveys: Good Practice Guidelines (Bat Conservation Trust UK, 2012).
- Bats & Lighting Guidance Notes for Planners, engineers, architects and developers (Bat Conservation Ireland, December 2010).
- Bats in Buildings Guidance Notes for Planners, engineers, architects and developers (Bat Conservation Ireland, December 2010).
- Bat Mitigation Guidelines for Ireland (NPWS, 2006).
- Bat Mitigation Guidelines (English Nature, 2004).
- Guidelines on the Protection of Fisheries during construction works in and adjacent to water. (Inland Fisheries Ireland, 2016).
- Riparian breeding bird surveys methods (Cummins et. al, 2010).

6.1.1.4 Consultation

During development of the Glashaboy River (Glanmire/Sallybrook) Drainage Scheme and production of this Environmental Impact Statement consultations were held with Inland Fisheries Ireland (IFI) and Cork County Council's Heritage Officer; any recommendations have been incorporated into this assessment, including in relation to survey methodology and mitigation measures proposed.

University College Cork were also helpful in providing information regarding important Riparian bird species, including Dipper. The following were also consulted, however no responses in relation to ecology have been received to date:

- Bat Conservation Ireland;
- BirdWatch Ireland;
- Department of Environment, Heritage and Local Government;
- Irish Wildlife Trust;
- NPWS local and regional staff;
- Tree Council of Ireland; and
- Woodlands of Ireland.

6.2 Ecological Baseline surveys

A walkover survey of the area (Joint Nature Conservation Committee (JNCC) Phase I Survey) was conducted on 14/03/14 to record the habitats and flora of the scheme as part of the Constraints Study, and to detect the presence or likely presence of protected species. The study was chiefly concerned with recording habitats suitable for protected habitats and species; and notes were also made on other flora and fauna. The more detailed ecological surveys and species specific surveys were carried out during 2016 for the proposed scheme, by a number of specialist ecologists and other technical specialists as follows:

Name	Company	Role	Ecological Receptor
Francis Tobin and Anne Murray	JBA Consulting	Ecologists and Bird Specialists	Breeding Birds and Wintering birds
Niamh Sweeney	JBA Consulting	Ecologist and Aquatic Specialist	Aquatic macroinvertebrates, Reptiles, Amphibians and Large Mammals
Matthew Hemsworth	JBA Consulting	Geomorphologist	Geomorphology interactions with Ecology
Jonathan Whitmore	JBA Consulting	Fisheries Specialist	Fisheries interactions with Geomorphology and Hydrology
Dr Kieran Connolly	JBA Consulting	Botanist	Habitats and Flora
Ross Macklin	Triturus Environmental Services	Fisheries Scientist	Fisheries

Dr Tina Auchney	Bat Conservation	Bat Specialist	Bats
------------------------	------------------	----------------	------

Ecological Survey methods were in general accordance with those outlined in the following documents:

- Heritage Council (2010). Best Practice Guidance for Habitat Survey and Mapping. [Pre-Publication Version];
- Phase 1 Habitat Survey methodology (Joint Nature Conservation Committee (JNCC), 1990, revised 2003); and
- Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes (NRA, 2009).

Aerial photographs and site maps assisted the habitat survey. Mammals and birds were surveyed based upon sightings and signs of mammal activity during the habitat survey and also the identification of possible suitable habitats.

Habitats have been named and described following Fossitt (2000). Nomenclature for higher plants principally follows that given in Webb's An Irish Flora (Parnell and Curtis, 2012).

6.2.1 Electrofishing Surveys

6.2.1.1 Methodology

Consultations & Desktop Research

Consultation was undertaken with Inland Fisheries Ireland (IFI) in April 2016 to attain information on the fisheries status of the Glashaboy River and tributaries overlapping the drainage scheme works areas. Desktop research was conducted to obtain baseline information of the fisheries status of the rivers while the site surveys obtained detailed information at the specific flood relief working areas detailed on the scheme drawings provided (Refer to **Appendix 3.1**). The following methodology is outlined for the surveys:

Fish stock assessment (Electro – Fishing)

Electro-fishing establishes the fisheries composition of a river and its tributaries and also identifies its importance as a fish nursery for salmon, sea trout, brown trout and lamprey. A state of the art single anode Smith-Root LR24 backpack (12V DC input; 300V, 100W DC output) was used to electro-fish the main channel of the Glashaboy River and tributaries during July 2016 under a DCMNR license. A precise start date for the survey was negotiated with Inland Fisheries Ireland and all of the data records were returned to IFI in their format as standard following the completion of the survey to close the license. Two primary species groups were specifically targeted during the survey, i.e. lamprey and salmonids, and therefore the electro-fishing settings were tailored for each species. Survey areas were selected at each of the flood relief working zones and / or immediately downstream.

By undertaking electrofishing using the rapid electro-fishing technique (see methodology below), the broad characterisation of the fish community at each crossing point was determined as a longer representative length of channel was surveyed.

For salmonid species (i.e. trout & Atlantic salmon), electro-fishing was carried out in an upstream direction (as previously stated) for a standard 5 minute CPUE according to Kennedy (1984) and O' Connor & Kennedy (2002). Electro-fishing for lamprey ammocoetes was conducted using targeted box quadrat-based electro-fishing (as per Harvey & Cowx, 2003) in areas of sand/silt, where encountered, in the three survey reaches as outlined above. Lamprey species were identified as river / brook and sea lamprey ammocoetes using myomere counts and other physical cues.

In order to acquire a more representative estimate of the fish density and abundance at each site, targeted electro-fishing for lamprey included areas of sand/silt after the standard 5- minute CPUE for salmonids and any other potential species. As lamprey take longer to emerge from silts and are targeted at a lower frequency (20-30hertz) than salmonids (i.e. 40hertz), they were to be targeted after electro-fishing for salmonids.

This reduced the risk of damage to other species if targeted lamprey surveys in sands/ silts were to be undertaken first. The species-specific settings and further detail were scoped under licence requirements as advised by Inland Fisheries Ireland.

Survey areas were located at flood relief working zones and are given in Table 6.1. These included a first station, commencing slightly upstream but overlapping the instream works zone and at a second station downstream of this location to provide improved knowledge of the fisheries value of the wider site. Electro-fishing was conducted at ten locations where instream works are expected. Of note is that significant instream works were already being conducted at the time of survey and before this survey commenced.

Table 6.1: Locations of electrofishing survey sites

Site number and name	River	River Type	EPA Code	Hydrometric Area
Bleach Hill Stream Culvert	Bleach Hill Stream	Upland eroding stream	19U02	19
Culvert Sallybrook Industrial Estate	Unnamed	Modified drainage ditch	n/a	19
Culvert at Millrace 3	Unnamed	Flood relief channel	19G01	19
Culvert on Cois na Glenn Stream	Cois na Gleann Stream	Modified Stream	19L45	19
Flood Relief Culvert at Hazelwood Avenue	Glashaboy River	Lowland depositing River	19G01	19
Hazelwood Centre Bridge	Glashaboy River	Lowland depositing River	19G01	19
Culvert on Springmount Stream	Springmount Stream	Modified Stream	19R31	19
Meadowbrook	Glashaboy River	Lowland depositing River	19G01	19

Culverts on Glenmore Stream	Glenmore Stream	Lowland depositing large stream	19B06	19
Barry's Terrace	Glashaboy River	Transitional (tidal river)	19G01	19

6.2.2 Bat Surveys

The Glashaboy River and its tributaries in the environs of Sallybrook and Glanmire were surveyed, in relation to potential bat roosts, bat commuting routes and bat foraging areas. Refer to Table 6.2. Bats are protected species under the Wildlife Act (1976) and Wildlife [Amendment] Act (2000). Across Europe, they are further protected under the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention 1982), which, in relation to bats, exists to conserve all species and their habitats. The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention 1979, enacted 1983) was instigated to protect migrant species across all European boundaries. The Irish government has ratified both these conventions.

Also, the EC Directive on The Conservation of Natural habitats and of Wild Fauna and Flora (Habitats Directive 1992), seeks to protect rare species, including bats, and their habitats and requires that appropriate monitoring of populations be undertaken. All bat species are protected under Annex IV of the EU Habitats Directive, while the lesser horseshoe bat is listed under Annex II. Member states are required to designate Special Areas of Conservation for all species listed under Annex II in order to protect them.

Table 6.2: Bat Survey for the proposed scheme

Location of works (N-S)	Works requiring consideration for Bats	Bat works undertaken
Bleach Hill Stream	-Culvert replacement	-Inspection of existing culvert for Potential Roosting Features (PRFs).
Sallybrook Industrial Estate	-Construction of new flood defence walls -Removal of vegetation and trees (800m) -New culvert -New wall constructions (80m)	-Inspection of trees scheduled for removal for PRFs if known -Transect activity survey along 880m -Inspection of any existing culvert(s) for PRFs
Cois na Gleann	-Under road culvert replacement	-Inspection of existing culvert for PRFs
Hazelwood Avenue	-Construction of new flood defence wall (150m)	-Inspection of trees for PRFs and transect activity survey along parts of the flood defence wall proposed for vegetation removal
Hazelwood Avenue Bridge	-Construction of new flood relief culvert -Local regrading works	-Inspection of any existing culvert(s) for PRFs -Inspection of trees for PRFs to facilitate regrading
Hazelwood Centre	-Construction of new flood defence wall	-Inspection of trees for PRFs to facilitate new flood wall

Location of works (N-S)	Works requiring consideration for Bats	Bat works undertaken
Hazelwood Centre Bridge	-Bridge replacement -Local regrading works and construction of retaining wall -Removal of existing embankment and reconstruction for 110m	-Inspection of bridge for PRFs -Inspection of trees for PRFs to facilitate regrading and bank replacement works (110m) and transect activity survey
Springmount Stream	-Replacement of existing culverts (over 25m) -Minor channel regrading	-Inspection of culverts for PRFs
Meadowbrook Estate	-Replacement of existing flood defence wall for 345 m	-Inspection of trees for PRFs to facilitate replacement of existing flood defence wall (345m) and transect activity survey
Riverstown Road Bridge	-Construct new flood defence wall and regrade existing footpath with a retaining wall to be constructed along northern edge of regraded footpath -Vegetation removal of western arch.	-Inspection of any trees for PRFs if requiring removal ahead of flood wall construction and regrading works.
Brooklodge Grove Road	-Replacement of bridge parapets and crash barriers (40m) -installing flood relief culvert and localised regrading -Construction of embankment (66m)	-Inspection of PRFs associated with existing parapets -Inspection of any trees for PRFs if requiring removal ahead of these works -Transect activity surveys
Butlerstown Stream	-Construction of new flood relief culvert in parallel with existing masonry arch bridge -Local regrading of river channel	-Identifying any PRFs associated with existing features likely to be affected by works; including any trees requiring removal as part of construction/regrading works
The Grove and Glanmire Bridge	-Upgrading of existing wall for approximately 50-100m in length	-Inspection of any trees for PRFs if requiring removal ahead of these works and transect activity surveys along vegetated corridors

6.2.2.1 Methodology

Inspection of Potential Roosting Features (PRF)

Any structures (including buildings, bridges and culverts) and trees likely to be impacted by site preparatory (particularly vegetation removal and felling) and construction works were inspected to determine their potential value for roosting bats.

This involved applying the methods specified in the Bat Conservation Trust (BCT) Bat Surveys for Professional Ecologists - Good Practice Guidelines (3rd ed.) (Collins, 2016). Any Potential Roosting Features (PRFs) were further categorised as having either 'negligible', 'low', 'medium' or 'high' roosting potential from applying the definitions given within the BCT Guidelines.

Evidence of bat activity associated with potential roost sites includes bat droppings, urine staining, feeding remains and dead/alive bats. Indicators that potential roost locations and access points are likely to be inactive include the presence of cobwebs and general detritus within the apertures.

PRFs associated with trees include cracks, crevices, loose bark, woodpecker holes and splits. Evidence indicating bat presence, includes dark stains running below holes or cracks, bat droppings, odours, or scratch marks.

Dusk Emergence/Dawn Re-entry Surveys

Following on from identifying PRFs, dusk emergence and/or dawn re-entry surveys were conducted at any structures and trees that were determined as having significant PRFs. Dusk emergence surveys commenced 15 minutes prior to sunset and ceased 1.5-2 hours after sunset, whilst dawn surveys began at 1.5-2 hours prior to sunrise and ceased 15 minutes prior to sunrise. The surveys aimed to capture any roosting activity associated with these structures and to assist to identify occupant species and roost status.

Transect Activity Survey

The value for habitats across the site to support commuting and foraging bats were assessed in terms of habitat type, abundance, connectivity and distribution. These were categorised as having either 'negligible', 'low', 'medium' or 'high' value for bats which was determined by applying the categories given within the BCT Guidelines. Further to this, bat transect activity surveys along habitat features (particularly bankside woodland habitats) that are proposed for removal or are likely to be significantly reduced in value for bats as consequence of the works were undertaken. Transect activity surveys were undertaken along the main key areas proposed for embankment works; including Sallybrook Industrial Estate, downstream of Hazelwood Centre.. Areas determined to be of 'moderate' and 'high' value for bats were the main focus of the surveys.

Following the initial inspection of the works area, transect routes were predetermined and walked by two surveyors using automatic recording equipment. Further to the outcome of these surveys, a number of static detectors at 'interest points' along transect routes were set to maximise species and activity recordings. All sonogram recordings were analysed to species level using Anabat software.

6.2.3 Breeding Birds Survey

6.2.3.1 Methodology

This survey was carried out using a modified version of the Countryside Bird Survey and the Riparian Bird Survey methods (BWI, 2010). Two surveys were carried out during the breeding season. Interest has been noted from members of the public regarding nesting Dippers, during the public consultation days.

In particular, from UCC Bird Studies group who are currently planning to install bird nest boxes under bridges on the Glashaboy River Liaison with this group will continue during detailed design to determine the use of the nest boxes as part of the drainage scheme mitigation measures.

Surveys were timed to coincide with the main period of activity of breeding birds in the scheme. The breeding status of birds encountered within the site were classified in three categories: confirmed, probable and possible breeders.

The survey evidence required to allow the assignment of these categories is explained below:

Confirmed breeding:

- Distraction display or injury feigning;
- Used nests or eggshells found (occupied or laid within the survey period);
- Recently fledged young or downy young;
- Adults entering or leaving a nest site in circumstances indicating occupied nest or an adult sitting on nest;
- Adults carrying food for young or faecal sacs;
- Nest containing eggs; and
- Nest with young seen or heard.

Probable breeding:

- Pairs observed in suitable nesting habitat in breeding season;
- Permanent territory presumed through registration or territorial behaviour (song etc.) on at least two different days, a week apart, at the same place;
- Display and courtship;
- Visiting probable nest site;
- Agitated behaviour or anxiety calls from adults; and
- Building nest or excavating nest hole.

Possible breeding:

- Species observed in breeding season in possible nesting habitat; and
- Singing male(s) present or breeding calls heard in breeding season.

Following completion of the survey, registrations were mapped showing the location and density of breeding territories or breeding pairs estimated within the area.

Records of non-breeding species were made also; including flying birds (a note of the species, height and direction was noted).

The mapped results of the visits were combined. The total number of pairs and their exact location (where possible) were recorded for each field and on a 1:10,000 scale map of the scheme.

6.2.4 Large Mammal Surveys

Following the walkover surveys a number of species specific surveys were identified.

Therefore, mammal surveys were carried out along the reach of the drainage scheme design including the potential construction areas and the following methodologies were referred to for specific species:

6.2.4.1 Otter

An intensive survey was carried out to establish the value of the area to Otter using the following guidance:

- National Rivers Authority (1993). Otters and River Habitat Management. Conservation Technical Handbook Number 3. Ward D, Holmes N and José P (1994);
- The New Rivers and Wildlife Handbook. RSPB, Bedfordshire. Macdonald DW, Mace G and Rushton S (1998); and
- Proposals for future monitoring of British mammals. DETR, London.

Otter activity signs recorded during the survey otters include:

- dung (spraints);
- tracks (footprints);
- feeding remains;
- otter slides (into water);
- holts (underground dens); and
- couches (above ground sites where otters rest during the day).

6.2.4.2 Badger

Badger was searched for to establish if lands adjacent to the proposed works may be used by badger e.g. embankments etc. This survey was carried out using the following guidance:

- Harris S, Cresswell P and Jefferies D (1989). Surveying Badgers;
- Mammal Society. Scottish Natural Heritage (2003); and
- Best Practice Guidance - Badger Surveys. Inverness Badger Survey 2003. Commissioned Report No. 096. Delahay RJ, Brown JA, Mallinson PJ, Spyvee PD, Handoll D, Rogers LM and Cheeseman C L (2000).

6.2.5 Flora and Habitats Survey

The habitats and flora survey were carried out in general accordance with those outlined in the following documents;

- Heritage Council (2011). Best Practice Guidance for Habitat Survey and Mapping;
- Phase 1 Habitat Survey methodology (Joint Nature Conservation Committee (JNCC), 1990, revised 2003); and
- Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes (NRA, 2009).

A habitat survey was carried out on 01/06/16 and 02/06/16. The survey area covered the proposed scheme, following the course of the Glashaboy River and its tributaries, from its confluence with the River Lee in Cork harbour at the south end of the site, to Sallybrook, approximately 5km to the north.

Habitats were surveyed following standard methodology (Heritage council, 2011; JNCC, 2003), and were classified under the national habitat classification system of Fossitt (2000). The relationships of these habitats to EU Annex I habitats (European Commission, 2013), were discussed in the context of areas of possible high conservation importance.

Particular attention was paid to those areas throughout the site where specific measures form part of the proposed scheme and where construction works - forming part of the proposed drainage scheme - are proposed, with a view to identifying areas or habitats of conservation value that may be disrupted by construction activities.

Plant names follow Stace (2010). The survey was undertaken during the optimum flowering plant season (typically May-September inclusive).

6.2.6 Aquatic Macroinvertebrates

Macroinvertebrates are used widely as biological indicators for water quality as they are sensitive to water quality conditions within a river. Three sampling sites were selected; two on the Glashaboy River and one on the Butlerstown River (Table 6.3). The sampling site on the Glashaboy River upstream of the proposed works is located at Upper Glanmire Bridge, approximately 50m downstream of the bridge. As the Glashaboy River is a transitional water body in its lower reach, the second sampling site is located adjacent to the R639, downstream of the Butlerstown River confluence and to the south of John O'Callaghan Park. The third sampling site is located on the Butlerstown River, approximately 20m upstream of the bridge at the confluence of the Butlerstown and Glashboy Rivers. These samples sites are also existing EPA sampling sites.

Table 6.3: Macroinvertebrate sampling site locations

Sampling Site Number	Sampling Site Location	Grid Reference (Irish Grid)	EPA Site Code
Site 1	Downstream of Upper Glanmire Bridge	W 71386 78357	0400 - River Glashaboy
Site 2	Downstream of the Butlerstown River confluence (John O Callaghan Park)	W 72823 74948	0600 - River Glashaboy
Site 3	Butlerstown River, upstream of confluence with Glashaboy River	W 73235 75055	0800 - Butlerstown River

Semi-quantitative macroinvertebrate kick samples were taken in line with ISO 10870 and CEN FprEN 16150:2011 on July 4th 2016 by JBA aquatic ecologist Niamh Sweeney.

A 3 minute kick sample was collected from a riffle or fast glide section of the channel using a 1mm mesh size sampling net, accompanied by a one-minute hand search.

The macroinvertebrate sample was retained in the sampling net and flushed with river water to remove as much silt as possible. The contents of the sampling net were placed in a white and flat bottomed sorting tray on the riverbank. Macroinvertebrates were identified to the level necessary for the EPA Q-value scheme. A magnifying glass or hand lens was used to aid identification if necessary. The abundance of each taxon was recorded on a field sheet and using the EPA Q-value system, an assessment of the ecological condition of the site was determined.

Relevant physical river characteristic data was also recorded, such as wetted width, substrate type and condition, degree of siltation, flow type, water clarity, degree of shading, % in-stream macrophyte cover and presence of filamentous algae.

6.2.7 Reptiles and Amphibians

The walkover surveys of the study area identified any areas of suitable potential for amphibians or Common Lizard (*Zootoca vivipara*), particularly areas of still or standing water, drainage ditches, wet grassland or woodland and potential basking areas for Common Lizard.

6.3 Impact assessment Methods

Habitats and species were assessed in accordance with the guidance contained in the document Guidelines for Ecological Impact Assessment in the United Kingdom 2nd Edition (CIEEM, 2016), and also with reference to Guidelines for Assessment of Ecological Impacts of National Roads Schemes (NRA, 2009).

6.3.1 Desk-based Assessment

A desk-based assessment was carried out to collate information regarding protected/notable species and statutorily designated nature conservation sites in, or within close proximity to, the scheme.

A data search for protected and notable species was conducted using the National Biodiversity Data Centre Mapping System (National Biodiversity Data Centre, 2016).

Information for statutory designated sites including Special Protection Areas (SPAs), Special Areas of Conservation (SACs), Ramsar Sites, Natural Heritage Areas (NHAs) and proposed NHAs (pNHA) was collected from the online resources provided by the National Parks and Wildlife Service (NPWS) (NPWS, 2016).

Other information on the local area was obtained, including:

- 2010/2011 Waterbird Survey Programme as undertaken by The National Parks & Wildlife Service (Cummins and Crowe, 2011);
- Irish Wetland Bird Survey (I-WeBS) data;
- Cobh Municipal District Local Area Plan;
- Cork City Council prepared a Cork City Biodiversity Plan (2009-2014);
- Heritage Plan 2014-2018;
- Cork City Development Plan 2015-2021;
- Environmental Protection Agency online databases on water quality (Available online at <http://gis.epa.ie/Envision> Accessed 2016;
- Ordnance Survey Mapping available from www.osi.ie
- Aerial photography available from www.osi.ie and Google Maps <http://maps.google.com/>;
- Online data available on Natura 2000 sites as held by the National Parks and Wildlife Service (NPWS) from www.npws.ie; Accessed June 2016;
- Information on the South Western River Basin District from www.wfdireland.ie;
- Information on soils, geology and hydrogeology in the area available from www.gsi.ie;
- Birdwatch Ireland and British Trust for Ornithology Bird Atlas 2007-2011 online database. Available online at: <http://app.bto.org/mapstore/StoreServlet?id=46> . Accessed 2016;
- Protected and rare species data provided by the National Parks & Wildlife Service Research Branch;
- Gittings, T. (2006) Waterbird monitoring in Cork Harbour: 1994/95-2002/03. In C. Cronin, C. Barton, H. Hussey, & M. Carmody (Eds.), (pp. 319–339). Cork: Cork Bird Report Editorial Team;

- Cork Barn Owl Research Project Reports for 2009 & 2010 (Lusby et al., 2009, 2010)
- Botanical Society for the British Isles website – Species Distribution Maps; Available online at <http://www.bsbi.org.uk/> Accessed on various dates;
- National Biodiversity Data Centre – Species Distribution Maps; Available online at www.biodiversityireland.ie Accessed on various dates;
- All Ireland Red Data lists for vascular flora, mammals, butterflies, non-marine molluscs, dragonflies & damselflies, amphibians and fish (see reference list);
- Cork Harbour Survey Report (South-western Regional Fisheries Board, 2006) –fisheries, bird, and marine mammal distribution maps for Cork Harbour including Dunkettle;
- Transitional water fish surveys have been carried out in Lough Mahon and the Glashaboy River Estuary as part of the programme of monitoring for the Water Framework Directive (WFD). Fish sampling was carried out in Lough Mahon in October 2008 by staff from the Central Fisheries Board (CFB) and the South Western Regional Fisheries Board (SWRFB) (Kelly et al., 2009);
- Fish stock surveys were also conducted in Greater Cork Harbour as part of the programme of fish monitoring for the WFD by staff from Inland Fisheries Ireland (IFI, 2010). Available online at <http://www.fisheriesireland.ie/>;
- Lough Mahon WFD fish sampling 2008 (available online at <http://www.wfdfish.ie/wpcontent/uploads/2009/09/Lough-Mahon1.pdf>);
- Lough Mahon and Glashaboy WFD fish sampling 2010 (available online at http://www.wfdfish.ie/wpcontent/uploads/2011/02/SWRBD_Cork_TW_preliminary_report_2010.pdf);
- Water Framework Directive fish stock survey of the Glashaboy 2011 (available online at http://www.wfdfish.ie/wpcontent/uploads/2011/08/SWRBD_prel_report_2011.pdf);
- Water Framework Directive water maps (available online at <http://www.wfdireland.ie/maps.html>); and
- International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species (available online at <http://www.iucnredlist.org>).

6.4 Receiving Environment

The survey area is mostly within an urban/suburban environment, with many buildings, roads and car parks throughout. The majority of the habitats edging the Glashaboy River comprise amenity grasslands, encompassing lawns, playing fields and parks, along with hedgerows, treelines and woodlands.

The habitats and species of the receiving environment are described in detail the sections that follow:

6.4.1 Terrestrial Ecology

6.4.1.1 Field Surveys

The field surveys for the proposed scheme were carried out in June and July 2016. These are summarised below:

Name	Ecological Receptor	Timing of Survey
Dr. Kieran Connolly	Habitats and Flora	June 2016
Ross Macklin	Fisheries	July 2016
Dr Tina Auchney	Bats	July 2016
Francis Tobin	Breeding Birds	June & July 2016
Niamh Sweeney	Aquatic macroinvertebrates, Reptiles, Amphibians and Large Mammals	July 2016

6.4.1.2 Habitats and Flora

Desktop Study

A desktop review was conducted of available published and unpublished information, and review of data available on the NPWS (www.npws.ie/en/) and National Biodiversity (NBDC) (<http://maps.biodiversityireland.ie/>) web-based databases in order to identify key habitats and species that may be present, particularly those protected by legislation.

Protected Flora

The following protected plant species have been noted in the 10km Square W77 on NPWS website as follows:

- Round Prickly Headed Poppy at Blackrock and Little Island, Red Hemp Nettle at Little Island and Meadow Barley at Little Island, Mahon, Brickfield and Cork Harbour; and
- Also an interspecific hybrid of Herb Robert, *G. robertianum* x *G. purpureum* (a world rarity) has been recorded in the Rathcooney Glanmire.

Statutory Nature Conservation Sites

European Designated Sites

There are two Natura sites located in, or within 2km of, the Scheme are:

- Cork Harbour SPA; and
- Great Island Channel SAC (within 2km to the east of the Scheme).

The proposed drainage scheme occurs upstream of these Natura 2000 sites. These are considered the most relevant Natura 2000 sites as they are hydrologically linked to the Glashaboy River and may be impacted by the proposed drainage scheme.

They may be impacted through surface water, groundwater, and air and land pathways. These are considered in detail in the Natura Impact Statement that accompanies this EIS.

Natural Heritage Areas

There are no Natural Heritage Areas in, or within 2km of, the Scheme.

Four proposed Natural Heritage Sites (pNHAs) are located in, or within 2km of, the Scheme:

- Glanmire Wood pNHA;
- Dunkettle Shore pNHA;
- Douglas River Estuary pNHA; and
- Great Island Channel pNHA.

Glanmire Wood pNHA consists of mixed broad-leaved woodland with patches of saltmarsh fed by the tidal Glashaboy River below the wood. The wood itself is dominated by Oak *Quercus* spp., Beech *Fagus sylvatica* and Sycamore *Acer pseudoplatanus*, with a rich ground flora including the ancient woodland indicators Wood Fescue *Festuca altissima* and Wood Millet *Milium effusum*. This type of woodland is rare in East Cork and parts of it also fall within the Cork Harbour SPA (NPWS, 2009).

Dunkettle Shore pNHA is located north of the River Lee at Dunkettle and at the mouth of the River Glashaboy. This pNHA also forms part of Cork Harbour SPA.

Douglas River Estuary pNHA is located on the South Bank of the River Lee at the Mouth of the Douglas River, this is another stretch of pNHA which also forms part of the Cork Harbour SPA.

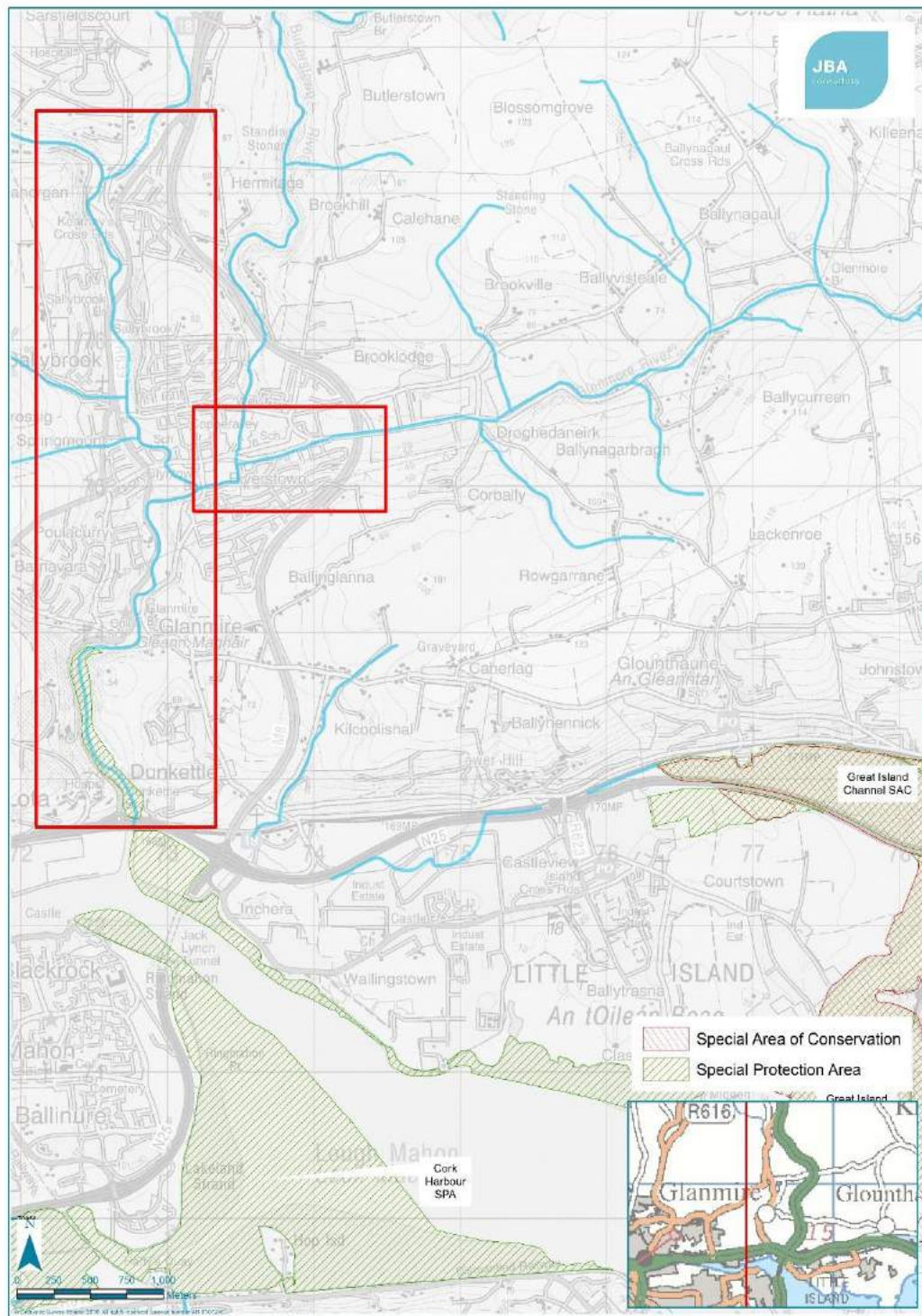


Figure 6.1: Natura 2000 sites relevant to the Glashaboy Flood Scheme (red line boundary indicates the scheme location)

Dunkettle Shore pNHA is located north of the River Lee at Dunkettle and at the mouth of the River Glashaboy. This pNHA also forms part of Cork Harbour SPA.

Douglas River Estuary pNHA is located on the South Bank of the River Lee at the Mouth of the Douglas River, this is another stretch of pNHA which also forms part of the Cork Harbour SPA.

Great Island Channel pNHA is part of the Cork Bay complex, and is also designated as a SAC. It is located to the east of the Glashaboy River and is important for its intertidal habitats and bird populations.

Both the Dunkettle Shore pNHA and Douglas River Estuary pNHA are designated for the same wetland habitats and species that make the Cork Harbour SPA internationally important.

The most relevant pNHAs are the **Glanmire Wood pNHA** and the **Dunkettle Shore pNHA** and these are shown in **Figure 6.2**.

These are considered throughout the assessment. The pNHA sites are considered relevant where a source-pathway-receptor link exists between the proposed development and the pNHA sites.

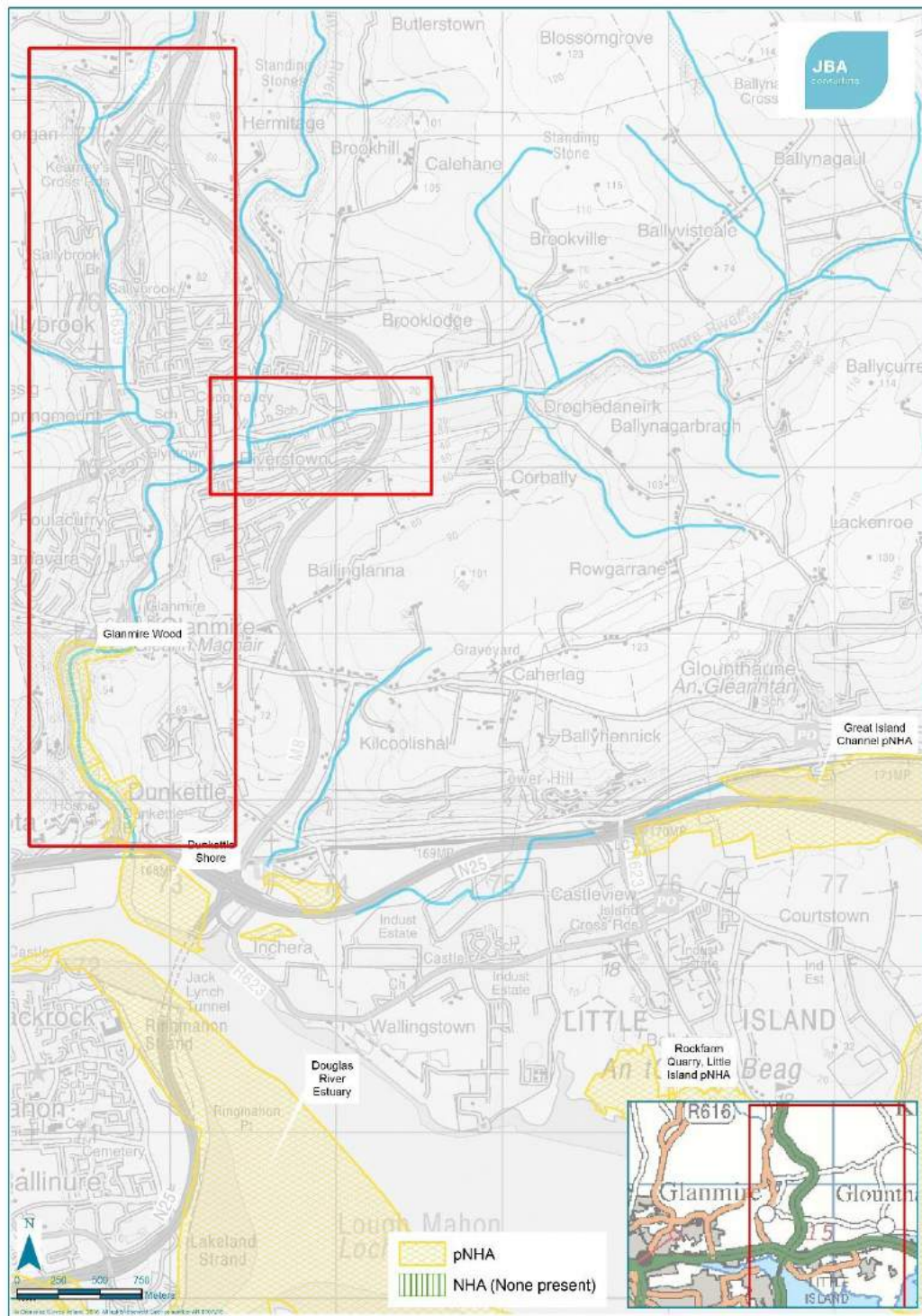


Figure 6.2: Natura 2000 sites and Proposed Natural Heritage Areas (pNHAs) relevant to the Glashaboy Flood Scheme.

6.4.1.3 Habitat and Flora Survey Results

The main habitats recorded are listed in **Table 6.4**. The habitat maps of the proposed scheme are detailed in Appendix 6.1.

Table 6.4: Habitats recorded in the scheme

Habitat	Fossitt Habitat code
Treelines	WL2
Riparian woodland	WN5
Hedgerow	WL1
(Mixed broadleaved woodland)	WD1
Amenity grassland (improved)	GA2
Buildings and artificial surfaces	BL3
Stone walls and other stonework	BL1
Scrub	WS1
Improved agricultural grassland	GA1
Tidal rivers	CW2
Recolonising bare ground	ED3
Mud shores	LS4
Ornamental/non-native shrub	WS3
Improved agricultural grassland	GA1
Dry meadows and grassy verges	GS2

The survey area is mostly within an urban/suburban environment, with many buildings, roads and car parks throughout. Amenity grassland, encompassing lawns, playing fields and parks, is also much recorded throughout the site.

Natural habitats adjacent to the river channel are frequently reduced to narrow treelines (WL2), along riverbanks, some of which are on low earth embankments. Treelines are taken to include narrow rows or single lines of trees that are greater than 5m in height, and no greater than approximately 4m wide at the base.

There are a number of wet woodland areas along the river margins in the site that are categorised as Riparian woodland, WN5. This category of woodland includes those that are generally subject to periodic or frequent flooding, and are dominated by Willows (*Salix* spp.), with Alder (*Alnus glutinosa*) also occasional. This woodland type has some clear affinities with the priority EU Annex I habitat ‘Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-padion, Alnion incanae, Salicion albae)’ (91E0). However, in a recent woodland survey encompassing alluvial forests in Ireland (O’Neill, F.H. & Barron, S.J., 2013), sites were rejected for consideration under the Annex I type ‘Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-padion, Alnion incanae, Salicion albae)’ (91E0) when they did not sufficiently conform to the habitat type, either through a lack of target species in the canopy or lack of typical species in the field layer, or a combination of both. This is true of all of the riparian woodland mapped here, and the Annex I habitat is, therefore, not deemed to be present within the survey area.

Mixed broadleaved woodland (WD1) occurs in the survey area and cannot be satisfactorily classified into a more specific category of semi-natural woodland. Non-native tree species are often present.

Other occasional habitats mapped included scrub (WS1), improved agricultural grassland (GA1) and dry meadows and grassy verges (GS2).

The habitats are described in further detail relative to the proposed drainage scheme design.

6.4.1.4 Habitat Descriptions relative to Proposed Works

Sallybrook Industrial Estate and Bleach Hill Stream

Habitat - Treeline (WL2)

In this location, it is proposed to replace existing twin culverts with new rectangular culvert. Vegetation along the stream channel here consists of Alder (*Alnus glutinosa*), Willows, Ash (*Fraxinus excelsior*), Hawthorn (*Crataegus monogyna*) and Oak (*Quercus robur*) on narrow, steeply-sided banks. There are mature trees of some amenity value adjacent to the existing bridge/culvert, but no particular floristic value attaches to the vegetation here. The treeline in the existing habitat adjacent to the bridge is flanked by amenity grassland, with some municipal planting of trees and shrubs.

Sallybrook - Replacement of embankment

Habitat - Riparian woodland (WN5)

A proposed flood defence embankment (5.4m wide) will modify the existing earth embankment that is mostly c. 4-5m above the riverbed level. The proposed embankment will be placed on the dry side of the existing embankment so as to preserve the trees growing on the wet side of the existing embankment. Some of the woodland here is classified as Riparian woodland (WN5), as the canopy layer is dominated by Alder and Willows (mostly *Salix cinerea* subsp. *oleifolia* (Sally)). Riparian woodland generally has affinities with the priority Annex I type 'Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-padion, *Alnion incanae*, *Salicion albae*)' (91E0). However, with the exception of occasional *Oenanthe crocata* (Hemlock water-dropwort) and *Anemone nemorosa* (wood anemone), the wood here is mostly lacking in the herbaceous plants that are characteristic of this habitat. As stated above, a lack of target species in the canopy or lack of typical species in the field layer, or a combination of both, is taken as precluding the habitat from classification as the Annex I type.

Broadleaved woodland (WD1) on the opposite (right) bank of the river has species such as Oak (*Quercus robur*), Hazel (*Corylus avellana*), Ash, Elm (*Ulmus* sp.) and the invasive Cherry Laurel (*Prunus laurocerasus*).

Non-native Invasive Species – Japanese Knotweed

There is extensive cover of invasive Japanese Knotweed species in this area, which has significantly compromised the habitat quality. This area will require treatment of this species prior to entering this area (**Photo 6.1**).



Photo 6.1: Japanese Knotweed, downstream of Hazelwood Avenue Bridge on the right bank facing downstream.

Sallybrook Mill Race

In this location, there is a proposed replacement of existing channel (old mill race) with a reinforced concrete culvert. The existing channel is flanked by a treeline (WL2), mostly comprised of Alder and Sycamore, with a ground flora comprising species such as Winter heliotrope (*Petasites fragrans*) and Bramble (*Rubus fruticosus* agg.). No particular interest attaches to the flora of the habitat here.

Sallybrook - Flood Defence Wall

Habitat - Buildings and artificial surfaces (BL3) and Treeline (WL2)

It is proposed to provide a reinforced concrete flood defence wall typically 1.7m above existing ground levels in this location. This proposed wall is in the Sallybrook industrial area, with much of the works area on built or artificial surfaces. A narrow treeline along the edge of the river channel here does not hold any particular conservation interest from a flora perspective.

Habitat - Buildings and artificial surfaces (BL3)

The proposed reinforced concrete flood defence wall extends southwards. The proposed work is within an industrial/built area.

The existing habitat consists of a narrow channel edged by rock gabions and boulders on one side, and a low built wall on the other. Vegetation is of rough grasses and ruderal or weed species and is of little flora conservation interest.

Cois na Gleann Stream

Habitat - Scrub (WS1)

In this location it is proposed to replace the two existing culverts with a single a new culvert. The vegetation along the narrow stream channel here consists of a fringe of scrub species including Hawthorn, Blackthorn (*Prunus spinosa*), Bramble and Elder (*Sambucus nigra*). The ground flora is mostly composed of rough grasses and common herbaceous species, and is of no particular flora conservation interest.

Hazelwood Avenue and Hazelwood Shopping Centre

Habitat – Amenity Grassland (GA2), Buildings and artificial surfaces (BL3) and Treeline (WL2)

A number of proposed measures here include flood defence walls, a culvert under the roadway and proposed new flood relief channel 5.5m wide by 2.25m deep.

The works area here is within amenity grassland, roadway and other artificial surfaces and narrow treelines fringing the river channel. There are mature Alder and Willow trees in the treelines, which are of some amenity value, but no particular interest in a vegetation/floristic context.

Amenity grassland here is dominated by common grass species such as *Anthoxanthum odoratum* (Sweet vernal-grass) and *Holcus lanatus* (Yorkshire-fog), and other common species such as Red clover (*Trifolium pratense*), Daisy (*Bellis perennis*) and creeping buttercup (*Ranunculus repens*).

Habitat – Buildings and artificial surfaces (BL3) and Treeline (WL2)

There is a narrow strip of riverbank alongside the car park, where the existing embankment is to be replaced by a flood defence wall. Vegetation here is mostly a narrow strip of good-sized Alder and Sycamore trees, with shrub-sized hawthorn and sycamore also. The soil here is mostly compacted, with a very sparse ground vegetation cover, comprised of species such as Bramble, Nettle and Cleavers (*Galium aparine*).

Habitat – Treeline (WL2)

Proposed replacement of existing embankment with a flood defence wall. The Treeline (WL2) alongside the river channel is typical of the habitat in the wider area, with species such as Sycamore, Alder and Hawthorn.

Habitat – Amenity Grassland (GA2) and Buildings and artificial surfaces (BL3)

Proposed replacement of existing culvert under roadway. The proposed works here are on artificial surfaces and amenity grassland which are of no particular ecological interest.

Habitat – Buildings and artificial surfaces (BL3) and Treeline (WL2)

Proposed concrete flood defence wall along existing treeline and wall. The existing Treeline habitat, which is composed of species which are common throughout the survey area, such as Alder, Willows and Sycamore.

Habitat – Buildings and artificial surfaces (BL3) and Treeline (WL2)

Replacement of Hazelwood shopping centre bridge, construction of retaining wall and regrading of existing ground to facilitate bridge construction. The works area here is on built surfaces and treelines which are of no particular conservation interest, although there are some fine trees along this stretch, including a large Beech (*Fagus sylvatica*) on the north side of the existing bridge, and a large Sycamore on the south side. There are several more good-sized Sycamores and Alders along the embankment to the south, which are at least of some amenity value.

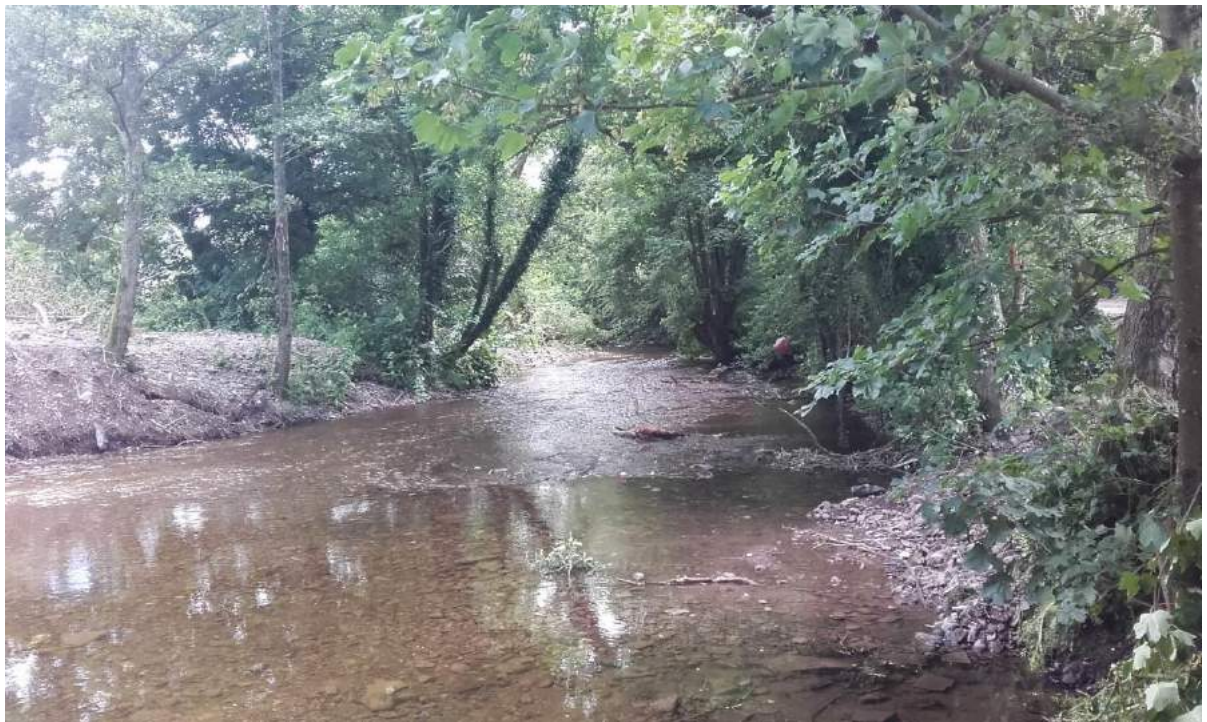


Photo 6.2: Example of river channel in the Hazelwood area, facing downstream.



Photo 6.3: Example of river channel in the Hazelwood area adjacent to SuperValu – note the current flood defence walls in place. Photo taken from Hazelwood bridge, facing downstream.

Meadowbrook Housing Estate – Springmount Stream

Habitat – Amenity Grassland (GA2) and Buildings and artificial surfaces (BL3)

Proposed regrading of the existing carriageway and footpath on the L3010 road, and construction of reinforced concrete retaining wall along Springmount stream and the Glashaboy River. There are mostly no natural habitats here except for some amenity grassland and scattered trees on the north side of the roadway and adjacent to the bridge. The amenity grassland and scattered trees referred to here are mostly municipal planting/maintenance, and therefore of no particular flora interest.

Habitat – Buildings and artificial surfaces (BL3), Amenity Grassland (GA2) and Treelines (WL2)

Existing arch of the Riverstown bridge on the L3010 road, downstream of Meadowbrook estate, is to be cleared by removing vegetation and a manhole. There are some well-grown trees here including Willow, Ash and Alder, which, although common species throughout the area, are of some amenity value, mostly due to their age and size. Ground vegetation at the river edge is of a weedy type, including species such as nettles, hogweed (*Heracleum sphondylium*) and Knotweed. No particular floristic interest attaches to the vegetation here.

To the south of the existing bridge on the western side is a public park, John O' Callaghan Pak. Along the riverbank there is an earth embankment approximately 2m high with Alder, Beech, Sycamore and Willows forming a continuous treeline.

Scrub/ground vegetation here includes bramble, nettle and hogweed and is of no particular floristic/conservation interest.

Habitat – Buildings and artificial surfaces (BL3), Treeline (WL2), and Broadleaved woodland (WD1)

Proposed reinforced concrete flood defence walls to be constructed along the riverbank.

There is an existing wall (BL1), c.1.6m tall here, with treelines which are typical of this habitat in species composition and structure as it is found throughout the site, and there is no particular conservation interest attaching to this habitat here.

The treeline here includes Hawthorn, which in places is continuous enough to warrant mapping as hedgerow, although individual plants are up to 10m tall. Other species here include Sycamore, Elm (*Ulmus* sp.), Elder, Blackthorn (*Prunus spinosa*) and a stretch of Leyland cypress (*x Cupressocyparis leylandii*).

On the right riverbank (facing downstream), north of the existing bridge on the L3010 road, there is a narrow strip of broadleaved woodland – classified as such, as it exceeds the 4-5m width, taken as the general maximum width of Treeline habitat - composed of species such as Sycamore, Ash and Alder. There is no particular floristic interest here, but the habitat is of some amenity value, due to its location in an urban/suburban environment.

Butlerstown Stream and Glenmore Stream

Habitat – Buildings and artificial surfaces (BL3), Treeline (WL2) and Riparian Woodland (WN5)

There is a very small patch of Riparian woodland habitat (WN5) at the junction of the Glenmore stream and Butlerstown stream, with a low canopy of Alder and Willows (*Salix cinerea*) and a field layer comprising species such as *Angelica sylvestris* (Wild Angelica), *Chrysosplenium oppositifolium* (Golden saxifrage), *Equisetum fluviatile* (Water horsetail), *Filipendula ulmaria* (Meadow-sweet), *Scrophularia auriculata* (Water figwort) and *Urtica dioica* (Common nettle). Like other areas of Riparian woodland (WN5) within the survey area, there are affinities here with the priority Annex I habitat ‘Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-padion*, *Alnion incanae*, *Salicion albae*)’ (91E0), although a combination of lack of diversity in canopy species and in the typical field layer species would preclude it from consideration as such. This habitat is not at, or adjacent to, any proposed construction works, and is therefore not likely to be directly affected by construction activities.

Brooklodge Grove

Habitat – Amenity Grassland (GA2), Buildings and artificial surfaces (BL3) and Treeline (WL2)

A number of proposed construction works, including channel deepening, channel widening, construction of a reinforced concrete flood defence wall, and the replacement of existing culverts with a single large culvert are proposed over a small area here. The proposed works area mostly affects built surfaces, amenity grassland and treelines.

The treeline, which in much of this area is on a low earth embankment, consists mostly of Alder, Elm and Hawthorn. Scrub species occurring through the scattered trees include Blackthorn, Bramble, Ivy and Privet (*Ligustrum* sp.). The ground flora consists of common species such as Hogweed, Bramble, Ivy and Cleavers (*Galium aparine*). There is no particular floristic interest attaching to the treeline habitat here, although there are some good-sized trees within the proposed works area, including a fine specimen of the uncommon *Quercus cerris* (Turkey Oak), which although a non-native species could be considered to be of value.

Glanmire Bridge

Habitat – Scrub (WS1), Riparian Woodland (WN5) and (Mixed) Broadleaved Woodland (WD1)

Proposed reinforced concrete flood defence wall and local surface water pumping station. The proposed concrete wall follows the line of an existing stone wall (BL1) of c.1.5m height that extends alongside the public roadway.

The southern part of the wall is directly alongside the river edge, where there is a very narrow strip of vegetation that includes small Ash, Alder, Elm and Sycamore trees. The northern half of the proposed concrete wall will be separated from the riverbank by what is currently a patch of both scrub (WS1) and riparian woodland (WN5). This rather open scrub is dominated by species such as Bramble, Snowberry (*Symphoricarpos albus*), Wilson's honeysuckle (*Lonicera nitida*), Sycamore and nettles.

The wetter ground beside the river channel is dominated by Willows (mostly *Salix cinerea* subsp. *oleifolia* (Sally)). *Iris pseudacorus* (Yellow flag) and *Holcus lanatus* (Yorkshire-fog) are common here.

The parts of woodland mapped as (Mixed) Broadleaved Woodland (WD1) here are typical of the habitat in the wider area, with species such as Sycamore, Ash and Alder and an exotic conifer component. Although neither the scrub (which has a significant cover of invasive species), nor the broadleaved woodland, are of particular conservation interest, they may be of local interest, as indeed is the riparian woodland, which is uncommon in the wider area.

The existing stone wall supports a typical wall flora, including species such as *Asplenium ruta-muraria* (Wall-rue), *Centranthus ruber* (Red Valerian) and *Polypodium vulgare* (Common Polypody).



Photo 6.4: Section of Glashaboy River adjacent to Glanmire Bridge, taken from Glanmire Bridge facing downstream.

Downstream of Glanmire Bridge

Habitat – Amenity Grassland (GA2), Buildings and artificial surfaces (BL3), Scrub (WS1) and Mud shores LS4

South of Glanmire, towards Cork harbour, the river channel broadens considerably. The western side of the river channel towards the estuary the habitat consists of a narrow fringe of scrub (WS1) and ground vegetation, contained by a quay wall and adjacent path/roadway. The vegetation consists of species such as bramble, knotweed, nettles, ivy, Traveller's-joy (*Clematis vitalba*), Herb Robert (*Geranium robertianum*), Himalayan honeysuckle (*Leycesteria formosa*) and Winter heliotrope (*Petasites fragrans*). There are occasional stands of Knotweed (*Fallopia* sp.), and scattered shrubby *Acer pseudoplatanus* (Sycamore). Amenity grassland (GA2), in the form of a narrow strip of roadside grass runs alongside the quay wall/footpath here. No particular conservation interest attaches to these habitats. The survey was carried out during a high tide, but aerial photographs indicate that the receding tide exposes substantial Mud shores (LS4) here. Cork Harbour SPA extends into the lower reaches of the river channel and mudflats here, reflecting the importance of the habitat to wintering waterbirds. Mud shores may also be referred to as the EU Annex I habitat 'mudflats and sandflats not covered by sea water at low tide (1140)'.

On the left bank of the river here, Glanmire wood forms a significant local feature. It was classified as (Mixed) Broadleaved Woodland (WD1) here, due to the dominance of Oak *Quercus spp.*, Beech and Sycamore, and the presence of a significant exotic conifer component within the canopy. However, at least part of the wood has elsewhere been classified as WN1 Oak-Birch-Holly woodland and there is also a relatively rich ground flora including the ancient woodland indicators Wood Fescue *Festuca altissima* and Wood Millet *Milium effusum*.



Photo 6.5: Section of the tidal area of the Glashaboy River, north of the Dunkettle Roundabout and south of Glanmire Bridge.



Photo 6.6: Section of the tidal area of the Glashaboy River, south of Glanmire Bridge where buildings start to line the riverbank.

6.4.1.5 Flora – Species of conservation importance

There were no Flora Protection Order (FPO) species recorded during the field survey.

6.4.1.6 Invasive species

A number of invasive plant species were recorded, most notably the knotweed species Japanese Knotweed (*Fallopia japonica* (*Reynoutria japonica*)), Giant Knotweed (*Fallopia sachalinensis*) and a hybrid knotweed *R. x bohemica*, that is a hybrid between *F. japonica* and *F. sachalinensis*.

Knotweed is common over much of the survey area, particularly in the more northern parts, and it is typically invasive and whose spreading habit has negatively affected significant areas of habitat.

Himalayan Knotweed (*Persicaria wallichii*) was also recorded, in the most southerly part of the survey site, but appears to be quite limited in its occurrence at present.

Other invasive species, all of which were uncommon or generally restricted in their occurrence throughout the survey area included the Butterfly-bush (*Buddleja davidii*), Traveller's-joy, Himalayan honeysuckle (*Leycesteria formosa*), Cherry-laurel (*Prunus laurocerasus*) and Snowberry.

An invasive plant species survey was conducted and is detailed in Appendix 4.1 of the EIS.

6.4.1.7 Birds

Breeding Birds

The results of the breeding bird surveys are given in Table 6.5 and illustrated in Figure 6.3. Given the sensitivity of important breeding bird locations, their exact locations have been withheld in order to protect them from disturbance. The breeding bird surveys were carried out on the 01/06/16, 02/06/07, 16/07/16 and 20/07/16. The survey area encompassed the entire riparian area from the northern part of the drainage scheme as far south as Dunkettle and also included areas where construction access routes and compounds may be located.

Table 6.5: Breeding bird surveys for Glashaboy including Terrestrial and Riparian Habitats. Important Birds noted breeding in the scheme are shaded blue.

Common Name	Latin name	Conservation Status		Riparian Action Plan Species	Breeding status	Comments	Habitat
		EU Birds Directive ¹	BoCCI ²				
Kingfisher	<i>Alcedo atthis</i>	Annex I	Amber	✓	Probable	Kingfisher nesting embankment - 4-5 nest holes (longer term nesting site)	Nests in river bank between areas of walled river and also an historical nesting site now collapsed.
Little Egret	<i>Egretta garzetta</i>	Annex I	Green	✓	Probable	Observed in suitable habitat	Estuary habitat adjacent to woodland. Known to breed in Pfizer Woodland
Grey Wagtail	<i>Motacilla cinerea</i>	-	Red	✓	Confirmed	Observed nesting at bridges and cobble wall along river	Bridge structures and walls
Dipper	<i>Cinclus cinclus</i>	-	Green	✓	Confirmed	Observed 2 nests in bridge structure	Bridges
Kestrel	<i>Falco tinnunculus</i>	-	Amber		Possible	Observed in suitable habitat	Woodland
Mute Swan	<i>Cygnus olor</i>	-	Amber	✓	Confirmed	Cygnets present	River

¹ Annex I of the Birds Directive lists 193 species and sub-species which are: in danger of extinction; vulnerable to specific changes in their habitat; considered rare because of small populations or restricted local distribution; requiring particular attention for reasons of the specific nature of habitat.

² BoCCI = Birds of Conservation Concern Ireland: Red-listed species are those of highest conservation priority, Amber listed species those which are of lesser priority and Green-listed species those of least conservation priority.

Conservation Status							
Common Name	Latin name	EU Birds Directive ¹	BoCCI ²	Riparian Action Plan Species	Breeding status	Comments	Habitat
Cormorant	<i>Phalacrocorax carbo</i>	-	Amber	✓	Possible	Observed in suitable habitat; feeding	Estuary
Swallow	<i>Hirundo rustica</i>	-	Amber		Possible	Observed in suitable habitat	Nearby buildings
Lesser Black-backed Gull	<i>Larus fuscus</i>	-	Amber		Not Breeding	Observed foraging in estuary	Colonial breeders Buildings or may nest on coast/ islands
Swift	<i>Apus apus</i>		Amber		Not Breeding	Flyover only	
Black-headed Gull	<i>Chroicocephalus ridibundus</i>	-	Red		Not Breeding	Flyover only	
Blackbird	<i>Turdus merula</i>	-	Green		Probable	Pair observed in suitable habitat; agitated behaviour indicating presence of nest site nearby	Riparian woodland
Blackcap	<i>Sylvia atricapilla</i>	-	Green		Possible	Observed in suitable habitat; males singing	Riparian woodland and scrub
Blue Tit	<i>Cyanistes caeruleus</i>	-	Green		Possible	Observed in suitable habitat; males singing	Riparian woodland and scrub
Bullfinch	<i>Pyrrhula pyrrhula</i>	-	Green		Possible	Observed in suitable habitat	Scrub
Carrion Crow	<i>Corvus corone</i>	-	Green		Possible	Observed in suitable habitat	Woodland
Chaffinch	<i>Fringilla coelebs</i>	-	Green		Probable	Female and males observed alarm calling in the survey areas.	Woodland and scrub habitat
Chiffchaff	<i>Phylloscopus collybita</i>	-	Green		Possible	Observed in suitable habitat; males singing	Scrub and riparian woodland
Coal Tit	<i>Parus ater</i>	-	Green		Confirmed	family observed	Riparian woodland
Dunnock	<i>Prunella modularis</i>	-	Green		Possible	Observed in suitable habitat;	Hedgerow and riparian scrub

Common Name	Latin name	Conservation Status			Breeding status	Comments	Habitat
		EU Birds Directive ¹	BoCCI ²	Riparian Action Plan Species			
						males singing	
Goldfinch	<i>Carduelis carduelis</i>	-	Green		Probable	Pair observed in suitable habitat	Hedgerow along a ditch
Great Tit	<i>Parus major</i>	-	Green		Possible	Observed in suitable habitat; males singing	Woodland and riparian scrub
Grey Heron	<i>Ardea cinerea</i>	-	Green		Possible	Observed in suitable habitat; hunting	Estuary and river Colony at Dunkettle Shoreline pNHA Woodland edge at Pfizer.
Hooded Crow	<i>Corvus cornix</i>	-	Green		Possible	Observed in suitable habitat	Woodland
Jackdaw	<i>Corvus monedula</i>	-	Green		Confirmed	Nest site present in woodland	Woodland
Jay	<i>Garrulus glandarius</i>	-	Green		Possible	Observed in suitable habitat	Woodland and scrub
Mallard	<i>Anas platyrhynchos</i>	-	Green		Possible	Observed in suitable habitat	River
Magpie	<i>Pica pica</i>	-	Green		Confirmed	Observed carrying food material for young.	Riparian woodland
Pied Wagtail	<i>Motacilla alba</i>	-	Green		Confirmed	Observed carrying food material for young; Pied Wagtail families observed within the survey area	Improved grassland, riparian woodland
Robin	<i>Erithacus rubecula</i>	-	Green		Confirmed	Observed carrying food for young	Riparian scrub
Rook	<i>Corvus frugilegus</i>	-	Green		Possible	Observed in suitable habitat	Woodland
Song Thrush	<i>Turdus philomelos</i>	-	Green		Possible	Observed in suitable habitat	Amenity grassland; riparian woodland and

Common Name	Latin name	Conservation Status			Breeding status	Comments	Habitat
		EU Birds Directive ¹	BoCCI ²	Riparian Action Plan Species			
Woodpigeon	<i>Columba palumbus</i>	-	Green		Possible	Observed in suitable habitat; males singing	<i>hedges nearby</i> Woodland and scrub
Wren	<i>Troglodytes troglodytes</i>	-	Green		Confirmed	Adult entering and leaving an area which is indicative of nesting behaviour	Scrub

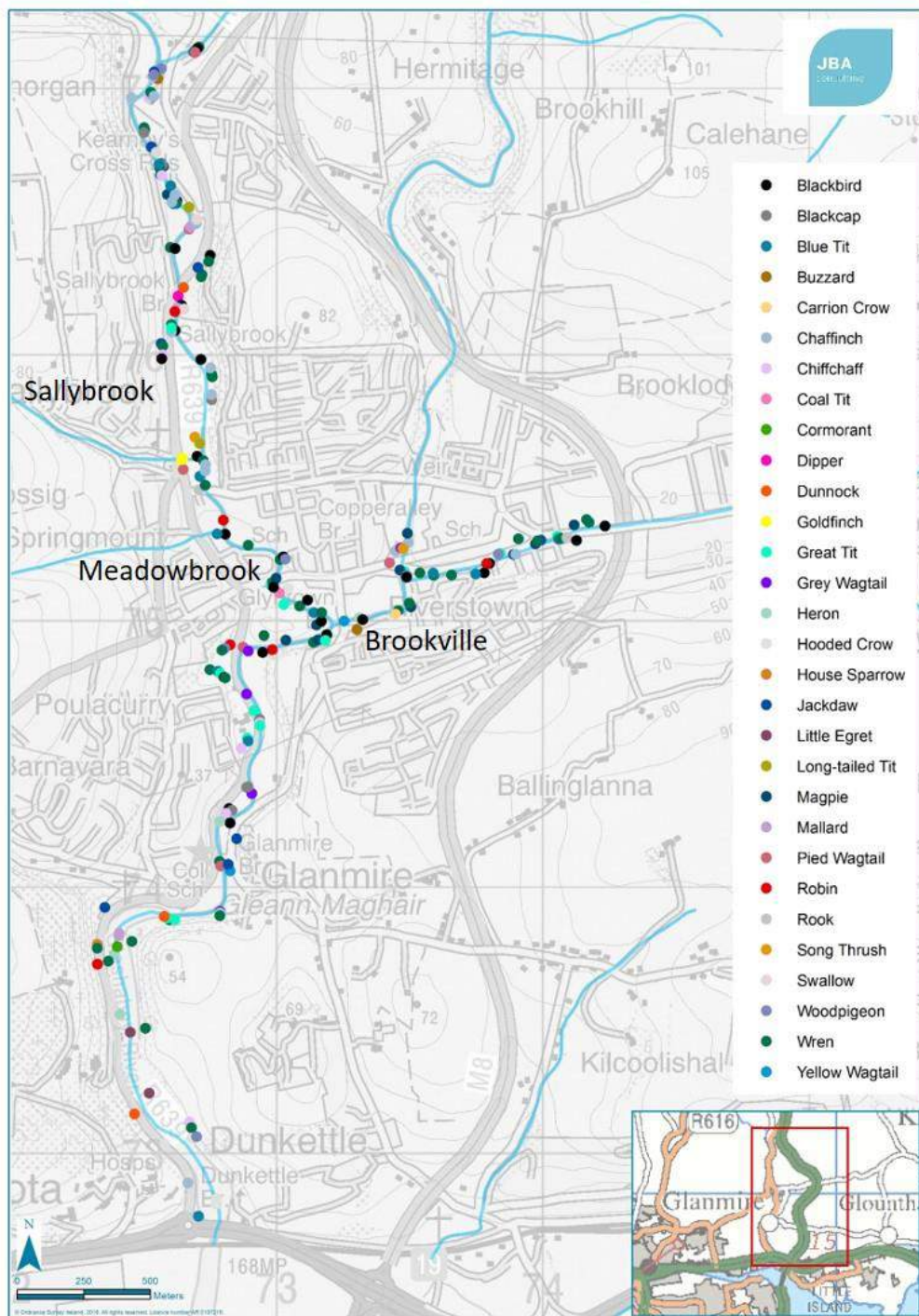


Figure 6.3: Breeding bird surveys for Glashaboy including Terrestrial and Riparian Habitats.

Important Bird Species

The important bird species noted breeding either within the proposed drainage scheme design works and/or possible construction access/compound areas are as follows:

- Kingfisher;

- Grey Wagtail;
- Dipper; and
- Mute Swan.

A Kingfisher nesting embankment was noted in the Meadowbrook area where a floodwall is planned as part of the drainage scheme design. Due to the sensitivity of the nests, the exact location, have not been shown in the EIS however this data can be made available upon request. The flood wall has been moved back to minimise disturbance on the kingfisher nests. Grey Wagtail, a Red listed species was noted nesting in bridges and river walls.

Dipper are well known to use the river and a number of active Dipper nests were also noted in the bridge structures and other locations along the river. Additional information on Dipper breeding areas was provided by the Dipper research unit of UCC. Mute Swan are also noted to nest along the banks of the Glashaboy at Glanmire.

The riparian habitats and the channel itself provide feeding opportunities for a variety of species including important bird species such as Little Egret and Kingfisher which are an Annex 1 species (EC Birds Directive).

Kestrel, an Amber listed species, was noted in the adjacent woodland areas and may nest there. Other important bird species such as Cormorant were noted fishing in this river and any potential impacts on this species is considered at an International level (please see NIS).

Any loss of scrub, trees or hedgerow will reduce the nesting habitat available within the works footprint, for other green listed species however given that there is abundant suitable habitat within the surrounding area it is unlikely that the net loss of nesting habitat will be significantly adverse, provided that appropriate mitigation, for example undertaking works outside the bird breeding season, is implemented. The provision of additional embankment and treelines will aim to offset any overall biodiversity loss.

The dense vegetation cover along and adjacent to the watercourses provides good nesting habitat for birds and loss of this habitat within the vicinity could impact adversely on breeding birds, particularly if undertaken in the breeding season. There may be disturbance also during channel maintenance work to the stream, depending upon access and requirement for vegetation clearance.

Wintering Birds

The proposed works that are located outside Cork Harbour SPA however they will occur upstream of the SPA.

Information obtained from the desktop study including NPWS Supporting Documents of Cork Harbour SPA³ and Irish Wetland Bird Survey (I-WeBS) data, were used to complete the impact assessment.

³ Cork Harbour Special Protection Area (Site Code 4030) Conservation Objectives Supporting Document Version 1 NPWS 2014

Additionally, the precautionary approach is taken and it is assumed that wintering bird species including those designated features of the SPA will use the area of mudflat that occur downstream of the proposed works. An important night time roost for Cormorant is located in Glanmire Woods.

Waterbirds were counted within a series of 73 count sub-sites in Cork Harbour SPA as part of I-WeBS many of these extending beyond the SPA boundary. Although, these datasets are not absolute, the data provides an indication of the distribution of birds across the SPA and surrounding areas. As noted above, the precautionary approach is taken in the assessment that follows and it is assumed that the birds use the area of mudflat in the zone of influence that is directly downstream of the proposed Glashaboy drainage scheme. This information along with habitat surveys and an understanding of each bird species' ecology is used to inform the impact assessment of the Glashaboy drainage scheme. The most relevant I-WeBS sub-sites are Glashaboy 0L538 which occur directly downstream of the proposed works and Rathcoursey 0L483 which is further south of the N8 road.

The wintering birds may be impacted by the proposed works mainly as a result of impacts during construction and therefore water quality controls will be very important. The main habitat they rely upon in this area are the transitional waters and the mudflats and estuarine habitats. The area is used by a number of designated features of the Cork Harbour SPA for foraging and roosting. Also, disturbance due to the physical presence of machinery and humans working on the scheme near the most northern part of the SPA may reduce or interfere with the feeding and roosting times for the birds and cause energy expenditure in avoiding source of disturbance. This is assessed further in the NIS.

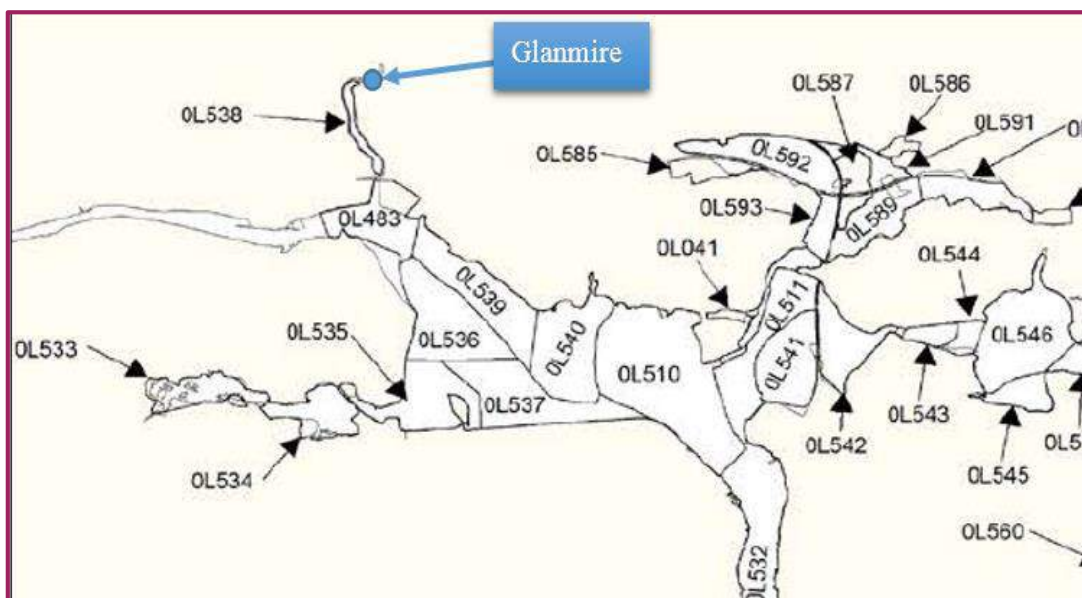


Figure 6.4: Wintering bird surveys sub-sites Glashaboy 0L538 and Rathcoursey 0L483 (NPWS, 2014)

Table 6.6: Wintering bird surveys for Glashaboy for the sub-sites Glashaboy 0L538 and Rathcoursey 0L483 (NPWS, 2014)

Survey	Glashaboy 0L538	Rathcoursey 0L483	Designated Features of Cork Harbour SPA
Low Tide	Common Gull	Common Gull	✓
	Black-headed Gull	Black-headed Gull	✓
	Curlew	Curlew	✓
	Black-tailed Godwit	Black-tailed Godwit	✓
	Cormorant	Cormorant	✓
	Oystercatcher	Oystercatcher	✓
		Lesser Black-backed Gull	✓
		Bar-tailed Godwit	✓
		Lapwing	✓
		Dunlin	✓
		Heron	✓
		Shelduck	✓
		Wigeon	✓
		Teal	✓
High Tide	None Recorded	Blackheaded Gull	✓
		Curlew	✓
		Great Black-backed Gull	✓
		Black-tailed Godwit	✓
		Greenshank	✓
		Redshank	✓
		Heron	✓
		Mallard	
		Shelduck	✓
		Teal	✓
		Wigeon	✓
Night time Roost		Cormorant (Glanmire Woods)	✓

6.4.2 Aquatic Ecology

6.4.2.1 Fisheries

Fish Stock Composition

Site 1 – Bleach Hill Stream

Both the fish abundance and species composition was low for the Bleach Hill stream site, although the site did support healthy numbers of Brown trout despite the sub-optimal morphology of the channel, i.e. being narrow ($\leq 2\text{m}$), shallow (av. $< 15\text{cm}$) and lacking of good holding pool habitat. The majority of fish ($n=18$) were recorded upstream of the existing culvert (section A) where better quality habitat (deeper water, more pools) existed. Incidentally, the current culvert likely acts as a barrier to upstream migration of Atlantic salmon at the site. A number of adult and juvenile eel were captured in the limited pool habitats in section A.

Juvenile Brown trout (likely 0+ age class) were present at low densities both upstream and downstream of the culvert, most likely given the current moderate (at best) spawning and nursery habitat at the site.

Site 2 – Unnamed stream (called Sallybrook stream on drawings), Sallybrook Industrial Estate

No fish of any species were recorded from the small unnamed stream at site 2 during the survey, with the exception of n=3 Brown trout present at the confluence of the stream and main Glashaboy river channel (section B). Fisheries potential was very low at the time of survey (effectively zero) due to lack of water (often <5cm depth), low basal flow, lack of holding pools and its higher elevation (>1m) relative to the main Glashaboy channel (i.e. barrier to migration/immigration). However, the small stream may support fish populations during periods of higher flow (e.g. winter) when it most likely acts as a refuge from higher flow rates in the adjoining main river channel. Although the stream was heavily silted in areas surveyed, coarse/medium gravels are present and may even support limited salmonid spawning in periods of higher water flow.

Site 3 – Culvert at Mill Race No. 3

Site 3 was the uppermost site surveyed on the main channel of the Glashaboy River. It was situated adjacent to where an existing flood relief culvert diverts water from the main river. Both upstream (section A) and downstream (section C) of this culvert, as well as the culvert entrance itself (section B) were electro-fished. A very high density of fish (n=183) was recorded throughout the site, comprising six species (Brown trout, European eel, Atlantic salmon, Stone loach (*Barbatula barbatula*), Three-spined stickleback (*Gasterosteus aculeatus*) and River/ Brook lamprey ammocoetes. Fish abundance was substantially higher upstream of the small weir in section A (n=95) than downstream in section C (n=39), with more optimal salmonid nursery habitat present than downstream. Section C featured more pool and holding habitat and, as such, supported a higher quantity of larger fish.

In the main river channel Brown trout were the most abundant species overall (n=90) followed by Atlantic salmon parr (n=21) and eel (n=16). Inter-species ratios were similar in both sections A and C in the main channel of the Glashaboy River. A range of year classes was evident for Brown trout, unsurprising given the ample good holding, nursery (especially for 1+ fish) and spawning habitat present both upstream and downstream of the small weir/riffle area at the site. Good numbers of Atlantic salmon parr also reflect these habitat characteristics. Both adult and juvenile eel were present in the deeper boulder-strewn areas of section A, reflecting the good overall feeding opportunities and clear migration pathway from Cork Harbour to this site.

Section B, the culvert channel entrance (from the main river as far as the culvert) featured a slower flow relative to the main river and as such had a higher deposition of soft/fine sediments with a high organic content, providing a small (<20m²) but very good juvenile lamprey habitat immediately upstream of the concrete culvert apron.

Sediment depth was invariably >10-15cm and a mixture of organic rich silt which corresponds to good juvenile lamprey habitat, regardless of species (Maitland, 2003). Lamprey ammocoete density was high (n=43) and represented the best example of juvenile lamprey habitat observed during these surveys.

Site 4 – Culvert at Cois na Gleann stream

No fish species were recorded either upstream or downstream of the Cois na Gleann culvert. Evidently, this was due to both the high gradient of the stream (particularly upstream of the culvert) and, most notably, the inaccessible culvert adjoining the main Glashaboy river channel. This culvert is located approx. >70cm above the basal flow level of the Glashaboy and even during periods of higher water would be impassable to fish species due to its inherent design and aspect. The channel was also very narrow and shallow, typically less than 15cm deep and narrow (<1m wide). It is however recommended that eel passage (at least) be accommodated given the overhang of the existing culvert adjoining the Glashaboy River.

Despite the absence of fish recorded in the stream, moderate nursery and spawning conditions exist for juvenile salmonids, although it is noted that suitable fish holding areas are severely lacking.

Site 5 – Flood relief channel and culvert at Hazelwood Avenue

A total of five species were recorded at site 5 on the main Glashaboy River channel, namely Brown trout, Sea trout, Atlantic salmon, European eel and Stone loach. Fish abundance was similar both the upstream (A) and downstream (B) sections, although fish size was slightly larger in the upstream section. Overall abundances were relatively high, with Brown trout the most numerous in both sections (n=24; n=13), followed by Atlantic salmon (n=4; n=8) and eel (n=7; n=4).

Section A (upstream) featured more deep (>1.5m) holding/pool habitat and a small number of adult Sea trout (n=3) and eel were recorded.

Such areas are key for adult migratory fish species. Overall, both nursery habitat was good upstream and downstream of this site, along with good spawning conditions for salmonids. However, holding habitat was considered excellent at section A and among the best encountered on the Glashaboy River.

Site 6 – Hazelwood Shopping Centre Bridge

Three fish species were recorded at site 6 on the Glashaboy River, where fish abundances were high in both section A (upstream) and section B (downstream). Brown trout were present in highest numbers (n=38; n=33 respectively) followed by much lower but still healthy densities of Atlantic salmon parr (n=8; n=12) and low numbers of eel (n=3; n=2).

Abundances were similar both upstream and downstream of the bridge area earmarked for flood relief works, likely given the comparable habitat characteristics present, namely riffle and glide habitat dominated by cobble and coarse gravels which provide moderate to good spawning conditions for salmonids. Optimal holding areas were lacking compared to other sites on the river, however small pool areas existed adjoining the root zones of riparian trees. Similar to other areas surveyed on the Glashaboy, a good range of size (and age) classes of Brown trout were recorded, although numbers of postulated 0+ fish (based on size class) were absent or at best infrequent at this site. A small number of large adult eel were also captured, reflecting the highly suitable feeding habitat present.

Site 7 – Culvert on Springmount stream

Only one species (eel) was recorded at site 7 on the small Springmount stream and in low numbers in sections A (n=2) and B (n=1). Despite the fact that some salmonid habitat exists upstream between the upstream culvert and wooden weir, the weir was impassable to fish apart from eel. Even so, small numbers of eel exist in the channel, which avail of a competition free foraging habitat. Two of the three fish recorded (n=2) were present in section A upstream of the weir, while a single eel was captured downstream of the weir (section B).

The absence of salmonids reflects the access/connectivity issues between the main Glashaboy and this stream.

Site 8 - Meadowbrook

A total of six species were recorded at site 8 on the Glashaboy River at Meadowbrook – Brown trout, sea trout, Atlantic salmon, River/brook lamprey, eel and a single koi carp – giving this site the highest species diversity of any surveyed. Overall, fish abundance was high both downstream (section A; n=70) and upstream (section B; n=99) of the bridge. As with all other sites surveyed on the river, Brown trout were the most frequently caught species in both downstream (n=45) and upstream (n=63) sections. Atlantic salmon were recorded in particularly good numbers also at this site (n=20 downstream and n=27 upstream).

Two adult Sea trout were also recorded in the section upstream of the road bridge (B), although many other areas in the vicinity of the bridge site are likely to be utilised by migrating fish.

In general, downstream of the culvert on the Springmount stream (site 7) and upstream of the road bridge the river had some good quality (deeper) holding habitat for salmonids in a glide-pool sequence, particularly for Sea trout. Good quality spawning also existed, being most suitable for salmon and Sea trout due to the higher proportion of cobble and large gravels. Incidentally, this good quality spawning habitat extended downstream as far as Riverstown Bridge.

The especially high abundance of salmonids of multiple size classes at this site (and downstream in general) was a testament to the amount of good quality holding habitat (that improves downstream of the Riverstown Bridge) coupled with good spawning and nursery conditions.

Notably, a small area (approx. 20m²) of optimal juvenile lamprey habitat is present in Section B immediately downstream of the bridge. This characteristic slack/eddy area (west bank) is composed of loosely compacted, soft/fine substrates invariably >5-10cm in depth. A small yet significant amount of River/brook lamprey ammocoetes (n=24) was captured from this small area, which represents one of the few suitable habitat for the species among the surveyed sites.

A single example of ornamental koi carp (*Cyprinus carpio*) was also recorded at this site, upstream of the road bridge in section B. It is highly likely that the individual was released from a personal residential aquarium in the locality, with no other koi carp observed or captured during the survey at this or any other site – it would appear to exist in isolation. The generally good condition of the small (likely immature) fish would indicate that it was released or escaped relatively recently. Shallow rivers subject to frequent flooding and high flow rates such as the Glashaboy are certainly sub-optimal for cyprinid species such as koi carp and it is highly doubtful that the species will be capable of surviving and persisting in the watercourse.

Site 9 – Glenmore stream

Site 9 on the Glenmore stream, a tributary of the Glashaboy, produced a total of three species, namely Brown trout, Atlantic salmon and eel. Brown trout were the most abundant fish encountered in both surveyed sections (n=20; n=14) followed by low numbers of Atlantic salmon (n=4; n=4) and eel (n=1; n=1). Fish abundances were similar in both the upstream (A) and downstream (B) sections due to the comparable habitats, i.e. mixtures of glide, small sections of riffle and localised pool habitat. The deeper pool habitat present in section A likely accounted for the larger number of adult trout as illustrated on the graph below. Overall lower numbers of salmonids were present in the Glenmore Stream than in the main channel of the Glashaboy River. This is reflected by the smaller size of the stream relative to the main catchment and the slightly lower spawning value due to sedimentation and ‘bedding’ of the gravels within sections of the channel. This is likely due to historical channel modification works i.e. straightening and the installation of retaining walls that are evident for long reaches of the channel.

Site 10 – Barry’s Terrace

Barry’s Terrace, Glashaboy River was the only tidal section of channel surveyed. By electro-fishing during low tide, when a small channel of water <8m wide was present, a good representation of the fish community could be established. The channel contained good numbers of Common Goby (*Pomatoschistus microps*) and Flounder (*Platichthys flesus*), with lesser numbers of Grey Mullet (*Chelon labrosus*) and eel. Overall fish abundances were similar in both sections surveyed, although Site B (downstream) was found to support more fish, particularly Common goby (n=23) and Flounder (n=23), most likely due to the greater depth and more prevalent holding (pool) habitat present in this area at low tide. Although low numbers of Grey mullet were recorded (n=3, n=2 in A and B respectively), the estuary is known locally to support large numbers of both juvenile and adult fish at high tide.

Although none were recorded, the same can be said for Sea trout and Atlantic Salmon during their migration towards the freshwater reaches of the river.

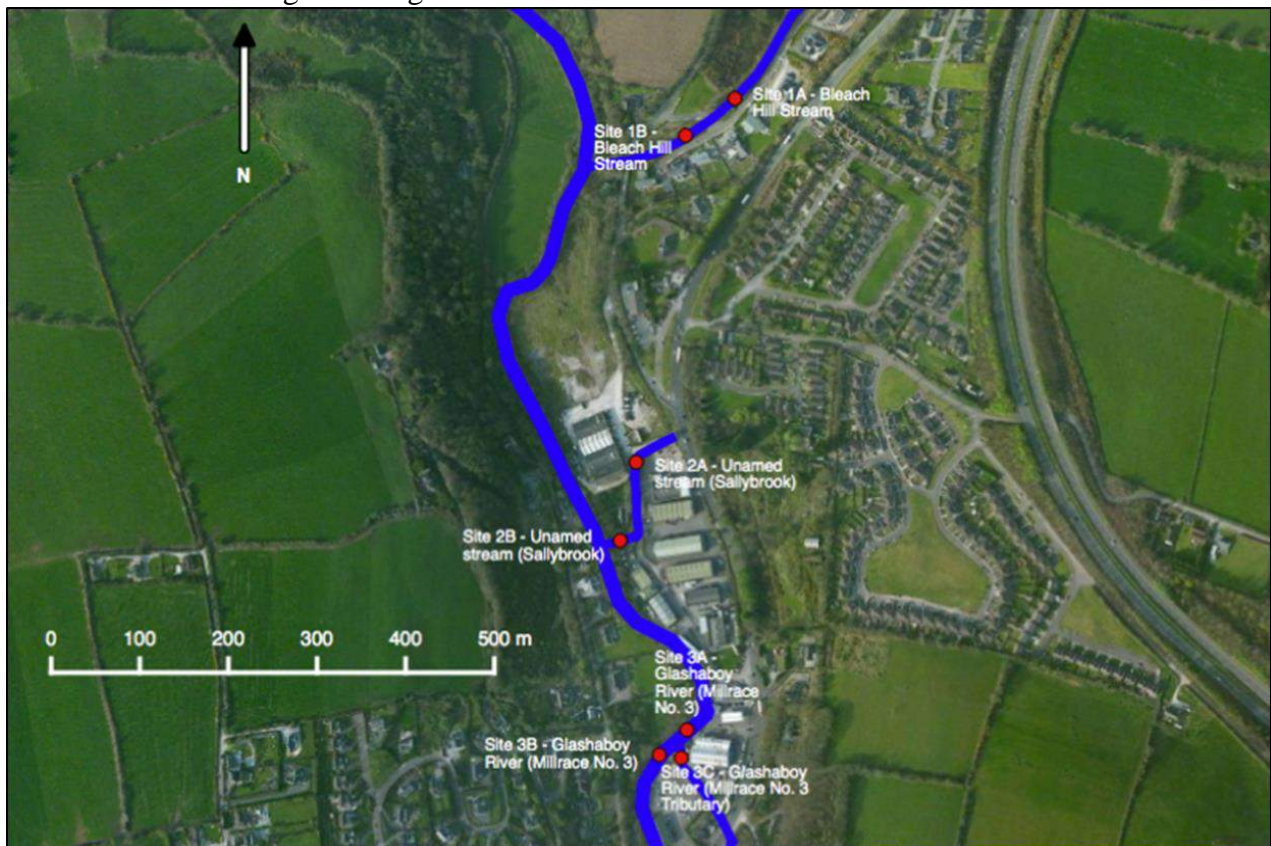


Figure 6.5: Locations for electrofishing surveys in the upper Glashaboy Scheme

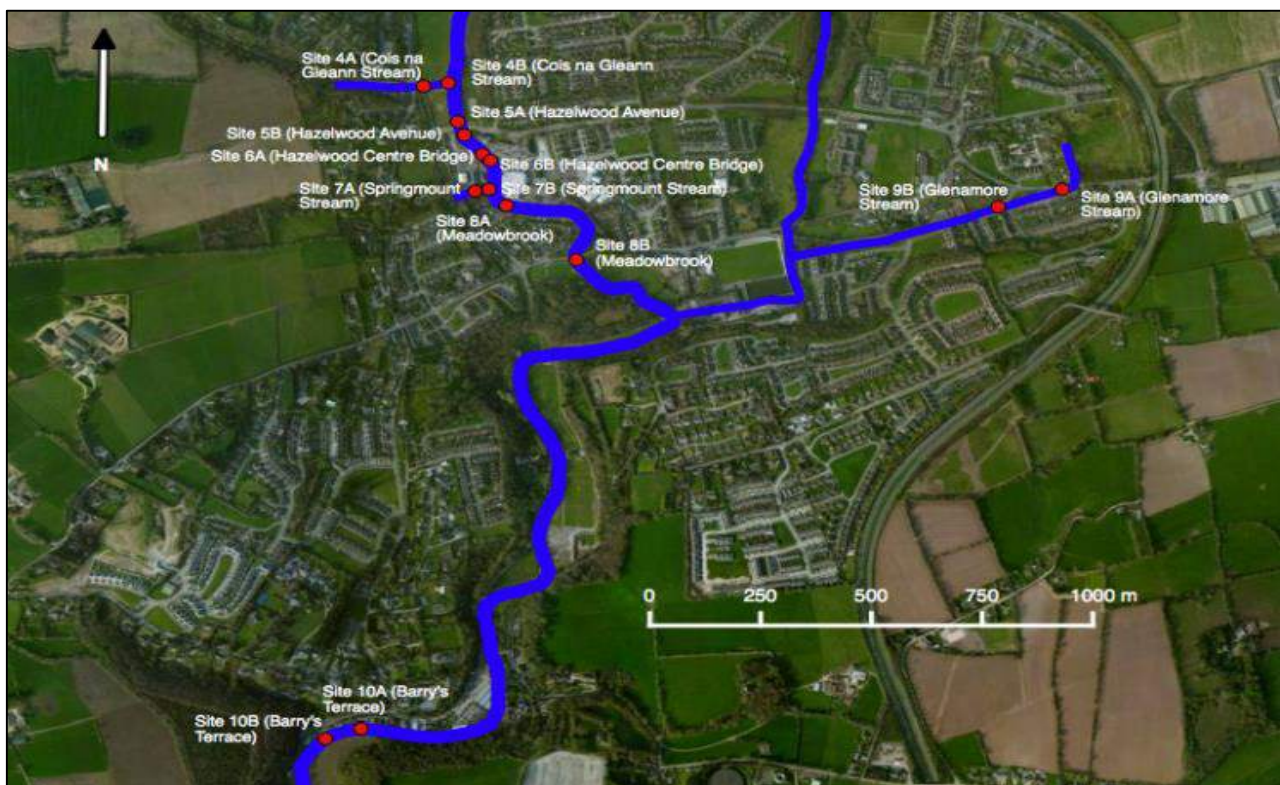


Figure 6.6: Locations for electrofishing surveys in the Lower Glashaboy Scheme

A summary of the fish composition at all survey sites on the Glashaboy River and tributaries is detailed in **Table 6.7**.

Table 6.7: Summary of fish composition at survey sites on the Glashaboy River and tributaries.

Site	Sub-site	No. Fish Species (species in parenthesis)	Total No. of fish (n)	Target Notes
Site 1 - Bleach Hill stream	1A – u/s	2 (Brown trout, eel)	18	Small shallow upland eroding stream with clean gravels of moderate value to salmonids and eel. The stream channel cascades in this section with repeating sections of shallow pool, riffle and glide. Culvert downstream appears to be fish passable.
	1B – d/s	2 (Brown trout, eel)	6	Small upland eroding stream of moderate value to salmonids and eel (heavily tunnelled with vegetation). Starts to lose gradient downstream of the culvert. Gravels less clean but none the less of moderate value to salmonids and eel. Lower quantities of fish due to lower productivity from shading in channel.
Site 2 - Unnamed stream, Sallybrook Industrial estate	2A – u/s	0	0	Poor quality highly modified stream suffering from heavy siltation. Very shallow with imperceptible flow in places.
	2B – d/s	1 (Brown trout)	3	Poor quality highly modified stream suffering from heavy siltation. Some shallow pools near confluence with Glashaboy. Downstream in the Glashaboy excellent spawning habitat.
Site 3 - culvert at Mill race no. 3, Glashaboy River	3A – u/s	4 (Brown trout, Atlantic salmon, Stone loach, eel)	95	Glashaboy River upstream of small natural weir behind Grandon's Garage. Excellent nursery habitat with localised good spawning areas (hampered somewhat by siltation in margins and algal mats on river bed). Dominated by glide habitat.
	3B – culvert	3 (River/brook lamprey, Brown trout, Three-spined stickleback)	49	High quality nursery habitat for salmonids with some moderate quality holding habitat for salmonids. Of good value for spawning with spawning habitat improving downstream.
	3C – d/s	3 (Brown trout, Atlantic salmon, eel)	39	Culvert section of millrace with soft sediment excellent quality lamprey habitat, with small trout population.
Site 4 - Culvert on Cois na Glenn stream	4A – u/s	0	0	Highly modified channel with very shallow water. Has moderate quality gravel substrata but depth very shallow meaning habitat overall is poor and did not support fish.
	4B – d/s	0	0	Culvert lip overhanging adjoining Glashaboy indicated the stream is inaccessible to salmonids and eel. No populations of fish in the lower reaches despite moderate quality gravels. Shallow nature unsuitable for fish.
Site 5 - Flood Relief culvert	5A – u/s	4 (Brown trout, Sea	38	Excellent quality holding habitat for sea trout with deep pools upto 1.8m adjoining glide habitat.

Site	Sub-site	No. Fish Species (species in parenthesis)	Total No. of fish (n)	Target Notes
at Hazelwood Avenue, Glashaboy River		trout, Atlantic salmon, eel)		Mixed substrata that includes good quantities of boulder mean that the habitat is an excellent refuge for European eel. Shallower areas of the upper part of the stretch provide good nursery habitat for salmonids but the substrata are less optimal for spawning overall.
	5B – d/s	5 (Brown trout, Sea trout, Atlantic salmon, eel, Stone loach)	28	Good quality riffle, glide and pool habitat with adjoining good quality spawning gravels.
Site 6 - Hazelwood Centre bridge, Glashaboy River	6A – u/s	3 (Brown trout, Atlantic salmon, eel)	49	Good quality riffle, glide and pool habitat with adjoining good quality spawning gravels. Localised sedimentation of gravels but of good quality overall.
	6B – d/s	3 (Brown trout, Atlantic salmon, eel)	47	Good quality riffle, glide and pool habitat with adjoining good quality spawning gravels. Localised sedimentation of gravels but of good quality overall.
Site 7 – Culvert on Springmount stream	7A – u/s	0	0	Poor quality heavily modified shallow stream, considered inaccessible to salmonids given impassable weir-board. Gravels present but suffering from heavy siltation.
	7B – d/s	1 (eel)	3	Poor quality heavily modified shallow stream with heavy sediment loading in lower reaches. No lamprey found present as sediment appeared anoxic in nature.
Site 8 – Meadowbrook, Glashaboy River	8A – d/s	4 (Brown trout, Atlantic salmon, eel, River/brook lamprey)	94	Sequence of pool, deep glides and localised riffle. Excellent quality holding and nursery habitat with moderate quality spawning. Localised good quality lamprey habitat in beds of sediment near bridge.
	8B – u/s	5 (Brown trout, Atlantic salmon, eel, Stone loach, koi carp)	99	Shallower section of river dominated by shallow glide and riffle with localised pockets of pool. Good quality spawning and nursery habitat despite localised siltation.
Site 9 – culverts on Glenmore stream	9A – u/s	3 (Brown trout, Atlantic salmon, eel)	25	Historically straightened section of river channel bounded by retaining wall on roadside. Mixture of pool, shallower glide and riffle. Gravels are suffering from moderate siltation and somewhat compacted and bedded reducing spawning value.
	9B – d/s	3 (Brown trout, Atlantic salmon, eel)	19	Historically realigned section of channel (cobble retaining wall on left hand bank). Despite such modifications historically the stream retains a high degree of naturalness with sequences of equidistant riffle, glide and pool. Gravels suffering from siltation but of slightly better quality than upstream. Stream partially canopied by treelines.

Site	Sub-site	No. Fish Species (species in parenthesis)	Total No. of fish (n)	Target Notes
Site 10 – Barry’s Terrace, Glashaboy River	10A – u/s	4 (Common goby, Grey mullet, eel, flounder)	35	Estuarine section of the Glashaboy River at Barry’s Terrace with mixed sediment base, muds, gravels and boulder supporting mixed estuarine fish population.
	10B – d/s	4 (Common goby, Grey mullet, eel, flounder)	50	Estuarine section of the Glashaboy River at Barry’s Terrace with mixed sediment base, muds, gravels and boulder supporting mixed estuarine fish population.

Figure 6.7: Fish species diversity recorded in the Glashaboy River and tributaries

Fisheries Habitat

The evaluation of the salmonid habitat asset of the Glashaboy River and tributaries in each of the surveyed sections is provided below in **Table 6.8**. Those habitats with poor quality substrata, shallow depth and a poorly defined river profile receive a higher score.

Higher scores in the Life Cycle Unit method of fisheries quantification are thus of poorer value, with lower scores being more optimal despite this appearing counter intuitive. Site 3 (Culvert at Millrace No. 3), 5 (Flood Relief Channel and Culvert at Hazelwood Avenue), 6 (Hazelwood Shopping Centre Bridge) and 8 (Meadowbrook) had the best quality salmonid habitat, in terms of spawning, nursery and holding (pool) habitat.

Sites 1 (Bleach Hill Stream) and 9 (Glenmore Stream) had moderate to good quality habitat because of poorer nursery or spawning habitat respectively.

Heavily modified streams with very poor river profiles because of historical modification and associated higher levels of sedimentation and or of a shallow nature scored poorly. These included the unnamed stream in the Sallybrook industrial estate (Site 2), the Cois na Gleann Stream (Site 4) and the Springmount Stream (site 7). Barry’s Terrace was not evaluated given it is in the upper parts of the Glashaboy estuary and outside the scope of the scoring system.


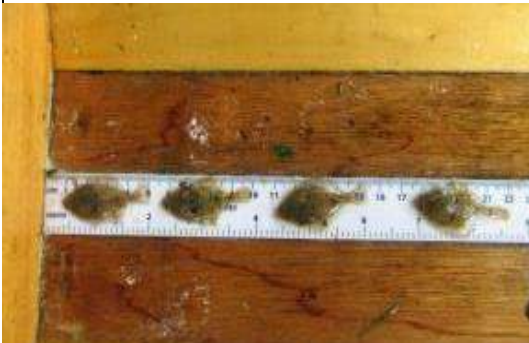



	
Brown Trout (<i>Salmo trutta</i>)	Atlantic salmon parr (<i>Salmo salar</i>)
	
European eel (<i>Anguilla anguilla</i>)	Brook/ River Lamprey (<i>Lamprologus spp.</i>)
	
Juvenile European flounder (<i>Platichthys flesus</i>)	Koi carp (<i>Cyprinus carpio sp.</i>)
	
Stone loach (<i>Barbatula barbatula</i>)	Sea trout (<i>Salmo trutta</i>)

Table 6.8: Summary of the Life Cycle Unit Scores for the Glashaboy River and tributaries.

Site No.	Sub site	Fisheries Habitat Value	Spawning	Nursery	Holding (Pool)	Total Score (Lower scores indicate superior habitat)
Site 1 - Bleach Hill Stream	1A – u/s	Moderate	2	3	3	8
	1B – d/s	Moderate	2	3	3	8
Site 2 - Unamed Stream (Sallybrook Ind. Estate)	2A – u/s	Poor	4	4	4	12
	2B – d/s	Poor	4	4	4	12
Site 3 - Culvert at Millrace No. 3	3A – u/s	Good	2	1	3	6
	3B – d/s	Good	2	1	3	6
	3C	Poor	3	3	2	8
Site 4 - Culvert (Cois na Gleann Stream)	4A – u/s	Poor	2	4	4	10
	4B – d/s	Poor	2	4	4	10
Site 5 - Flood Relief Culvert (Hazelwood Avenue)	5A – u/s	Poor	3	2	1	6
	5B – d/s	Excellent	1	1	2	5
Site 6 - Hazelwood Centre Bridge	6A – u/s	Excellent	2	1	2	5
	6B – d/s	Excellent	2	1	2	5
Site 7 – Culvert on Springmount Stream	7A – u/s	Excellent	3	4	4	11
	7B – d/s	Poor	3	4	4	11
Site 8 - Meadowbrook	8A – u/s	Poor	2	1	2	5
	8B – d/s	Excellent	2	1	2	5
Site 9 – Glenmore Stream	9A – u/s	Excellent	3	2	2	7
	9B – d/s	Good	3	2	2	7
Site 10 – Barry’s Terrace	10A – u/s	Good	n/a	n/a	n/a	n/a
	10B – d/s	Not Applicable	n/a	n/a	n/a	n/a

6.4.2.2 Geomorphology

Two geomorphological walkover surveys have been completed (2014 and 2016) and are documented in the Glashaboy Hydromorphological Audit document in **Appendix 6.2**.

The geomorphological audit has shown that the Glashaboy is presently not actively transporting much gravel sized material.

The river in its upper reaches has good floodplain connectivity, but in its lower reaches, as the urban influences encroach into the channel and floodplain and confine the river corridor, instabilities in the channel occur and erosional processes increase.

Sediment deposition is generally at a low level. The main supply of sediment into the system is from bank erosion, steep tributaries and glacial sediment re-working (in the very upper reaches). Run off from agricultural areas also inputs fine sediment in to the system with limited buffer strips due to a poor quality riparian zone in many locations. Where sediment accumulation issues exist within the system these tend to be as a result of modifications to the channel which has acted to disrupt the natural river system processes. This includes impoundment disrupting the downstream transport of sediment, over widening which reduces channel velocity (increasing sedimentation), channel narrowing increasing velocities (decreasing sedimentation and increasing bank erosion) and poor placement of in channel features and structures.

6.4.2.3 Aquatic Macroinvertebrates

The macroinvertebrate Q-value system is used nationally by the Environmental Protection Agency (EPA) to report the water quality of Irish rivers to the EU. The Q-value is a quality measurement ranging from Q1-Q5, with Q1 being the poorest quality and Q5 being pristine and unpolluted. The system groups macroinvertebrate taxa into five groups (Group A to E). Group A taxa are pollution sensitive taxa and are those such as Stoneflies and flat Mayflies. As the groups move from Group A to Group E, the taxa assigned to these groups become more pollution tolerant. The relative abundances of these Groups within a macroinvertebrate community are used to assign a Q-value to a river site.

Site 1, Upper Glanmire Bridge (upstream of proposed scheme)

Site 1 is a riffle-run site with clear water clarity, an average wet width of 3m and average water depth of 20cm. The main substrate type in order of dominance was; cobble, coarse gravel, fine gravel, sand and boulder. There was a slight silt plume present when the substrate was disturbed. The degree of shading was moderate, with Ash and Sycamore comprising the main part of the canopy.

Mosses and macrophytes constituted less than 5% cover each and no filamentous algae was visible at the time of sampling.



Photo 6.7: Site 1 sampling site.

The macroinvertebrate community of Site 1 was assigned a Q4, which denotes Good ecological conditions. Four Group A taxa of the Mayfly and Stonefly families, Chloroperlidae, Ecdynurus sp., Perlidae and Rhithrogena sp., individually represented less than 5% of the sample. Group B taxa were generally common, with the Mayflies *Baetis rhodani* and *Serratella ignita* being numerous in the sample. Simuliidae, a black fly larvae and Group C taxon, was also numerous.

Table 6.9: Macroinvertebrate taxa recorded at Site 1.

Taxa	Q value Group
<i>Asellus aquaticus</i>	D
<i>Baetis rhodani</i>	C
Caenidae	B
Chloroperlidae	A
Chironomidae	C
<i>Ecdynurus sp.</i>	A
<i>Elmis sp.</i>	C
Eropobdellidae	D
<i>Gammarus duebeni</i>	C
Glossosomatidae	B
Hydropsychidae	C
<i>Leuctra sp.</i>	B
Oligochaeta	E
Perlidae	A
Philopotamidae	C
Polycentropodidae	C
<i>Rhithrogena sp.</i>	A
<i>Serratella ignita</i>	B
Simuliidae	C
Tipulidae	C

Site 2, John O' Callaghan Park (downstream of Butlerstown River confluence)

Site 2 is a riffle-run site with clear water clarity, an average wet width of 3m and average water depth of 15cm. The main substrate type in order of dominance was; cobble, coarse gravel, fine gravel, sand. There was a slight silt plume present when the substrate was disturbed. The degree of shading was moderate, with Ash and Sycamore comprising the main part of the canopy. A large stand of Japanese knotweed was present on the gravel island of the channel. Mosses constituted less than 5% cover each and filamentous algae was not visible at the time of sampling. Dipper were also noted at the sampling site.



Photo 6.8: Site 2 sampling site.

The macroinvertebrate community of Site 2 was assigned a Q4, which denotes Good ecological conditions. Three Group A taxa that are in the Mayfly and Stonefly families, Chloroperlidae, Ecdynurus sp., and Rhithrogena sp., individually represented less than 5% of the sample. The freshwater shrimp Gammarus duebeni were also less than 5% of the sample. Group B taxa were generally common, with the Mayflies B. rhodani, S. ignita and Stonefly Leuctra sp. being numerous. Simuliidae, a Group C taxon, was also numerous.

Table 6.10: Macroinvertebrate taxa recorded at Site 2.

Taxa	Q value Group
<i>Asellus aquaticus</i>	D
<i>Baetis rhodani</i>	C
Chironomidae	C
Chloroperlidae	A
<i>Ecdynurus sp.</i>	A

<i>Elmis sp.</i>	C
<i>Gammarus duebeni</i>	C
Hydropsychidae	C
<i>Leuctra sp.</i>	B
Limnephilidae	B
Oligochaeta	E
<i>Rhithrogena sp.</i>	A
Rhyacophilidae	C
<i>Serratella ignita</i>	B
Simuliidae	C
Tipulidae	C

Site 3, Butlerstown River

Site 3 is comprised of riffle and glide habitat with clear water clarity, an average wet width of 3m and average water depth of 20cm. The main substrate type in order of dominance was; cobble, coarse gravel, fine gravel, sand and boulder. There was a slight silt plume present when the substrate was disturbed. The degree of shading was moderate, with Sycamore comprising the main part of the canopy. Mosses and macrophytes both individually constituted less than 5% cover and filamentous algae was not visible at the time of sampling.



Photo 6.9: Site 3 sampling site.

The macroinvertebrate assemblage of Site 3 was assigned a Q4, which denotes Good ecological conditions. Two Group A taxa were recorded in the sample at low numbers, as were other Group B Cased Caddis, Limnephilidae and Goeridae. Cased Caddis taxa Sericostomatidae and Glossomatidae were common, as were the Mayflies *B. rhodani* and *S. ignita* and the Stonefly *Leuctra sp.*, *G. duebeni* and Chironomidae, both Group C taxa, were also common in the sample.

Table 6.11: Macroinvertebrate taxa recorded at Site 3.

Taxa	Q value Group
<i>Baetis rhodani</i>	C
Chironomidae	C
Chloroperlidae	A
<i>Elmis sp.</i>	C
<i>Gammarus duebeni</i>	C
Glossosomatidae	B
Goeridae	B
<i>Leuctra sp.</i>	B
Limnephilidae	B
Oligochaeta	E
<i>Rhithrogena sp.</i>	A
Sericostomatidae	B
<i>Serratella ignita</i>	B
Tipulidae	C

In summary, all three sampling sites were assigned a rating of Q4, which represents Good ecological conditions. The Glashaboy and Bulterstown Rivers are classed as being of Good status under the WFD classification system (EPA, 2016).

Macroinvertebrate assemblages are one biological quality element considered when calculating the status of a river, with the ‘one out all out rule’ whereby overall classification is defined by the lowest observed individual quality element. Rivers of Q4 rating also represent waters that provide good fishery potential, as outlined in the Water Quality for Phosphorus Regulations 1998 (S.I. 258/1998). Curtis et al. (2009) also describe the ecological requirements of Salmon as requiring very high water quality and waters less than Q4 put Salmon populations at risk. The proposed works for the River Glashaboy (Glanmire/Sallybrook) Drainage Scheme must ensure that good water quality is maintained to support continued Good ecological conditions.

6.4.3 Terrestrial Mammals

6.4.3.1 Otter

A number of otter activity signs and holts were recorded along the Glashaboy River. These were in the form of footprints, spraints, slides, couches and holts, as shown in Figure 6.8. Both active and inactive otter holts were recorded during the survey. Due to the sensitivity of these locations and for the protection of the species, the types of otter activity signs are not differentiated in Figure 6.8, however this data can be made available upon request. The presence of otter was mainly recorded along the Glashaboy River in the vicinity of John O’ Callaghan’s Park, Meadowbrook, upstream of Hazelwood Centre road, Sallybrook Industrial estate and along Glenmore stream.

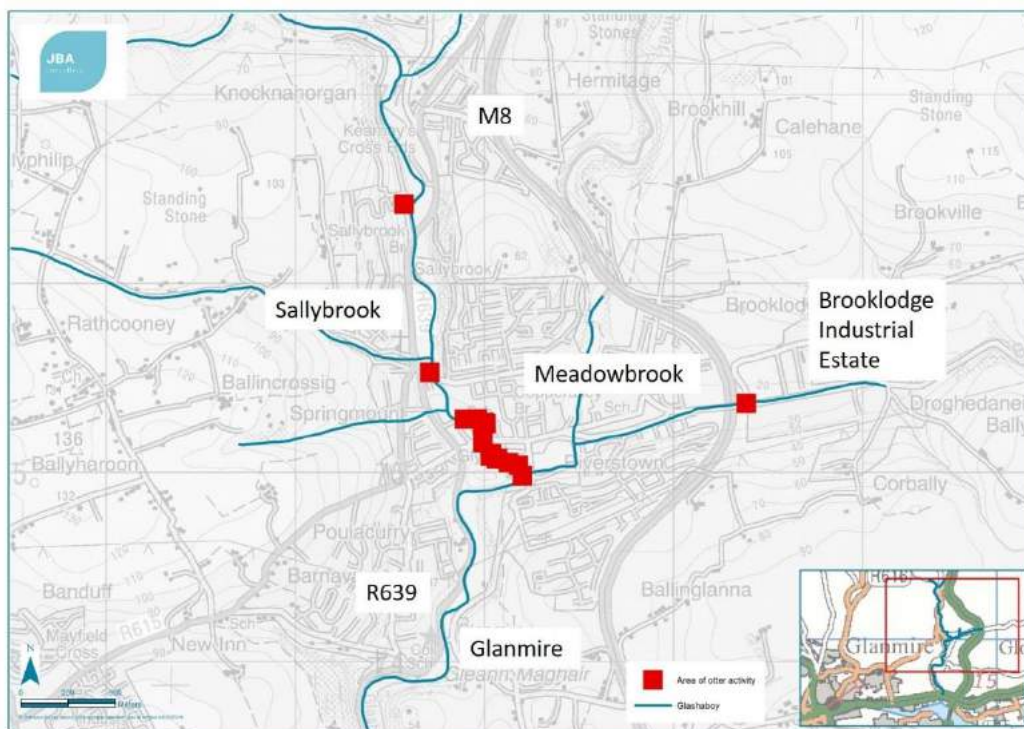


Figure 6.8. Otter activity signs.

6.4.3.2 Badger

No badger setts were recorded within the proposed working area of the proposed drainage scheme. The nearest known badger sett to the works is in Glanmire Wood pNHA, which is located on the eastern side of the Glashaboy River. No structural flood defences or construction access are proposed south of chainage C01_1900 (Drg. No. GR_403), which will be constructed on the west riverbank along the R639.

6.4.3.3 Bats

Trees were surveyed along the chainage sections of the river where works are proposed to be undertaken. These surveys were completed during the daytime assessment on the 12th, 13th and 25th July 2016. Much of the chainage where embankments or proposed flood works are to be located is already cleared of mature trees with many immature or young trees remaining, as these areas tended to be located where housing/apartments and industrial zones are already located. Therefore, there were only 23 trees considered to be Potential Bat Roosts (PBRs) for roosting bats in these surveyed areas. There are large sections of woodland and mature treeline adjacent to other sections of the river, however no works are proposed in these areas. An extra section of the Glenmore stream, east of the M8 motorway along Brooklodge Grove, was added to the scheme design after the surveys were conducted, and hence a section of the Glenmore stream was not surveyed for bats. This area will require surveying prior to the commencement of the works.

Dawn & Dusk Survey

Each survey point where bats were recorded is listed in Tables 6.12 and 6.13 along with the grid reference and general description. Twenty-eight points along the survey area for Night 1 recorded foraging bats. Soprano pipistrelles were the most frequently recorded species followed by Daubenton's bats, which is to be expected as both species prefer to feed over water. There was a high encounter rate of Natterer's bats, which is a woodland specialist species and reflects the dense woodland and treelines present in much of the area survey on Night 1 – 26th July. Leisler's bats were recorded only in John O'Callaghan Park, which reflects the open parkland habitat adjacent to the woodland and river system. There is likely to be large number of trees within woodland of the park providing roosting sites for bats, but this was beyond the scope of the current survey as these trees are not specifically located to along the river. Brown long-eared bats were recorded emerging from the gate lodge located at W 72823 74791 and commuting across the road at W 72883 74692 where there are suitable buildings for roosting bats.

Table 6.12: Bat Survey from 12th July 2016

No.	Grid Reference	Bat Species	Bat Activity
1	W 72840 74946	SP, CP, Daub	Foraging
2	W 72933 74943	SP, Daub, Natt	Foraging – high level of activity
3	W 73044 74963	CP, SP, Duab, Natt, Leis	Foraging
4	W 73148 75013	SP, Duab, CP	Foraging – high level of activity
5	W 73171 75042	SP, CP, Daub	Foraging
6	W 73113 75079	SP, CP, Duab	Foraging
7	W 73076 75115	SP, Daub, Natt, Leis	Foraging
8	W 72990 75141	SP, CP, Natt, Daub, Leis	Foraging
9	W 72949 75187	SP, Natt, Daub	Foraging
10	W 72899 75179	SP, CP, Daub	Foraging
11	W 72811 74897	SP, Natt, Daub	Foraging – high level of activity
12	W 72822 74806	SP, Daub, Natt	Foraging – high level of activity
13	W 72838 74765	SP, Daub, Natt, BLE	Foraging – high level of activity
14	W 72889 74719	BLE, SP, Daub	Foraging – high level of activity
15	W 72886 74598	SP, Natts, Daub	Foraging
16	W 72878 74535	SP, Daub, CP	Foraging
17	W 72942 75218	SP, Daub	Foraging
18	W 72959 75291	SP, Daub	Foraging
19	W 72901 75324	SP, Daub	Foraging
20	W 72800 75335	SP, Daub	Foraging
21	W 72786 74250	Daub	Foraging
22	W 72756 74156	SP, Daub	Foraging
23	W 72778 74116	SP, Daub	Foraging
24	W 72761 74011	SP, Daub	Foraging
25	W 72704 73953	SP	Foraging
26	W 72643 73949	SP, Daub	Foraging
27	W 72528 73084	SP	Foraging
28	W 72636 72880	SP	Foraging

Where, SP = Soprano pipistrelle, CP = Common pipistrelle, Daub = Daubenton's bat, Natt = Natterer's bat, Leis = Leisler's bat, BLE = Brown long-eared bat

A similar procedure was followed on Night 2 – 27th July (Table 6.13) and the results from the four minute survey spot are below. The area surveyed was from Hazelwood Centre and heading north to the most northern point of the survey area. Twenty-three survey spots recorded foraging bats. Again the most encountered bat species was Soprano pipistrelles followed by Daubenton's bats. There was also a high incidence of Natterer's bats and common pipistrelles with occasional calls of Leisler's bats and brown long-eared bats recorded. The woodland just north of Hazelwood Centre and running adjacent to the sports fields is an important foraging area for bats. This small woodland also provides potential roosting sites and due to the steep slopes, is an important dark corridor for commuting and foraging bats.

Table 6.13: Survey results from 27th July 2016.

No.	Grid Reference	Bat Species	Bat Activity
1	W7251376752	SP roost	Emerging – building in Sallybrook
2	W7250676759	SP	Foraging
3	W7244776854	CP	Foraging
4	W7243476777	SP	Foraging
5	W7243077077	SP, CP	Foraging – 3 individuals
6	W7246777190	SP	Commuting along treeline
7	W7245777236	SP, CP	Foraging
8	W7245877272	SP, CP, BLE, Daub	Foraging – high level of activity
9	W7251277230	SP, CP, Daub	Foraging
10	W7254477161	SP, CP, Daub	Foraging along dense tree line
11	W7263676276	SP, Leis, Daub	Foraging
12	W7263276242	SP, Daub	Foraging
13	W 72577 76129	SP, CP, Daub	Foraging
14	W 72596 76076	SP, CP, Daub, Natts	Foraging
15	W 72637 76029	SP, CP, Daub, Natts	Foraging
16	W 72687 76009	SP, CP, Daub	Foraging
17	W 72704 75956	SP, CP, Daub, Natts	Foraging
18	W 72680 75833	SP, CP, Daub	Foraging
19	W 72676 75731	SP, CP	Foraging
20	W 72674 75619	Daub	Foraging
21	W 72734 75459	SP, Leis	Foraging
22	W 72334 77321	SP, CP, BLE, Daub	Foraging
23	W 72106 77370	SP, CP, BLE, Daub	Foraging

Where, SP = Soprano pipistrelle, CP = Common pipistrelle, Daub = Daubenton's bat, Natt = Natterer's bat, Leis = Leisler's bat, BLE = Brown long-eared bat

A Soprano pipistrelle roost was identified from an old building located within the Sallybrook Industrial area. This occupied house is located adjacent to the river and contains a large Soprano pipistrelle roost (>100 individuals). In addition, there are other roosting sites located in buildings along the local road off the R639 (heading north from The Brook Inn).

Static Surveillance

River Bank, 12th July 2016

This unit was located along the bank of the Glashaboy River across from the gate lodge located on the R639. A total of five bat species were recorded on the unit. There was a very high level of bat activity recorded throughout the night.

Soprano pipistrelles were the most frequently recorded species reflecting continuous foraging individuals located along this section of the river.

Daubenton's bats were also recorded in high levels with occasional passes of Leisler's bats and Common pipistrelles. A small number of bat passes were recorded for brown long-eared bats reflecting emerging individuals of this species from adjacent buildings.

River Bank adjacent to Lidl, 12th July 2016

A total of five species of bat were recorded during surveillance (7 hours). Soprano pipistrelles were the most frequently recorded bat species at this surveillance site while Daubenton's bat were recorded throughout the night feeding along the river. Common pipistrelle was also recorded but in lower numbers. A small number of bat passes were recorded for Leisler's bats and brown long-eared bats.

Carpark – Sallybrook, 25th July 2016

A total of four species of bat were recorded during surveillance (7 hours). Soprano pipistrelles were the most frequently recorded bat species at this surveillance site, closely followed by bat passes from Common pipistrelles while Daubenton's bat were recorded throughout the night feeding along the river. A small number of bat passes were recorded for Leisler's bats.

Woodland – Hazelwood Area, 25th July 2016

A total of five species of bat were recorded during surveillance (7 hours). Soprano pipistrelles were the most frequently recorded bat species at this surveillance site and these were recorded in very high level indicating the importance of this woodland for foraging bats. All other bat species recorded were in lower number of bats passes.

Bridge & Culvert Surveys

The bridges and culverts detailed in Table 6.14 were surveyed along the proposed drainage scheme working area.

Table 6.14: Bridge and Culverts surveyed for bat potential.

Bridge or Culvert Description	Result
Glanmire Bridge W 72761 74157	No crevices for bats
Single natural stone arch located d/s of Glanmire Bridge W 72769 74116	Some small crevices suitable for individual roosting bats
Mill Race Arch (u/s of Glanmire Bridge) W 72760 74192	Some small crevices suitable for individual roosting bats
Double arch road culvert south of St. Patrick's Mill W 72863 74564	Some small crevices suitable for individual roosting bats
Riverstown Bridge north of John O'Callaghan's Park (L3010) W 72936 75194. Five natural stone arch bridge	Some small crevices suitable for individual roosting bats
Bridge within John O'Callaghan's Park (Cliff Road) W 73203 75045. Three natural stone arch bridge	Some small crevices suitable for individual roosting bats
Copper Valley Bridge W 73456 75283. Three arch bridge	Some small crevices suitable for individual roosting bats
Natural Stone Bridge d/s of Copper Valley Bridge W 73437 75249. Single arch bridge	Some small crevices suitable for individual roosting bats
Natural Stone Bridge adjacent to derelict buildings and Lidl. Double arch bridge	Some small crevices suitable for individual roosting bats
Natural Stone double road culvert (low) in south Sallybrook. Double square culvert	Too low to be suitable

Specific Chainage Areas

Defence Wall Chainage 900m-1600m & The Fountains

This area is located south of Glanmire Bridge where there are an array of businesses located on the western banks of the river. There are little to no trees on this side of the river but there are extensive mature trees on the eastern banks.

In addition, there is a private building (the Fountains) adjacent to the river. There is a large array of trees especially located on a series of islands within the river or adjacent canals. There is a single natural stone arch (W 72769 74116) adjacent to the building which could potentially provide roosting sites for some individual bats. There are also some mature trees on the island immediately adjacent to this single natural stone arch.

Defence Wall (upstream of Glanmire Bridge, adjacent to R639)

This is located on the western bank of the river. There are no PBRs located along this short section but there are foraging and commuting areas for bats that need to be protected from works.

St. Patrick's Mill

This area is located north of Glanmire and south of Riverside. There is a private building located along the mill race of the main river channel. There is a large area of woodland with suitable foraging, roosting and commuting areas for bats. There is a natural stone culvert under the road where the mill race enters the area of this property.

Various Works Chainage (Meadowbrook housing estate)

Protection of trees, PBRs and habitats is required along this section of the river.

Various Works Chainage (Hazelwood)

Protection of trees, PBRs and habitats is required along this section of the river.

Various Works Chainage 1,4900-1,4700 (Hazelwood Avenue Bridge)

Protection of trees, PBRs and habitats is required along this section of the river.

Summary

In summary, at least six species of bats were recorded feeding and commuting within the survey area. This is indicative of the importance of this area for bats. While three of the bat species recorded are common Irish bat species (Common pipistrelle, Soprano pipistrelle and Leisler's bat), two typical woodland species were recorded (brown long-eared bats and Natterer's bats), one bat species relies on both woodland and waterways (Daubenton's bat) This is a rich bat fauna for one survey area and reflects that the Glashaboy River and its tributaries are principal commuting routes especially along dark treelines and woodland areas. The Leisler's bat was the only species flying across the open fields/parklands. This emphasises the importance of these habitats for the suite of bat species recorded on-site.

Soprano pipistrelles were recorded roosting in one building in the Sallybrook area and additional unconfirmed roosts are further north. A brown long-eared roosts was also recorded in a gate lodge located south of Glanmire and potential additional roost in buildings located near this gate lodge. However, the scope of this survey did not allow emphasis for the recording of roosting sites, but there are likely to be roosts in mature trees and additional buildings along the entire 6km route surveyed. Therefore, mitigation is detailed in **Section 6.8.6** to ensure that bats will not be negatively impacted by the proposed drainage scheme.

The survey area located along the Glashaboy River is an important habitat for bats species. A total of six out of a potential seven species of bat has been recorded along the river.

There are a number of large mature trees located in woodlands (Hazelwood, John O'Callaghan Park and north of Sallybrook) that are considered highly suitable for roosting bats. The areas for proposed drainage scheme measures were surveyed for PBRs and twelve PBRs were identified in these areas.

However, the majority of mature trees were located outside these areas and as a consequence these should be protected from works to prevent any damage to them.

6.5 Evaluation of Ecological Receptors

This section evaluates the nature conservation importance of the scheme for its habitats and for the species it supports in terms of its relative importance in a geographical context, following the assessment criteria outlined in the NRA (2009) and CIEEM (2016) guidance documents.

The value of the receptor is defined with reference to the geographical context of the scheme i.e. the specific importance of the scheme to each of the habitats or protected species populations identified as being present within it, or making use of it. This assessment of value is based on the condition of the site during the survey period, although, where information is available, reference is made to these.

Geographic context for determining value

The following geographic frame of reference (NRA, 2009) has been used when determining value:

- International importance;
- National importance;
- County importance (or vice-county in the case of plant or insect species);
- Local importance (higher value); and
- Local importance (lower value).

One EU designated Natura 2000 site is located within the zone of influence of the project. Determining the potential for impact and the zone of influence is based on source > pathway > receptor chain principles and involves assessing likely significant effects on protected sites within the zone of influence of the proposed drainage scheme in relation to three pathways:

1. Surface water;
2. Land & air; and
3. Groundwater.

The Cork Harbour SPA which is an EU designated Natura 2000 site is hydrologically linked to the proposed Glashaboy drainage scheme and the Glashaboy River, with potential for land, air, surface water and groundwater impacts.

This will be assessed separately under the requirements of the Habitats Directive and Articles 6(3) and 6(4) of the Habitats Directive which have been transposed into Irish legislation by means of the Habitats Regulations, 1997 (S.I. No. 94 of 1997) and the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 / 2011). Therefore, a Natura Impact Statement will accompany this EIS to address potential impacts on Cork Harbour SPA.

Other protected sites in the zone of influence of the Glashaboy drainage scheme include the proposed nationally protected sites outlined below.

Four proposed Natural Heritage Sites (pNHAs) are located in, or within 2km of, the Scheme:

- Glanmire Wood pNHA;
- Dunkettle Shore pNHA;
- Douglas River Estuary pNHA; and
- Great Island Channel pNHA.

Glanmire Wood pNHA consists of mixed broad-leaved woodland with patches of saltmarsh fed by the tidal Glashaboy River below the wood. The wood itself is dominated by Oak, Beech, and Sycamore, with a rich ground flora including the ancient woodland indicators Wood Fescue and Wood Millet. This type of woodland is rare in East Cork and parts of it also fall within the Cork Harbour SPA (NPWS, 2009).

Dunkettle Shore pNHA is located north of the River Lee at Dunkettle and at the mouth of the River Glashaboy. This pNHA also forms part of Cork Harbour SPA.

Douglas River Estuary pNHA is located on the South Bank of the River Lee at the Mouth of the Douglas River, this is another stretch of pNHA which also forms part of the Cork Harbour SPA.

Great Island Channel pNHA is part of the Cork Bay complex, and is also designated as a SAC. It is located to the east of the Glashaboy River and is important for its intertidal habitats and bird populations.

Both the Dunkettle Shore pNHA and Douglas River Estuary pNHA are designated for the same wetland habitats and species that make the Cork Harbour SPA internationally important.

The most relevant pNHAs that have the potential to be affected by the Glashaboy drainage scheme, are the Glanmire Wood pNHA and the Dunkettle Shore pNHA.

Table 6.15: Evaluation of Ecological Receptors

Receptor	Evaluation Rationale	Value of Receptor or Value of Site to Receptor
Cork Harbour Bay SPA	As these sites are designated under the European Communities (Birds and Natural Habitats) Regulations 2011, made under European Habitats Directive, they are considered to be of international importance	International
Dunkettle Shore pNHA	Dunkettle Shore occurs directly south of Glanmire Woods pNHA. Given that this pNHA directly overlaps with Cork Harbour Bay SPA, and is designated for the same habitats and species, it is considered to be of equivalent ecological value.	International/ National

Receptor		Evaluation Rationale	Value of Receptor or Value of Site to Receptor
Glanmire Wood pNHA		The Glanmire Wood pNHA lies adjacent to and overlaps with the transitional waters of Cork Harbour SPA. It also provides an important night time roosting habitat for Cormorant – a designated feature of Cork Harbour SPA. It is therefore considered of equivalent ecological value where it overlaps with the SPA. Glanmire Wood pNHA consists of mixed broad-leaved woodland with patches of saltmarsh fed by the tidal Glashaboy River below the wood.	International/ National
Dunkettle Shore pNHA		Dunkettle Shore occurs directly south of Glanmire Woods pNHA. Given that this pNHA directly overlaps with Cork Harbour Bay SPA also, and is designated for the same habitats and species, it is considered to be of equivalent ecological value.	International/ National
Habitats and Flora	Glashaboy River	The Glashaboy River, being the principal watercourse in the locality is considered to be of local importance, despite the heavily modified nature of its downstream reaches, as it contains a diverse macroinvertebrate community that represents Good ecological conditions (Q4) that is of a quality to support salmonid populations. A low level of siltation was recorded, both during the macroinvertebrate and fishery surveys, and no filamentous algae was observed. A number of areas are of high quality and value to fisheries. Important fish species present include Salmon, Brown Trout, Eel, etc. (see fisheries below)	Local (higher)
	Estuarine and Intertidal habitats	Given that Cork Harbour SPA and its supporting habitat is important for its estuarine and intertidal habitats, the area south of Glanmire which contains this habitat type is considered to be equivalent ecological value.	International
	Other Watercourses	Three sites within the scheme are considered heavily modified small streams of Low Local Importance. These streams are the unnamed stream at the Sallybrook Industrial Estate, the Cois na Gleann Stream and the Springmount Stream.	Local (lower)
	Grasslands	As the grassland habitats present within the Scheme are generally managed improved and amenity types, of which there are considerable proportions elsewhere within the region, this habitat type is considered to be of less than local importance only	Local (lower)
	Hedgerows and Treelines	Due to the considerable age and diversity of many of the hedgerows/treelines and field boundaries within the scheme they are considered to be of local importance	Local (higher)
	Woodland	The woodlands within the scheme are varied with some generally of plantation origin or coniferous or mixed species composition, some riparian woodland occurs also which generally has affinities with the priority Annex I type ‘Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-padion</i> , <i>Alnion incanae</i> , <i>Salicion albae</i>)’ (91E0).	Local (higher)

Receptor	Evaluation Rationale	Value of Receptor or Value of Site to Receptor
	<p>However, in a recent woodland survey encompassing alluvial forests in Ireland (O'Neill, F.H. & Barron, S.J., 2013), sites were rejected for consideration under this Annex I type when they did not sufficiently conform to the habitat type, either through a lack of target species in the canopy or lack of typical species in the field layer, or a combination of both. This is true of all of the riparian woodland surveyed along the Glashaboy, and the Annex I habitat is, therefore, not deemed to be present within the survey area. The remaining woodland areas are considered of high local value. However, one area of riparian woodland at Sallybrook has been altered in recent years by the installation of an embankment and this may have compromised the trees in terms of root stability and habitat quality, the area has also become infested with Japanese knotweed. Note given that Glanmire woods is designated a pNHA as noted above and is categorised separately above.</p>	
	<p>Scrub</p> <p>The scrub habitats within the scheme are generally associated with woodland or river edge and provide transitional and buffer habitat functions, they are considered of local importance only.</p>	Local (lower)
	<p>Urban Environment</p> <p>The heavily developed nature of the town of Glanmire results in its assessment of being of less than local ecological value</p>	Local (lower)
Birds	<p>Overwintering wetland birds</p> <p>Given that Cork Harbour SPA is primarily designated for its overwintering wetland bird populations, this group of species is considered to be equivalent ecological value.</p>	International
	<p>Other bird populations</p> <p>The Scheme provides ample habitat and supports a range of other common bird species, consequently the valuation of local importance is applied. This is considered higher value local importance due to the presence of three important breeding bird species nesting along the river including the Annex I species - Kingfisher, the Red listed - Grey Wagtail and the Important Riparian Bird Species – Dipper.</p>	Local (higher)
Otter	<p>Otter are listed on Annex IV of the Habitats Directive and also on the Wildlife Acts, it is considered that the Glashaboy River contains a population of Otter given the presence of a number of Otter holts that appear to be active. The Otter population within the Scheme is therefore considered to be of Regional/ County importance</p>	Regional/ County
Badger	<p>Although no evidence of Badger was found during the ecological walkover survey, the desk-based assessment returned records of this species in Glanmire Wood pNHA and in the upstream portion of the scheme, as it provides suitable habitat for this species. The Scheme is therefore considered to be of local importance for this species.</p>	Local

Bats	At least six species of bats were recorded feeding and commuting within the survey area. This is indicative of the importance of this area for bats. While three of the bat species recorded are common Irish bat species (common pipistrelle, soprano pipistrelle and Leisler's bat), two typical woodland species were recorded (brown long-eared bats and Natterer's bats), one bat species relies on both woodland and waterways (Daubenton's bat) This is a rich bat fauna for one survey area and reflects that the Glashaboy River and its tributaries are principal commuting routes especially along dark treelines and woodland areas. In view of the nature of the species recorded and the numbers of the commoner species present, the Scheme is considered to be of Regional/County importance.	Regional/ County
Fisheries	Whilst not listed as a designated salmonid watercourse, in an overall context the Glashaboy River (all sites in the main channel) and its tributaries the Bleach Hill stream and Glenmore stream can be considered of High Local importance, given that they support healthy salmonid, trout and eel populations.	Local (higher)

Non-native invasive species are not an ecological receptor that require an assessment of value, they will however be considered throughout this assessment in terms of management as a negative indicator for ecological receptors. Invasive species can spread easily and compete with native species.

6.6 Evaluation of Impacts

6.6.1 Identification of Potential Sources of Impact

This section examines the potential sources of impact that could potentially result in adverse effects arising on the biodiversity, and protected habitats and species, that occur within the zone of influence of the propose scheme. These potential sources of impact could arise during both the construction and operational phases, but require complete source > pathway > receptor changes for adverse impacts to arise.

6.6.1.1 Physical Damage

Physical damage includes degradation to, and modification of, protected habitats. It can occur in working areas and along access routes where construction works are undertaken, and it may be temporary or permanent.

The construction of the defences around the head of the estuary could potentially result in direct physical damage to designated habitats should works encroach within the boundaries. As no permanent works will be constructed within the boundaries of the pNHAs and SPA there will be no habitat loss, but the footprint of the construction works, which will be greater than the finished footprint of the defences, may encroach into the pNHA and SPA and result in physical damage.

6.6.1.2 Changes in physical regime

This source of impact may result in changes to physical processes that can alter the present characteristics of the pNHA and SPA (e.g. estuarine, fluvial and geomorphological processes, salinity levels, tidal regimes, erosion, deposition, sediment transport and accumulation).

In the majority of cases the geomorphic impacts of the scheme will be minimal. Proposals such as de-culverting, will improve sediment continuity and improve the supply of gravels to the main Glashaboy channel. This will have fisheries benefits.

In some cases the proposals could result in degradation or loss of habitats indirectly, either temporarily or permanently. During extreme flood events large flood walls and embankments will lead to increases in channel energy capable of eroding bed material (particularly gravels). In most cases this impact is expected to be small.

In order to mitigate against the potential for increased bank erosion steep banks should not be created and vegetation disturbance should be kept to a minimum. Where vegetation has to be removed, replanting of the bank should be carried out to increase its stability during flood conditions.

6.6.1.3 Changes in hydrological regime

Certain activities may result in changes to the current hydrological regime. For example, a reduction or increase in the frequency, extent, duration and/or depth of flooding may affect estuarine, riverine and floodplain habitats. Activities which may affect surface and groundwater levels, such as impoundments or defence construction, may also have adverse impacts on water dependant habitats and species.

The hydrological change in the catchment will affect extreme flood events only. Works in the proposed scheme are designed to reduce flooding to heavily urbanised area in the floodplain. The only expected increase to floodplain depths are on the right floodplain of the Glashaboy upstream of Hazelwood Avenue. These locations would not be deemed to be reducing any floodplain habitats.

6.6.1.4 Disturbance (noise, visual)

A number of activities can result in disturbance, including visual and noise.

This is more frequently associated with construction activities, but could also be associated with some aspects of the operational phase (e.g. structure maintenance). Disturbance can cause sensitive species, such as birds, to deviate from their normal, preferred behaviour, resulting in stress, increased energy expenditure and, in some cases, species mortality.

6.6.1.5 Changes in water quality

A number of activities can impact upon water quality, in particular nutrient status and turbidity levels. For example, inundation of contaminated/nutrient enriched land and sediment mobilisation can all impact on water quality. This can adversely impact on habitats and also species, for example by impacting upon macroinvertebrate communities.

6.6.1.6 Pollution

Certain activities, in particular construction works, may lead to the release of pollutants, into water, air or the ground. This can impact upon habitats directly and also the species they support.

6.7 Impact Assessment

This section assesses each of the sensitive ecological receptors in more detail and examines where potentially adverse impacts may arise from the sources of impact identified above. Where potentially significant adverse impacts are identified, avoidance and mitigation measures are proposed to offset these impacts. Further information on the avoidance and mitigation measures is provided in section 6.8.

6.7.1 In-combination Effects

This assessment requires consideration of the impacts of a scheme, in-combination with other plans or projects. Potential sources of in-combination effects identified as part of this assessment include:

- **Channel Maintenance**

Under the 1945 Arterial Drainage Act the OPW have a statutory requirement to undertake channel and embankment maintenance operations within a scheme and this will apply to the channel maintenance of the Glashaboy River. Channel and embankment maintenance operations can encompass a variety of activities, including silt and vegetation management, aquatic vegetation cutting, bank protection, bush cutting/branch trimming, tree cutting, mulching, mowing and structure maintenance (Ryan Hanley, 2014).

The exact nature and scale of channel and embankment maintenance work likely to be required for the Glashaboy is currently unknown, however IFI has indicated that dredging is to be avoided in the Glashaboy.

All OPW maintenance work is undertaken in accordance with Environmental Management Protocols and Standard Operating Procedures (OPW, 2011) along with additional measures where the SOPs show deficiencies, to ensure adverse impacts on the environment are considered and minimised. OPW drainage maintenance activities are also be subject to a separate Ecological and Appropriate Assessment process to ensure no adverse impacts arise.

Consequently, adverse in-combination effects on the sensitive ecological receptors of the Glashaboy from the delivery of this drainage scheme and its ongoing maintenance are not anticipated on the basis that project specific ecological assessments including as a minimum Screening for Appropriate Assessment are carried out at the more detailed design stage of the OPW drainage maintenance activities.

- **Local Area Plan**

The Blarney Local Area Plan 2nd Edition (2015) contains details of the Glanmire development area. This contains Special Area Policy Objectives including the following proposed objective to facilitate residential development:

Special Area Policy Objective X-01: It is an objective to facilitate the development of a minimum of 1200 dwellings on this site through a phased programme of development that will secure the timely provision of the necessary physical and social and economic infrastructure. Development of this area will only be in accordance with a masterplan to be prepared by the developer in conjunction with key stakeholders and to be approved by Cork County Council.

It goes on to state that the masterplan will pay particular attention to:

“This zone is adjacent to Cork Harbour Special Protection Area and Dunkettle Wood proposed Natural Heritage Area. Development planned for this area as per the LAP should be planned to ensure that favourable conservation status of these sites can be protected, and all new development shall be designed to ensure the protection and enhancement of biodiversity generally. Development proposals will require the provision of an ecological impact assessment report (Natura Impact Statement) in accordance with the requirements of the Habitats Directive and may only proceed where it can be shown that they will not have significant negative impact on the SPA. Buffer zones are likely to be required between any development proposed for this area and the SPA. The size of the buffer zone will be determined at project level.”

Consequently, adverse in-combination effects on the sensitive ecological receptors of the Glashaboy (including the nature conservation sites of Dunkettle Woods pNHA and Cork Harbour SPA as mentioned above) from the delivery of this drainage scheme and its ongoing maintenance are not anticipated on the basis that project specific ecological assessments including and as a minimum, Screening for Appropriate Assessment are carried out at the more detailed design stage of the proposed residential developments as part of Special Area Policy Objective X-01.

- **Draft Cork Harbour Study**

This is a study to support a more integrated approach to the planning and development of Cork Harbour. The study aims to inform Local Area Plans including Blarney and within that area – Glanmire. This includes the protection of the natural environment of the harbour (as per Cork Harbour Integrated Management Strategy 2008).

Although the study is not a statutory document it aims to inform the local authority planners in their role for developing statutory plans and providing sustainable and integrated plans. Therefore, no in-combination adverse effects are anticipated as a result of the study's role in promoting a more sustainable and integrated approach to planning.

- **County Cork Biodiversity Action Plan**

The overall aim of the County Cork Biodiversity Action Plan is: *to conserve and to enhance biodiversity, and to ensure that every person in the county has the opportunity to appreciate and understand its importance in our lives.*

The action plan aims to protect biodiversity and therefore no in-combination adverse effects are anticipated as a result of the role of the action plan in promoting and enhancing biodiversity.

- **Glashaboy Water Management Unit (WMU) Action Plan**

The Glashaboy falls under the South West River Basin District and within the Glashaboy WMU. The WMU identifies a number of risks and pressures on the river and these include diffuse nutrient sources from mainly agriculture and wastewater treatment systems and also point sources of nutrients from septic tanks. The aim of the plan is to achieve compliance with the Water Framework Directive and to maintain good status. The overall aim to improve the status of the Glashaboy and therefore no in-combination adverse effects are anticipated.

- **Other Developments**

A search of Cork County Council's online planning enquiry database was undertaken to identify other projects in and around Glanmire, which are proposed or have been constructed over the last two years, to determine if there was any potential for in-combination effects. The vast majority of these developments are small-scale, associated with residential dwellings and involve alteration or extension to existing structures. From these small-scale localised developments, no in-combination effects are anticipated. The Dunkettle Interchange upgrade is proposed for 2018, however the timing of these works has not been confirmed. This project will be subject to an Environmental Impact Assessment and appropriate assessment to ensure no adverse impacts on Natura 2000 sites and their designated habitats and species. Therefore, no in-combination effects are anticipated.

Based upon the information available no in-combination effects of Glashaboy Drainage scheme are anticipated on the ecology of the river and protected habitats and species.

6.7.2 Impacts of the Proposed Scheme

The following section identifies the potential impacts of the proposed Glashaboy drainage scheme, both in the short-term during the construction period and in the long-term once the scheme becomes operational.

6.7.2.1 Short-term Construction Impacts

Designated Conservation Sites

The proposed Glashaboy scheme will require construction works to be undertaken north of Cork Harbour SPA and also north of the Glanmire Woods pNHA. However, no aspects of the works will encroach on the designations. Upon completion no part of the permanent flood structures will encroach within the boundaries of the designated site.

In addition, construction works north of the designated site would generate disturbance as a result of machinery operation and workforce movement; this may impact upon the waterbird populations within the adjacent SPA.

Although the proposed works are at distance from the SPA, in the vicinity south of Glanmire Bridge there is a possibility of increased levels of disturbance that may cause some displacement of bird populations from the head of the estuary area, resulting in increased stress and additional energy expenditure. At certain times of year (i.e. during cold spells in the winter) the effect of this could be particularly severe (i.e. of medium magnitude) and have a moderate negative impact. Further discussion of disturbance impacts of birds is provided below.

Indirect impacts on the designated sites could also occur as a result of construction activities both within the site, and also upstream. During the construction phase there is the potential that silt within watercourses will be mobilised or that pollution incidents could occur. The Glashaboy River could then act as a pathway for this contaminated material to reach the river and also downstream to the designated Cork Harbour SPA, adversely impacting upon the habitats and species present. Contaminated water or silt may locally adversely affect the habitats, flora and macro-invertebrate fauna they support at the head of the estuary, including mudflats, sandflats and saltmarsh. This could then impact upon the food source of the waterbird populations in this area, causing them to have to find alternative feeding areas. However, given the large size of the estuary, the resulting dilution effects, and the relatively localised nature of the works, a large proportion of which are upstream of the site, this is unlikely to have a widespread impact across the bay. Furthermore, during the construction phase, minor increases in flow velocities would be expected and this would remain within the deposition range and an impact of low magnitude is therefore anticipated, resulting in a conclusion of a **minor- moderate negative impact**.

Given that the Cork Harbour SPA and Great Island Channel SAC are both located downstream of the proposed drainage scheme and given the presence of surface water, land and air pathways, there is potential for likely significant impacts on the integrity of these Natura 2000 sites in the absence of mitigation measures.

Therefore a Natura Impact Study has been prepared in order to assist the competent authority to carry out its obligations under Article 6(3) of the Habitats Directive.

Habitats and Flora

The construction phase will involve in-channel working for works such as culvert installation and regrading of river channels, and a large proportion of work will be conducted within the bankside environment.

This will have a direct impact on the habitats and flora present within the river, resulting in loss of, and damage/disturbance, to habitats and species. Whilst the majority of this will be temporary in nature and confined to the construction phase, it could have an impact of medium magnitude, which would result in a minor-moderate negative impact. Impacts on riverine and riparian fauna are discussed in the sections below.

Indirect impacts on the Glashaboy River may also arise as a result of silt mobilisation and pollution incidents which could then adversely impact upon the river and species it supports, resulting in temporary declines in water quality, increased turbidity, fine sediment redistribution and nutrient enrichment.

However, construction activities will give a small reduction in flow velocities but due to their temporary nature, this is unlikely to have a significant impact. The overall impact posed by silt mobilisation and pollution incidents is assessed as having an impact of medium magnitude, which would result in a **moderate negative impact** in the absence of mitigation measures.

During construction, the impacts on estuarine and intertidal habitats, given that they are located downstream and form part of the Cork Harbour SPA, Glanmire Woods pNHA and the Dunkettle Shore pNHA, the same assessment applies as a **minor to moderate negative impact** in the absence of mitigation measures.

A large part of the scheme and areas within the Glashaboy drainage scheme comprises buildings and artificial surfaces, improved, species-poor grassland types and amenity grasslands. During the construction phase some of this grassland habitat will be lost and damaged as a result of construction of the embankment and associated works including access routes and storage compounds. However, given that the habitat to be affected is generally species-poor and intensively managed the impact is considered to be of low magnitude resulting in a **neutral impact**.

During the construction phase short lengths of hedgerow and treelines will require removal to allow construction of the flood embankment and flood walls as well as during channel maintenance works. This will result in the loss of this habitat for the bird, invertebrate and small mammal populations it supports, and also disrupt the continuity of the wildlife corridor that the treelines provide along the river.

Therefore, some treeline or habitat enhancement will be required where possible and there are considerable lengths of hedgerow habitat elsewhere within the scheme, and the river will still provide some continuity of wildlife corridor; consequently, an impact of low magnitude is anticipated which will result in a **minor negative impact** in the absence of mitigation measures.. The specific impact of hedgerow removal on bird and bat species is discussed further below.

Potential adverse construction impacts on other watercourses within the scheme, may occur however these will be temporary and standard best practice will apply.

Therefore, assuming some disturbance during construction only, a **minor negative impact** is concluded.

There will be no tree removal from Woodland as a result of the construction of the proposed drainage scheme with the exception of the removal of a number of trees from a previously disturbed section of riparian woodland at Sallybrook (see Tree Removal map). The area was previously altered by the placement of an embankment in recent years and this may have compromised the tree stability and roots of the trees. Therefore, a number of the trees may require removal and these will be identified by an arborist and each individual tree will be examined by a bat specialist. No other protected species have been noted in this area during the surveys of 2016. However, the area is infested by Japanese Knotweed and therefore will require careful management to ensure that the works do not cause any further spread of the species. The planned embankment for this proposed scheme at this location has been stepped back in order to retain the overall habitat and avoid complete loss of the riparian woodland. Therefore, the loss of a number of trees that have been damaged is considered a **minor impact**. An area of Mixed Broadleaved Woodland (WD1) and Riparian Woodland (WN5) occurs north of Glanmire Bridge at Poulacurry South and this will be avoided during the construction and operation of the proposed flood defence wall and water pumping station adjacent to it.

Birds

Breeding Birds

The impact of the proposed works on the overwintering waterbird population which Cork Harbour SPA supports is discussed above in relation to the SPA and also in the NIS; this section considers impacts on the wider bird population within the scheme, including breeding bird populations and non-waterbird populations in winter.

The design of the proposed scheme would result in the direct loss of Kingfisher embankment habitat and nests along the Meadowbrook area where a flood wall is planned. However, the wall has been set back to the existing wall in order to avoid the Kingfisher embankment and thereby reducing the impact. This species is an EU Annex I species and is protected under the Birds and Habitats Directive. Therefore, the potential impacts are mainly during construction with some disturbance possible working next to the embankment and are considered a **minor negative impact** in the absence of mitigation measures. A licence may be required for any disturbance of this area and mitigation measures to address this impact will also be required.

Other important bird species noted at bridges and walls include Red listed Grey Wagtail and Dipper. There is potential for **major negative impacts** on these and therefore mitigation measures are required.

By the nature of the construction works involved in this scheme, a degree of disturbance to birds present in the vicinity of the works areas is inevitable. The magnitude of this impact, however, depends on a number of characteristics of the works, including:

- The timing of the construction activities;
- The level of disturbance, both spatially and temporally; and
- The availability of equivalent habitats outside of the influence of disturbance to accommodate displaced birds.

There is little published literature available on the effects on birds of disturbance associated with construction activities such as those likely to be created by this scheme. The majority of studies are related to wetland, estuarine and marine species, and to the impacts of recreation, as opposed to the impacts of construction on terrestrial passerines and waterbirds that are most relevant to this scheme.

Gill (2007) in a review of the approaches to measuring the effects of human disturbance on birds, with regard to recreation, provides a useful summary of the potential impacts disturbance can have on birds, that is of relevance here. There are four key types of measure, analogous to effect, which can result from disturbance:

- Changes in distribution (e.g. avoidance of disturbed areas; movements in response to humans on site);
- Changes in behaviour (e.g. increased vigilance; changed flight responses; altered breeding behaviour);
- Changes in demography (e.g. reduced fecundity or survival in disturbed areas); and
- Changes in population size (e.g. severe changes in demography causing permanent population impacts).

The works proposed in this scheme will be conducted in relatively localised areas, and in relation to the flood walls aspects, in areas where levels of disturbance are already relatively high as result of the urban location. This, in combination with the substantial amounts of similar habitats for hedgerow and treeline species outside the likely influence of the disturbance, should minimise the potential for long-term population impacts from disturbance throughout the construction phases.

The potential for the other three key changes (see bullet points above) to occur would, however, appear to be quite high. Although the birds present will be to some degree habituated to disturbance as a result of the urban location, the proposed works are likely to be beyond the range of variation normally experienced between years.

Depending on the scheduling of works, there is the potential that some bird species will be nesting when works commence; this is of particular concern when considering the hedgerow and tree removal works to accommodate the embankment or flood wall repair works; this could result in disturbance and damage/destruction of nests, particularly of passerine species or alterations to existing bridges, walls and embankments used by riparian birds. Without appropriate mitigation, the magnitude of this impact is predicted to be medium, which would have a **moderate negative impact** on breeding bird populations in the absence of mitigation measures.

Otter

Otter presence in the scheme was confirmed during the ecological walkover survey.

During the construction phase Otter movements along the Glashaboy River including foraging activity, may be disrupted, particularly in relation to works on the embankments and flood walls where otter holts have been noted.

The Glashaboy River, as the main watercourse in the area, contains a significant food source for Otter, as identified by the fish survey, and as the construction period will extend for approximately 18 months, an impact of high magnitude is anticipated in relation to disturbance of Otter populations, which could result in a **moderate negative impact** in the absence of mitigation measures..

The construction of the flood defence wall and flood relief channels and culvert at the Hazelwood Centre, the construction of the flood defence wall adjacent to Meadowbrook housing estate, and the construction of a flood defence wall, replacement of a culvert and regrading works at Brooklodge Grove along the Glenmore Stream, as these are in close proximity to active otter holts. It may arise that the Otter holt at Glenmore may be removed. Therefore, the works have potential to cause disturbance and displacement of otter from these holts and resting places and the potential loss of the holt at Glenmore. This could have a high magnitude impact on Otter populations in the location area, resulting in a **moderate negative impact** in the absence of mitigation measures.

Badger

The desk-based assessment identified records of Badgers within the Scheme, although the ecological survey identified no evidence of this species. The footprint of the construction works on the flood defence walls will not encroach into Glanmire Wood pNHA However, this species is highly mobile and could therefore come into works areas during the construction period, potentially resulting in disturbance to foraging and commuting activity. Nevertheless, given the large amount of suitable habitat within the Scheme and surrounding landscape the potential impact has been assessed as being of negligible magnitude only with a consequent **neutral impact**.

Bats

There were no roosting sites recorded within the current flood defence walls. There were 23 trees identified along the route where proposed works are planned that have bat roosting potential. If the construction of new defence walls will entail the felling of these trees, then there will be a **minor negative impact** on local bat populations, as this would result in the potential loss of roosting sites in structures and trees within the areas where works are proposed.

The sealing up of crevices in bridges will have a **major negative impact** on local Natterer's bats and Daubenton's bat populations due to the high usage of the bridges by these bat species.

In order to reduce this impact, mitigation works should involve retaining crevices for bats post-works and incorporating bat tubes into the structure during maintenance works if possible. Discussion with engineers at design stage is recommended to determine the most suitable option for these structures.

Fisheries

All works undertaken within or immediately adjacent to the channel have the potential to have negative impacts on fish populations of the Glashaboy and associated tributaries through a variety of mechanisms, including: mortality caused by direct physical contact (for example, with machinery or workforce); mortality caused by indirect physical contact (for example, acute physiological damage caused by contact with mobilised sediments); mortality caused by chemical exposure (for example, as a result of a pollution event); negative population impacts as a result of physiological impairment or disturbance (for example, physiological damage and/or disturbance caused by excessive noise and/or vibration).

Removal and replacement of culverts (including Bleach Hill Stream, Cois na Glenn, Hazelwood stretch, Glenmore Stream and Springmount Stream) has the potential to have a **minor negative** impact on all fish populations of the associated reaches as a result of the low impact magnitude of the disturbance created.

Complete culverting of the un-named watercourse in the Hazelwood stretch is likely to have a moderate magnitude and therefore a **minor-moderate negative** impact on local fish populations in the absence of mitigation measures.

Creation of the flood relief channel and bridge replacement on the Hazelwood stretch will likely have a low magnitude and therefore give rise to a **minor negative impact**.

Non-native Invasive Species

Construction activities in areas infested with non-native invasive species have the potential result in their spread to locations previously un-infested.

There are a number of areas where non-native invasive species occur and a separate report has been prepared by Arup (see **Appendix 4.1**), some of these occur in areas where flood structures are proposed to be built and consequently this species could be spread should appropriate measures not be followed; this could have a moderate negative impact, however, this impact could be more severe if the plant is transferred to a habitat of high ecological value. Therefore, an Invasive Species Management Plan is recommended.

6.7.2.2 Long-term Operational Impacts

Designated Conservation Sites

The proposed Glashaboy River (Glanmire/Sallybrook) Drainage Scheme involves the construction of permanent defences downstream of Glanmire Bridge and in very close proximity to Cork Harbour SPA and Glanmire Woods pNHA whilst also occurring upstream of Dunkettle Shore pNHA. However, upon completion of the works, the new defences will not encroach within the boundaries of the SPA and pNHAs.

There will therefore be no permanent, negative impact on the designated site in terms of habitat loss or physical damage.

The flood walls proposed for a number of locations and embankments could heighten in-channel energy conditions during extreme flood conditions, potentially mobilising some of the coarse gravel substrate within the Glashaboy River, preventing deposition. This gravel material may then be transported into the SPA whereas previously it would have been deposited within the channel of the Glashaboy. This indirect impact on geomorphological processes within the river and the effect on sediment supply to the mudflats at the head of the estuary could potentially impact upon the quality and extent of these habitat types within the SPA. The hydromorphological audit identified that gravel is being transported through the system (see Geomorphology Report, **Appendix 6.2**), however, the potential for this to significantly change is low. Therefore, the volumes of coarser sediment that may be deposited within the mudflat habitats is considered to be very low and in localised areas only. Therefore, this would have an impact of only negligible magnitude, which would result in a **minor impact**.

Habitats and species

Operation of the Glashaboy drainage scheme will change the flow of the river during flood events. Any interruption of natural flow regimes could impact upon the aquatic and riparian habitats. Within the channel of the Glashaboy River energy levels are likely to be increased in some locations as a result of enlarged flood defence walls and embankments.

The proposed works will result in some change to the existing sediment dynamics, as they are likely to increase the delivery of sediment to downstream reaches of the Glashaboy River.

However, they are unlikely to result in significant deterioration (as there is only a small risk of change from current conditions). Thus, the net impact of these on watercourses in the study area is likely to be **minor negative**, resulting in spatial redistribution of existing habitat within the channel and along the banksides.

The operational impact on estuarine and intertidal habitats, given that they are located within the Cork Harbour SPA, Glanmire Woods pNHA and Dunkettle Shore pNHA, as all of the sites are designated for these habitat types, is discussed above and the same assessment applies as under designated conservation sites.

A large proportion of the Glashaboy drainage scheme consists of buildings and artificial surfaces as well as amenity or improved, species-poor grassland types and the impact on these low value habitats is considered of low magnitude, and will result in a **minor negative impact**. However, losses in some areas of low value grassland will be replaced by new embankments and an opportunity to provide more diverse grasslands through appropriate management of the new embankments.

In addition, some loss of treelines and some hedgerow is likely, however most of the treelines are of amenity type and not considered of floristic conservation value. The operational impact (including channel maintenance) of the loss of a significant number of trees and the potential loss of additional numbers of trees is likely to impact not only on the trees but also most species using the riparian edge and river and is considered to be medium magnitude resulting in a **moderate negative impact** in the absence of mitigation measures.. However, losses will be offset by providing additional areas of scrub, trees and hedgerows where feasible as part of the Glashaboy Drainage Scheme.

In relation to woodland, no woodland areas will be removed or trees removed from woodland as a result, the operational impact or channel maintenance and is therefore considered a **neutral impact**. Other areas where important Riparian Woodland occur and that are not within hard structures e.g. Butlerstown Stream, but occur in areas that may require channel maintenance and therefore only individual trees that may be a source of channel blockage will be removed manually and without machinery access or along the Glenmore Stream where Riparian Woodland occurs directly upstream of the proposed channel widening and flood wall works and so will be avoided. An area of Riparian Woodland north of Sallybrook Bridge will be retained and the flood wall will be constructed along the landward edge of it which is an area of car park and wall edging this riparian habitat. No adverse operational impacts on the urban environment is anticipated.

Birds

Upon completion of the drainage scheme, operational impacts on bird populations are considered to be minimal including for the important bird species Kingfisher, an EU Annex I species.

The potential impact on this species has been reduced by moving the flood wall to avoid the Kingfisher embankment and place the wall behind the existing wall and is considered to be reduced to a **minor negative impact** due to disturbance during construction.

The impacts on the important riparian species such as Dipper and Grey wagtail remain potentially **moderate negative impact** and require mitigation.

As detailed in the geomorphology study (**Appendix 6.2**), indirect impacts of flows and velocities will be negligible on in-stream habitats and downstream habitats for birds of the SPA and pNHA such as Cormorant for fishing and foraging waders. Therefore, the impact is considered **minor negative impact**.

Otter

The operational phase of the drainage scheme could potentially impact upon the otter populations of the Glashaboy River, as a considerable length of channel is to be maintained in the future. Although, it has been stipulated that dredging will not be a component of these works, works such as vegetation removal and tracking of machinery along the river bank could cause disturbance and displacement of otter from their holts. If tree removal is planned as part of these channel maintenance activities, otter holts and couching sites could be disturbed and physically damaged, resulting in a loss of these sites, as their location is often at the base of exposed tree roots or fallen trees. A potential loss of an otter holt at Glenmore has been identified due to the need to replace a culvert and a retaining wall. It would appear that the structure C05_L02 i.e. wall on south bank is to be 'strengthened' according to the drawing. The holt is sited at the base of this wall and immediately downstream of the existing concrete apron at outfall of existing box culvert. If the 'strengthening' could be achieved without excavating the holt it could be saved but this may prove very difficult and the holt may need to be removed.

It is envisaged that because the holt has benefited from the collapsed wall i.e. dug in where boulders have fallen out at base of existing wall on south bank, it is likely to be in the path of the works and strengthening may prove difficult without blocking the holt off. Therefore, it is likely that a derogation will be required. Mitigation could include the construction of a new holt along the bank (perhaps north bank) to help alleviate impacts if the existing holt were to be removed.

Thus, the potential impact on otter is considered to be a **major negative impact** in the absence of mitigation measures.

Badger

The operational phase will have limited impacts on badger populations potentially present in the wider area, resulting in a neutral impact, given the abundance of suitability habitat elsewhere in the locality. The permanent works (i.e. the flood defence walls) will not encroach into Glanmire Wood pNHA.

Bats

The operational phase of the drainage scheme could potentially impact bat species as a result of a loss of riverside vegetation. This loss in riverside vegetation could impact local bat populations due to the following reasons and would result in a minor negative impact on local bat populations.

- Dark riverine corridors will be open to lighting pollution from adjacent street lights and lighting of residential and industrial areas;
- Reduction in insect prey items and foraging areas;
- Disturbance to commuting routes; and
- Potential loss of roosting sites in structures and trees within the areas where works are proposed.

Fisheries

Impacts associated with changes to sediment transfer processes and therefore sediment distribution within the scheme are likely to have the largest operational phase impacts on fish. This is likely to be notable on the following reaches:

- On the mill race (C08) immediately downstream of the Sallybrook industrial estate where the inclusion of a sluice gate to limit peak flows may give rise to increased retention of fine sediments and therefore provide more stable, fine sediment habitat exploited by lamprey ammocoetes. Despite this, the impacts are still likely to be **minor negative**.
- The proposed flood relief channel (C01_C01 & C01_C02) on the Hazelwood stretch of the Glashaboy may give rise to slightly increased and highly localised fine sediment deposition which would be beneficial to lamprey ammocoetes; the impacts are still likely to be **minor negative** however.
- All culvert replacements that will facilitate the sediment transport will give rise to greater supply of sediments

Some of the constructed elements will impact upon longitudinal migration and the ability of species to access habitats. The following constructed elements are likely to have particular impacts:

- Culverting of the un-named stream (Sallybrook stream) entering the left bank of the Glashaboy on the Sallybrook stretch will likely create a substantial behavioural barrier that will reduce the likelihood of fish exploiting this watercourse, both for its very limited existing habitat quality and as a high flow refuge. These impacts are likely to be **minor negative** for all fish species however.
- Replacement of the culvert on the Bleach Hill Stream will likely facilitate upstream migration of Atlantic Salmon, rendering more accessible the upstream spawning habitats and giving rise to **minor positive impacts** on Atlantic Salmon populations.
- Replacement of the culverts on the Cois na Glenn Stream will likely facilitate upstream fish migration, rendering more accessible the upstream spawning habitats giving rise to **minor positive impacts** on Brown Trout populations.
- Inclusion of the flow control structure which will limit flows in the mill race immediately downstream of the Sallybrook industrial estate. A reduction in peak velocities in this channel will provide a degree of refuge from flood flows, reducing risk of wash out of individuals and therefore having a **minor positive impact** on those species already present within/able to access this reach.

Non-native Invasive Species

Operational impacts may occur as a result of the presence of invasive species along the banks of the Glashaboy if these are not treated and managed appropriately. An invasive species management plan is required and this may need to extend to catchment level planning by the local authority.

6.8 Mitigation Measures

6.8.1 Designated Conservation Sites

In order to mitigate identified construction and operational impacts on the Cork Harbour SPA, and also the pNHAs, the following mitigation measures will be implemented:

- The permanent works (i.e. the flood defence walls) **will not** encroach into Cork Harbour SPA and Glanmire Wood pNHA.
- Wherever possible works on the flood defence walls will be conducted from the roadside to limit damage to riverine/estuarine and intertidal habitats along the toe of the walls and works.
- Follow pollution prevention measures as detailed in Section 6.8.9.

6.8.2 Habitats and Flora

In order to mitigate identified construction and operational impacts on the habitats and flora of the scheme, the following mitigation measures will be implemented:

- In-channel working will be minimised, wherever possible;
- Upon completion of the works channel vegetation will be allowed to re-colonise naturally, however, this will be monitored and if deemed necessary additional planting of suitable aquatic plant species will be undertaken;
- Upon completion of in-channel works, in-channel sediment features will be reinstated;
- To ensure the impacts on altered sediment transport processes.
 - Review of construction works to capture immediate channel geomorphological response
 - Repeat hydromorphological audit that captures change associated with flood events of significant and known magnitude (key return periods to be agreed with IFI). A hydromorphological audit is required to understand any changes to fisheries habitats and sediment transport. This will be carried out at least after any major flood events following the completion of the scheme and taken into consideration with the fish surveys. Should the hydromorphological audit demonstrate that the magnitude of change to sediment transport processes is significant and there is a net change in extent and quality of in-habitat, further reach-scale remediation will be agreed with fisheries specialist in consultation with IFI and implemented. This could include the installation of in-channel features to maintain the extent and quality of existing spawning gravels (for salmonids and lamprey species) and fine sediment deposits (for adult Brook Lamprey).
 - Annual fish population survey for at least three years to capture changes in length-frequency distribution.
- Follow pollution prevention measures as detailed in **Section 6.8.9**.

- Upon completion of the works the new embankments, and in any other grassland areas disturbed during the construction works, will be re-sown with an appropriate species-rich grass and/or native wildflower seed mix option.
- Hedgerow/tree planting will be undertaken to replace any length of hedgerow/treeline lost to accommodate the new drainage scheme. Hedgerows will be replanted as close to the existing alignment and location as possible and will use native, locally sourced species appropriate to the locality.

6.8.3 Birds

In order to mitigate identified construction and operational impacts on birds, not including the overwintering waterbird populations in the SPA which are discussed above and in the NIS, the following mitigation measures will be implemented:

- All vegetation clearance works and site preparatory works will be conducted outside of the bird nesting season (March to September inclusive). If this is not possible, a breeding bird survey will be undertaken in advance of the works to ensure that there will be no impacts on nesting birds. If nests are found, they will be safeguarded, with an appropriate buffer, until the chicks have successfully fledged. In particular the Kingfisher nesting area will be screened off from proposed works in the vicinity of the Kingfisher embankment,
- Hedgerow planting will be undertaken to replace any length of hedgerow/treeline lost to accommodate the new drainage scheme. Hedgerows will be replanted as close to the existing alignment and location as possible and will use native, locally sourced species appropriate to the locality.
- Impacts on Kingfisher shall be mitigated through the scheme design, by moving the flood wall to avoid the Kingfisher embankment and place the flood defence wall behind the existing wall and within Hazelbrook housing estate. In order further minimise impacts to Kingfisher.
- Works to existing walls and bridge structures shall require a breeding bird survey prior to the commencement of works to ensure there will be not impacts on Dipper and Grey wagtail. If nests are found, they will be safeguarded, with an appropriate buffer, until the chicks have successfully fledged. If nesting areas of Dipper and Grey wagtail, as identified in the breeding bird survey, will be damaged or lost through the proposed scheme, enhancement measures to wall and bridge structures shall involve the installation of dipper nest boxes in these areas. This will require consultation with the UCC research department who currently run a Dipper project on the Glashaboy and who have provided information to JBA's ecologists throughout this project.

6.8.4 Otter

In order to mitigate identified construction and operational impacts on Otter the following mitigation measures will be implemented:

- The loss of an otter holt may be necessary at Glenmore and this will require mitigation. A derogation licence will be required from NPWS and will include the provision of an artificial otter holt.
- With the exception of the loss of an otter holt at Glenmore,, no works will take place within 20m of the known Otter holts and resting place (National Roads Authority, 2008), with this area appropriately demarcated and fenced if necessary.
- Prior to commencement of works, a further survey to identify the presence of any new Otter resting places/holts within 200m of the works areas will be undertaken. If found and likely to be damaged/disturbed by the works an appropriate mitigation strategy will need to be devised and a derogation license will need to be applied for from NPWS.
- Night-time working will not be permitted within 20m of the known Otter holts and resting place, or those that may be identified as part of the pre-works Otter survey. If a derogation licence is applied for from NPWS for the disturbance of Otter holts/resting places, night-time work within these locations will be detailed in the licence application and an appropriate mitigation strategy devised.
- To minimise the potential for Otters becoming trapped, all excavations will be left open for the minimum possible time, and not over-night. If excavations have to be left open over-night they will be fitted with an escape ramp (no more than 45°) to allow accidentally trapped animals to escape. Materials to cover excavations or create escape ramps will be on site at all times so that all excavation areas can be made safe before leaving site.
- All materials stored on site will be stacked securely so as to prevent accidental collapse if investigated by an Otter, or any other large mammals.

6.8.5 Badger

In order to mitigate identified construction and operational impacts on Badger potentially commuting and foraging in the works area the following mitigation measures will be implemented:

- To minimise the potential for Badgers becoming trapped, all excavations will be left open for the minimum possible time, and not over-night. If excavations have to be left open over-night, they will be fitted with an escape ramp (no more than 45°) to allow accidentally trapped animals to escape. Materials to cover excavations or create escape ramps will be on site at all times so that all excavation areas can be made safe before leaving site.
- All materials stored on site will be stacked securely so as to prevent accidental collapse if investigated by Badger, or any other large mammals.
- Prior to commencement, all works areas, site compounds and access routes will be re-surveyed to ensure that new Badger setts have not been established. If found, appropriate mitigation strategies will need to be devised and implemented.

6.8.6 Bats

In order to mitigate identified construction and operational impacts on bats the following mitigation measures will be implemented:

In survey areas where habitats present and currently provide good commuting and some foraging potential for bats, it is best practice to avoid damaging measures. It is proposed that the following measures be put in place to avoid or lessen the degree of construction and operational impacts on bats.

Mitigation by avoidance

- Do not remove trees and shrubs along waterway banks adjacent to the bridge structures, where feasible. Protect this habitat from any potential damage as a result of the proposed development works.
- Treelines and shrubs should remain in-situ and remain protected from potential management work.
- Minimise damage to the woodland habitat adjacent to the bridges / culverts and along the rivers.
- Ensure that all equipment, construction materials are stored on the roadway and not in adjacent habitats to the bridges.
- Open areas required to facilitate works should be limited, where feasible, to areas where tree and hedgerows are not present. Lighting of such work spaces can also disrupt traditional foraging grounds for bats and therefore should be limited and should not occur during foraging period (30 minutes prior to sunset to 30 minutes after sunrise).

Priority Mitigation Measures for Bats – Bridges in general

Retain crevices for roosting bats – this applies to any bridge proposed to have works on and identified in this report as suitable for roosting bats.

- In discussion with engineers, where a selection of crevices should be retained and blocked temporarily until works are finished in relation to the bridge. Once works are finished, the crevices should be unblocked to allow bats to use the structures post-works.
- However, a bat survey is required prior to such works for these bridges/culvert to ensure that there are no bats present prior to and during works. This survey work should involve a detailed examination of all arches and crevices. The bat specialist should mark any crevices to be retained. Such crevices, once no bats are present should be filled with bubble wrap in order to prevent filling in of such.
- Crevices that remain open will have to be daily checked prior to filling in not unless the canvas sheeting procedure as recommended below in undertaken.



Photo 6.10: Example of a bat-suitable crevice filled/blocked with bubble wrap to prevent bat occupancy during proposed works (Photograph courtesy of Caroline Shiel).

- Due to the number of open crevices found in some of the bridges, a bat inspection of any bridge is required the night before works are due to be undertaken. In preparation for this survey, two sheets of canvas that will close the arches (post bat survey), are required to be in place (i.e. canvas sheeting to be erected from the top of the bridge and held in place. When the sheeting is unfurled, the length of it should reach the water level. The width of the sheeting should also ensure that entire opening to the 1/2 arches of the bridges (upstream and downstream) are covered to prevent bats accessing the bridge for the duration of the works. Once the bat inspection and survey determines that there are no bats within the bridge, the canvas sheets are to be released. While the canvas sheeting can be opened during the daytime to allow works to be undertaken, it is of paramount importance that each evening, the canvas sheets are released to close the arches during the night for the duration of the works under the arches. Once the works are finalised and a bat inspection is completed, the crevices blocked to be retained are unblocked and the canvas sheets removed.



Photo 6.11: Example of canvas sheets used to close the bridge once it has been declared bat free by a bat specialist.

- Bat tubes should be incorporated into new structures, where possible – e.g. into the parapet walls for example.
- A further bat inspection is recommended prior to works and also a meeting with on-site engineers to in relation to the bridge.
- Works are recommended outside the bat maternity season (typically May to August, but can also be weather dependant).

Removal of Trees

- Minimise the removal of mature trees, where possible.
- If the retention of mature trees on or around bridge structures is not feasible, a limited number shall be removed to facilitate the construction working area. An assessment of the trees according to the PBR value (detailed below within this section) shall be conducted prior to any removal works.
- If the trees are to be removed, felling should be undertaken during the months of September, October, February and March during mild weather conditions. Planting will be required to mitigate for tree removal and landscaping plans will be required to be planted “like for like” in relation to tree and shrub species removed. Some restrictions of species may apply however in the vicinity of structures so that structures are not compromised by roots in the future. Consideration should be given towards hawthorn, blackthorn mix with individual ash, alder and birch to form a native tree hedge) and deciduous trees (native tree species include ash, oak, alder, birch) should be planted to buffer the new development area.

An assessment of trees according to their PBR value determines the methodology of felling. Trees with B-value PBR have a medium suitability for roosting bats and require more intensive procedures prior to felling, for example:

- Any trees showing crevices, hollows, *etc.*, should be removed while a bat specialist is present to deal with any bats found. Such animals should be retained in a box until dusk and released on-site. Large mature trees will be felled carefully, essentially by gradual dismantling by tree surgeons, under supervision of a bat specialist. Care will be taken when removing branches as removal of loads may cause cracks or crevices to close, crushing any animals within. These cracks should be wedged open prior to load removal. The dead branches should be lowered to the ground using ropes to avoid impacts which may injure or kill bats within. This measure refers to B-value trees. These trees should be marked with spray paint prior to felling in order for them to be felled correctly in relation to method described above.
- A bat expert will survey all trees due for removal prior to construction works commencing once there is a consensus on what trees are to be removed and there is a clear access to all of the trees on-site.
- Any ivy covered trees which require felling will be left to lie for 24 hours after cutting to allow any bats beneath the cover to escape.

Alternative roosting sites – Bat Boxes

If trees are proposed to be felled then, a bat box scheme is required to mitigate for this. The number of bat boxes is calculated according to the number of trees to be felled and their PBR value. Bat box locations (exact trees for erection of bat boxes) should be undertaken by bat specialist prior to construction works are undertaken. ‘Schwegler’ woodcrete bat box designs are recommended.

- For every three B-value trees to be felled – one bat box is required.
- For every five C-value trees to be felled – one bat box is required.

To ensure that bats use the bat boxes, it is very important to site them carefully and this should be undertaken by a bat specialist. Some general points to follow include:

- Straight limb trees (or telegraph pole) with no crowding branches or other obstructions for at least 3 metres above and below position of bat box.
- Diameter of tree should be wide and strong enough to hold the required number of boxes.
- Locate bat boxes in areas where bats are known to forage or adjacent to suitable foraging areas. Locations should be sheltered from prevailing winds.
- Bat boxes should be erected at a height of 4-5 metres to reduce the potential of vandalism and predation of resident bats.
- It is recommended to erect a number of bat boxes on one tree at an array of aspects. South facing boxes will receive the warmth of the sun, which is necessary for maternity colonies. In large bat box schemes, it is generally recommended to have three bat boxes arranged at the same height facing North, South-East and South-West. This ensures a range of temperatures are available all day. If the South facing boxes become warm, bats can safely remove to the cooler North facing box.

- Locations for bat boxes should be selected to ensure that the lighting plan for the proposed site does not impact on the bat boxes.

Acceptance of boxes by bats is less predictable than those for birds. Therefore, it is essential to monitor their use over a period of time. Those boxes that remain unused within two years of date of erection should be re-located. Bat boxes should also be checked in wintertime for general wear and tear and to remove droppings from the previous summer use.

Bat boxes should be inspected, by bat licence holder (bat specialist), at least once within 12 months of erection at appropriate season in order to monitor bat use and the species using boxes. This should be followed up with another inspection within 24 months of setting up. At this point, any bat boxes not used should be re-located to a new site. Any bats found should be counted and identified to species level. All data collected should be submitted to Bat Conservation Ireland.

As the Glenmore stream, east of the M8 motorway along Brooklodge Grove, was not surveyed for bats due to its late addition to the scheme, this area will require surveying prior to the commencement of the works, in particular the existing wall and trees in the vicinity of the works. If PRBs are found in this area, the mitigation measures outlined above shall be implemented.

6.8.7 Fisheries

In order to mitigate identified construction and operational impacts on fisheries the following mitigation measures will be implemented:

IFI Guidance on the Protection of Fisheries During Construction Works in and adjacent to Water (2016) should be followed and consultation with IFI will be carried out prior to works.

- In-channel working will be minimised, wherever possible. Where in-channel working is unavoidable, works should be preferentially done in the dry wherever possible, through the use of temporary coffer dams and dewatering, following a fish rescue from any wetted channel area within the coffer dam. Fish rescues should be undertaken by an appropriately experienced fisheries contractor in possession of the relevant permits and consents from the regulator.
- In-channel working during the salmonid spawning season (November to March inclusive) will not occur.
- During the construction phase it will be ensured that fish can migrate past areas of in-channel working.
- Where piling is required, a presumption against the use of percussive piling should be made. Where possible, a press-in piling technique should be used, with a presumption to use vibration piling, using a variable moment vibrator, where press-in techniques are not appropriate due to ground conditions.
- Any pumps used for over-pumping/de-watering must be fitted with appropriate screens.

- Method statement to be drafted and approved with IFI for in-channel works relating to fitting of all non-return drainage outlets to new flood defence walls.
- Undertake a redd survey on the Hazelwood stretch immediately prior to mobilisation relating to bridge replacement (C01_B03) and flood relief channel creation (C01_C01 and C01_C02) works to identify if evidence of spawning is in proximity of works. Works to be delayed for a period to be agreed with IFI if redds found during survey.
- Hard engineering of the river bed will be avoided.
- Any riverbed materials removed or disrupted as part of the works will be replaced and any areas where new bed materials will be installed (i.e. wall footings, bed armour to prevent scour), will be designed to replicate natural bed conditions. Existing bed material will be used to cover new bed materials, wherever possible. Bed material removed from the river will be stored on the bankside. The storage facility will be such that there will be no loss of sediments from the material stored and no external contamination (e.g. a bunded plastic sheet or sealed plastic container). Once excavations are complete, and any new material has been introduced, the stored material will be replaced over the bed. Once normal flows are restored after demobilisation, the replaced material will be redistributed by the currents. These measures will ensure no net loss of material and no significant changes to bed sediment morphology or composition.
- Follow pollution prevention measures as detailed in section 6.8.9.
- Ensure that all culverts and trash screens are designed and installed in line with published best practice on fish passage (e.g. CIRIA 2010; Armstrong et al 2010; Turnpenny & O'Keefe 2005).
- Inclusion of daylight chimneys/tubes in the culverting of the un-named watercourse in the Sallybrook stretch to reduce the behavioural impact of the culverting.
- Inclusion of cost effective fish passage measures at the wooden weir on the bottom end of the Springmount Stream to enable upstream migration and exploitation of habitat (albeit limited)
- Annual fish population survey for at least three years to capture changes in length-frequency distribution.
- A hydromorphological audit is required to understand any changes to fisheries habitats and sediment transport. This will be carried out at least after any major flood events following the completion of the scheme and taken into consideration with the fish surveys. Should the hydromorphological audit demonstrate that the magnitude of change to sediment transport processes is significant and there is a net change in extent and quality of in-habitat, further reach-scale remediation will be agreed with fisheries specialist in consultation with IFI and implemented. This could include the installation of in-channel features to maintain the extent and quality of existing spawning gravels (for salmonids and lamprey species) and fine sediment deposits (for adult Brook Lamprey).

6.8.8 Non-native Invasive Species

In order to mitigate the possible spread of non-native invasive species, the mitigation measures will be implemented:

- Where feasible, avoid working in areas where Japanese Knotweed is present; all areas within 7m of visible above-ground growth will be avoided and clearly demarcated.
- If work is required in areas infested with Japanese Knotweed (including any area within 7m of visible above-ground growth) an appropriate Japanese Knotweed Mitigation Strategy will need to be devised and implanted to prevent spread. Refer to **Appendix 4.1** for further details.
- Prior to commencement, all works areas, site compounds and access routes will be re-surveyed to ensure that stands of non-native invasive species have not become established. If found, appropriate mitigation strategies will need to be devised and implemented.
- An overall site specific Invasive Species Management Plan will be developed to address any areas that may affect the proposed scheme prior to the commencement of works.
- All contractors and staff shall adhere to Biosecurity Protocols for invasive species.

6.8.9 Construction and Environment Management Plan

Chapter 4 of this EIS details the main constraints required to be contained in the Construction and Environmental Management Plan (CEMP) during the construction phase and will be included in the tender documents for the construction of the proposed scheme.

- A detailed and site specific CEMP will be provided to the competent authority by the contractor prior to works commencing. This shall be completed in consultation with a suitably qualified ecologist.
- All works will be monitored by a suitably qualified ecologist who will report to the Heritage Officer of Cork County Council. Reporting format and programme to be agreed with Cork County Council.

6.8.10 Pollution Prevention Measures

Appropriate mitigation measures will be implemented prior to the construction phase to ensure that water quality of the Glashaboy River is not adversely affected through pollution incidents and silt mobilisation. This mitigation will include:

- Appropriate sediment control measures will be employed.
- Any chemical, fuel and oil stores will be located on an impervious base within a secured bund with a storage capacity 110% of the stored volume.
- Biodegradable oils and fuels will be used where possible.

- Drip trays will be placed underneath any standing machinery to prevent pollution by oil/fuel leaks. Where practicable, refuelling of vehicles and machinery will be carried out on an impermeable surface in one designated area well away from any watercourse or drainage (at least 10m).
- Emergency spill kits will be available on site and staff trained in their use.
- Operators will check their vehicles on a daily basis before starting work to confirm the absence of leakages. Any leakages will be reported immediately.
- Daily checks will be carried out and records kept on a weekly basis and any items that have been repaired/replaced/rejected noted and recorded.
- Any items of plant machinery found to be defective will be removed from site immediately or positioned in a place of safety until such time that it can be removed. All items of plant will be checked prior to use before each shift for signs of wear/damage.
- All washing out of grout pumps will be carried out in designated areas away from the river, such as in the lined compound area. At no point will grout pumps be washed out at the worksite.

6.8.11 Tree Removal

The plans for tree removal for the construction of the scheme are shown in **Appendix 3.1**. Hedgerow/tree planting will be undertaken to replace any length of hedgerow/treeline/individual trees lost to accommodate the new flood scheme. Hedgerows and trees will be replanted as close to the existing alignment and location where feasible and will use native, locally sourced species appropriate to the locality.

A tree management plan will be designed prior to the works by a landscaper in consultation with an arborist and a suitably qualified ecologist. This plan will include an assessment and recommendations to offset tree loss overall, as a result of the scheme and will be agreed with the planning authority.

A number of trees may require removal at Sallybrook within Riparian Woodland. This area is disturbed and it appears that an embankment may have been installed in recent times. This has compromised some of the trees and therefore these require removal as they are considered a hazard to the scheme. This area is also covered in Japanese Knotweed and therefore, measures and controls must be in place to ensure that the works do not cause the spread of Japanese Knotweed.

See also bat mitigation above regarding tree removal.

6.8.12 Channel Maintenance

As there are no specific design details for channel maintenance specific mitigation measures cannot be determined at this stage. However, an ecological impact assessment and as a minimum Screening for Appropriate Assessment will be necessary at project design stage of channel maintenance. Consultation with IFI and NPWS will also be required and any derogation licences required as a result of the ecology assessment will be obtained.

6.9 Residual Impacts

The assessment of potential impacts identified that potentially the most significant ecological impacts will arise during the construction phase as a result of disturbance to otter, fish, birds and bats, damage to and loss of small areas of notable habitats including trees and hedgerows and water pollution incidents and sediment mobilisation. The significance of construction impacts ranged from moderate negative to minor negative in relation to the designated bird species of Cork Harbour SPA. The potential operational impacts identified ranged from a minor negative impact to a major negative impact in terms of otters. A moderate negative was also identified in terms of the tree loss as a result of the proposed scheme.

A range of mitigation measures have been proposed in this EIS chapter to offset potentially significant negative impacts, including appropriate timing of the works, replacement planting, pollution prevention measures and habitat reinstatement. Consequently, the residual impact for the majority of identified impacts has been reduced to neutral or not significant once mitigation measures listed above are implemented and a tree management plan is designed to address the loss of trees in consultation with an ecologist. It can therefore be concluded that the ecological impact of the construction and operation of the Glashaboy River (Glanmire/Sallybrook) Drainage Scheme will not be significant, provided that the identified mitigation measures are fully implemented.

Following a comprehensive evaluation of the potential direct, indirect and cumulative impacts on the qualifying interests and conservation objectives for the Cork Harbour SPA and Great Island Channel SAC and ensuring that avoidance and mitigation measures are implemented as proposed in the EIS and Natura Impact Statement (NIS), it has been concluded by the authors of the NIS that the proposed drainage scheme will not have an adverse effect on the integrity of the Natura 2000 sites.

6.10 References

Armstrong, G S, Aprahamian, M W, Fewings, G A, Gough, P J, Reader, N A and Varallo, P V (2010). *Environment Agency fish pass manual: guidance notes on the legislation, selection and approval of fish passes in England and Wales*, Version 2.2. Environment Agency.

Balkham, M, Fosbeary, C, Kitchen, A, Rickard, C. *Culvert design and operation guide*. CIRIA report C689, 2010.

Bat Conservation Trust (2007) *Bat Survey - Good Practice Guidelines*. Bat Conservation Trust, London.

Chanin, P. (2003) *Monitoring the Otter Lutra lutra*. Conserving Natura 2000 Rivers Monitoring Series No.10. English Nature, Peterborough.

Cork County Council (2014) *Cork County Development Plan 2014*.

Cork County Council (2015) *Blarney Electoral Area - Local Area Plan 2011* 2nd Edition 2015.

Cummins, S. and Crowe, O. (2011) *Collection of baseline waterbird data for Irish coastal Special Protection Areas 2010/ 2011*. Report commissioned by the National Parks and Wildlife Service.

Colhoun K and Cummins S. (2013). *Birds of Conservation Concern in Ireland 2014 – 2019*. Irish Birds 9: 523—544.

Cummins, S., J. Fisher, R. Gaj McKeever, L. McNaghten & O. Crowe (2010). *Assessment of the distribution and abundance of Kingfisher Alcedo atthis and other riparian birds on six SAC river systems in Ireland*. Unpublished BirdWatch Ireland report to the National Parks and Wildlife Service. Kilcoole, Co Wicklow.

EPA (2014) EPA Maps. Available online: <http://gis.epa.ie/Envision>. Accessed 2016.

Fossitt, J. A. (2000) *A Guide to Habitats in Ireland*. The Heritage Council, Dublin.

Lewis, L. J., & Kelly, T. C. (2012). *Aspects of the spatial ecology of waders along an estuarine gradient*. Irish Birds, 9, 375-384.

National Biodiversity Data Centre (2014). Live Maps. Available online: <http://maps.biodiversityireland.ie/#/Map>. Accessed 2016.

National Parks and Wildlife Service (1999). Site Synopsis: Clonakilty Bay SAC. Site Code: 000091. Available online: <http://www.npws.ie/protectedsites/specialareasofconservationsac/clonakiltybaysac/>. Accessed 2016.

National Parks and Wildlife Service (2007). Site Synopsis: Clonakilty Bay SPA. Site Code: 004081. Available online: <http://www.npws.ie/protectedsites/specialprotectionareasspa/clonakiltybayspa/>. Accessed 2016.

National Parks and Wildlife Service (2014). Protected Sites. Available online: <http://www.npws.ie/protectedsites>. Accessed 2016.

RSPB (1994) *The New Rivers and Wildlife Handbook*. The Royal Society for the Protection of Birds, Sandy.

Smith, G.F., O'Donoghue, P., O'Hora, K. and Delaney E. (2011) *Best Practice Guidance for Habitat Survey and Mapping*. The Heritage Council, Kilkenny.

Turnpenny, A W H & O'Keefe, N J. *Screening for intake and outfalls: a best practice guide*. Environment Agency Science Report SC030231, 2004.

7 Landscape and Visual

7.1 General Introduction

This chapter presents the landscape, townscape and visual impact assessment of the proposed Glashaboy River Drainage Scheme. The scheme comprises works along north-south sections of the Glashaboy River from Glanmire through Riverstown and extending into and beyond Sallybrook Industrial Estate, as well as a small section of works extending along the Butlerstown River and Glenmore River (tributaries of the Glashaboy River) east of the main Glashaboy River corridor. This assessment has been carried out by Brady Shipman Martin.

The objective of the assessment is to appraise the existing landscape character of the site and its wider setting to assess the likely landscape and visual impacts arising from the proposed development. Potential mitigation measures are also included.

7.2 Methodology

7.2.1 Introduction

The proposed development was assessed with regard to key landscape and visual concerns. Firstly, the existing landscape/townscape character was evaluated with regard to criteria such as landform, land cover and land use, key features and focal points, key views and prospects, scale of the receiving visual unit, quality of the environment and amenity, and the valued aspects integral to how the character is experienced or perceived. Secondly, the visual impact regarding the sensitivity of this character to the type and degree of change arising from the proposal was assessed. In both cases a high degree of subjectivity may be involved in the consideration of the significance of any changes. In general the proposed development is localised in nature, yet will likely have some significant impacts with regard to the visual aesthetics of the river amenity. Construction impacts will be temporary, negative and localised.

The landscape and visual impact assessment involved:

- Field visits to site and environs;
- Review of relevant planning legislation, policy and other documentation to establish the local and wider significance of the area or features of the area in a landscape and visual context;
- Desk studies of ordinance survey mapping and aerial photography;
- Review of details of the proposed development including plans, sections, elevations and photomontages;
- Review and cross referencing of other chapters within EIS, in particular in relation to ecology and heritage.

7.2.2 Relevant Guidelines and Legislation

The landscape and visual impact assessment has had regard to the following legislation, policy documents and reference material:

- Cork County Council. (2007) Cork County Draft Landscape Strategy;
- Cork County Council. (2014) Cork County Development Plan 2014 ;
- Cork County Council. (2015). Blarney Electoral Local Area Plan 2011, 2nd Ed.;
- Environmental Protection Agency. (2015) Draft Revised Guidelines on the information to be contained in Environmental Impact Statements;
- Environmental Protection Agency. (2015) Draft Advice Notes on current practice in the preparation of Environmental Impact Statements;
- Environmental Protection Agency. (2002) Guidelines on the information to be contained in Environmental Impact Statements;
- Environmental Protection Agency. (2003) Advice Notes on current practice in the preparation of Environmental Impact Statements;
- Government of Ireland. Planning and Development Acts 2000-2010; and
- Landscape Institute, and Institute of Environmental Management & Assessment (2002) Guidelines for Landscape and Visual Impact Assessment. 3rd Ed. Oxon: Routledge.

7.2.3 Significance, Nature And Duration of Impact Criteria

The impact significance criteria used in the assessment are based on the EPA Draft Revised Guidelines, 2002 and Draft Advice Notes, 2003 as set out in **Table 7.1**, with additions from EPA's 2015 revised guidelines and notes. The nature of landscape and visual impacts may be positive, neutral or negative/adverse as defined in **Table 7.2**. The duration of impacts is as described in the EPA Guidelines and as set out in **Table 7.3**. The terminology used to define impacts is outlined in **Table 7.1**:

Impact Level	Definition
Imperceptible	An impact capable of measurement but without noticeable consequences.
Not significant	An impact which causes noticeable changes in the character of the environment but without noticeable consequences.
Slight	An impact which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate	An impact that alters the character of the environment in a manner that is consistent with the existing and emerging trends.
Significant	An impact which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Very significant	An impact, which by its character, magnitude duration or intensity, significantly alters the majority of a sensitive aspect of the environment.
Profound	An impact that obliterates sensitive characteristics.

Table 7.1 - Significance of Effects Terminology (Guidance on the information to be contained in Environmental Impact Statements, EPA. 2002). Note: ‘Not significant’ and ‘Very significant’ definitions introduced in Draft EPA Revised Guidelines on the information to be contained in Environmental Impact Statements, 2015.

As per the EPA Guidelines, landscape and visual impacts (or effects) can be considered to be negative/adverse, neutral or positive in effect. Impacts are considered where they may be direct, indirect and/or cumulative as appropriate. Impact duration is considered as being Momentary (effects lasting seconds to minutes), Brief (less than a day), Temporary (for up to one year), Short-term (from 1 to 7 years), Medium-term (7 to 15 years), Long-term (from 15 to 60 years) or Permanent (in excess of 60 years).

There were no limitations or constraints in carrying out the assessment.

Table 7.2: Nature of Impacts

Nature of Impact	Description
Positive	A change that improves the quality of the environment
Neutral	A change that does not affect the quality of the environment
Negative/adverse	A change that reduces the quality of the environment.

Table 7.2: Duration

Nature of Impact	Description
Momentary	Lasting from seconds to minutes
Brief	Lasting less than a day
Temporary	Lasting one year or less
Short-term	Lasting one to seven years
Medium-term	Lasting seven to fifteen years
Long-term	Lasting fifteen to sixty years
Permanent	Lasting over sixty years

7.2.4 Photomontages

A number of photomontages have been prepared so as to more fully illustrate the physical and visual nature of aspects of the proposed development. These have been prepared to convey a time period of c.5-7 years including planting maturity. The Photomontages, which are included in **Appendix 7.1**, are from/of the following locations:

- View 1 – View of Hazelwood Centre commercial complex at Riverstown from adjoining car park; see Figures 7.1.1.1 and 7.1.1.2.
- View 2 – View from north of Hazelwood Centre near the basketball court, facing south towards existing open channel; see Figures 7.1.2.1 and 7.1.2.2.
- View 3 – View from within Meadowbrook residential estate, south of the Hazelwood Centre; see Figures 7.1.3.1 and 7.1.3.2.
- View 4 – View of Riverstown Bridge and adjacent entrance area to Meadowbrook residential estate; see Figures 7.1.4.1 and 7.1.4.2; and

- View 5 – View east along Brooklodge Grove adjacent to Copper Valley Vue residential estate; see Figures 7.1.5.1 and 7.1.5.2.

7.3 Receiving Environment

7.3.1 General Context

Because of the spatial extent of the site works, following a long section of the main Glanmire river corridor and areas to the east along the Glenmore Stream, descriptions of the receiving environment are divided into three main areas for the purposes of this landscape and visual assessment; Glanmire Town, Riverstown and Brooklodge.

Glanmire Town

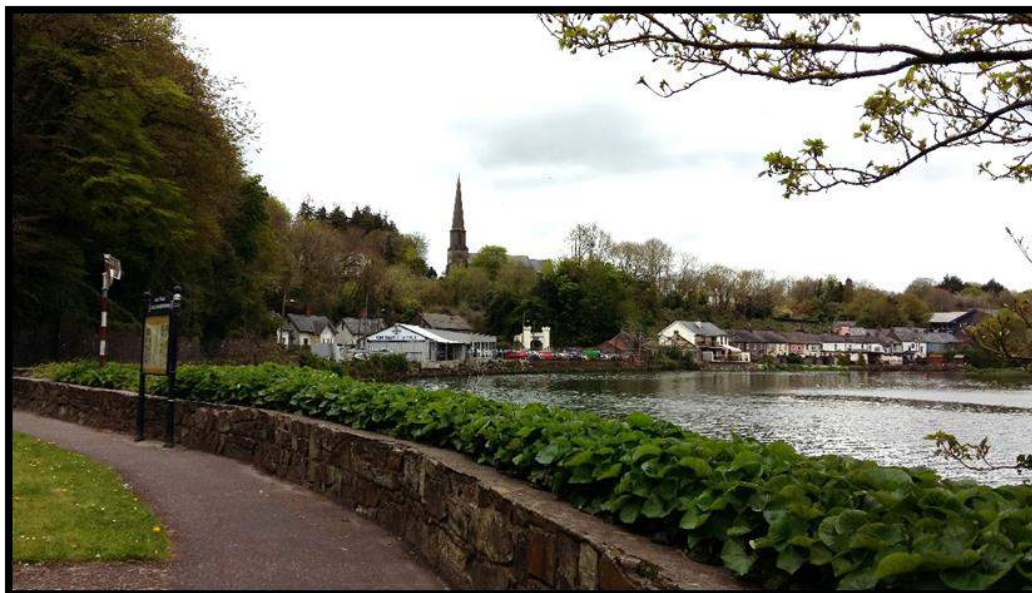


Figure 7.1: Entrance to Glanmire at Glashaboy River. Key vista from R639 across Glashaboy River at high tide, showing entrance to Glanmire and St Mary and All Saint's Church in background, and with existing stone wall boundary to river in foreground.

The Glanmire Town section of the site is set within a defined and scenic narrow river valley with steep wooded and sandstone sides, particularly around the western cliff face and the eastern Glanmire Wood. This rare and mature wood, comprising a mixture of broad-leaved native and non-native species and rich flora, is a dominant and important feature on the landscape, made more prominent by its position on an elevated slope that rises to the Dunkettle Estate.

The Glashaboy River is the most significant focal point, with a pronounced and widened bend opening up a key vista (**Figure 7.1**), the point at which lies the entrance to Glanmire town.

This part of the town is defined by contained, spatially coherent settlement patterns, displaying a modest, consistent and vernacular scale, form and layout, nestling into the landscape at the foot of the valley sides and set against a backdrop of mature and mainly deciduous trees. The land uses in this area are recreational, residential, and commercial, as well as including a busy thoroughfare alongside the river. Settlement/spatial boundaries are largely defined by an old stone walls, reflecting the historic character of the built environment. The area has a particularly strong industrial heritage, with mills scattered along the Glashaboy River area. The Fountains mills (within Glanmire Town) and St. Patrick's Mills (en route to Riverstown) are protected structures directly influenced by the scheme.

The townscape at this point has number of important built heritage features, including three 19th century Alms Houses (visible as the first [left to right] buildings of the built fabric in **Figure 7.1**, on the western side of the road), St. Mary and All Saint's Church on the skyline, Glenmervin House and its eye-catching castellated entrance arch, the Old Post Office, and The Fountains corn mill further upstream.

The most notable focal point, other than the river, is in the form of the spire from St. Mary and All Saint's Church, located on an elevated slope above the town entrance, acting as an iconic landmark for the area.

Ecologically, the landscape character is enriched by diverse vegetation and wildlife, determining its status as a proposed Natural Heritage Area and Special Protection Area. The sheltered intertidal sand and mudflats are important in this regard, especially for wading birds as protected by the EU Directive for Wild Birds.

Despite the intersection of the area by a busy regional road, R639, it nevertheless holds high recreational and scenic amenity value, mostly evident by the inclusion of one of three loop walks compiled by the Glanmire Area Tidy Towns Committee.

The valley itself runs in a north-south orientation. Spatially, the overall scale of the immediate valley, on entrance to Glanmire town, visually extends to c.50m. (Malin Head Datum) in a fairly abrupt vertical elevation on both steep sides, to c.1km in length and width an average width of c.100m. Glanmire wood reaches a full height of c.60m on the eastern side of the river while the western elevation gradually extends to an unseen height (beyond the 50 meters) of c.100m.

A key aesthetic feature of the valley are the tree tunnels enclosing road sections in the area, particularly on the main road between Glanmire Town and Riverstown, including along The Grove – an small section of the road which includes two semidetached dwellings nestled into sloped land, north of Glanmire Bridge. These are a defining characteristic in the sequential experience of the wider landscape along the river corridors.

Riverstown



Figure 7.2: Hazelwood Centre commercial complex at Riverstown, with trees and vegetation around a narrow section of the Glashaboy River corridor visible to the left of the photograph.

The main centre of Riverstown lies within quite a different character backdrop to the previous, set between the Glashaboy and Butlerstown Rivers (Butlerstown River being a tributary of Glashaboy). While still a continuation of the Glashaboy river valley, the valley here is less sensitive and of a more open, less defined expanse. The topographically defined visual unit is generally wider, but this is broken in places due to tree clumps and pronounced river meanders creating smaller more enclosed spaces.

Being further into the wider urban settlement of Glanmire, the area is noticeably more built-up, with the proposed site section located within a more compact area of focused commercial development surrounding the serving car parks. This is set within the suburban residential environs of Riverstown and reflects a continuous style and scale. The commercial complex of the Hazelwood Centre defines much of the land use on the valley floor. The slopes surrounding the valley floor are characterised by typically suburban residential development schemes, while a large sports pitch and MUGA area occupies part of the river catchment area behind the Hazelbrook centre to the north. A central elevation (c.50m) topographically defines the immediate area between the Glashaboy and Butlerstown Rivers, at the bottom of which the Hazelwood Centre sits. Large residential schemes occupy the southern half of the elevation and on the lower and mid slopes, while the peak and northern half of the elevation is zoned as open space and includes a section of dense woodland on the western slopes as part of the Glashaboy River woodland corridor.

The Glashaboy River at this point is narrower and less of a focal feature, yet still largely contributes to the public realm and identity for Riverstown, mostly from its associated woodland corridor, and with place names in the area reflecting this value.

Immediately south of the Hazelwood centre is Meadowbrook residential estate, with its entrance adjacent to the protected structure of Riverstown Bridge. At this point the wooded river corridor is an important amenity aspect within this estate, defining its spatial layout, and visually screening the estate from the Hazelwood Centre. As a result the estate feels highly enclosed and physically separate from the commercial area. A line of mature trees screens much of Meadowbrook from the R639. The river continues into John O' Callaghan Park to the south which contains a wooded elevation overlooking Meadowbrook.

Approximately 700m north of the Hazelwood centre lies the Glanmire/Sallybrook Industrial estate set on western banks of the river and extends for c.600m along the main road of the R639. Although industrial in character and scale, the estate is set in within an area of dense mature woodland and along a meandering section of the wooded river corridor, continuing on the Glashaboy River. The protected structure of Sallybrook Mills is located to the far north of the site at Kearney's Cross and visible from the main road, with Sallybrook House (former miller's house), listed on the NIAH, in close proximity. A line of trees along an open channel intersecting the estate restricts views of the house from the main road and within the estate. A row of detached residential houses lies behind the estate, visually screened and physically separated from the estate by tree lines along the river corridor. A solitary dwelling sits with frontage onto the R639 and alongside the existing open channel intersecting the industrial estate. It is screened from the channel and industrial estate by a row of ornamental conifers within its curtilage.

A short distance north of Kearney's Cross along the L2973 lies the site works location at Cúil Chluthair residential estate, located within the neighbouring townland of Sarsfieldcourt. This row of large contemporary detached houses is nestled within a dip in the topography around the catchment area of a small channel branching off from the Glashaboy River. It is screened from the L2972 and R639 by mature tree lines and manicured hedging, making the site very enclosed and private. The wooded river corridor continues through the estate opposite the row of houses acting as an added visual screening. The wooded corridor of the main Glashaboy River is situate immediately opposite the entrance area providing further seclusion for the estate.

The scheme also extends into two tributaries west of the Glashaboy River, with contained works at Springmount Stream (adjacent to Hazelwood to the south west) and Cois na Glean (north of Hazelwood in the lands adjacent to the Multi Use Games Area and overlooked by the protected structure of St. Joseph's Church). Cois na Glean also lies at the point of the transition to Sallybrook townland, as marked with an attractive roadside landscaped area and sign. These areas occupy generally enclosed sections of the R639 with extended views restricted by mature trees and topography.

Brooklodge



Figure 7.3: Along Brooklodge Grove adjacent to Copper Valley Vue residential estate (behind trees to the right) with M8 overpass slightly visible in the back left.

An additional area connected with the proposed works lies off the main river corridor and along the wooded Glashaboy tributaries of the Butlerstown River and Glenmore River. The Butlerstown River section lies c.400km east of Meadowbrook and within the private grounds of the protected structure of Riverstown House (not visible), and separated from the public road by a gated entrance and high old stone wall. Public views of the house and grounds are restricted. The site is also adjacent to an NIAH listed structure of Copperalley¹ bridge.

Approximately 570m further east along Brooklodge Grove lies the beginning of the Glenmore River section of the proposed works in and around the entrance to Copper Valley Vue – a contemporary suburban residential estate in the neighbouring townland of Ballinglanna (the specific works also straddle the townland boundary of Brooklodge). The Glenmore River channel and associated tree lines separate the main road from the estate, with access provided across a culvert at the entrance. The trees provide a substantial screening between the road and dwellings within the estate.

The immediate environs are generally defined by large suburban residential housing schemes, linear rows of detached roadside properties, a mixture of contemporary stone and old stone boundaries, and a large volume of mature tree clumps/lines and wooded river corridors. Tree tunnels also provide attractive features along sections of the road in Brooklodge Grove.

¹ Possible misspelling of 'Coppervalley' on NIAH/historic maps.

The final works area lies c.300m further east continuing along Brooklodge Grove, beyond the M8 overpass. It marks the beginning of a more peri-urban area, with medium and large sized field parcels together with large industrial sites occupying the immediate lands. The works area comprises a very contained site at a junction between the main Brooklodge Grove road, a slip road and a local access road into the industrial estate opposite. This section of the Glenmore River channel is flanked by a contemporary stone roadside wall on the southern bank, and a wooded and densely vegetated parcel of land on the northern bank that separates the M8 from the slip road.

7.3.2 Landscape Character Type and Designs

The *Cork County Draft Landscape Strategy 2007* defines the landscape character for the County. This is supported by the *Cork County Development Plan 2014* and the *Blarney Electoral Local Area Plan 2015*. The Strategy identifies the wider character context of the area as ‘City Harbour and Estuary’, as having very high value and sensitivity, and as being of national importance. It does not provide detail descriptions or recommendations specific to the areas in question beyond the description below:

“The rural areas around much of the greater harbour area are now characterised by a prevalence of infrastructure such as roads, bridges and electricity powerlines and some urban sprawl”.

The most northerly section of the study area around Cúil Chluthair marginally extends into an adjacent landscape character type identified in the CPD as “*Fissured Fertile Middleground*” and associated with medium value, high sensitivity and county level importance in the Cork County Draft Landscape Strategy. It therefore falls outside the High Value Landscape designation. However this should not be gauged as a strict or sudden character and sensitivity change as the key characteristics and sensitivities of the wooded river corridor continue into this area.

The CDP and LAP outline in greater detail the characteristics of the landscape in which the proposed development sits, including designations directly and indirectly relating to the landscape character of the areas in question. The CDP identifies how the rural character of the wider landscape is not prevalent in the areas around Scenic Route S41 which dissects the Glanmire section of the proposed development. The designations in the area are listed below:

Scenic Route S41 and associated protected view:

- *R639 Regional Road & Local Road from Dunkettle to Glanmire and eastwards to Caherlag and Glounthane. Views of the Estuary & Harbour, wooded landscape, open countryside & hillsides;*
- Area of High Landscape Value;
- pNHA (001054 – Glanmire Wood); and
- SPA (004030 – [part of] Cork Harbour SPA).

Of the protected structures identified in the overall study area, the following are particularly notable with regard to their proximity to the works areas.

Glanmire

- St. Mary and All Saint's Church 1766 (00391);
- Three Alms Houses c1830 (01291, 01292, 01293);
- Ballinglanna Corn Mill (00485) (Referenced as The Fountains Mills in Plan Layout);
- Glanmire Bridge (00483); and
- Cloth Mill and Mill Race (00484) (Referenced as St. Patrick's Mills in Plan Layout).

Riverstown

- Riverstown Bridge (00394);
- Riverstown House (00395);
- Glansillagh Mills (00389); and
- Sallybrook Mills (00390).

7.3.3 Landscape Value and Sensitivity

The LAP emphasises important landscape aspects within the study area:

3.1.6: "Glanmire is defined by steeply sloping fringes, some of which are developed, and pockets of woodland. The Glashaboy River is a significant feature to the south of the village where it opens into the upper reaches of Cork Harbour at Dunkettle. The settlement lies in the steep sided, wooded valley of the River Glashaboy".

3.2.23: "Much of this landscape is associated with Glashaboy River and also included, to the north of the town, is a steeply sloping area of land which makes a significant contribution to the setting of Riverstown. Scenic route S41 traverses the town to the south".

This landscape falls within a designation of high landscape value and high sensitivity, also incorporating a scenic route (S41) along the Glashaboy River. The LAP reiterates the role of the Glashaboy River as an integral receptor in how the landscape is valued. Collectively, the landscape holds multiple value layers, including scenic, recreational, ecological, historic and religious. These are predominantly determined by the following aspects, elements and focal points which are the most sensitive to future landscape change and development:

- River valley landscape and woodland corridor;
- Glashaboy River including ecologically rich sand and mud flats;

- Viewshed from R639 across Glashaboy River towards Glanmire;
- Glanmire Wood;
- Natural steep cliff face;
- St Mary and All Saint's Church - focal point and landmark on skyline;
- Grotto amenity built into cliff face (and associated precession walk route);
- Glen Mervyn Entrance (crenelated style – 1700s);
- Old stone bridges (Glanmire, Riverstown, Copperalley);
- Industrial heritage features (Alms Houses, Fountains Corn Mills);
- Traditional townscape at entrance to Glanmire;
- Stone boundary walls throughout area;
- John O Callaghan Park including children's play area, woodland and designated walkway along river (LAP);
- Tree tunnels along roadways (near Glashaboy and Glenmore Rivers);
- Designated river walkway along Butlerstown River (LAP); and
- Riverstown Estate.

7.3.4 Landscape Planning Context

The *Cork County Development Plan 2014* and the *Blarney Electoral Local Area Plan 2015* set out the area's planning context and contain a number of references to the landscape, townscape and amenity of the Glashaboy River in these areas. Glanmire is listed as one of eight existing 'Metropolitan towns' in the County Development Plan, and regarded as one of the 'smaller' of these towns. It is separated from the city suburbs by short stretch of green belt. As outlined in Section 3.1.5 of the LAP, the town has developed over the last 20 years from a collection of small villages to an important suburb in close proximity to the major employment centre of Little Island. The section of the site around the Hazelwood Centre in Riverstown is located in an area zoned as 'Town Centre/Neighbourhood Centre' in the LAP.

A number of observations and objectives from the CDP and LAP are identified for their relevance to and implications for the landscape, public realm, and amenity concerns within the wider planning context of the proposed development. These are listed in full in **Appendix 7.2** with key points summarised below. It is deemed that proposed development, by means of design and mitigation, adheres to and does not contravene the policies identified:

- Protect the visual and scenic amenities of County Cork's built and natural environment;
- Ensure that the approach roads to towns and villages are protected from inappropriate development, which would detract from the setting and historic character of these settlements. This is particularly relevant for the site sections around the entrance to Glanmire;

- Ensure that new development meets high standards of siting and design;
- Discourage proposals necessitating the removal of extensive amounts of trees, hedgerows and historic walls or distinctive boundary treatments;
- Minimise visual and environmental impact of development particularly in areas of High Value Landscapes where higher design standards are required;
- Preserve the character of all important views and prospects (incl. river views and views of historical/cultural significance like townscapes and buildings);
- Require those seeking to carry out development in the environs of a scenic route to demonstrate that there will be no adverse obstruction or degradation of the views towards and from vulnerable landscape features;
- Encourage appropriate landscaping and screen planting of developments along scenic routes which provides guidance in relation to landscaping;
- Potential to creating a pedestrian orientated urban environment in the Hazelwood centre and ensure appropriate pedestrian and cycling connectivity and improve the quality of the streetscape through public realm enhancements in Riverstown;
- Prominent slope zoned open space (O-01) as it provides a significant contribution to the setting of Riverstown;
- Open space zonings for informal recreation around John O' Callaghan town park – recognised as an important community amenity; and
- Develop and maintain pedestrian walk through existing open space and extend through proposed open space (O-04) along river bank.

7.4 Characteristics of Proposed Development

As outlined in detail in **Chapter 3 Description of the Development**, the proposed Glashaboy River (Glanmire/Sallybrook) Drainage Scheme comprises various works, including new and reinforced concrete flood defence walls, new and replacement culverts, ground regrading, replacement bridge and pumping stations. The works are mostly focused on the Glashaboy River, with a small section of the works proposed along the Butlerstown and Glenmore Rivers to the east and the tributaries of Springmount Stream and Cois na Glean to the west.

From a landscape and visual perspective, the characteristics of the development of most concern are the new flood defence walls and tree removal along the existing wooded river corridors, especially in areas where they contribute to residential and recreational amenity and the overall character of the river valley.

7.5 Evaluation of Impacts

7.5.1 Construction Impacts

Landscape and visual impacts will be most pronounced during the construction stage while disturbance is at its greatest and mitigation is least effective.

Adverse visual and amenity aspects will arise at a number of residential and other property types in close proximity to the works areas. The overall construction of the flood defence system will necessitate some tree removal along the river corridor in the works areas, while noise, dust and vibration levels during construction will have the potential to impact on residential and public amenity in immediate locations.

Mitigations outlined in **Section 7.7** will ensure construction impacts are restricted to the lowest possible level and to ensure that all machinery operates within the works area. These effects will be temporary and generally localised during the **construction** stage:

- **Moderate negative** impact on the existing wider landscape character of the wooded river corridor from the removal of trees and vegetation and the construction of new flood defence walls;
- **Significant to moderate negative** localised and temporary visual impacts on residential and public amenity from the removal of trees and vegetation, mainly within Meadowbrook, at Riverstown Bridge, Hazelwood and at the entrance to Copper Valley Vue;
- **Slight negative to imperceptible** impacts on residential amenity from the removal of trees within the general screening between dwellings and the Sallybrook industrial estate;
- **Moderate negative** visual impacts on the historical character of the built environment and immediate settings of protected structures;
- **Moderate negative** visual impact from construction of new embankments; and
- **Significant to moderate negative** impact on public realm and residential amenity from the localised noise, dust, vibration, access restrictions and visual disturbance associated with the construction works.

7.5.2 Operational Impacts

Post construction, a number of negative and positive impacts during the initial operational stage are likely to be experienced with regard to the overall landscape character and visual appearance of the study area. Moderate impacts are limited to a short term duration, and with mitigation measures reducing any significant negative impacts to moderate/slight:

- **Moderate negative** and **short term** impact on overall character of wooded river corridor after trees/vegetation removal throughout the study area, reducing to **slight negative/neutral** as vegetation and new planting matures.
- **Moderate negative, short term** and **localised** visual impact on residential and public amenity after the removal of trees at within Meadowbrook, at Riverstown Bridge, Hazelwood and at the entrance to Copper Valley Vue, with **slight negative to imperceptible** impacts on dwellings around Sallybrook. All such impacts generally reducing to **slight negative** as existing and new planting matures.

- **Moderate negative** and **short term** visual impact from new fair face concrete walls, generally reducing to **slight negative/neutral** to **imperceptible** as planting matures, and where ivy establishes in select locations diminishing visibility of the wall.
- **Slight negative** and **short term** visual impacts on the historical character of the built environment and immediate settings of protected structures, reducing to **slight neutral/imperceptible** as existing and new planting matures.
- **Slight neutral** visual impact from new embankments.
- **Significant positive** impact from the improvement of appearance of existing and visually fragmented boundary in Riverstown.
- **Significant positive** impact from the enhancement of public realm by means of replacing the existing bridge at the Hazelwood Shopping Centre.
- **Significant positive** impact from the protection of Glanmire and Riverstown townscapes and built heritage from future flooding.

7.6 Cumulative Impacts

It is envisioned that the main cumulative impact concern is from the relatively limited but combined tree removal at the various sections of the site thereby diminishing the experience of the woodland river corridors that run throughout the entire study area. However this impact will be most significant during the construction stage, with new and existing planting substantially reducing impacts as they mature and establish.

7.7 Mitigation Measures

Measures have been considered to avoid, reduce and/or remediate, where possible the likely impacts of the proposed development and works. These are categorised under the phases of mitigation outlined below.

7.7.1 Detailed Design Measures

General

- Design of Glashaboy River (Glanmire/Sallybrook) Drainage Scheme shall be sympathetic to the riparian character of the woodland river corridor and historical built environment.
- In advance of construction a Tree Management Plan and Landscape Plan shall be prepared for the full extent of the works, to include details of tree removal and tree replanting, location, species, size and spacing of trees. This will be carried out by a qualified landscape architect in conjunction with a qualified ecologist and arborist.
- Retain existing trees where possible in the interest of residential amenity, public realm and visual character of the river landscape.
- River banks will be left intact and vegetated wherever possible.

- Where retention of existing trees is not an option, these shall be replaced with new native species as close as possible to the original location, on the dry side of the wall, in the interest of residential and public amenity and visual character of the river landscape. Species to include Alder (*Alnus glutinosa*), Birch (*Betula pubescens*), Willow (*Salix viminalis*), Pedunculate Oak (*Quercus petraea*), Pine (*Pinus sylvestris*), Hazel (*Corylus avellana*) and Holly (*Ilex aquifolium*).
- Galvanised black powder coated finish to be applied to new railings and barriers.
- Location of the flood wall requirement to be along the line of an existing wall on river bank for the most part where possible in the interest of minimising intrusion on the existing landscape character (with the exception of Meadowbrook where wall will be set back in order to retain trees).

Specific

- Installation of 1.2m high timber post/rail fence and hedging along eastern river bank adjacent to Multi Use Games Area in Riverstown in replacement of removed trees (as per **Figure 7.1.2.2** in **Appendix 7.1**)
- Sandstone cladding on exposed sections of new walls is of particular importance for the following areas:
 - the approach road and entrance to Glanmire town (dry and wet side of new wall);
 - any new sections approaching Riverstown Bridge. Contemporary capping and railing is deemed appropriate to define boundary with protected structure and avoid a pastiche approach;
 - on entrance to (including wall near Mutli Use Games Area) and within the Hazelwood Centre (on sections of exposed walls in public areas, mainly dry side).(as per Figure 7.1.1.2);
 - on exposed side of any reinstated/altered sections of the existing wall opposite Copper Valley Vue (as per Figure 7.1.6.2);
 - at The Grove: on dry side of new wall along R639 north of Glanmire Bridge (C01_L08 – Works Chainage 0-101); and
 - Ivy (*Hedera helix* 'Hibernica') shall be planted at 1m gaps along the dry side of fair faced concrete wall running through Meadowbrook (as per **Figure 7.1.4.2** in **Appendix 7.1**).

7.7.2 Construction Mitigation Measures

- Existing trees to be retained where possible in the interest of public realm and visual character of the river amenity. River banks will be left intact and vegetated wherever possible. Coppicing and/or selective removal of trees may be considered where required in preference to total vegetation removal.

- Disturbance to private boundaries, gardens, etc. shall be avoided wherever possible and where impacted shall be reinstated prior to completion of the works.
- Machinery shall not enter the river unnecessarily.
- All landscape, footpath, roads etc., disturbed during the course of the works shall be fully reinstated prior to the completion of the construction works.
- Japanese Knotweed is particularly common along stretches of the river (e.g. on main entrance road to Hazelwood centre towards sports pitch). Works on river banks should seek to control/eradicate such invasive weeds. Such weeds shall not spread or relocated in the course of the works.

7.7.3 Operational Mitigation Measures

The following mitigation measures are included for the post construction stage of the scheme:

- Where retention of existing trees is not an option, these shall be replaced with new native species as close as possible to the original location, on the dry side of the wall.
- Where shrubs and vegetation are removed, new plants of appropriate species shall be planted in replacement.
- Where fair faced concrete is used, Ivy (*Hedera helix* 'Hibernica') shall be planted at 1m gaps along the wall face where feasible. Areas where this is deemed necessary are as follows:
- All trees retained in proximity (*i.e.* within root protection area (RPA) as per BS 5837) shall be subject of a detailed post-construction tree survey carried out a qualified Arborist. Any works recommended shall be undertaken and the survey shall be made available to the Client.

7.8 Residual Impacts

The landscape, townscape and visual impacts of the works are relatively localised and at their most significant during construction stage works. For the most part, impacts on the wider landscape character are limited due to the generally enclosed views defining the area, limited tree removal, and the generally localised scale of the individual works areas throughout the study area. Overall the impacts on residential and public amenity are considered to be slight negative once new planting matures and screening begins to establish. Considering the scale of the project, on adhering to mitigation measures outlined, the proposed Glashaboy River Drainage Scheme will not have an appreciable impact on the integrity or landscape planning aspects of the Glashaboy River corridor, with impacts reducing as existing and new planting matures.

7.9 References

Cork County Council. (2007) *Cork County Draft Landscape Strategy* Cork.

Cork County Council. (2014) *Cork County Development Plan 2014*.

Cork County Council. (2015). *Blarney Electoral Local Area Plan 2011*, 2nd Ed.

8 Population and Human Health

8.1 Introduction

This chapter addresses potential impacts of the proposed Glashaboy River (Glanmire / Sallybrook) Drainage Scheme on population and human health.

The proposed scheme has the potential to affect human beings in several ways. The potential impacts on human beings from construction activities, landscape and visual impacts, built and natural heritage, and air, noise and vibration are dealt with in the specific chapters in this EIS dedicated to those topics. In this chapter, the impacts on sensitive receptors, relating to issues such as population, and social and economic activity, are examined.

8.2 Methodology

The current socio-economic status in the areas close to the proposed development was reviewed. Baseline information with respect to the demographic and employment characteristics of the resident population within the catchment area was sourced from the 2006, 2011 and 2016 Censuses and CSO Quarterly National Household Survey (where available). The data included information on population, number of persons at work and unemployment profile. Information was also sourced from the following documents/websites.

- Censuses of Ireland 2006 and 2011,
- Central Statistics Office *Quarterly National Household Survey Quarter 2 2016* (www.cso.ie),
- Cork City and County Councils *Cork Area Strategic Plan 2001-2020*,
- Cork County Council *Blarney Electoral Area Local Area Plan 2011 2nd Edition*,
- Cork County Council, *Cork County Development Plan 2014*,
- Fáilte Ireland Annual Report 2014,
- Indecon, RPS and Savills HOK (2008) *The Cork Area Strategic Plan – Strategy for Additional Economic and Population Growth – An Update*,
- Local Electoral Area Boundary Committee, *Committee Report 2013*,
- South West Regional Authority *Regional Planning Guidelines 2010-2022*.

8.3 Receiving Environment

A description of the existing environment is provided in the following subsections.

The proposed drainage scheme is located in the vicinity of the Glashaboy River in County Cork. The main settlement within the Study Area is Glanmire, with smaller settlements at Riverstown and Sallybrook. The villages of Knockraha, Watergrasshill and Carrignavar are located in the surrounding area.

8.3.1 Heritage and Amenity

8.3.1.1 Heritage

Archaeological, architectural and cultural heritage are discussed in **Chapter 13 Archaeological, Architectural and Cultural Heritage**. Nature conservation areas are discussed in **Chapter 7 Biodiversity**.

The geology of the area is discussed in **Chapter 11 Soils, Geology, and Hydrogeology**.

Designated views and prospects, scenic routes and protected views, designated in the *Cork County Development Plan 2014* are discussed in **Chapter 13 Landscape and Visual**.

8.3.1.2 Local Amenity

The Glanmire/Sallybrook area has significant recreational value. Local amenity in the area includes Glanmire's wooded and riparian areas, including riverside walks, which provide recreational assets for the community. The Glashaboy River in general is known for sea trout angling. Other amenity areas include John O'Callaghan Park, Sallybrook multi-use games area, the Glanmire Area Community Association playing fields, the Rock Road/Heritage Walkway, the Coillte Trail at Moanbaun and an estate demesne garden.

Numerous sports clubs are located in the study area, including GAA clubs and football clubs.

The area also houses numerous small businesses, particularly in the hospitality sector, such as cafes, restaurants, public houses, as well as a variety of shops.

8.3.1.3 Homes

Homes and dwellings are considered sensitive receptors during construction works. Temporary negative construction impacts will arise in a number of residential areas due to the close proximity of the works to these areas. In the longer term, post-construction, the proposed scheme will provide flood protection to the majority of these residential areas and therefore a positive operational impact will arise.

Construction works are likely to have temporary negative impacts on homes due to noise, dust and traffic disruptions, among others. These impacts are addressed in the relevant chapters of this EIS (**Chapter 9 Noise and Vibration, Chapter 10 Air Quality and Climate, and Chapter 14 Roads and Traffic**). Other impacts on homes are described below.

Homes and dwellings line the majority of the extent of the scheme. Please refer to **Section 8.5.2.3** for a description of the location and potential impacts on homes and dwellings.

8.3.1.4 Industrial Emissions Licensed Facilities

Large scale industrial and agricultural activities are licensed by the Environmental Protection Agency (EPA) under the Industrial Emissions Directive.

The EPA online mapping indicates that the nearest licenced Industrial Emissions licensed facility is Pfizer Ireland Pharmaceuticals, Little Island, approximately 2.5km south-east of Glanmire Bridge.

8.3.2 Tourism

In 2011, Fáilte Ireland published ‘*Guidelines on the treatment of tourism in an Environmental Impact Statement*’, noting that there are two interactions between tourism and the environment:

- Impacts caused by tourism projects (e.g. marinas and holiday villages); and
- Impacts affecting tourism (e.g. the quality of a destination or a tourism activity).

The Guidelines note that the assessment of effects on tourism should be treated as a specialist sub-section of the topic ‘Population and Human Health’, with particular elements being considered, as appropriate within other sections, e.g. Landscape, Flora and Fauna and Cultural Heritage etc. Chapter 3 of the Guidelines lists a number of factors, in order of priority, which are the reasons that tourists visit and enjoy Ireland. These factors have been considered where relevant in various sections of this EIS as follows:

Table 8.1: Reasons why tourists visit and enjoy Ireland in order of priority (according to the Guidelines).

Factor	EIS Chapters / Notes
Beautiful scenery	Landscape and Visual (Chapter 7)
Friendly & hospitable people	The guidelines note that “ <i>this is not an environmental factor though it is indirectly covered under the ‘Human Beings’ section of the EIS</i> ”. Refer to Section 8.3.3 for demographic details.
Easy, relaxed pace of life	The Guidelines note that “ <i>this is not an environmental issue though it is partially covered under ‘Human Beings’ see comments above</i> ”. Refer to Section 8.3 on receiving environment.
Unspoilt environment	Biodiversity (Chapter 6), Landscape and Visual (Chapter 7). Emissions are addressed in Noise and Vibration (Chapter 9), Air Quality and Climate (Chapter 10), Soils, Geology and Hydrogeology (Chapter 11) and Material Assets (Chapter 12). Traffic is addressed in Roads and Traffic (Chapter 14)
Nature, wildlife, flora	Biodiversity (Chapter 6), Landscape and Visual (Chapter 7) Emissions are addressed in Noise and Vibration (Chapter 9), Air Quality and Climate (Chapter 10), Soils, Geology, and Hydrology (Chapter 11) and Material Assets (Chapter 12). Traffic is addressed in Roads and Traffic (Chapter 14) The guidelines note that “ <i>this topic also considers the effect on physical access to and visibility of these sites</i> ”. Access to areas of amenity during construction is addressed in Construction Activities (Chapter 4). Visibility is addressed in Landscape and Visual (Chapter 8).
Interesting history and culture	Landscape and Visual (Chapter 7) and Archaeological, Architectural and Cultural heritage (Chapter 13). The guidelines note that “ <i>the principal issues are to avoid damage to sites and structures of cultural, historical, archaeological or architectural significance – and to their contexts or settings. It also considers the effect on physical access to and visibility of these sites</i> ” Access to and visibility of specified sites of cultural heritage areas addressed in Landscape and Visual (Chapter 7) and Archaeological, Architectural and Cultural Heritage (Chapter 13).
Good range of natural attractions	Biodiversity (Chapter 6), Landscape and Visual (Chapter 7) and Archaeological, Architectural and Cultural Heritage (Chapter 13)
Plenty of things to see and do	The Guidelines note that “ <i>this is not an environmental issue though it is partially covered by the Human Beings section, where tourism resources of an area are described and assessed</i> ”. Refer to Section 8.3.5 and 8.3.6 for details on heritage and amenity

Although Glanmire is not currently a popular tourist destination, the area includes a number of attractions for tourists. Recreation and amenity areas, a hotel, restaurants, public houses and retail outlets are important tourist facilities in the area. Sea trout fishing is also popular on the river. The *Cork County Development Plan 2014* states that the main aims of the plan include “Develop, enhance, and protect new and existing tourism assets, products, attractions and tourism infrastructure” (CDP 2014).

Tourism is a major contributor to the national economy and is a significant source of full-time and seasonal employment. The area for the proposed scheme is located in the South West Region. The *South West Regional Planning Guidelines 2010-2022* state that Cork is a prime location for regional tourism in Ireland, and that the South West Region, on an annual basis, generates €1.3 billion in tourism revenues and has in excess of 3.6 million visitors.

Fáilte Ireland’s Annual Report 2014 states that in 2014, the tourism and hospitality industry employed almost 205,000 people in the State, and generated an estimated €6.4bn in revenue. This represents an increase in both employment and revenue from 2013.

8.3.3 Recent Trends in Population

The *Blarney Electoral Area LAP 2011* states that the 2006 Census recorded a population of 8,385 people in Glanmire, an increase of 22% on 2002 population levels (LAP 2011). Population targets set out in the *Cork County Development Plan 2009 2nd Edition* suggest a target population of 10,788 for Glanmire in 2020, an increase of 2,403 on the 2006 population (LAP 2011).

The Blarney LAP states:

“It is envisaged that the future population growth to 2020 for the Town will be in the region of 2,403 people, this figure being derived from growth targets for the County and having regard to CASP update proposals. This gives rise to a need to provide an additional 2,241 dwelling units in the period 2006-2020.” (Blarney LAP, Section 3.2.4.)

The smallest geographical units distinguished by the Central Statistics Office (CSO) are Electoral Divisions.

Local electoral areas were reconfigured in 2014 following recommendations made by the Local Electoral Area Boundary Committee. Under the revised Electoral Area boundaries, the areas to be impacted by the proposed scheme are located within the Caherlag, Rathcooney and Riverstown Electoral Divisions, within the Blarney Electoral Area (LEA 027).

Table 8.2 outlines the population change between 2006 and 2011 and the growth rate of these population figures.

Table 8.2: Population change between 2006 and 2011 and the growth rate of these population figures.

District	2006	2011	Change from 2006-2011 (%)
State	4,239,848	4,588,252	+8.2
Cork (County and City)	481,295	519,032	+7.8
Cork County	361,877	399,802	+10.5
Cork City	119,418	119,230	-0.2
Cork Rural Area	119,520	131,100	+9.7
Caherlag (Electoral Division No 18081)	6,555	6,958	+6.1
Rathcooney (Electoral Division 18101)	7,118	8,181	+14.9
Riverstown (Electoral Division 18102)	4,451	4,565	+2.6

The trend in population change for the three electoral divisions largely follows the regional and national trend, of slight population increase. Rathcooney has seen much larger growth in this period than the Caherlag and Riverstown areas.

8.3.4 Household Size

Table 8.3 below outlines the average household size in each of the geographical areas assessed. The statistics illustrate a general decrease in household size from 2006 to 2011, in line with the national trend. However, the household size in the area of the proposed development is still higher than the State and County averages.

Table 8.3 Average household size change between 2006 and 2011

District	2006	2011
State	2.81	2.73
Cork County	2.88	2.80
Caherlag (Electoral Division No 18081)	3.18	3.01
Rathcooney (Electoral Division 18101)	3.13	3.00
Riverstown (Electoral Division 18102)	3.27	3.21

8.3.5 Trends in Employment and economic activity

The CSO Quarterly National Household Survey, Quarter 2 of 2016 states that 2,014,900 persons were in employment in the State in the second quarter of 2016, an annual increase in employment of 56,200 in the year to the second quarter of 2016, or 2.9 %. This compares with an annual increase in employment of 2.3% in the previous quarter and an increase of 3.0% in the year to Q2 2015.

The survey states that unemployment decreased by 23,400 (-11.1%) in the year to Q2 2016 bringing the total number of persons unemployed to 187,800. This is the sixteenth quarter in succession where unemployment has declined on an annual basis.

In the 'Southern and Eastern' region, there were 1,516,400 in employment in the second quarter of 2016 and 135,100 unemployed.

This is an unemployment rate of 8.2% which is lower than the unemployment rate for the State (8.6%). The unemployment rate in the second quarter of 2015 was 8.9%, so there was an improvement in the year to the second quarter of 2016.

The Blarney LAP 2nd Edition (2015) states that were 1,364 people in employment in the Glanmire/Riverstown area when data were collected in 2006. *The Cork Area Strategic Plan – Strategy for Additional Economic and Population Growth – An Update* (Indecon, RPS and Savills HOK July 2008) shows an updated employment projection for Glanmire/Riverstown for 2020 of 5,862 persons.

The 2011 CSO census data include detail of the industries in which people are employed. Looking at these data can provide insight into the economic activity in the three EDs in the area of the proposed scheme.

Table 8.4: Persons employed by economic sector (Census 2011)

Industry	Caherlag	Rathcooney	Riverstown
Agriculture, forestry and fishing	29	60	47
Building and construction	118	183	90
Manufacturing industries	597	610	339
Commerce and trade	830	883	486
Transport and communications	278	285	155
Public administration	168	174	135
Professional services	681	775	485
Other	360	516	231
Total	3,061	3,486	1,968

The 2011 Census data indicate that the two largest industries in the area of the proposed scheme are Commerce and Trade, and Professional Services. The Glanmire/Riverstown area is an area of important commercial activity, due to the presence of numerous small businesses, shopping centres, and a car dealership.

According to the Blarney LAP 2nd Edition (2015) (section 3.2.7, page 43), “*there were three industrial sites zoned in the 2005 LAP, none of which are developed. There are further established industrial lands east of the N20.*” The LAP also states that the Glanmire Business Park is partially developed and has potential for expansion.

Retail facilities are largely provided for by the Hazelwood neighbourhood centre and there is fragmented retail elsewhere (Blarney LAP 2011).

8.4 Characteristics of Proposed Development

The proposed development will consist of the implementation of flood defences, in various forms, along the Glashaboy River and its tributaries. The proposed drainage scheme will include the construction of flood defence walls along the river banks; construction and replacement of culverts; removal and replacement of bridges; construction of embankments conveyance improvements (river channel widening and deepening), and localised regrading of ground levels.

During the construction phase, the proposed drainage scheme will generate temporary additional traffic, as well as air and noise emissions. These temporary impacts are addressed in the relevant sections of the EIS.

When operational, the proposed drainage scheme will provide protection from flooding for the residents, businesses and amenity facilities located in the area, in both the villages and the industrial estates.

8.5 Evaluation of Impacts

Impacts on humans as a result of the proposed development have been considered in detail in other chapters of this EIS, as follows:

Chapter 4 Construction Activities,

Chapter 7 Landscape and Visual,

Chapter 9 Noise and Vibration,

Chapter 10 Air Quality and Climate,

Chapter 11 Soils, Geology and Hydrogeology,

Chapter 12 Hydrology,

Chapter 13 Archaeological, Architectural and Cultural Heritage,

Chapter 14 Roads and Traffic, and

Chapter 15 Material Assets.

The impacts of the proposed development on human beings in relation to health and safety, residential and recreational amenity and economic activities are evaluated in the following sections.

8.5.1 Do-Nothing Impacts

The do-nothing scenario relates to the impacts likely to arise if the proposed scheme were not to proceed. If this were the case, the river channel would remain unchanged, resulting in the same impacts on human beings that have already been experienced previously. The history of flooding in the area and the need for the scheme provide an indication of what the impacts have been and therefore what they are likely to be in the do-nothing scenario. These are discussed in **Chapter 2 Need for the Scheme and Alternatives Considered.**

The potential impacts of failure to implement the proposed scheme include impacts to the following:

- Properties in the area (both commercial and residential);
- Local amenities (parks, walkways, sports facilities, commercial outlets, etc.);
- The integrity of transportation in the area, including the road and public transport network;
- Services in the area, including gas distribution, electricity, waste- and surface water collection, and telecommunications infrastructure; and
- Risk to public health.

If the proposed scheme were not to be implemented, there would be little opportunity to decrease the likelihood that future flooding events would occur. Equally, the employment opportunities arising in the construction phase would also be lost.

8.5.2 Construction Impacts

8.5.2.1 Heritage

Impacts on heritage are likely to occur only in the construction phase of the proposed scheme. Impacts on heritage are dealt with in **Chapter 13 Archaeological, Architectural and Cultural Heritage**.

8.5.2.2 Local Amenity Impacts

During the construction phase (approximately 18 months), the impacts on local amenities will relate primarily to closures and accessibility.

The Glanmire GAA club is located along the regional road R639. As no works are planned in the vicinity of the club, no direct impact is expected on the GAA club.

The Sarsfields GAA club is situated within the proposed scheme area, along the local road L3010. The principal impacts on the GAA club will be related to the generation of construction traffic, noise, vibrations, and dust. These are discussed in the relevant chapters of this EIS (**Chapter 9 Noise and Vibration, Chapter 10 Air Quality and Climate, and Chapter 14 Roads and Traffic**). Access to the club and pitches will be maintained throughout the construction phase.

Community playing fields are located at the Hazelwood Centre, where various works are proposed. Adjacent to the playing fields, works will be required to construct a reinforced concrete culvert, and ground will be regraded. This has the potential to indirectly impact on the playing fields during the construction phase in terms of construction traffic, noise and dust. However, access will be maintained throughout the construction period, which will mean that the playing fields remain functional. Refer to the relevant chapters of this EIS (**Chapter 9 Noise and Vibration, Chapter 10 Air Quality and Climate, and Chapter 14 Roads and Traffic**).

Additional playing fields are also located in lower Glanmire along the regional road R639. No works are proposed in the vicinity of the fields, therefore there will be no impact on the fields during the construction phase.

John O’Callaghan Park is located within the scheme area, and is a valuable amenity for the local community. Works are proposed in the vicinity of the park at Riverstown Bridge, which have the potential to impact on it. Construction traffic may temporarily disrupt the amenity value of the area, due to noise and dust. Refer to the relevant chapters of this EIS (**Chapter 9 Noise and Vibration, Chapter 10 Air Quality and Climate, and Chapter 14 Roads and Traffic**).

8.5.2.3 Homes

Typical temporary construction impacts at individual residences include noise, vibration, dust and traffic associated with construction works (refer to **Chapter 9 Noise and Vibration, Chapter 10 Air Quality and Climate, and Chapter 14 Roads and Traffic**). Trees and vegetation will require to be removed to facilitate the construction works. While the construction period is estimated to last approximately 18 months, works duration in each area is generally expected to be much shorter. With appropriate mitigation, including a construction environmental Management Plan (CEMP) to be implemented for the construction stage, the impacts are not considered to be significant. Construction works are proposed in the vicinity of sensitive receptors at the following locations, and impacts other than those described in other chapters of this EIS are summarised in **Table 8.5** below. Refer also to the exhibition drawings for details of the proposed works which are provided in **Appendix 3.1** of this EIS.

Table 8.5: Potential Construction Impacts on Homes

Area	Location	Description/Potential Impacts
Area 1: Sallybrook Industrial Estate	Bleach Hill Stream - Cúil Chluthair housing estate	There are a number of houses in this estate. There is only one entrance to this housing estate, leading from the local road L2973, a bridge over the Bleach Hill Stream. Construction works are required to replace the existing twin culverts with a larger culvert. These works may result in temporary vehicular restrictions on access and egress. The Contractor will be required to maintain access to the housing estate during the construction phase.
	Downstream of Cúil Chluthair housing estate	Works are proposed on the left bank of the River for the construction of a flood defence wall, and an embankment, adjacent to the Sallybrook Industrial Estate. There are a number of residences located in the vicinity including (Sallybrook House). There is a potential for the generation of noise, vibration and dust emissions and construction traffic due to construction activities in this area.
	Mill Buildings	A flood defence wall is proposed on the left bank of the right branch of the River at the Mill Race. A residence is located on the right bank of the left branch of the River (the old Pike Mill).
Area 2: Hazelwood	To the north of the Hazelwood Centre Shopping Centre	Bridge replacement proposed at Hazelwood Shopping centre. New flood relief channel and new culvert proposed beneath Hazelwood Avenue. Culvert replacements at Cois na Gleann. Flood defence walls proposed along Glashaboy River at this location. There is a potential for the generation of noise, vibration and dust emissions as well as construction traffic due to construction activities in this area.
	Meadowbrook	Works to construct flood defence walls are planned for the Meadowbrook housing estate, located to the southwest of the shopping centre. There is a potential for the generation of noise, vibration and dust emissions and construction traffic due to construction activities in this area.
Area 4: Butlerstown /Glenmore	Brooklodge Grove	A number of residential properties are located within the vicinity of the works proposed along Brooklodge Grove. There is a potential for the generation of noise, vibration and dust emissions and construction traffic due to construction activities in this area

Area	Location	Description/Potential Impacts
	Copper Valley Vue	Copper Valley Vue is a housing estate located along the Glenmore River. Works are proposed on the left bank of the River to the north of the housing estate. There is a potential for the generation of noise, vibration and dust emissions and construction traffic due to construction activities in this area
Area 5: O'Callaghan Park	The Grove, Glanmire Rd	A flood wall is proposed along the R639 in order to minimise flood risk to a number of residences (The Grove). There is a potential for the generation of noise, vibration and dust emissions and construction traffic due to construction activities in this area.

8.5.2.4 Tourism

The proposed development will have limited impact on the tourist facilities in the area. Facilities at the disposal of tourists in the area are predominantly commercial outlets, accommodation, public houses and restaurants. There is potential for short-term disturbance due to the impacts of construction works. Impacts on these facilities have been discussed in Section 8.4.2.2 Local Amenity Impacts.

8.5.2.5 Population

The total duration of the works will be 18 months. The works proposed at the individual areas listed in **Table 8.5** will be significantly less than this time period (generally between 8-16 weeks in each location and significantly less so in some locations). It is not envisaged therefore that those working on the scheme will be required to relocate to the area in order to carry out their work, and will be able to travel daily to and from the site. This means there will be no significant impact on population due to influx of construction workers, nor any pressure on housing supply. The proposed drainage scheme will have limited potential to impact on population trends, household size or housing density.

8.5.2.6 Employment

The proposed scheme has the potential to positively impact on employment in the area. The duration of the construction phase will be approximately 18 months. Where possible, a local labour force will be employed. Materials required will also be sourced locally where possible. This will have a short-term positive impact on employment in construction in the local area and those supplying building materials.

8.5.2.7 Economic Activity

The construction phase of the proposed scheme will last approximately 18 months. There is the potential for short-term negative impacts on economic activity during this phase, in particular in the Hazelwood Shopping Centre area. These are likely to be as a result of traffic and disruptions in accessibility to individual businesses, and also to their associated parking facilities, which would result in a temporary loss of business. Further detail of construction traffic impacts is provided in **Chapter 14 Roads and Traffic**.

The proposed scheme has the potential to positively impact on economic activity in the area in an indirect manner. This is due to the short-term increase in employment, which can lead to an increase in household spending. Local businesses may benefit from an increase in demand for their goods and services.

The proposed scheme will have no impact on industrial emissions licensed facilities during the construction phase.

8.5.3 Operational Impacts

8.5.3.1 Heritage

There will be no operation impact on the local heritage.

8.5.3.2 Homes

As discussed in **Chapter 2 Need for the Scheme**, there is a history of flooding in the Glashaboy River catchment. There was a significant flood event in June 2012 in the Glanmire/Sallybrook area which occurred following extremely heavy rainfall. The June 2012 flooding was the highest recorded flooding event. This significant flooding resulted in considerable damage to residential and commercial properties throughout the area.

Flooding also recently occurred during the winter of 2015. The cumulative rainfall that fell in the Cork area in December 2015 was unprecedented, being circa three times the long term average and having an estimated return period of circa 1 in 200 years. This meant that the catchment was extremely saturated in advance of the flood event of 29th December 2015. This led to extremely high groundwater levels and a high rate of runoff from the surrounding lands. As a result there was a considerable amount of flooding experienced in the Glanmire/Sallybrook area and in particular in the Meadowbrook estate, The Grove, Copper Valley View and Hazelwood shopping centre. Like in 2012, this resulted in considerable damage to properties in the area.

Flooding has caused severe damage to properties in Glanmire in the past. Such flood events destroy the internal contents of the house including the electrics, plumbing, interiors and may cause structural damage. Cars and other vehicles often have engines flooded and are not deemed road worthy. Many people do not have the financial means after a flood to replace personal belongings or repair the damage for some time or at all.

The proposed flood protection measures as part of the Glashaboy (Glanmire/Sallybrook) Drainage scheme will significantly reduce the risk of flooding in the area and as a result, the scheme will have a long-term significant positive impact.

8.5.3.3 Tourism and Local Amenity Impacts

The operation phase of the drainage scheme will not have a negative impact on tourism in the area. The flood protection measures will reduce the risk of flood damage to tourism amenities in the area such as shops, cafes, restaurants, hotels and guesthouses. The scheme will have a long-term positive impact on the tourism and local amenities of the area.

8.5.3.4 Population

There will be a positive impact on health and safety for those living and working in the Glanmire area. As stated in the OPW document '*The Planning System and Flood Risk Management: Guidelines for Planning Authorities*' (OPW, 2009), flooding has the potential to cause physical injury, illness and loss of life. Such events also cause severe stress and trauma on those affected and especially on those most vulnerable due to age, illness or limited mobility.

There will be no significant air or noise emissions from the scheme once it is operational. The pumping stations will generate noise but the pumps will be located underground and therefore the resulting noise impacts will be negligible. A foul pumping station will be installed and ventilation will be part of the design to prevent odours. The foul pump will serve to protect floodwater from being contaminated with sewage.

The drainage scheme will have a long-term positive impact on the local population.

8.5.3.5 Employment and Economic Activity

The increase flood protection as a result of this proposed scheme will contribute to securing businesses and jobs in the area. Existing properties will benefit from the greater flood protection and this will also contribute towards attracting additional investment and jobs to the area as properties become more attractive to rent or buy.

There will be no impacts on traffic during the operational phase unless maintenance works are required. Significant maintenance works are not envisaged therefore the corresponding traffic impacts during maintenance will be minimal.

8.5.4 Potential Cumulative Impacts

Cumulative impacts are those impacts that are compounded by the parallel undertaking of other developments in the same area. There are no proposed developments in the area with the potential to exert significant cumulative impacts on the population of the area.

The N8 Dunkettle Interchange Improvement Scheme has been proposed to improve traffic flows at the Dunkettle roundabout. This scheme will involve the upgrade of the existing interchange to fully free-flowing status. Plans for the scheme were first announced in 2011 and it is currently part of the capital expenditure programme. However there is no construction timeframe for the programme. The scheme may commence construction in late 2018.

Planning permissions for 103 dwelling units are still extant outstanding on zoned lands in Glanmire, according to the Blarney Electoral Area LAP (2015). Should these developments go ahead, in parallel with the drainage scheme, there is a potential that the impacts of the proposed development would be compounded by the additional construction works, and associated impacts in the immediate vicinity of those developments. These impacts could include increased congestion on roads due to construction vehicles, increased noise and vibration during construction works, and increased dust generation.

A variety of large-scale construction projects have the potential to generate cumulative impacts in conjunction with the proposed drainage scheme. In the event that such a project were to be undertaken in parallel, the construction impacts, and particularly those relating to the road and transport infrastructure, would need to be taken into account in the preparation of the construction traffic management plan.

8.6 Proposed Mitigation Measures

8.6.1 Construction Mitigation Measures

The outline design has considered, where possible, likely construction impacts such as noise, vibration and dust emissions as well as construction traffic impacts. Where practicable, construction methodologies have been proposed which will minimise these short term impacts. Mitigation measures as discussed below, will also help to minimise impacts during the construction stage of the scheme.

8.6.1.1 Heritage

Mitigation measures for Heritage are dealt with in **Chapter 13 Archaeological, Architectural and Cultural Heritage**.

8.6.1.2 Local Amenity

A construction environmental management plan (CEMP) will be implemented to reduce the impact of construction works. Refer to **Chapter 4 Construction Activities** for further information.

Industry-standard traffic management measures will be put in place to alleviate construction-related traffic disruptions. Refer to **Chapter 14 Roads and Traffic** for further details.

Noise and vibration disturbance will also be minimised. Best practice measures for noise control on construction sites will be adhered to during construction. Refer to **Chapter 9 Noise and Vibration** of the EIS for further detail of noise mitigation measures.

8.6.1.3 Tourism

The period of construction works will be approximately 18 months. The works programme will be designed to minimise impacts on the value of local amenities to the tourism industry. In particular, they will include provisions for protecting the river from silt and limiting working hours to avoid disruption. Access to tourist amenities such as shops, restaurants and public houses will be maintained throughout the construction stage to ensure minimal impact on tourism.

8.6.1.4 Population

Noise disturbance will be minimised. Best practice measures for noise control will be adhered to during construction. Refer to **Chapter 4 Construction Activities** and **Chapter 9 Noise and Vibration** of the EIS for further detail of noise mitigation measures.

A traffic management plan will be implemented to minimise disruptions to traffic. Refer to **Chapter 14 Roads and Traffic** for further details.

Dust emissions will be controlled throughout the construction phase. Refer to **Chapter 4 Construction Activities** and **Chapter 10 Air Quality and Climate** for details of dust mitigation measures.

8.6.1.5 Economic Activity

The impact on local economic activity can be reduced through ensuring access to local businesses is maintained. A construction traffic management plan will be prepared and implemented to ensure that any impacts are minimised. Traffic restrictions will be limited in time and to ensure that impacts are only felt for the shortest possible period of time. The period of works will also account for “high season” and busy periods, e.g. Christmas. Refer to **Chapter 14 Roads and Traffic** for further information on traffic management.

Noise and dust disturbance will be minimised. Best practice measures for noise control will be adhered to during construction. Refer to **Chapter 9 Noise and Vibration** of the EIS for further detail of noise mitigation measures.

Dust emissions will be controlled throughout the construction phase. Refer to **Chapter 10 Air Quality and Climate** for details of dust mitigation measures.

8.6.2 Operational Mitigation Measures

The overall impacts of the proposed drainage scheme will be permanent and positive, and therefore mitigation is only proposed for the operational phase when maintenance works are required.

Maintenance works may be undertaken at various intervals post-construction in order to ensure that blockages (e.g. fallen trees) within the river are not impacting on conveyance or to repair structural elements of the drainage scheme such as flood walls, culverts etc. Mitigation measures during the operation phase will relate primarily to these maintenance works, and will broadly reflect those employed for the construction phase but on a much smaller scale. Refer to section 8.6.1.

8.7 Residual Impacts

The proposed Glashaboy (Glanmire/Sallybrook) Drainage Scheme will significantly reduce the risk of flooding in the area and as a result, the scheme will have a long-term significant positive impact both for residents, local amenity, tourism and economic activities.

The overall impact of the scheme on the local amenities will be positive and permanent with flood defence measures designed to protect local amenities such as shops and restaurants.

Likewise, the flood protection measures will reduce the risk of flood damage to tourism amenities in the area such as shops, cafes, restaurants, hotels and guesthouses. The scheme will have a long-term positive impact on the tourism and local amenities of the area.

The drainage scheme will have a long-term positive impact on the local population.

The increase flood protection as a result of this proposed scheme will contribute to securing businesses and jobs in the area. Existing properties will benefit from the greater flood protection and this will also contribute towards attracting additional investment and jobs to the area as properties become more attractive to rent or buy.

The residual impacts of the scheme are also described in the following chapters:

Chapter 4 Construction Activities

Chapter 7 Landscape and Visual

Chapter 9 Noise and Vibration

Chapter 10 Air Quality and Climate

Chapter 11 Soils, Geology and Hydrogeology

Chapter 12 Hydrology

Chapter 14 Roads and Traffic

Chapter 15 Material Assets

Chapter 16 Cumulative Impacts.

8.8 References

Censuses of Ireland 2006 and 2011

Central Statistics Office *Quarterly National Household Survey Quarter 2 2016* (www.cso.ie).

Cork City and County Councils *Cork Area Strategic Plan 2001-2020*.

Cork County Council *Blarney Electoral Area Local Area Plan 2011 2nd Edition*.

Cork County Council, *Cork County Development Plan 2014*.

Fáilte Ireland Annual Report 2014.

Indecon, RPOS and Savills HOK (2008) *The Cork Area Strategic Plan – Strategy for Additional Economic and Population Growth – An Update*.

Local Electoral Area Boundary Committee, *Committee Report 2013*.

South West Regional Authority *Regional Planning Guidelines 2010-2022*.

Office of Public Works (2009) *The Planning System and Flood Risk Management: Guidelines for Planning Authorities, November 2009*

9 Noise and Vibration

9.1 Introduction

This section of the EIS comprises an evaluation of the noise and vibration impacts associated with the Glashaboy River (Glanmire/Sallybrook) Drainage Scheme. The assessment identifies any potential sensitive noise receptors and the current environmental noise levels at these locations. The section identifies the main noise and vibration impacts associated with the proposed scheme as relating to construction work and traffic generated during the construction phase. It then addresses the potential exposure of these receptors to noise generated as a result of the proposed drainage scheme.

9.2 Methodology

A desktop assessment was carried out to determine the noise and vibration impacts of the proposed drainage scheme. Due to the nature of the works, noise and vibration impacts are not expected during the operational phase. The desktop assessment has therefore analysed the potential impacts of the noise generated during the construction phase of the proposed scheme on the sensitive receptors. In doing so, it has taken cognisance of the following standards and guidelines:

- *Revised Guidelines on the Information to be contained in Environmental Impact Statements Draft September 2015;*
- *Advice Notes for Preparing Environmental Impact Statements Draft September 2015;*
- *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)", 2012; and*
- *Cork Agglomeration Noise Action Plan 2013-2018, Cork County and City Councils.*

The Transport Infrastructure Ireland (TII, formerly NRA) *Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes* (TII, 2014), the *Guidelines for the Treatment of Noise and Vibration in National Road Schemes* (TII, 2004) was also considered in the preparation of the assessment. This document sets out noise and vibration limits for the construction phase which are generally applied by planning authorities to all construction projects.

9.2.1 Noise Assessment Criteria

There is currently no statutory guidance relating to the maximum permissible noise level for a project's construction phase. Current guidance on permissible noise levels is therefore considered somewhat limited. In the absence of any statutory guidance or other specific limits prescribed by local authorities, an appropriate best practice measure has been adopted as the standard for this project. Best practice guidelines are taken from the British Standard BS 5228 – 1: 2009 +A1 2014: '*Code of practice for noise and vibration control on construction and open sites – Noise*'.

BS 5228 sets out an approach for setting appropriate construction noise limits for residential dwellings, but it does not provide guidance for commercial or office buildings.

The BS 5228 ‘ABC Method’ calls for the designation of a noise sensitive location into a specific category (A, B or C) based on existing ambient noise levels in the absence of construction noise. This then sets a threshold noise value that, if exceeded, indicates a significant noise impact is associated with the construction activities as summarised in **Table 9.1**.

Table 9.1: Example Threshold of Significant Effect at Dwellings

Assessment Category and Threshold Value Period (L_{Aeq})	Threshold Value (dB)		
	Category A ^A	Category B ^B	Category C ^C
Night-time (23:00 to 07:00hrs)	45	50	55
Evenings & Weekends ^D	55	60	65
Daytime (07:00 – 19:00hrs) and Saturdays (07:00 – 13:00hrs)	65	70	75

Note A: Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.

Note B: Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.

Note C: Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.

Note D: 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.

9.2.2 Vibration Assessment Criteria

Vibration standards come in two varieties: those dealing with human comfort, and those dealing with cosmetic or structural damage to buildings. For the surface construction works proposed here, vibration is expressed in terms of Peak Particle Velocity (PPV) in mm/s. There are no expected significant vibration sources associated with the development once the facility becomes operational.

Building Damage Building Response British Standard 7385-2 (1993) gives guidance regarding acceptable vibration in order to avoid damage to buildings. British Standard BS 5228-2 (2009) reproduces these guidance values.

These standards differentiate between transient and continuous vibration. Surface construction activities are transient because they occur for a limited period of time at a given location. Risk of cosmetic damage to residential buildings starts at a Peak Particle Velocity (PPV) of 15mm/s at 4Hz. Below 12.5 mm/s PPV, the risk of damage tends to zero. Important buildings that are difficult to repair might require special consideration on a case by case basis, but buildings of historical importance should not (unless it they are structurally unsound) be assumed to be more sensitive. If a building is in a very unstable state, then it will tend to be more vulnerable to the possibility of damage arising from vibration or any other groundborne disturbance.

The most significant sources of transient vibration during the construction phase of the development are likely to be from the following activities:

- Rock breaking during excavation;
- Breaking of existing road surfaces during road works;
- Vibratory rolling during road works, and

- Piling foundations, depending on the methodologies chosen.

Table 9.2 summarises the vibration levels below which there is no risk of damage to buildings. These limits apply to vibration frequencies below 15Hz where the most conservative limits are required. For protected or potentially vulnerable buildings, the recommended construction vibration limit is reduced by 50%.

Table 9.2: Transient Vibration Impact Criteria for Buildings (conservative criteria below which there is no risk of cosmetic damage).

Category of Building	Threshold of potential significant effect (Peak Particle Velocity - PPV - at building foundation) for Transient Vibration
Structurally sound and non-protected buildings	12 mm/s
Protected and / or potentially vulnerable buildings	6 mm/s

9.2.2.1 Human Perception

Humans are sensitive to vibration stimuli, and perception of vibration at high magnitudes may cause concern. Vibration typically becomes perceptible at around 0.15 to 0.3 mm/s and may become disturbing or annoying at higher magnitudes. During surface construction works (piling, rock breaking etc.) the vibration limits set within **Table 9.2** would be perceptible to building occupants and would have the potential to cause subjective impacts.

However, higher levels of vibration are typically tolerated for single events or events of short term duration, particularly during construction projects and when the origin of vibration is known. For example, piling can typically be tolerated at vibration levels up to 6 mm/s during the daytime and the evening if those affected are aware of the time-frame and origin of the vibration, and if they have been informed about the limit values relating to the structural integrity of neighbouring properties.

Therefore, regarding the human perception of vibration, the best way to reduce impacts on those in the locale is to plan and implement an effective public communications strategy informing neighbours about the time and duration of the vibration, that the vibration is being monitored, and that it is within safe limits.

9.3 Receiving Environment

9.3.1 Noise Receptors

Noise receptors are the entities likely to be sensitive to the increasing noise levels resulting from construction activities. The EPA defines noise sensitive locations as “*any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels*”.

Noise sensitive locations across the proposed scheme consist predominantly of homes and businesses. As the scheme is proposed in a built-up area, with many residences and commercial properties, the potential impacts are likely to be on homes and businesses. These will be affected only during daytime hours, when construction activities are intended to be carried out.

The study area is along the course of the Glashaboy River, passing through the settlements of Sallybrook, Glanmire and Riverstown. The noise environment is largely urban, and the noise profile is dominated by road traffic. The M8 motorway is within the vicinity of the proposed scheme, and there are many regional and local roads in the area also. Housing estates accessed from the roads tend to have lower levels of background noise, and there are also more rural areas along the route of the scheme that experience lesser noise levels. Typical noises may include local traffic and car movements, and human activities such as children playing and other voices. Many of the amenity areas along the scheme are characterised by birdsong, children playing, dogs barking, and pedestrian voices, i.e. O'Callaghan Park and the riverside walks.

9.4 Characteristics of the Proposed Development

The characteristics of the proposed development with respect to noise and vibration are related to construction phase, as there will be no noise or vibration generated by the scheme once it becomes operational. Sources of noise are related to the required plant and machinery and to the works to be carried out. Construction works likely to generate noise and vibration are as follows:

- Reinstatement or replacement of existing flood defence walls;
- Construction of new flood defence wall;
- Formalising or reinstatement of existing flood defence embankment;
- Replacement of a bridge;
- Conveyance improvements;
- Construction of new flood relief culverts;
- Replacement of existing culverts;
- Provision of road ramps;
- Regrading of road/footpaths;
- Culverting of local drains;
- New surface water pumping stations and foul pumping station; and
- Protecting drainage outlets along flood defence lines with flap valves.

All construction works are likely to generate noise and vibration to varying degrees, due to intensity of the works and due to the machinery involved. In addition, the noise and vibration will be perceived differently in proportion to the distance from the receptor to the source.

9.5 Evaluation of Impacts

9.5.1 Construction Impacts

9.5.1.1 Construction of flood defence walls, culverts and bridges

Works proposed: Reinstatement or replacement of existing flood defence wall and construction of new flood defence walls; construction or replacement of culverts; culverting local drains; replacement of a bridge.

Flood defence walls are proposed at Sallybrook Industrial Estate, Hazelwood, Meadowbrook, Copper Valley Vue, O'Callaghan Park, and downstream of Glanmire Bridge.

Culverts are to be constructed or replaced at Cúil Chluthair housing estate, Cois na Gleann Stream in Hazelwood, the Hazelwood Shopping Centre, Meadowbrook, and the entrance to the Copper Valley Vue estate.

The bridge at Hazelwood Shopping Centre will be replaced. There are many houses and small businesses in close proximity to areas where flood defence walls, culverts, and bridges require construction, which means there is potential for impacts on sensitive receptors in the vicinity of the proposed works.

Where in-stream works are required as part of construction, this may require over pumping, which will produce low levels of noise. Pumps are also a source of vibration, which is likely to be a constant low-frequency vibration for the duration of the use of the pump.

Site excavations will be required. Excavators, scrapers, concrete mixers and concrete pumping can be noisy and can potentially impact on sensitive receptors, with the greatest impact on those located within a close distance of the construction site. The impact is likely to be moderate and temporary.

9.5.1.2 Flood Defence Embankments

Works proposed: Formalising, reinstatement and construction of existing flood defence embankment

An embankment is proposed at Sallybrook Industrial Estate. Where it is proposed to construct embankments, a number of HVG movements will be required to deliver materials to the site. This will generate noise, however it is not expected that this impact will be significant, as the noise environment is already dominated by traffic noise.

9.5.1.3 Works to Roads

Works proposed: Provision of road ramps, and regrading of road/footpaths

Works required to roads generate noise. It is likely that the increased movement of HGVs will result in an increase in overall noise levels, but this impact is not expected to be significant due to the noise environment already being dominated by traffic noise.

9.5.2 Operational Impacts

Once the scheme is built, the surface water and foul pumping stations have potential to generate noise. The surface water stations will be installed underground so it is not envisaged it will have a significant impact. The pump will also only be in operation during flood events. The foul pumping station will be installed underground with a smaller kiosk above ground. This will also only be operational during flooding events and it is unlikely to have a significant effect.

9.5.3 Potential Cumulative Impacts

Cumulative impacts are those impacts that are compounded by the parallel undertaking of other developments in the same area. There are no proposed developments in the area with the potential to exert significant cumulative impacts on the population of the area.

In the vicinity of the scheme, the most significant pending construction scheme on the road network is the N8 Dunkettle Interchange Upgrade Scheme. This scheme will involve the upgrade of the existing interchange to fully free-flowing status. Although the scheme currently has planning permission, and is part of the current capital expenditure programme, there is currently no construction timeframe for this scheme. It is likely that the scheme may commence construction in mid-2018, although there is no current start date. It is assumed that the Glashaboy drainage scheme will commence in Q3 of 2017, which would result in a completion date in early 2019. The two schemes may therefore overlap slightly. Works such as excavation works, with potential impacts on noise and vibration, will occur in the initial stages of the construction and less likely to conflict with the Dunkettle Interchange Scheme.

Planning permissions for 103 dwelling units are still outstanding on zoned lands in Glanmire, according to the Blarney Electoral Area LAP (2015). Should these developments go ahead, there is a potential that the impacts of the proposed development would be compounded by the additional construction works, and associated impacts. These impacts could include increased noise and vibration during construction works.

A variety of large-scale construction projects have the potential to generate cumulative impacts in conjunction with the proposed drainage scheme. In the event that such a project were to be undertaken in parallel, the construction impacts, and particularly those relating to the increase in noise levels, would need to be taken into account.

9.6 Proposed Mitigation Measures

9.6.1 Construction Mitigation Measures

Construction noise will be kept to a minimum in accordance with BS 5228 (2009). The contract documents will specify that the contractor, undertaking the construction of the works, will be obliged to take specific noise abatement measures and will comply with the best practice outlined in British Standard BS 5228 – 1: 2009 +A1 2014: *Code of Practice for Noise and Vibration Control on Construction and Open Sites – Noise* and the NRA (now TII) guidelines *Good Practice Guideline for the Treatment of Noise during the planning of National Road Schemes* (NRA 2014). The following measures will also be employed:

- Selection of plant machinery with low inherent potential for generation of noise and/or vibration. All construction plant and equipment to be used at the site will be modern equipment and will comply with the relevant legislation and regulations
- Regular maintenance of plant will be carried out in order to minimise noise produced by on-site operations. The regular and effective maintenance of plant can play an important role in reducing noise emissions. In particular, attention will be paid to the lubrication of bearings and the integrity of silencers. Silencers and engine covers will be maintained in good and effective working order.
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the Contract.

- Any compressors used on-site will be of the “sound reduced” models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers.
- Machines, which are used intermittently, will be shut down or throttled back to a minimum during those periods when they are not in use.
- Any plant, such as generators or pumps, which are required to work outside of normal working hours, will be surrounded by an acoustic enclosure.
- Training of drivers to ensure smooth machinery operation/driving, and to minimise unnecessary noise generation.
- A maximum speed limit of 40 km/hr will be imposed for HGV’s and drivers will be instructed to maintain as far as possible the distances between vehicles.

In terms of minimising vibration levels, the Contractor will be required to select and utilise methods of working and items of plant so that the maximum measured ground vibrations do not exceed a peak particle velocity (PPV) of 8.5mm per second at any occupied property, with a lower PPV limit of 5mm per second applying to properties in poor condition or other sensitive receptors.

The Contractor will be required to monitor ground vibrations at selected locations to the approval of the Employer’s Representative during the progress of the works. Each vibrograph shall be certified as being in proper working order and shall unless otherwise approved, record vibrations in three directions simultaneously with print-out showing the amplitude and frequency of the vibrations.

Vibration measurements shall be taken at the base of buildings, on the side facing the source of vibration. Where feasible, the measurement should be taken on a hard surface on the ground outside the building.

A pre-condition survey will also be undertaken of all properties potentially affected by the works (likely within a 10m radius of works areas). Crack monitoring will be installed on such affected properties and monitored throughout the works.

9.6.2 Operation Mitigation Measures

The operational scheme will not generate noise or vibration and therefore mitigation is not required for this phase.

9.7 Residual Impacts

Residual impacts are not envisaged.

9.8 References

BS 5228-1 and 2:2009+A1:2014 (2014) *Code of practice for noise and vibration control on construction and open sites. Noise and Vibration*

European Communities (2001) *Noise Emission by Equipment for Use Outdoors Regulations, 2001*

International Electrotechnical Commission (IEC) (2002) *IEC 61672-1 Electroacoustics – Sound Level Meters – Part 1: Specifications*. IEC, Geneva, Switzerland.

International Standard ISO 1996: 2007: *Acoustics – Description, measurement and assessment of environment*.

Transport Infrastructure Ireland (TII), (formerly the National Roads Authority (NRA)) (2004) *Guidelines for the Treatment of Noise and Vibration in National Road Schemes*

TII (formerly the NRA) (2014) *Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes*. NRA, Dublin, Ireland

Cork County Council (2015) *Blarney Electoral Area Local Area Plan 2011, Second Edition*

10 Air Quality and Climate Introduction

This chapter of the EIS comprises an evaluation of the impacts that the Glashaboy River (Glanmire/Sallybrook) Drainage Scheme on the air quality and climate. The chapter evaluates the potential impacts of the scheme on air quality and climate during the construction and operation phases. It then discusses the measures that will be put in place to mitigate these potential impacts.

10.2 Methodology

10.2.1 Introduction

This chapter has been prepared sourcing the most relevant and recent air quality data for the Study Area. The following sources were used to source local air quality and climate information:

- Met Éireann (www.met.ie) The Irish Meteorological Service Online; and
- The Environmental Protection Agency – EPA Map Viewer Envision (www.gis.epa.ie/Envision).

10.2.2 Ambient Air Quality Standards

In order to reduce the risk of poor air quality, National and European statutory bodies have set limit values in ambient air for a range of air pollutants. These limit values are set for the protection of human health and ecosystems.

The Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011) transposed EU Directive 2008/50/EC into Irish law. The 2011 Regulations revoked the relevant previous Regulations.

The purpose of the 2011 Regulations is to establish limit values and alert thresholds for concentrations of certain pollutants, to provide for the assessment of certain pollutants using methods and criteria common to other European Member States, to ensure that adequate information on certain pollutant concentrations is obtained and made publically available and to provide for the maintenance and improvement of ambient air quality where necessary.

The limit values established under the 2011 Regulations are included in **Table 10.1** below.

Table 10.1: Air Quality Standards (AQS) from the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011)

Pollutant	Limit value for the protection of:	Averaging period	Limit value ($\mu\text{g}/\text{m}^3$)	Basis of application of limit value	Limit value attainment date
NO ₂	Human Health	1-hour	200	≤18 exceedances p.a. (99.79 %ile)	1 January 2010
		Calendar year	40	Annual mean	1 January 2010
NO _x	Vegetation	Calendar year	30	Annual mean	1 January 2010
PM ₁₀	Human Health	24-hours	50	≤35 exceedances p.a. (90%ile)	1 January 2005
		Calendar year	40	Annual mean	1 January 2005
PM _{2.5}	Human Health	Calendar year	25	Annual mean	1 January 2010
		Calendar year	20	Annual mean	1 January 2020

10.2.3 Climate

The Climate Action and Low Carbon Development Act 2015 is Ireland's first dedicated climate change law. The Act makes the provisions for requiring the Minister for Environment, Community and Local Government (as stated in the Act) to submit a National Mitigation Plan and a National Adaptation Framework to the Government for approval. These documents and framework are:

“For the purpose of enabling the State to pursue, and achieve, the transition to a low carbon, climate resilient and environmentally sustainable economy by the end of the year 2015...”

The Minister is required to submit the national mitigation plan within 18 months after the passing of the act and not less than once every five years.

The Act refers to the National Adaptation Framework which is to be known as the National Climate Change Adaptation Framework (NCCAF). This framework will develop a national strategy for the application of adaptation measures in different sectors and by local authorities to reduce the State's vulnerability to the negative effects of climate change, avail of the positive effects that may occur as a result of climate change and take into account existing obligations of the State under the EU or any international agreements. The 2012 NCCAF document published by the then Department of the Environment, Community and Local Government stated the projected impacts of climate change in Ireland as being:

- increasing average temperatures;
- more extreme weather conditions including storms and rainfall events;
- an increased likelihood of river and coastal flooding;
- water shortages, particularly in the east of the country;
- changes in types and distribution of species;
- the possible extinction of vulnerable species; and
- construction and operational phase impact methodology.

10.2.3.1 Significance Criteria

Significance criteria were adopted from the TII air quality guidelines, ‘*Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes*’ (2011) to assess the traffic impact of the construction phase of the scheme on air quality.

Table 10.2 includes significance criteria for the assessment of the potential impact of construction dust off-site.

Table 10.2: Assessment criteria for the impact of dust emissions from construction activities with standard mitigation in place

Source		Potential distance for Significant Effects (Distance from Source)		
Scale	Description	Soiling	PM _{10a}	Vegetation Effects
Major	Large construction sites, with high use of haul routes	100 m	25 m	25 m
Moderate	Moderate sized construction sites, with moderate use of haul routes	50 m	15 m	15 m
Minor	Minor construction sites, with limited use of haul routes	25 m	10 m	10 m

Note: ^a Significance based on the PM₁₀ Limit Values specified in SI No. 180 of 2011, which allows 35 daily exceedances/year of 50 µg/m³

10.3 Receiving Environment

10.3.1 Air Quality Zones

The EPA categorises Ireland into Air Quality Zones as required under the Clean Air for Europe (CAFE) Directive (2008/50/EC) whereby member states must designate air quality zones for the purposes of managing air quality. Four ‘Air Quality Zones’ were defined for Ireland under the Air Quality Standards Regulations (2011). There are currently four zones defined in Ireland:

Zone A: Dublin

Zone B: Cork

Zone C: Other cities and large towns comprising Limerick, Galway, Waterford, Drogheda, Dundalk, Bray, Navan, Ennis, Tralee, Kilkenny, Carlow, Naas, Sligo, Newbridge, Mullingar, Wexford, Letterkenny, Athlone, Celbridge, Clonmel, Balbriggan, Greystones, Leixlip and Portlaoise.

Zone D: Rural Ireland, i.e. the remainder of the State excluding Zones A, B and C.

The Study Area comes under both Zone B (Cork) and Zone D (rural Ireland) with Zone B Cork intersecting the lower section of the Glashaboy River to the estuary. **Table 10.3** shows the baseline monitoring data for Zone B and Zone D from the EPA for 2014.

Table 10.3: Baseline Monitoring Data for Zone B and Zone D for 2014

Pollutant	Annual mean 2014 Zone B	Annual mean 2014 Zone D	Air Quality Directive Limit Values
NO ₂	27 µg/m ³	4.6 µg/m ³	40 µg/m ³ /day
NO _x	64 µg/m ³	7.5 µg/m ³	30 (critical level or target value)
SO ₂	6 µg/m ³	2.5 µg/m ³	125 µg/m ³ /day
CO	400 µg/m ³	450 µg/m ³	10,000 µg/m ³ as 8 hr mean
PM ₁₀	17.5 µg/m ³	10.3 µg/m ³	40 µg/m ³ /year
PM _{2.5}	8 µg/m ³	9 µg/m ³	25 µg/m ³ /year

10.4 Characteristics of the Proposed Development

10.4.1 Construction Phase

Construction activities which are of relevance for air quality include excavations, general construction activities, movement of vehicles on-site during construction and air emissions arising from construction traffic. A detailed description of the proposed works to be constructed for the Glashaboy River (Glanmire/Sallybrook) Drainage Scheme is presented in **Chapter 4 Construction Activities**. Refer to **Section 10.5** below for details on potential impacts.

10.4.2 Operation Phase

Chapter 3 Description of the Proposed Scheme details the flood defence infrastructure that will be in operation once the scheme is complete. Of relevance to air quality are the five surface water pumping stations (different locations) and one foul pump station (at Meadowbrook). These will only be employed during a flood event. The surface water pumps will be installed underground. The main components of the foul pump will be installed underground with a small kiosk above ground. This kiosk will be well ventilated. The operation of this equipment be intermittent and temporary and therefore it is not envisaged they will have any significant effect on air quality or climate.

10.5 Evaluation of Impacts

10.5.1 Construction Impacts on Air Quality

The construction phase of the flood relief works may have a short-term impact on air quality in the immediate vicinity of the site due to the following activities that may generate some dust emissions. These activities include:

- Excavations;
- embankment works;
- general construction activities; and
- and movement of vehicles on-site during construction.

Dust emissions can lead to elevated PM₁₀ and PM_{2.5} concentrations. The potential for dust emissions will only arise during site clearance and excavation in dry weather. Dust may be raised by wind from dry surfaces and stockpiles.

Table 10.2 from the TII guidelines provides a semi-quantitative approach to determining the likelihood of a significant impact of dust in combination with the proposed mitigation measures. During the construction phase of the works, the works sites will typically be ‘*minor construction sites, with limited use of haul routes*’ (see **Table 10.2**). The TII guidelines state that under standard mitigation measures, the size and nature of the works sites proposed have the potential for significant effects by dust soiling for areas within 25m of the works. For areas within 10m of the works sites the guidelines state there is the potential for significant effects on vegetation and from PM₁₀ within 10m of the works site.

In the case of most works sites throughout the scheme there are a limited number of receptors within 25m and less within 10m of the works areas that will be potentially affected. The duration of works will also be less than the overall construction time estimated for the scheme. These works will be generally be to 14 weeks with many of the works being considerably less duration depending on the design.

In addition, dust emissions are significantly reduced where rainfall has occurred. Rainfall data collected from Cork Airport Meteorological Station (1962-1991) showed that the average year has 210 wet days (rainfall greater than 0.2mm). Therefore, just over 55% of time, no significant dust generation will be likely due to average meteorological conditions.

During construction there is also the potential impact on air quality by exhaust emissions generated by construction machinery on site and the transport of materials. Construction machinery movement generates exhaust fumes that will potentially increase the concentrations of nitrogen dioxide, PM₁₀, PM_{2.5} (as listed in **Table 10.3**) in the vicinity of the works sites. However, given the nature and scale of the works, the short-term duration and the number of construction vehicles required on the sites, exhaust emissions generated are not envisaged to have a significant impact. **Chapter 14 Roads and Traffic** describes the construction of the proposed scheme as having a “*temporary minor impact*” on the transport infrastructure in the area with mitigation measures implemented.

10.5.2 Operational Impacts on Air Quality

It is not envisaged that the Glashaboy (Glanmire/Sallybrook) Drainage Scheme works will have any significant impacts on air quality once operational. During a flooding event some surface water pumping stations. There are no constructed works that will have air emissions once operational.

10.5.3 Construction Impacts on Climate

Impacts on climate during the construction phase include the generation of greenhouse gases from exhaust emissions from on-site vehicle movements and the transport of materials. These emissions will be short-term and are not likely to be significant.

10.5.4 Operational Impacts on Climate

It is not envisaged that the Glashaboy (Glanmire/Sallybrook) Drainage Scheme works will have any significant impacts on climate once operational.

10.5.5 Potential Cumulative Impacts

Cumulative impacts are those impacts that are compounded by the parallel undertaking of other developments in the same area.

The N8 Dunkettle Interchange Improvement Scheme has been proposed to improve traffic flows at the Dunkettle roundabout. This scheme will involve the upgrade of the existing interchange to fully free-flowing status. Plans for the scheme were first announced in 2011 and it is currently part of the capital expenditure programme. However there is no construction timeframe for the programme. The scheme may commence construction in late 2018.

Planning permissions for 103 dwelling units are still extant on zoned lands in Glanmire, according to the Blarney Electoral Area LAP (2015). Should these developments go ahead, there is a potential that the impacts of the proposed development would be compounded by the additional construction works, and associated impacts.

These impacts could include increased localised dust and exhaust emissions associated with construction works and traffic during the construction phase.

10.6 Proposed Mitigation Measures

10.6.1 Construction Mitigation Measures

The construction mitigation measures are described in **Chapter 4 Construction Activities**. The following dust mitigation measures will be implemented by the contractor as part of the plan:

- Limiting vehicle speeds on the construction site;
- During very dry periods, spraying surfaces with water will control dust emissions from heavily trafficked locations;
- All vehicles exiting the site will make use of wheel wash facilities prior to entering onto public roads, to ensure mud and other wastes are not tracked onto public roads. Public roads outside the site will be regularly inspected for cleanliness, and cleaned as necessary. Wheel-washing facilities will be located away from sensitive receptors;
- Topsoil and other dusty material being moved onsite will be transported in covered trucks, where the likelihood of emitting dust is high, and during dry weather conditions the area of removal will be sprayed with water from a mobile tanker on a regular basis to control dust emissions;
- Exhaust emissions from vehicles operating within the site, including trucks, excavators, diesel generators or other plant equipment, will be minimised through regular servicing; and
- Dust monitoring will be carried out at the site boundary throughout the construction phase.

10.6.2 Operation Mitigation Measures

Operational mitigation measures for air quality and climate are not deemed necessary. The surface water stations and foul pumping station will only be in operation during a flood event. The use of the pumps are located underground and will be in temporary use when employed. They are not envisaged as having a significant impact on air quality and climate.

10.7 Residual Impacts

It is envisaged that once the drainage scheme works are complete and operational there will be no residual impacts on air quality or climate.

10.8 References

Department of the Environment, Community and Local Government (2012) *Building Resilience to Climate Change*.

Transport Infrastructure Ireland (2011) *Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Scheme*.

Cork County Council (2015) *Blarney Electoral Area Local Area Plan 2011, Second Ed.*

11 Soils, Geology and Hydrogeology

11.1 Introduction

This chapter describes the potential impacts of the Glashaboy River (Glanmire/Sallybrook) Drainage Scheme on soils, geology and hydrogeology. The existing environment is also described. Mitigation measures are proposed and the predicted residual impacts are described.

11.2 Methodology

This chapter has been compiled on the basis of a desktop assessment. The desktop assessment consisted of information on bedrock geology, superficial deposits, economic geology and geological heritage.

The following sources were consulted in compiling this section of the EIS:

- Geological Survey of Ireland (GSI) online database,
- Aerial photography,
- Envision online mapping, Environmental Protection Agency,
- Blarney Electoral Area Local Area Plan 2011 2nd Edition January 2015,
- Cork County Development Plan 2015-2022,
- Geology in Environmental Impact Statements – A Guide, Geological Society of Ireland 2002.

11.3 Receiving Environment

11.3.1 Bedrock Geology

The bedrock geology of the Study Area is dominated by Devonian Old Red Sandstones. Refer to **Figure 11.1**. These include the Gyleen Formation (GY in **Figure 11.1**) of sandstone with mudstone and siltstone and the Ballytrasna Formation (BS in **Figure 11.1**) of purple mudstone and sandstone to the north.

The central section of the Study Area is underlain with Dinantian mudstones and sandstones, the Cuskinny Member (KN cu in **Figure 11.1**) of flaser-bedded sandstone and mudstone of the Cork Group.

At the centre of the Study Area is a small section of Tournasian Limestone, the Ballysteen Formation (BA in **Figure 11.1**) dark muddy limestone and shale.

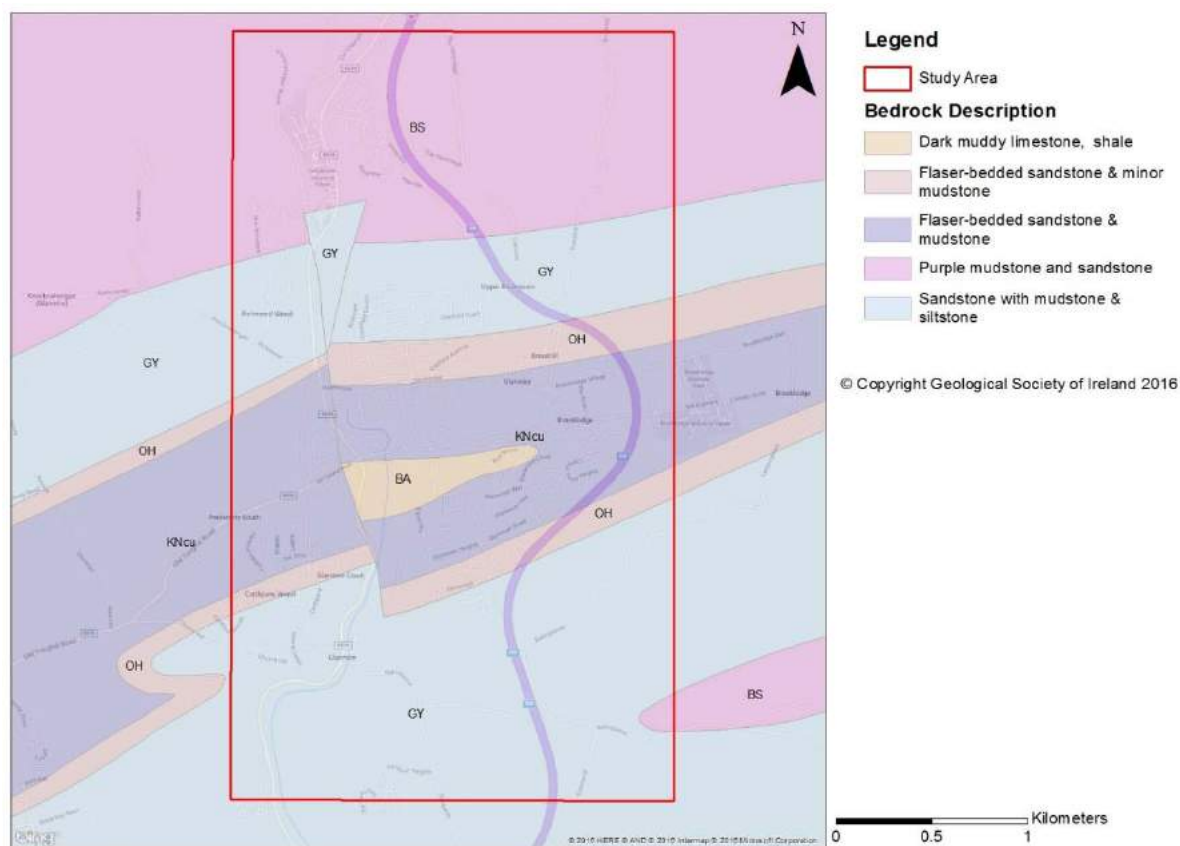


Figure 11.1: Bedrock geology of the Study Area. Source: Geological Society of Ireland (2016).

11.3.2 Subsoils

According to the GSI online database (Teagasc Subsoil map), the Study Area comprises of the following subsoils:

- Made Ground;
- Till derived from Devonian sandstones; and
- Alluvium.

There are also a number of bedrock outcrops along the upper (northern) and lower sections of the Study Area.

11.3.3 Hydrogeology

The Glashaboy River lies within the Balinhassig East groundwater body (GWB) which is described as poorly productive bedrock. In accordance with the Water Framework Directive 2000/60/EC, this GWB is identified as having “good status” but “at risk of not achieving good status”.

Groundwater flow in the Devonian Old Red Sandstones and Dinantian Mudstones and Sandstones generally occurs in fractures and faults with no intergranular permeability. Permeability is highest in the upper few metres but generally decreases rapidly with depth and in general, groundwater flow is concentrated in the upper 15m of the aquifer.

Groundwater recharge occurs diffusely through the subsoils and rock outcrops across the GWB. Groundwater discharges to springs and streams with the flow directions expected to approximately follow the local surface water catchments.

11.3.3.1 Aquifer Classification

The Geological Survey of Ireland has devised a system for classifying the aquifers in Ireland based on the hydrogeological characteristics, size and productivity of the groundwater resource. The three main classifications are Regionally Important Aquifers (RI), Locally Important Aquifers (LI) and Poor Aquifers (P).

The Geological Survey of Ireland aquifer classification for the Study Area and surrounds is “*Locally Important Aquifer (LI) – Bedrock which is Moderately Productive in Local Zones*”. Refer to **Figure 11.2**. In Glanmire, the locally important aquifer in the south of the scheme is made up of Devonian Old Red Sandstones with Dinantian Mudstones and Sandstones (Cork Group) in the northern area of the scheme.

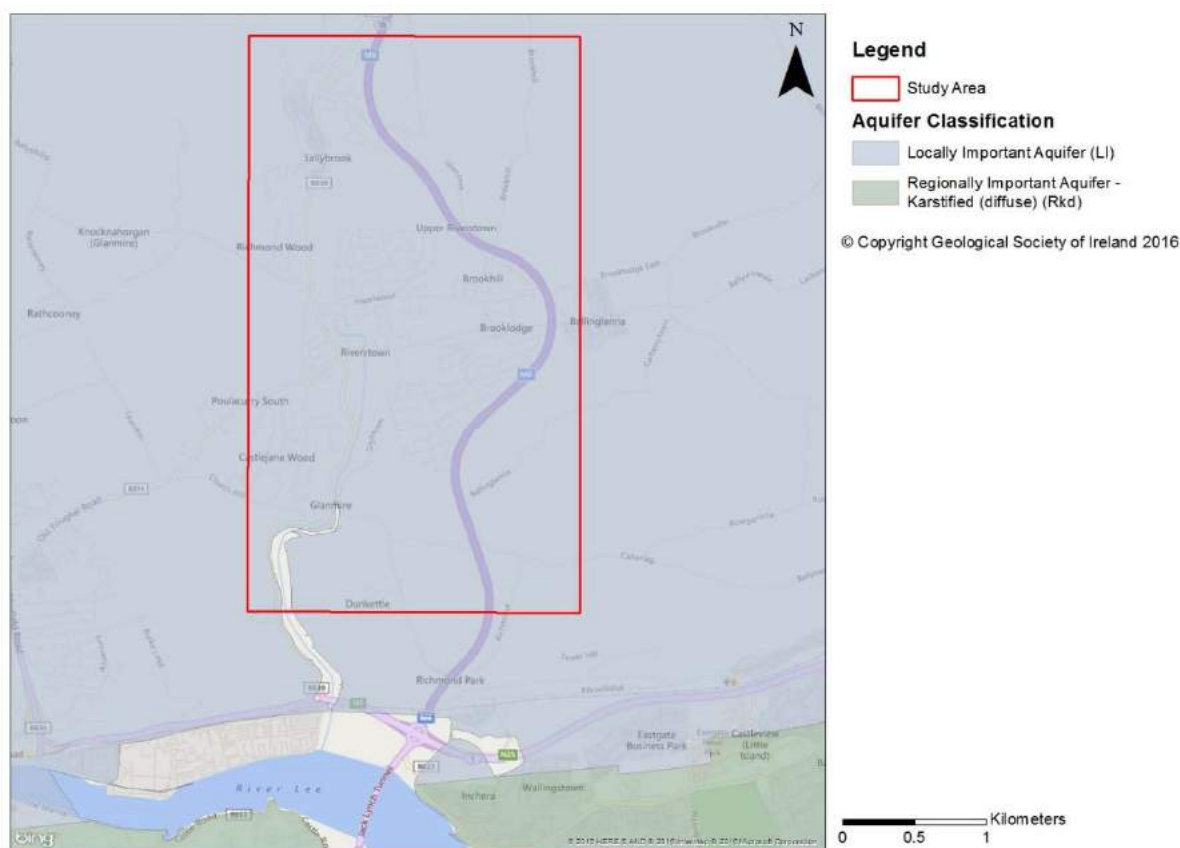


Figure 11.2: Aquifer classification of the Study Area. Source: Geological Society of Ireland (2016).

11.3.3.2 Groundwater Vulnerability

The vulnerability of a groundwater body is the term used to describe the ease with which the groundwater in the area can be contaminated by human activities. The vulnerability is determined by many factors including the travel time, the quantity of contaminants and the capacity of the deposits overlying the bedrock to attenuate contaminants.

These factors in turn are based on the thickness and permeability of the subsoil deposits, e.g. groundwater in bedrock which has a thick cover of low permeability clay is less vulnerable than the groundwater in bedrock which is exposed at the surface. The criteria for determining groundwater vulnerability, as developed by the Geological Survey of Ireland, are shown in **Table 11.1** below. The Extreme vulnerability class is further sub-divided into Extreme (X) – rock near Surface or Karst and Extreme (E) - subsoils <3m thick.

Table 11.1: GSI Groundwater Vulnerability Mapping Guidelines (DoELG 1999)

Vulnerability Rating	Hydrogeological Conditions				
	Subsoil Permeability (Type) & Thickness			Unsaturated Zone	Karst Features
	High Permeability (sand/gravel)	Moderate permeability (e.g. sandy subsoil)	Low permeability (e.g. clayey subsoil, clay, peat)	(sand/gravel aquifers only)	(<30m radius)
Extreme (E)	0 – 3.0m	0 – 3.0m	0 – 3.0m	0 – 3.0m	-
High (H)	>3.0m	3.0 – 10.0m	3.0 – 5.0m	>3.0m	N/A
Moderate (M)	N/A	>10.0m	5.0 – 10.0m	N/A	N/A
Low (L)	N/A	N/A	>10.0m	N/A	N/A
Notes: (1) N/A = not applicable					
(2) Precise permeability values cannot be given at present					
(3) Release point of contaminants is assumed to be 1-2m below ground surface					

The Geological Survey of Ireland groundwater vulnerability maps show that the main vulnerability rating of the bedrock aquifer on site ranges from ‘High (H)’ to ‘Rock at or near Surface or Karst’, indicating an overburden thickness of 0m to up to 10m. Refer to **Figure 11.3**.

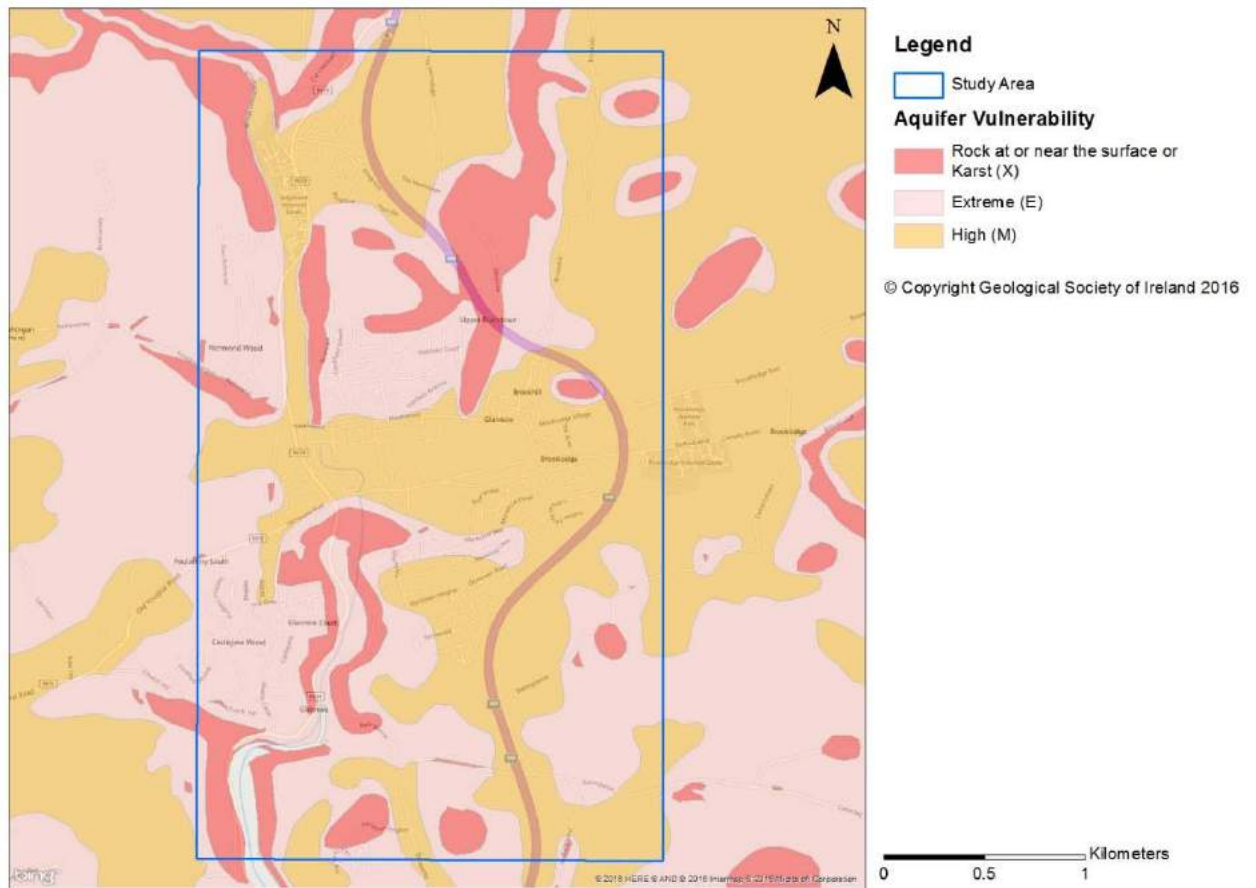


Figure 11.3: Aquifer vulnerability map. Source: Geological Survey of Ireland (2016).

11.3.4 Wells and Boreholes

The well card data by the GSI indicate that there are a number of wells within the Study Area. In particular there are two wells or springs adjacent to the Glashaboy River.

There is a recorded 'dug well' approximately 200m north of Glanmire Bridge between the R639 regional road and the river. The GSI database indicates that the location accuracy of this is to 100m. The second well or spring is described on the database as a borehole located south of the convergence of the Butlerstown Stream and Glashaboy River within 100m accuracy. Refer to **Figure 11.4**.

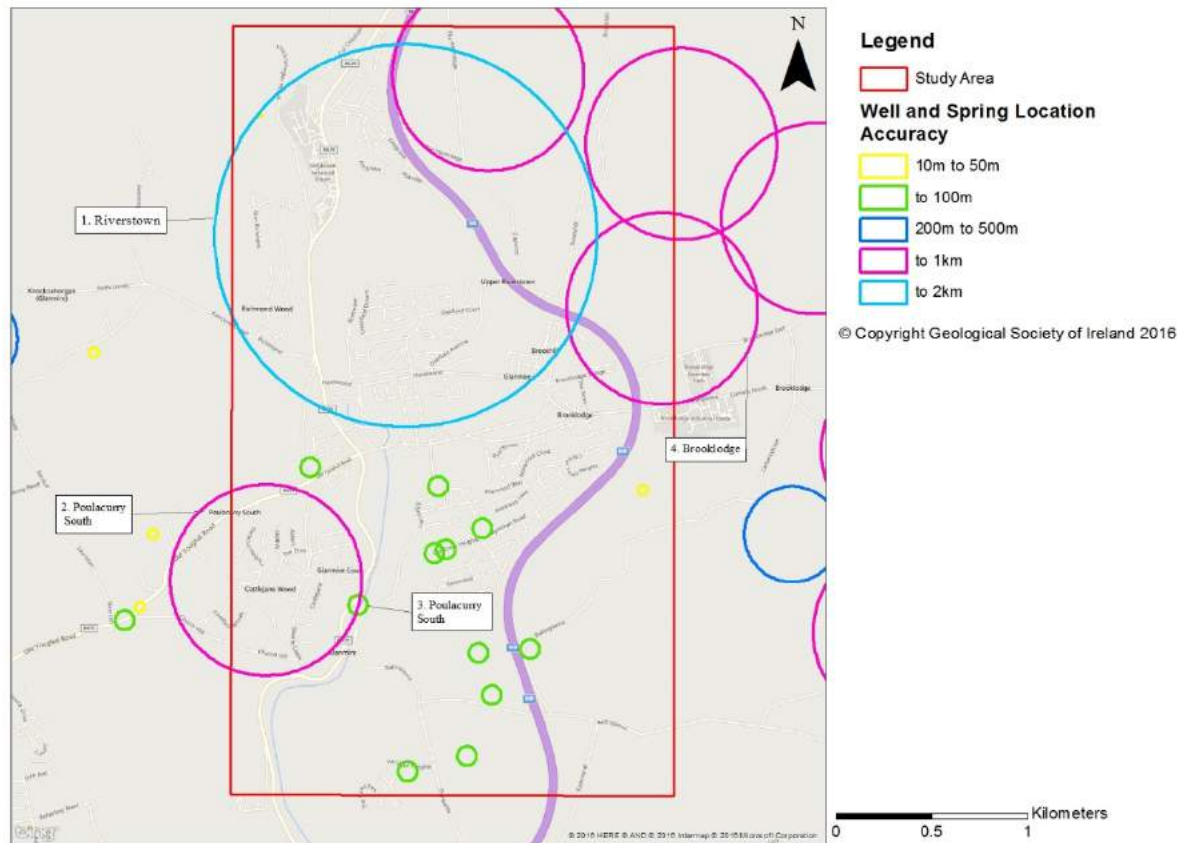


Figure 11.4: Wells and boreholes with location accuracy. Source: Geological Survey of Ireland (2016)

Table 11.2: Wells and boreholes identified in Figure 10.3. Source: Geological Survey of Ireland (2016)

No.	Townland	Depth (m)	Depth to rock (m)	Well Use	Yield Class	Yield (m ³ /day)
1	Riverstown	7	1.2	Unknown	Poor	9.9
2	Poulacurry South	28.7	NA	Unknown	Good	109
3	Poulacurry South	3.9	NA	Other	NA	NA
4	Brooklodge	36.6	6.4	Unknown	Poor	32.7

11.3.5 Geological Heritage

The GSI online database was checked for any geological heritage sites (GHS) in the Study Area. The online mapping showed no GHS sites within the Study Area.

11.3.6 Geohazards

The GSI National Landslide Database for Ireland was used to identify any past landslides in or near the Study Area. No such landslide events have been recorded in the Study Area.

11.3.7 Pits and Quarries

The Environmental Protection Agency online Map Viewer, Envision was used to identify any historical or current mines or quarries within or near the site. The nearest quarry to the site is in Carrigtwohill, approximately 10km east of Glanmire.

11.4 Characteristics of Proposed Development

The proposed scheme for the Glashaboy River comprises of a combination of flood defence walls, channel modifications, culverting (culvert replacement), bridge replacement, embankment construction, conveyance improvements and other minor works.

Whilst the majority of geotechnical investigation work has been completed, some further minor infill geotechnical investigations may be required prior to construction. These would consist of a mixture of shell and augur boreholes, cable percussive boreholes, rotary drilled boreholes, trial pits and slit trenches at the locations of the proposed structures. Soil samples collected on site will be sent to the lab for analysis. The soils will be characterised so that, should excess spoil material need to be disposed of off-site, it can be done appropriately in accordance with relevant waste legislation.

A detailed description of the works and their locations are presented **Chapter 3 Description of the Development**. A summary of the works in terms of the soils, geology and hydrogeology where relevant is described below.

- Reinstatement, replacement and construction of new flood defence walls,
- Formalising, reinstatement and construction of existing flood defence embankment,
- Construction or replacement of culverts,
- Channel modifications,
- Pumping stations
- Channel maintenance,
- Bridge replacement,
- Provision of road ramps and regrading of road/footpaths.

11.4.1 Reinstatement, replacement and construction of new flood defence walls

New flood defence walls will be constructed as part of the proposed scheme as well as the reinstatement or replacement of existing flood defence walls. Flood wall foundations will not be deeper than c. 1.5m in general.

Excavated material will be reused on site or within the wider Glashaboy flood relief scheme for works such as embankments. Where material must be disposed off-site it will be sent to a suitable facility depending on prior soil characterisation.

11.4.2 Formalising, reinstatement and construction of existing flood defence embankment

It is proposed to formalise/reinstate the flood defence embankments along the Glashaboy River at Sallybrook. This will require additional soil and engineering fill. Excess excavated material will be managed as described in section 11.4.1.

Any additional required soil and fill material will be imported to site. Where possible, the importation of additional fill material has been minimised in the design of the scheme.

11.4.3 Construction or replacement of culverts

The replacement of culverts will involve the widening and raising of existing culverts. River banks will be excavated to prepare for the wider culvert installation. Any excess excavated material will be managed as described in Section 11.4.1.

11.4.4 Channel modifications

Channel modifications along the Glenmore Stream will be required for increased flow and the replacement and widening of existing culverts. Where necessary, river channels are proposed to be deepened by up to 0.4m. Excavation of riverbank material and channel sediment will be required. Excavated material will be managed as described in Section 11.4.1.

11.4.5 Channel maintenance

These activities will be carried out once the flood defence scheme is complete. Maintenance activities do not include dredging or extensive excavation of river beds/banks.

Channel maintenance operations are defined as follows by the OPW (2011): *‘channel maintenance normally involves removing the build-up of foreign or natural material that impedes the free flow of water. Predominately this consists of the removal of water-entrained silt and associated vegetation from the bed of the channel by suitably rigged hydraulic excavators. In most cases, no alterations to the bank are required and in some cases the channel is not disturbed at all if no build-up of material is present.’*

This is a responsibility of the Office of Public Works (OPW) Under Section 37 of the Arterial Drainage Act 1945 whereby the OPW is statutorily obliged to maintain all rivers, embankments and urban flood defences on which it has executed works since the 1945 Act, in “proper repair and effective condition”.

11.4.6 Bridge works

It is proposed to replace the Hazelwood Shopping Centre Bridge with a wider structure. The existing bridge will be completely excavated before constructing the new structure. Cofferdams will be placed in the river at the existing abutments, to allow these to be removed and new abutments to be constructed. All excavated material will be managed as described in Section 11.4.1.

11.4.7 Provision of road ramps and regrading of road/footpaths

Construction of road ramps and road and footpath regrading will require minor excavation works and the input of suitable engineering fill. Excavated material will be managed as described in Section 11.4.1. Any fill required for these works will be imported to site from a suitable local source.

11.5 Evaluation of Impacts

11.5.1 Construction Impacts

11.5.1.1 Excavated Material

During construction there will be considerable quantities of soil including river bank material excavated for the proposed flood defence structures. It is proposed that as much of this excavated material as possible will be reused within the scheme for flood defence works such as the reinstatement and construction of new embankments and the regrading of footpaths as described in Section 11.4. The residual material will need to be removed off-site to a suitable facility.

During excavation there is also the potential for silt or mud to enter the river channel.

11.5.1.2 Invasive Plant Species

Many of the areas where flood defence works are proposed are known to have invasive plant species growing in or near the proposed works areas. Of most concern for this proposed drainage scheme is the plant species, Japanese knotweed. Knotweed has the potential to compromise the structural integrity of concrete structures and spreads very easily when disturbed. **Appendix 4.1** presents the strategy that will be taken to manage invasive plant species during the construction and operation of the drainage scheme.

The main objective of the invasive plant species strategy for the scheme will be to:

- Reduce the spread of invasive species to unaffected areas;
- Minimise the volume of material with invasive species being taken off site and therefore requiring landfilling; and
- Manage the growth invasive species during operation.

11.5.1.3 Hydrogeology

There is potential for the contamination of groundwater as a result of construction activities. There are numerous substances likely to be used during the construction phase that have the potential to contaminate groundwater including fuel and hydrocarbons, lubricants and cement. The washing of construction vehicles also poses a risk of groundwater contamination.

During the construction stage of the scheme, groundwater flow and groundwater levels may be temporarily affected.

The properties in the vicinity of the scheme are generally served by local authority water supply and foul water drainage systems. Also, there are no groundwater dependent terrestrial ecosystems in the vicinity of the works. Any impact on groundwater levels due to the construction of the scheme will be limited to the possible dewatering of excavations.

11.5.2 Operational Impacts

11.5.2.1 Soils and Geology

The OPW is responsible for channel maintenance and as stated in section 11.4.5, “[I]n most cases, no alterations to the bank are required and in some cases the channel is not disturbed at all if no build-up of material is present”. Disturbance to the soils and riverbank will only be in where the OPW deem it necessary and in cases where a build-up of material may hamper the flood defences

The operational phase will require on-going management of the Japanese knotweed around the flood defence structures. This should reduce the soil erosion on riverbanks and have a moderate positive impact on the surrounding area. By reducing the extent of Knotweed growth within the works area, there should be less exposed soil during in the winter; in the summer Knotweed restricts other vegetation growing and when the plant dies back in the winter the underlying soils and riverbanks are exposed and more vulnerable to erosion.

11.5.2.2 Hydrogeology

No significant impacts on the hydrogeology of the area are anticipated during the operational phase of the scheme. The construction of flood defence walls and embankments will result in higher water levels within the channel during flood events. This may result in a short term localised reversal in groundwater hydraulic gradients. However, the high water levels in the watercourse will occur over a limited time period and the impact on groundwater is considered to be low. There may also be localised impacts on groundwater levels in the immediate vicinity of the proposed flood defence walls and embankments.

11.5.3 Potential Cumulative Impacts

The Dunkettle Interchange Improvement Scheme has been proposed to improve traffic flows at the Dunkettle roundabout. Plans for the scheme were first announced in 2011. The scheme is listed on the Transport Infrastructure Ireland (TII) website as Road Scheme Activity project. An EIS was completed for the project in 2012 but and is currently listed on the website as being in the planning stage. According to the TII website:

“This scheme involves the upgrading of the Dunkettle Interchange between the N8 and N25 national routes on the outskirts of Cork City. The current interchange arrangement has free flow for the traffic going in an east - west direction but forces north - south traffic and turning traffic to use a traffic signal controlled roundabout. It is proposed to upgrade the interchange to fully free flow in all directions and to include measures to remove locally generated traffic from the interchange.”

Should the Dunkettle scheme be constructed at the same time as the Glashaboy Drainage Scheme, there may be an increase in demand for fill imports and an increased need to dispose excavated materials to permitted facilities.

11.6 Mitigation Measures

11.6.1 Construction Mitigation Measures

Chapter 4 Construction Activities outlines the employment of good construction management practices which will serve to minimise the risk of pollution of soils or groundwater during construction.

The employment of good construction management practices will minimise the risk of pollution of soil, storm water run-off, adjacent watercourses and groundwater. The construction management of the site will take account of the recommendations of the CIRIA guidance *Control of Water Pollution from Construction Sites, guidance for consultants and contractors* (Masters-Williams et al 2001) to minimise as far as possible the risk of soil, groundwater and surface water contamination.

Measures, as recommended in the guidance above, that will be implemented to minimise the risk of spills and contamination of soils and waters, include:

- Training of site managers, foremen and workforce, including all subcontractors, in pollution risks and preventative measures;
- Careful consideration will be given to the location of any fuel storage facilities. These will be designed in accordance with guidelines produced by CIRIA, and will be fully bunded;
- All vehicles and plant will be regularly inspected for fuel, oil and hydraulic fluid leaks. Suitable equipment to deal with spills will be maintained on site;
- Where feasible, soil excavation will be completed during dry periods and undertaken with excavators and dump trucks. Topsoil and subsoil will not be mixed together;
- Ensure that all areas where liquids are stored or cleaning is carried out are in a designated impermeable area that is isolated from the surrounding area, e.g. by a roll-over bund, raised kerb, ramps or stepped access;
- Use collection systems to prevent any contaminated drainage entering surface water drains, watercourses or groundwater, or draining onto the land;
- Wheel wash at site entrance to clean vehicles prior to exiting onto public road network;
- Minimise the use of cleaning chemicals;
- Use trigger-operated spray guns, with automatic water-supply cut-off;
- Use settlement lagoons or suitable absorbent material such as flocculent to remove suspended solids such as mud and silt; and
- Ensure that all staff are trained and follow vehicle cleaning procedures. Post details of the procedures in the work area for easy reference.

The implementation of the above measures will ensure that the risk of pollution of groundwater, soils and surface waters, resulting from the construction activities will be minimised. Refer to Section 4.7.2 of **Chapter 4 Construction Activities** for further details on specific construction mitigation measures for soils, geology and hydrogeology.

11.6.2 Operational Mitigation Measures

As stated in Section 11.5.2 the OPW may have to carry out channel maintenance activities on the river. These maintenance activities may disturb the river bank however they will only be carried out where they are deemed necessary for the integrity of the flood defences. No mitigation measures are deemed necessary other than good standard construction methods.

11.7 Residual Impacts

There are no residual impacts on the soil, geology and hydrogeology envisaged for the Study Area.

11.8 References

Office of Public Works (2012) *Arterial Drainage Maintenance & High Risk Designation Programme 2011-2015*.

Geological Survey of Ireland (2016) Groundwater Data Viewer, www.gsi.ie Accessed October 2016.

12 Hydrology

12.1 Introduction

This chapter describes the hydrological environment within the area of the proposed Glashaboy River (Glanmire/Sallybrook) Drainage Scheme, in the context of the potential impacts of the proposed development. Mitigation measures are proposed and the predicted residual impacts are described.

12.2 Methodology

12.2.1 Guidance

This section of the EIS was prepared in accordance with the following guidance documents:

- Guidelines on the information to be contained in EIS (EPA, 2002);
- Advice Notes on Current Practice in the Preparation of EIS (EPA, 2003);
- Revised Guidelines on the Information to be contained in Environmental Impact Statements Draft September 2015 (EPA, 2015);
- Advice Notes for Preparing Environmental Impact Statements Draft September 2015 (EPA, 2015).

Other reference documents used in the preparation of this section include the following:

- National Roads Authority (NRA) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- Good practice guidelines on the control of water pollution from construction sites developed by the Construction Industry Research and Information Association (CIRIA);
- Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters (Inland Fisheries Ireland, 2016);
- Department of Environment, Heritage and Local Government, The Planning System and Flood Risk Management Guidelines for Planning Authorities (Department of Environment, Heritage and Local Government, 2009).

Background information on the local and regional surface water network was obtained from an array of documents and online resources including the following:

- South Western River Basin District (SWRBD) Catchment Characterisation Report (SWRBD, 2010);
- SWRBD River Basin Management Plan 2009 – 2015 (SWRBD, 2010);
- SWRBD Programmes of Measures 2009 – 2015 (SWRBD, 2008);
- SWRBD River Basin Management Plan and Programmes of Measures – Strategic Environmental Assessment (SWRBD, 2011);
- EPA online Water Quality Database and Envision Map Viewer (www.epa.ie);

- Glashaboy Flood Relief Scheme Hydrology Report (Arup, 2016);
- Glashaboy Flood Relief Scheme Hydraulic Report (Arup, 2016);
- OPW Preliminary Flood Risk Assessment mapping, www.cfram.ie/pfra;
- OPW Lee Catchment Flood Risk Assessment and Management (CFRAM) Study Reports and Maps, www.cfram.ie; and
- Geological Survey of Ireland Online Mapping.

12.2.2 Legislation

12.2.2.1 Water Framework Directive 2000/60/EC

The EU Water Framework Directive (WFD) 2000/60/EC came into force on 22nd December 2000, and was enacted into Irish Legislation through S.I. No. 722 of 2003 European Communities (Water Policy) Regulations 2003. This legislation and regulation is a significant piece of legislation for water policy, as it provides a co-ordinated approach across Europe for all water policies, establishing a management structure for future water policy. A few key objectives of the Directive are to:

- Protect all waters, including rivers, lakes, groundwater, transitional and coastal waters;
- Achieve a “good status” in all waters by 2015, and maintain “high status” where the status already exists; and
- Have water management based on River Basin Districts (RBD).

The strategies and objectives of the Water Framework Directive in Ireland have been influenced by a range of National and European Union legislation and regulation including:

- European Communities (Quality of Salmonid Waters) Regulations 1988 (S.I. No. 293 of 1988);
- Local Government (Water Pollution) Acts 1977 – 1990; and
- Water Quality Standards for Phosphorus Regulations 1998 (S.I. No. 258 of 1998).

In turn the implementation of the Water Framework Directive and its associated policies has necessitated the introduction of new regulations in Ireland including, the European Communities Environmental Objectives (Surface Waters) Regulations 2009, which are discussed further in the following section.

12.2.2.2 European Communities Environmental Objectives (Surface Waters) Regulations 2009 (S.I. No. 272 of 2009)

These regulations have been devised as a more complete and stringent set of surface water quality regulations which covers the requirements of the Water Framework Directive and the Dangerous Substances Directive. These regulations came into effect on 30th July 2009 and have been adopted by the Government. These new regulations supersede previous water quality regulations (both EU and national). This project must still be cognisant of previous regulations as they form the basis for a wide range of impact assessment and monitoring methodologies.

It is envisaged that a detailed construction environmental management plan (CEMP) which will include the management or disposal of surface water runoff will be prepared in advance of construction commencing on site. The CEMP will be cognisant of these new regulations and will apply them throughout the construction phase.

12.2.2.3 European Communities Priority Substances Directive 2008

These regulations have been devised to assign a chemical status assessment for water bodies. Directive 2008/105/EC provides environmental quality standards in the field of water policy.

12.2.2.4 Local Government (Water Pollution) Acts 1977 – 1990

The Act is the main legislation for the prevention and control of water pollution, including the general prohibition of polluting matter to waters. While this act has largely been superseded by the 2009 Regulations, current impact assessment and monitoring methodologies must still be cognisant of this legislation.

12.2.2.5 Water Quality Standards for Phosphorus Regulations 1998 (S.I. No. 258 of 1998)

As part of the Water Pollution Acts, these regulations require water quality to be maintained or improved, with reference to the biological quality river rating system (Q Rating) as assigned by the Environmental Protection Agency between 1995 and 1997. While this act has also largely been superseded by the 2009 Regulations, current impact assessment and monitoring methodologies must still be cognisant of this legislation.

12.2.3 Site Visits

Site visits were conducted as part of the impact assessment process to ascertain specific areas which may be at risk from impact.

12.2.4 Water Quality Assessment

An assessment of the water quality in the study area was carried out which comprised a desk-top study examining water quality data gathered by the EPA and Cork County Council.

Under current regulation the water quality of River Basin Districts is assessed biologically, physically and chemically. Assessment using surveys is predominately conducted by the EPA and local authorities, and complemented by other government bodies including the Inland Fisheries Ireland (IFI) and the Marine Institute. **Table 12.1** summarises the quality classes used to establish and monitor the condition of rivers and streams in Ireland.

Table 12.1: River and Stream Water Quality Classes (EPA, 2013)

Q Value ^{Note 1}	WFD Status	Pollution Status	Condition ^{Note 2}
Q5, Q4-5	High	Unpolluted	Satisfactory
Q4	Good	Unpolluted	Satisfactory
Q3-4	Moderate	Slightly polluted	Unsatisfactory
Q3, Q2-3	Poor	Moderately polluted	Unsatisfactory
Q2, Q1-2, Q1	Bad	Seriously polluted	Unsatisfactory
where:	Biotic indices or Quality (Q) value indicates specified groups of macro-invertebrates sensitivity to pollution, with:		
Q5	Mostly pollution sensitive, a few to numerous less pollution sensitive, a few pollution tolerant, and no very pollution tolerant or most pollution tolerant macro-invertebrate species.		
Q4	At least one pollution sensitive, few to numerous less pollution sensitive, numerous pollution tolerant, and a few or no very pollution tolerant or mostly tolerant macro-invertebrate species.		
Q3	No pollution sensitive, few or no less pollution sensitive, dominant in pollution tolerant, a few to common in very pollution tolerant, and few or no most pollution tolerant macro-invertebrate species.		
Q2	No pollution sensitive or less sensitive, few or no pollution tolerant, dominant in very pollution tolerant, and few to common in most pollution tolerant macro-invertebrate species.		
Q1	No pollution sensitive, less sensitive, and pollution tolerant, a few to no very pollution tolerant, and dominant in most pollution tolerant macro-invertebrate species.		

Note 1: These values are based primarily on the relative proportions of pollution sensitive to tolerant macroinvertebrates resident at a river site.

Note 2: "Condition" refers to the likelihood of interference with beneficial or potential beneficial uses.

Table 12.2 describes in detail the classification system combined with the Biological Quality Q-Ratings, basic physico-chemical water quality, the status of the ecosystem and the human value associated with surface water systems.

In summary, quality classes relate to the potential beneficial use of a water body, with:

- Class A = Highest water quality, suitable for abstraction, game fisheries, very high amenity value, orthophosphate ~ 0.015 mg P/L, dissolved oxygen close to 100%, maximum BOD is < 3mg/L.
- Class B = Variable water quality, potential problems for abstraction, game fish at risk, considerable amenity value, orthophosphate ~ 0.045 mg P/L, dissolved oxygen <80% to >120%, maximum BOD is occasionally elevated.
- Class C = Doubtful water quality, advanced treatment of abstracted water, coarse fisheries, reduced amenity value, orthophosphate ~ 0.070 mg P/L, dissolved oxygen is very unstable with potential fish kills, maximum BOD is high at times.
- Class D = Poor to bad water quality, low grade to limited abstraction, fish usually absent, low or no amenity, orthophosphate >0.1 mg P/L, dissolved oxygen is low to zero, maximum BOD is usually high to very high.

Existing pollution has an impact on the value of surface waters and this has been taken into account when characterising individual surface water systems in the following section. The existing adverse effects are reflected in the EPA Q-Value, which describes the biological status of the watercourse. In general, the higher the level of pollution in a watercourse, the lower the Q-value.

The Q-value reflects impacts from surface water run-off (including run-off from agricultural land which may contain nutrients and urban run-off from roads and buildings which may contain solids, hydrocarbons and heavy metals).

Table 12.2: General Characteristics of the various Biological Quality Classes (DRA, 2006)

Quality Classes	Class A		Class B	Class C	Class D	
Quality Ratings (Q)	Q5	Q4	Q3-4	Q3	Q2	Q1
Pollution Status	Pristine, unpolluted	Unpolluted	Slight Pollution	Moderate Pollution	Heavy Pollution	Gross Pollution
Organic Waste Load	None	None	Light	Considerable	Heavy	Excessive
Maximum B.O.D.	Low (< 3 mg/l)	Low (< 3 mg/l)	Often elevated	High at times	Usually high	Usually very high
Dissolved Oxygen	Close to 100%	80%-120%	<80% to >120%	Very unstable.	Low to zero	Very low or zero
Annual Median ortho-Phosphate	~0.015 mg P/l	~0.030 mg P/l	~0.045 mg P/l	~0.070 mg P/l	usually > 0.1 mg P/l	usually > 0.1 mg P/l
Siltation	None	May be light	May be light	May be considerable	Usually heavy	Usually v. heavy and anaerobic
‘Sewage Fungus’	Never	Never	Never	May be some	Usually abundant	May be abundant
Filamentous Algae	Limited development	Diverse communities	Cladophora may be abundant	Cladophora may be excessive	May be abundant	Usually none
Macrophytes	Good diversity Limited growths	Considerable growths	Reduced diversity Luxuriant growths	Limited diversity Excessive growths	Tolerant species only. May be abundant.	Usually none or tolerant species only.
Macroinvertebrates (from shallow riffles)	Diverse communities. Normal density. Sensitive forms usually numerous.	High diversity. Increased density. Sensitive forms scarce or common.	Very high diversity. Very high density. Sensitive forms scarce.	Sensitive forms absent. Tolerant forms common. Low diversity.	Tolerant forms only. Very low diversity.	Most tolerant forms. Minimal diversity.
Water Quality	Highest quality	Fair quality	Variable quality	Doubtful quality	Poor quality	Bad quality
Abstraction Potential	Suitable for all	Suitable for all	Potential problems	Advanced treatment	Low grade abstractions	Extremely limited
Fishery Potential	Game fisheries	Good game fisheries	Game fish at risk	Coarse fisheries	Fish usually absent	Fish absent
Amenity value	Very high	High	Considerable	Reduced	Low	Zero
Condition	Satisfactory	Satisfactory	Transitional	Unsatisfactory	Unsatisfactory	Unsatisfactory

12.2.5 Existing Hydrological Environment Categorisation

Characterisation of surface water systems is based on the identification of features of the baseline hydrological environment that are relevant and can be assigned a functional value. The functional value of each of these features is compiled through the relevance of three factors: the importance of the feature, the sensitivity of the feature and the existing adverse pressures affecting the feature. The assignment of functional values is also cognisant of technical standards, regulations and relevant legislation.

12.2.5.1 Importance

Surface water systems act as resources for both aquatic and terrestrial ecosystems and are an essential factor to sustain human life. Surface water floodplains can also act as a reserve or store for floodwaters during times of significant flooding and this can prevent floodwaters from impacting farther downstream. **Table 12.3** indicates how the importance of surface water resources is evaluated using specific criteria that have been defined for the purpose of this hydrological baseline assessment.

Table 12.3: Hydrological Baseline Categorisation

Criteria	Functional Value
<ul style="list-style-type: none"> Surface Watercourses with Q-values of Q5 and/or Q4-5 or Q4, which are classified by the EPA as 'Class A - Unpolluted'. Surface Watercourses with flood plains that have significant storage capacity for potential floodwaters. 	Very High
<ul style="list-style-type: none"> Surface Watercourses with Q-values of Q3-4, which are classified by the EPA as 'Class B -Slightly Polluted'. Surface Watercourses with flood plains that have significant storage capacity for potential floodwaters. 	High
<ul style="list-style-type: none"> Surface Watercourses with Q-values of Q3 or Q2-3, which are classified by the EPA as 'Class C - Moderately Polluted'. Surface Watercourses with flood plains that have significant storage capacity for potential floodwaters. 	Medium
<ul style="list-style-type: none"> Surface Watercourses with Q-values of Q2 or Q1-2 or Q1, which are classified by the EPA as 'Class D - Seriously Polluted'. Surface Watercourses with flood plains that have no storage capacity for potential floodwaters. 	Low
<ul style="list-style-type: none"> Surface Watercourses that have been culverted. Surface Water Features solely used for visual amenity. 	Very Low

12.2.5.2 Sensitivity

Surface water features are highly sensitive to culverting, which can alter flow conditions and affect light penetration to the watercourse. Surface water features are also at risk from discharges of surface water run-off which may contain polluting substances that can have a significant adverse impact on the biological and physico-chemical status of a watercourse such as a salmonid river or stream.

Surface water features are also highly sensitive to morphological change through deepening, realignment or diversion of their natural channel which can also alter the hydrodynamic regime of the surface water feature. These factors were taken into account when defining the criteria to be used to assign a functional value to the baseline hydrological environment.

12.2.5.3 Existing Adverse Hydrological Pressures

Existing pollution has an adverse impact on the functional value of surface water features. Consequently the definition of the functional value for each individual watercourse has been cognisant of the pressures from pollution both upstream of the study area and within the study area. The existing hydrological pressures are reflected in the EPA Q-Value, which describes the biological status of the watercourse. The higher the pollution level in a watercourse, the lower the Q-value. The Q-value reflects impacts from surface water run-off (including run-off from agricultural land which may contain nutrients and run-off from roads and buildings which may contain solids, hydrocarbons and heavy metals). The existing pressures are also apparent in the physico-chemical status of the surface water feature with both organic and inorganic pollutants altering the physico-chemical status.

12.2.5.4 Functional Value

The functional value of the existing hydrological environment is evaluated through the assessment of surface water criteria and the importance and sensitivity of the surface water features. The surface water criteria are described below.

12.2.5.5 Significance Criteria / Impact Assessment

The source and type of all potential impacts is described in Sections 12.4 and 12.5. The criteria and durations used to assess the different impacts associated with the project are shown in **Table 12.4** and **Table 12.5**. The criteria have been defined in accordance with the aforementioned EPA and NRA Guidelines.

Table 12.4: Criteria for Assessment of Hydrological Impact Magnitude

Criteria	Impact Magnitude
<ul style="list-style-type: none"> Long-term to permanent change to a designated conservation site or designated salmonid river. Medium-term to permanent contamination of surface water over entire surface water catchment. Medium-term to permanent potential changes in drainage patterns over entire catchment. 	Profound
<ul style="list-style-type: none"> Medium term change to a designated conservation site or a designated salmonid river. Temporary to short-term contamination of surface water over entire surface water catchment. Temporary to short-term potential changes in drainage patterns over entire catchment. 	Significant
<ul style="list-style-type: none"> Temporary to short-term change to a designated conservation site or a designated salmonid river. Medium to long-term contamination of local surface water. Medium to long-term potential changes in local drainage patterns. 	Noticeable
<ul style="list-style-type: none"> Short-term contamination of local surface water. Short term potential changes in local drainage patterns. 	Slight
<ul style="list-style-type: none"> Temporary contamination of local surface water. Temporary potential changes in local drainage patterns. 	Imperceptible

Table 12.5: Definition of Duration Criteria

Impact Description	Definition
Permanent Impact	Impact lasting over sixty years
Long-Term Impact	Impact lasting fifteen to sixty years
Medium-Term Impact	Impact lasting seven to fifteen years
Short-Term Impact	Impact lasting one to seven years
Temporary	Impact lasting for one year or less

12.2.6 Flood Risk Information Collation

A detailed assessment of the fluvial and tidal flood risk, from the Glashaboy River and its tributaries, was undertaken to ascertain the extent of flood defence measures required as part of the scheme. The risk of flooding from other sources, including pluvial flooding, flooding from groundwater and flooding from artificial sources such as surface water drainage systems, was also assessed in the Hydrology and Hydraulics reports. These reports can be downloaded from the project website on www.glashaboyfrs.ie.

12.3 Receiving Environment

12.3.1 Hydrology

The study area is located within Hydrometric Area 19 which is the EPA classification for the catchments flowing into the River Lee, Cork Harbour and Youghal Bay.

This Hydrometric Area falls within the South Western River Basin District. Hydrometric Area 19 is 1,732km² in area with ground elevations ranging from sea level to over 500mOD. Agricultural land comprises the majority of the hydrometric area land use with the main centres of population being Cork City and its suburbs, and includes a number of towns such as Midleton and Macroom.

The following sub-sections outline the existing hydrological environment in the vicinity of the proposed scheme which includes the catchments of the Glashaboy River and its respective tributaries. These river systems are discussed in the following sections and all hydrological features relevant to the project are indicated in **Figure 12.1** and all areas of work outlined in **Figure 12.2**.

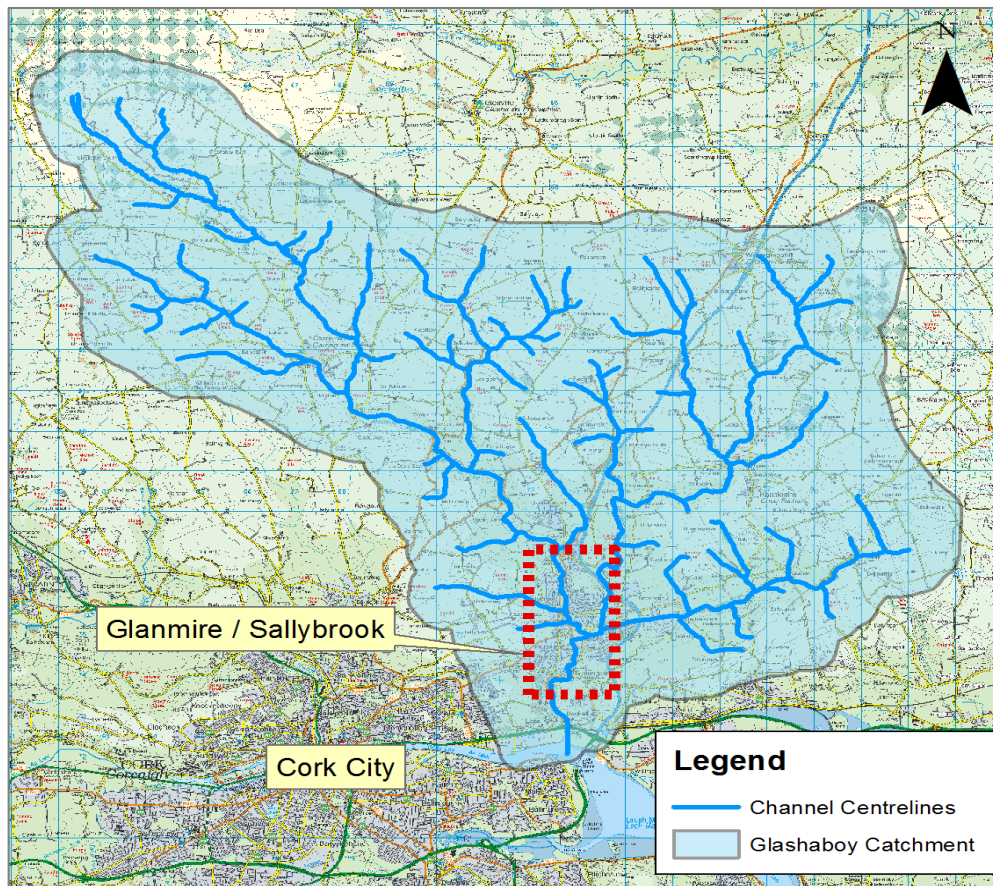


Figure 12.1: Hydrological Features

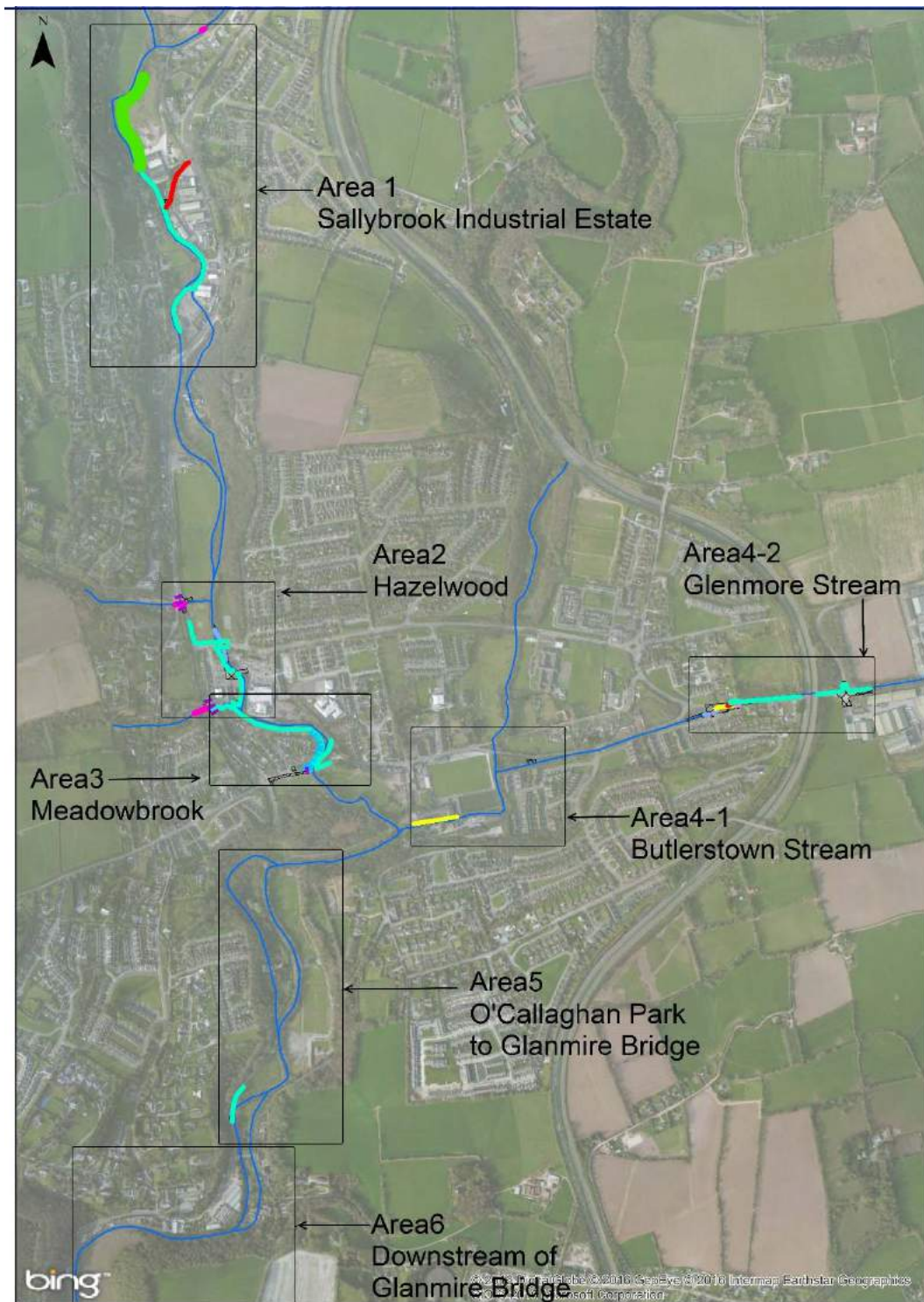


Figure 12.2 Areas of proposed works as highlighted in Figure 12.1

The South Western River Basin District management plan was consulted during the preparation of this chapter. The main objectives of the management plan are to:

- Prevent deterioration;
- Restore good status, reduce chemical pollution in surface waters; and

- Achieve protected areas objective.

The programme of measures designed to achieve these objectives outlined in the management plan, include the following:

- *“control of urban waste water discharges,*
- *control of unsewered wasted water discharges,*
- *control of agricultural sources of pollution,*
- *water pricing policy,*
- *sub-basin management plans and programmes of measures for the purpose of achieving environmental water quality objectives for Natura 2000 sites, designated for the protection of Freshwater Pearl Mussel populations,*
- *pollution reduction programmes for the purpose of achieving water quality standards for designated shellfish waters, and*
- *control of environmental impacts from forestry.”*

Information on status, objectives and measures in the South Western RBD has been compiled for smaller, more manageable geographical areas than river basin districts, termed water management unit action plans. There are twenty-eight Water Management Units (WMUs) in the South Western RBD. The proposed drainage scheme is located within the Glashaboy WMU. The key measures to be implemented in the Glashaboy WMU are summarised in Table 5.1 of the River Basin Management Plan, and include measures for:

- *“Control of urban waste water discharges,*
- *Treatment plants requiring capital works,*
- *Treatment plants requiring further investigation,*
- *Treatment plants requiring attention to meet Shellfish waters PRPs (Pollution Reduction Programmes),*
- *Treatment plants requiring improvements in operational performance,*
- *Urban agglomerations requiring investigation of CSOs (Combined Sewer Overflows),*
- *Agglomerations that require management of development,*
- *Properties that will be subject to performance, operational and maintenance standards for onsite waste water treatment systems,*
- *IPPC licences with discharges to waters that require review,*
- *Licences for discharges to waters under the Water Pollution Acts that require review, and*
- *River waterbodies assessed to be at risk from diffuse sources, including agriculture.”*

In relation to Future Pressures and Developments, the WMU Action Plan states:

“Throughout the river basin management cycle, future pressures and developments will need to be managed to ensure compliance with the objectives of the Water Framework Directive and the Programme of Measures will need to be developed to ensure issues associated with these new pressures are addressed.”

Glashaboy River Catchment

The Glashaboy River rises in the Nagle Mountains to the north of Cork and flows in a southerly direction, entering the Upper Cork Harbour downstream of Glanmire. The upper reaches are predominantly rural, however, the catchment becomes more urbanised in its lower reaches. The Glashaboy River enters the River Lee Estuary to the East of Cork City. The river is 22km long, and has a catchment area of over 140km² at its tidal limit.

The Glashaboy catchment is drained by a number of watercourses, the main one being the River Glashaboy which drains land to the west of the catchment. The Butlerstown Stream and Glenmore Stream join the Glashaboy River at Glenmore and drain land to the east. The lower reaches of the Glashaboy River are tidally influenced (up to Glanmire).

The geology of the Glashaboy catchment is predominantly sandstone till overlain by a cover of acid brown earth soils offering free drainage. The lower reaches are underlain by limestone. Low hills dominate the catchment with steeper sloping valleys located to the north.

The fine sediment dynamics of the Cork estuary result in deposition of extensive mud flats through Lough Mahon. However, there is no significant deposition of tidally derived silts along the Glashaboy, suggesting that depositional processes are largely controlled by fluvial processes. The Glashaboy River is likely to support salmonid species and other fisheries.

An essential step in the WFD monitoring process is the classification of the status of transitional waters, which in turn will assist in identifying the objectives that must be set in the individual River Basin Management Plans.

The Water Matters Report, available at www.wfdireland.ie, covers the catchment of the Glashaboy River. There are ten EPA assessment points within the Glashaboy Water Management Unit, four of which achieved an Ecological 'Good Status' and six of which achieved 'Moderate Status'. The EPA has assigned the Glashaboy River Catchment a classification of "Moderate" status, i.e. must be improved to 'Good Ecological Status' (GES) by 2021, based on general physico-chemical elements, phytoplankton and macro-algal growths as detailed in **Table 12.6**.

Table 12.6: Glashaboy Water Management Unit Action Plan

Member State Code	Donor Water							
	Monitored Y (Extrapolated N)	Q-Rating		Physio - chemical	Ecological Status	Drinking Water - Protected Area	Objective	Date Objective to be achieved
SW_19_1513	N		SW_18_1612		M		GES	2021
SW_19_1547	Y	M		G	M		GES	2021
SW_19_1740	N		SW_19_755		M		GES	2021
SW_19_1961	Y	G		G	G	Y	GES	2009
SW_19_741	Y	G		G	G		GES	2009
SW_19_742	Y	G		G	G		GES	2009
SW_19_743	Y	G		M	M		GES	2021
SW_19_746	N		SW_19_755		M		GES	2021
SW_19_755	Y	G		M	M		GES	2021
SW_19_977	N		SW_19_741		G		GES	2009

There are six monitoring stations located in the Glashaboy River Catchment, five of which achieved 'Good Status' and one achieved 'Moderate Status' according to Biological Elements (Q - Rating). According to the Supporting Elements (Physico - Chemical) four achieved 'Good Status' and two achieved 'Moderate Status'.

Figure 12.3 shows the location of the River Water Quality Stations and their Q-Rating.



Figure 12.3: Envision Maps showing River Water Quality Scores (2004-2015)

The report states that the watercourse is not heavily modified. The overall ecological status of the watercourse is classified as ‘Moderate’ with the watercourse classified as “not at risk of not achieving good status” in accordance with the WFD. The watercourse is identified as “probably at risk from diffuse sources” in the EPA diffuse model (2008) but “not at risk” from point sources.

The WFD ecological status of Lough Mahon, the water body to which the Glashaboy River discharges, was classified as ‘Moderate’ in the Water Quality in Ireland 2010 – 2012 report. This status was a reduction from the ‘Good’ status achieved in the 2007 – 2009 report. The WFD Risk Score assigned to Lough Mahon is ‘at risk of not achieving good status’.

Lough Mahon is a transitional water body and the Water Quality in Ireland 2010 – 2012 report classifies the eutrophication of the water body as intermediate. Intermediate status is given to water bodies that breach one or two of the three assessment criteria, namely nutrient concentrations, accelerated growth of plants and undesirable water quality disturbance. Lough Mahon is also classified as a nutrient sensitive water body. **Figure 12.4** presents the WFD risk scores for each of the watercourses within the Glashaboy River Catchment.

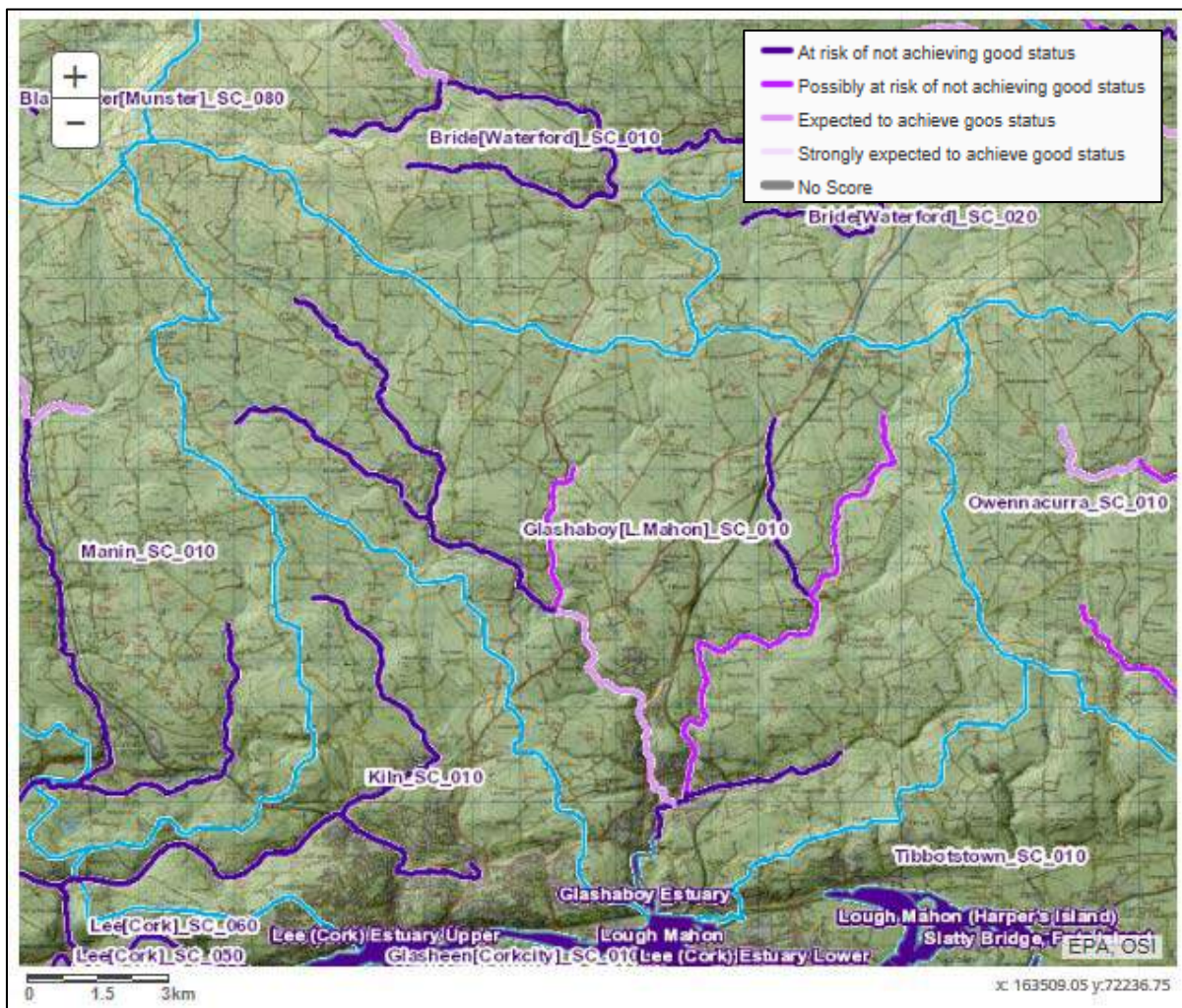


Figure 12.4: Envision Maps Risk Scores (EPA, 2016)

12.3.2 Flood Risk

The town has a long history of serious flooding, primarily due to high flows in the River Glashaboy exceeding the channel capacity. The majority of flood risk is in Glanmire and Sallybrook which are located at the mouth of the Glashaboy River. Flooding in the Glashaboy is generally caused by prolonged rainfall events. These rainfall events cause a build-up of flows in these rivers over a number of hours reaching peak flows at the mouth of these rivers within 7 to 10 hours.

Surface water flooding associated with heavy rainfall and exceedance of the drainage system capacity is also a problem. Glanmire and Sallybrook are prone to both fluvial and tidal flooding. Tidal flooding results from tides and storm surges propagating up the Glashaboy River estuary and extends upstream of Glanmire Village in extreme tide events, and would be experienced as far upstream as the weir at the council water intake. River levels can also be exacerbated by high tides in the River Lee estuary.

Fluvial and Tidal Flood Risk

Flood risk in Glanmire had been assessed as part of the Lee CFRAM Study. This assessment was reviewed in detail and updated as part of the Glashaboy River (Glanmire/Sallybrook) Drainage Scheme.

A number of watercourses were not included in the Lee CFRAM study, namely the Glenmore, Springmount, Cois na Gleann, Bleach Hill and the Mill Races. As part of this study, an infill survey was carried out and these watercourses were subsequently included in the study.

Accuracy of the original model was also improved by upgrading the original model from a 1D only to a 1D-2D hydraulic model. This model was then calibrated to the June 2012 flood event and also the more recent winter 2015 flood event. An extract from the flood mapping produced as part of this study is included in **Figure 12.5**.

Figure 12.5 indicates that there are a number of residential and commercial properties in Glanmire/ Sallybrook located within Flood Zone A, where the probability of flooding from rivers is highest (greater than 1% AEP or 1 in 100 for river flooding).

To determine the extent of flood defences required in Glanmire, detailed fluvial modelling of the Glashaboy River and its tributaries was undertaken.

Historical Flood Events

The National Flood Hazard Mapping website operated by the OPW (www.floodmaps.ie) has collated records of historic flooding events throughout Ireland. The website shows numerous historical flood events in Glanmire, primarily related to the 2009 and 2012 events. A summary report is included in **Figure 12.6**

Reports and other information on past flooding in the study areas were supplied by Cork County Council and the Office of Public Works (OPW).

Based on the above review, a timeline of flood events in Glanmire has been created and is summarised in **Table 12.6**.

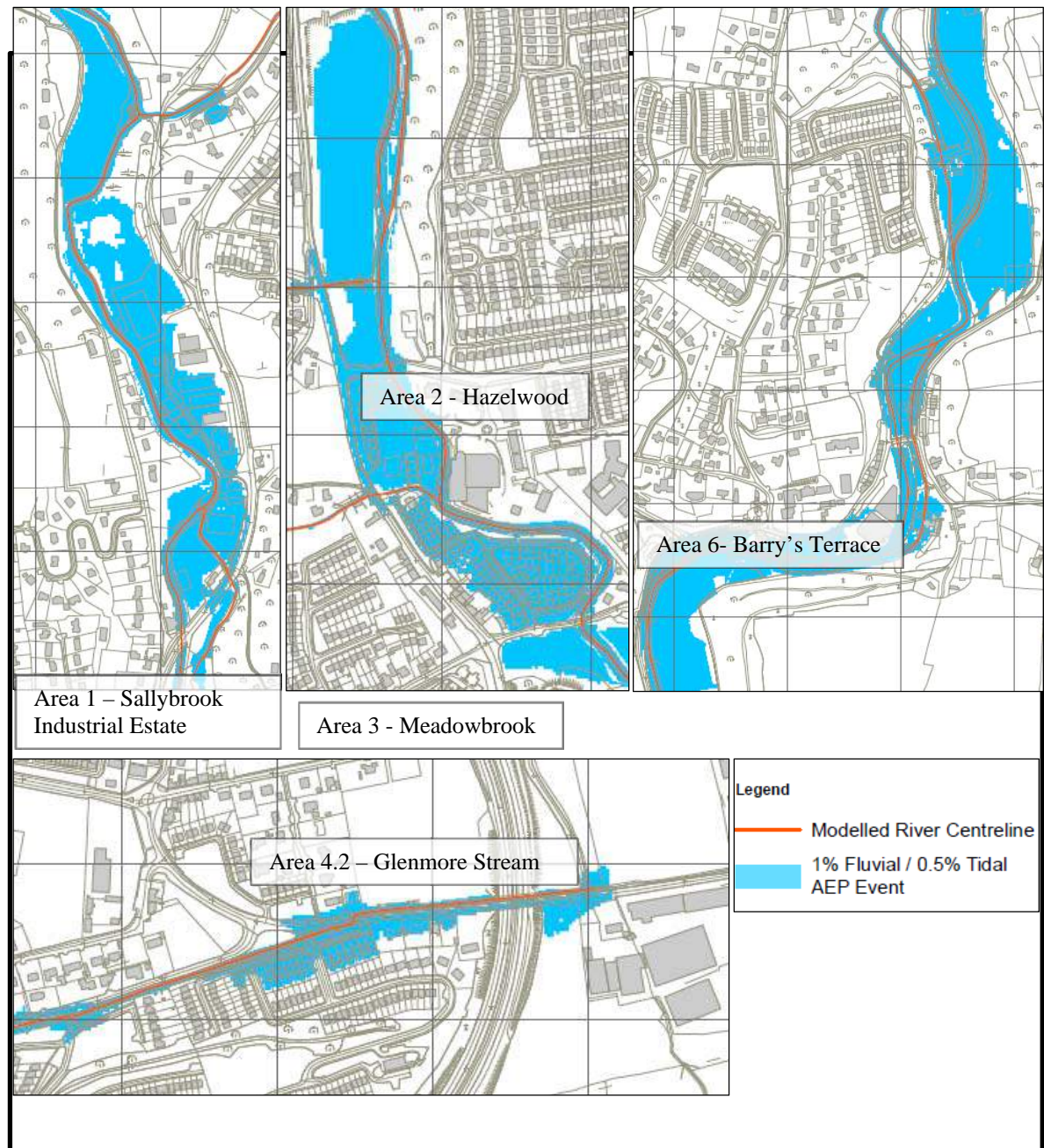


Figure 12.5: Extract from the Glashaboy Drainage Scheme Fluvial Flood Map

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

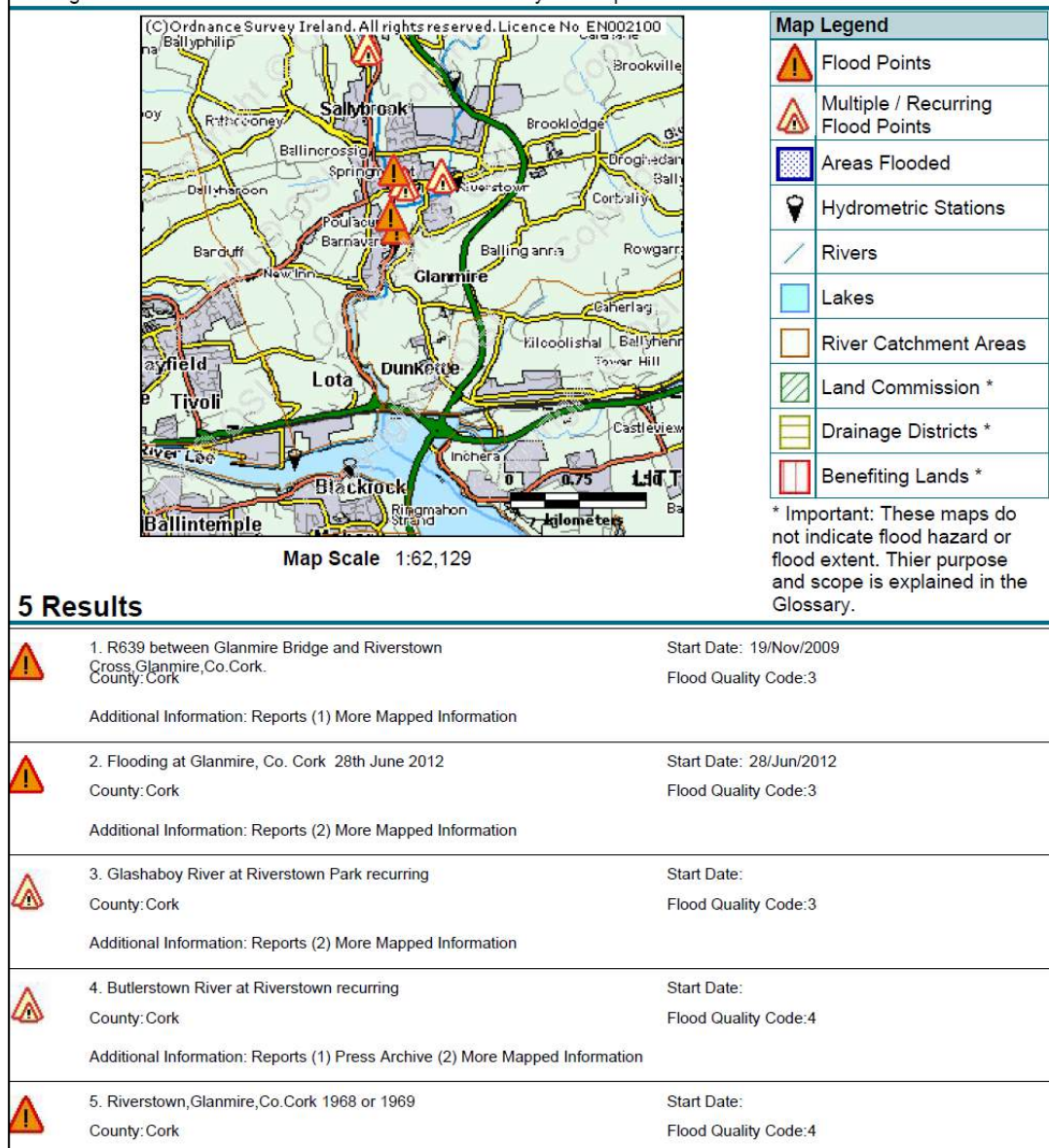


Figure 12.6: Extract from the National Flood Hazard Mapping reports

Table 12.6: Timeline of major fluvial and tidal flood events - Glanmire

Date of Flood Event	Mechanism	Areas Affected
December 2015	Fluvial	Copper Valley, Meadowbrook and The Grove
June 2012	Fluvial	Glanmire
November 2009	Fluvial	R639 between Glanmire Bridge and Riverstown Cross, Glanmire
October 2004	Fluvial	Glashaboy River - Glanmire
November 2000	Fluvial	Glashaboy River - Glanmire
1969	Fluvial	Glanmire

Pluvial Flood Risk

Pluvial flooding occurs when extreme rainfall overwhelms drainage systems or soil infiltration capacity, causing excess rainwater to pond above ground at low points in topography. In order to assess the risk of pluvial flooding in Glanmire, a rainfall to grid model was developed, which highlights low lying areas. An extract from the pluvial flood map for Glanmire is included in **Figure 12.7**.

The pluvial flood map indicates that Area 3 – Meadowbrook and Copper Valley located in Area 4.2 are at risk from pluvial flooding. Both of these areas are low lying and also have a strong history of flooding. Mapping as presented in **Figure 12.7** indicates that both of these areas are located in the 1% AEP (100 year event) pluvial flood extent. The area of the Grove, which is located in Area 5, was also found to be at pluvial flood risk.

Groundwater Flood Risk

Groundwater flooding can occur during lengthy periods of heavy rainfall, typically during late winter / early spring when the groundwater table is already high. If the groundwater rises above ground level, it can pond at local low points and can cause periods of flooding. In order to assess the risk of groundwater flooding to the subject site, the PFRA mapping undertaken by the OPW has been reviewed which does not indicate any areas in the vicinity of the scheme as being at risk of groundwater flooding.

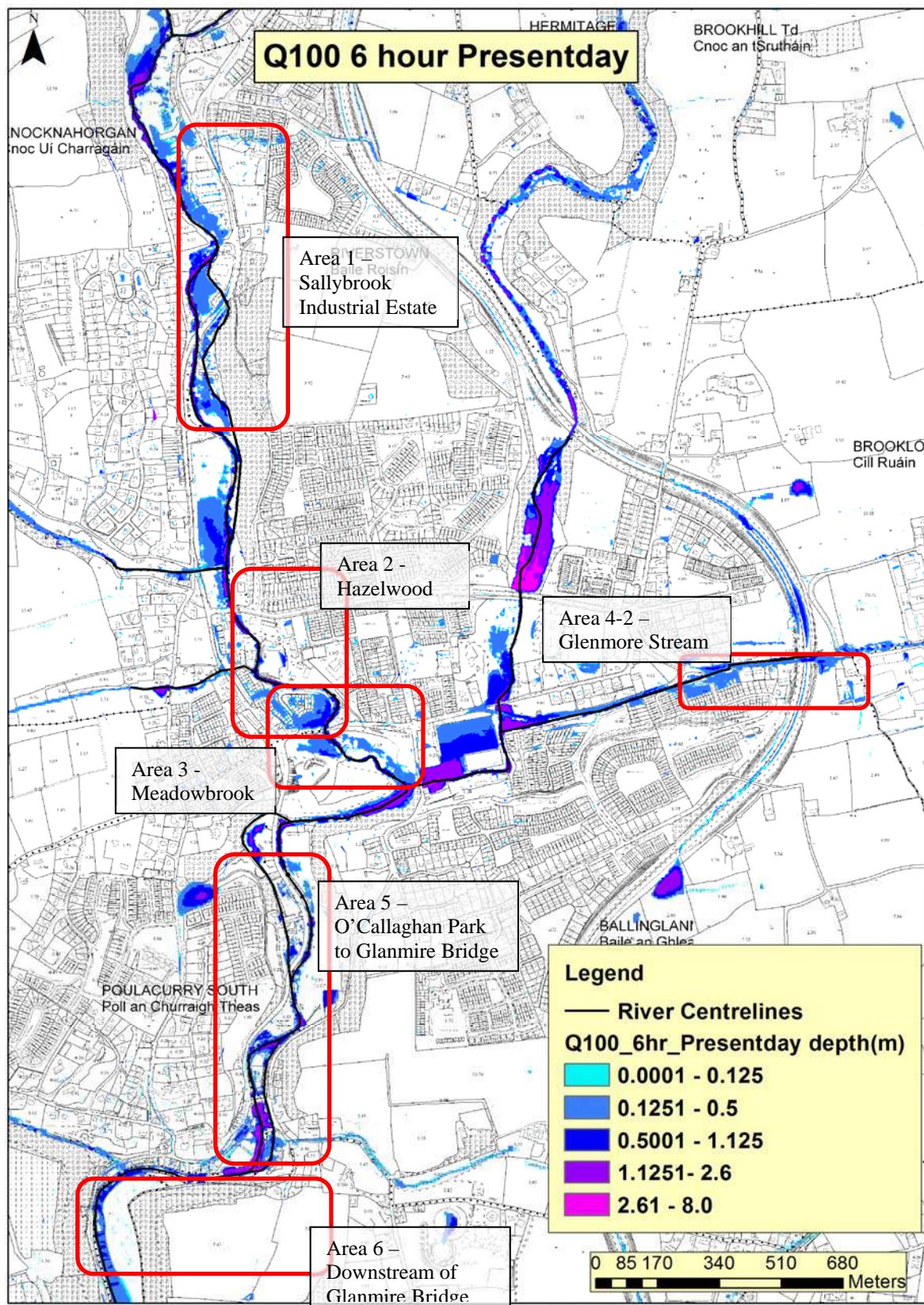


Figure 12.7: Extract from the Pluvial flood Map at Glanmire

12.4 Characteristics of Proposed Development

The objectives of this scheme are to:

- Assess and develop a viable, cost-effective and sustainable Scheme, to allow the design flood event along the Glashaboy River and its tributaries without causing flooding of properties, in so doing protecting against flooding from pluvial, fluvial, tidal and surge.

The Scheme will provide protection along the Glashaboy River and its tributaries, in particular through Glanmire/Sallybrook. The Scheme will have regard to the preferred options from the Lee CFRAM Study, and any emerging options from the Lower Lee FRM Scheme.

12.4.1 Hydrology

Hydrological impacts arise from the quality of water discharged to surface water during construction and operation, therefore, management of such risks are of relevance to the proposed development.

12.4.2 Flood Risk

The proposed scheme lies within an area at high risk of fluvial and tidal flooding. There is also a significant risk of pluvial flooding in the vicinity of the scheme. Therefore, consideration of flood risk management is relevant to the proposed scheme.

To mitigate the risk of increased pluvial flooding following the construction of the scheme, a non-return valve will be constructed on all surface water drainage outfalls surcharged during the 1 in 100 year fluvial and 1 in 200 year tidal flood including freeboard. Where surface water drainage networks will be unable to outfall due to high water levels in a watercourse, surface water runoff will be drained to a pumping station where it will be pumped to the outfall to mitigate the increased risk of pluvial flooding behind the defences.

New surface water drainage networks will be constructed to drain areas where overland flow routes will be severed by the construction of the flood defences. These drainage networks will outfall to the watercourses through non-return valves or will be pumped to the outfall as required

12.5 Evaluation of Impacts

12.5.1 Construction Impacts

12.5.1.1 Water Quality

Surface construction activities pose a potentially significant risk to all watercourses as these sites will be exposed to rainfall which has the potential to produce run-off.

Surface water run-off from surface construction activities has the potential to be mildly contaminated. Due to the nature of the proposed scheme, construction works within watercourse channels will be required which exacerbates the risk of contamination. The main contaminants arising from surface construction activities include:

- Suspended solids: arising from ground disturbance and excavation;
- Hydrocarbons: accidental spillage from construction plant and storage depots;
- Faecal coliforms: contamination from coliforms can arise if there is inadequate containment and treatment of on-site toilet and washing facilities;
- Concrete / cementitious products: arising from construction materials.

These pollutants pose a significant temporary risk to surface water quality for the duration of construction if not properly contained and managed. Suspended solids, which can include significant quantities of silt, can influence water turbidity and are considered to be the most significant risk to surface water quality from construction activities. Suspended solids can also reduce light penetration, visually impact the receiving water and damage the ecosystem. These suspended solids are likely to occur in:

- Water removed from surface excavations as a result of rainfall or groundwater seepage;
- Water in contact with exposed excavations within the watercourse channel;
- Vehicle wheel wash water;
- Runoff from exposed works areas and excavated material storage areas; and
- Cement wash-down areas: The potential for cement to increase the pH of water above a natural range, that is typically 6 to 9, can pose a threat to aquatic species living in a watercourse.

Contamination of surface water systems by the above pollutants may potentially occur due to:

- Inappropriate handling and storage;
- Leakage of temporary foul water sources; and
- Solid (municipal) wastes being disposed or blown into watercourses or drainage systems.

12.5.1.2 Flood Risk

The construction phase of the scheme poses a temporary and slight risk of fluvial and tidal flooding from the Glenmore River. In addition, the construction phases of the scheme poses a temporary and slight risk of fluvial flooding from a number of tributaries to the Glenmore River, namely the Springmount, Cois na Gleann and Bleach Hill stream. During the construction phase, it will be necessary to employ standard construction methodologies to ensure that the replacement of culverts are carried out in the dry.

There is a risk that flooding could be exacerbated if the construction methodologies such as temporary diversions do not have sufficient conveyance capacity or adequate overflow arrangements are not put in place. Over pumping of the watercourses, if used, may also increase the risk of flooding.

The construction phase also poses a temporary and slight risk of pluvial flooding in Meadowbrook and at The Grove. The construction of the scheme will generate debris, including silt, which if not handled correctly could result in blockage of the existing surface water drainage networks in the vicinity of the scheme. This will reduce the capacity of these networks to drain the surrounding areas during rainfall events and therefore increase the risk of pluvial flooding.

12.5.2 Operational Impacts

12.5.2.1 Water Quality

The impacts on hydrology as a result of maintenance of the proposed scheme will be temporary and minimal. Maintenance of the permanent defences will be carried out periodically and the impact will be similar in nature to the construction impacts. The main contaminants arising from maintenance activities include:

- Hydrocarbons: accidental spillage from construction plant and storage depots;
- Faecal coliforms: contamination from coliforms can arise if there is inadequate containment and treatment of on-site toilet and washing facilities; and
- Concrete / cementitious products: arising from construction materials.

Contamination of surface water systems by the above pollutants may potentially occur due to:

- Inappropriate handling and storage;
- Leakage of temporary foul water sources; and
- Solid (municipal) wastes being disposed or blown into watercourses or drainage systems.

12.5.2.2 Flood Risk

The proposed scheme will reduce the fluvial and tidal flood risk in Glanmire by providing a flood defence standard equal to the 1 in 100 year fluvial flood level and 1 in 200 year tidal flood event including freeboard. Therefore the risk of fluvial and tidal flooding in the areas to be protected by the scheme will be reduced. The risk of fluvial flooding downstream of the flood defences due to the increased volume of water being conveyed in the channel is considered to be imperceptible.

12.6 Mitigation Measures

12.6.1 Construction Mitigation Measures

12.6.1.1 Water Quality

Prior to construction, the Contractor will be required to develop a Construction Environmental Management Plan (CEMP) which will incorporate the mitigation measures detailed below. These mitigation measures apply for the prevention of pollution to all waters during construction.

Prepare an Emergency Response Plan detailing the procedures to be undertaken in the event of flooding, a spill of chemical, fuel or other hazardous wastes, a fire, or non-compliance incident. This plan will contain the following information:

- Containment measures;
- List of appropriate equipment and clean-up materials;
- Maintenance schedule for equipment;
- Details of trained staff, location, and provision of 24-hour cover;
- Details of staff responsibilities;
- Notification procedures to inform the relevant environmental authorities: Cork County Council, Cork City Council, the EPA and Inland Fisheries Ireland;
- Audit and review schedule;
- Telephone numbers of Cork County Council and Cork City Council Drainage Services;
- List of specialised pollution clean-up companies and their telephone numbers;
- Ensure all site staff are trained in the implementation of Emergency Response Plan and the use of any spill control equipment as necessary;
- Prepare method statements for the control, treatment and disposal of potentially contaminated surface water;
- Prepare a site plan showing the location of all surface water drainage lines and proposed infiltration areas / discharge to combined sewers. This shall include the location of all existing and proposed surface water protection measures, including monitoring points and treatment facilities;
- Ensure that all appropriate licences required for construction are obtained from the relevant authorities;
- The Contractor will comply with the following guidance documents:
 - CIRIA – Guideline Document C532 Control of Water Pollution from Construction Sites (CIRIA, 2001);
 - CIRIA – Guideline Document C649 Control of Water Pollution from Linear Construction Projects Site Guide (CIRIA, 2006);
 - CIRIA – Guideline Document C624 Development and Flood Risk – guidance for the construction industry (CIRIA, 2004); and

- Guidelines on Protection of Fisheries During Construction Works in and adjacent to Waters (Inland Fisheries Ireland, 2016).

The following construction mitigation measures will be utilised to minimise the risk of contamination during in channel works:

- Where cast-in-place concrete is required, all work must be carried out in the dry and effectively isolated from any flowing water (or water that may enter streams and rivers) for a period sufficient to ensure no leachate from the concrete;
- Waterproofing and other chemical treatment to structures in close proximity to watercourses shall be applied by hand; and
- All pumps used for dewatering excavations shall be located in sump to minimise the sediment generation.

The following construction mitigation measures will be utilised to control the interaction of wash down water from concrete and cementitious material, vehicle wash down areas and run-off from fuelling areas with surface water:

- All batching and mixing activities will be located in areas away from watercourses and drains;
- Surface water drainage around the batching plant will be controlled;
- There will be no hosing into surface water drains of spills of concrete, cement, grout or similar materials; and
- Washout from mixing plant or concrete lorries will be carried out in a designated, contained impermeable area.
- All oils and fuels shall be stored in secure bunded areas and care and attention taken during refuelling and maintenance operations. Particular attention shall be paid to the gradient and ground conditions which could increase the risk of discharge to waters.
- Vehicle wash down areas shall be bunded and run-off channelled to a treatment area, such as a settlement pond, prior to discharge.

As per the above listed guidelines, protection measures will be put in place to ensure that all materials used during the construction phase are appropriately handled, stored and disposed of in accordance with recognised standards and manufacturer's guidance.

The Contractor will ensure that any discharges to waterbodies will comply with the appropriate legislative requirements as addressed in Section 12.2.2.

12.6.1.2 Flood Risk

To mitigate the increased risk of fluvial flooding during the construction of the scheme, the Contractor will be required to ensure all temporary watercourse diversions have adequate hydraulic capacity and do not increase the risk of flooding during high fluvial flows or tidal water levels.

Adequate overflow arrangements will be required to ensure high flows can be conveyed downstream without increasing the risk of fluvial flooding.

To mitigate the risk of pluvial flooding during the construction stage the Contractor will be required to ensure all surface water drainage networks in the vicinity of the works remain clear and free flowing. The Contractor will also be required to ensure that all surface water drainage outfalls to existing watercourses are maintained or alternative outfalls are constructed.

12.6.2 Operational Mitigation Measures

12.6.2.1 Hydrology

No mitigation measures are required during the operation phase.

12.6.2.2 Flood Risk

The Glashaboy River (Glanmire/Sallybrook) Drainage Scheme will reduce the risk of fluvial and tidal flooding by providing a standard of protection equal to the 1 in 100 year fluvial and 1 in 200 year tidal flood level including freeboard. It should be noted that IPP measures proposed for two isolated properties will not include the full freeboard allowance. This is due to the flood depth and limitations associated with the structural resistance of these properties.

Therefore no mitigation measures are required in relation to fluvial and tidal flood risk.

12.7 Residual Impacts

A wide range of mitigation measures have been specified for the construction and operational phase of the project. These mitigation measures seek to ensure that construction and operational discharges are controlled to prevent potential pollution impacts to all receiving surface water systems, groundwater bodies and their downstream catchment areas. The mitigation measures also seek to ensure the risk of flooding from all sources is not exacerbated during the construction and operational phases.

No negative residual impacts to surface water quality, groundwater quality or flood risk are anticipated with the implementation of the construction and operational mitigation measures described above.

12.8 References

Arup, *Glashaboy Flood Relief Scheme Hydrology Report (2016)*.

Arup, *Glashaboy Flood Relief Scheme Hydraulics Report (2016)*.

Construction Industry Research and Information Association (CIRIA), *C532 - Control of water pollution from construction sites – Guidelines for consultants and contractors (2001)*.

Construction Industry Research and Information Association (CIRIA), *C649 – Control of water pollution from linear construction projects – Site guide (2006)*.

Construction Industry Research and Information Association (CIRIA), *Ciria C648 - Control of water pollution from linear construction projects - Technical guidance* (2006).

Department of Environment, Heritage and Local Government, *Guidelines for Planning Authorities – The Planning System and Flood Risk Management Guidelines for Planning Authorities* (2009).

Environmental Protection Agency, *Advice Notes for Preparing Environmental Impact Statements Draft September 2015*.

Environmental Protection Agency, *Advice Notes on Current Practice in the Preparation of EIS* (2003).

Environmental Protection Agency, *Guidelines on the information to be contained in EIS* (2002).

Environmental Protection Agency Online Water Quality Database and Envision Map Viewer, www.epa.ie

Environmental Protection Agency, *Revised Guidelines on the Information to be contained in Environmental Impact Statement Draft September 2015*

European Communities Environmental Objectives (Surface Waters) Regulations 2009 (S.I. No. 272 of 2009).

European Communities Priority Substances Directive 2008.

European Communities (Quality of Salmonid Waters) Regulations 1988 (S.I. No. 293 of 1988).

Geological Survey of Ireland, *Ballinhassig GWB: Summary of Initial Characterisation* (2004).

Geological Survey of Ireland Online Mapping, www.gsi.ie.

Inland Fisheries Ireland, *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters* (2016).

Local Government (Water Pollution) Acts 1977 – 1990.

National Parks and Wildlife Service Online Mapping, www.npws.ie.

National Roads Authority, *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes*.

Office of Public Works Lee Catchment Flood Risk Assessment and Management Study Reports and Maps, www.cfram.ie.

Office of Public Works Online National Flood Hazard Mapping Website www.floodmaps.ie.

Office of Public Works Preliminary Flood Risk Assessment Mapping, www.cfram.ie.

South Western River Basin District, *Catchment Characterisation Report 2010*.

South Western River Basin District, *River Basin Management Plan 2009 – 2015*.

South Western River Basin District, *Programmes of Measures 2009 – 2015*.

South Western River Basin District, *River Basin Management Plan and Programmes of Measures Strategic Environmental Assessment* (2011).

The Characterisation and Analysis of Ireland's River Basin Districts National Summary Report (Ireland) 2005.

Water Framework Directive 2000/60/EC.

Water Quality Standards for Phosphorus Regulations 1998 (S.I. No. 258 of 1998).

13 Archaeology, Architecture and Cultural Heritage

13.1 Introduction

This report comprises an appraisal of the Glashaboy River (Glanmire/Sallybrook) Drainage Scheme in Sallybrook, Riverstown and Glanmire Co Cork. The scheme will impact the Bleach Hill Stream and Glashaboy River in Sallybrook; the Cois na Gleann Stream, Springmount Stream and Glenmore Stream in Riverstown; and the Glashaboy River in Glanmire. The purpose of the appraisal is to evaluate the potential impact the proposed scheme will have on the archaeology, architecture and cultural heritage of the development site and surrounding area. The assessment was carried out by Lane Purcell Archaeology.

There are 26 recorded archaeological sites listed in the Record of Monuments and Places (RMP) for Co Cork and the Sites and Monuments Record (SMR) database of the National Monuments Service within a 1km radius of the proposed development. These provide evidence of human settlement and activity in the area dating back to the Bronze Age. There are 23 structures listed in the Record of Protected Structures (RPS) of the Cork County Development Plan (CDP) (2014) within a 1km radius of the drainage scheme. There are 46 buildings included in the National Inventory of Architectural Heritage (NIAH) within 1km radius of the drainage scheme areas.

Some terms used in this report are explained hereunder;

Archaeological Heritage

Archaeological heritage can be described as the study of past human societies through their material remains and artefactual assemblages. The Valetta Treaty (or the European Convention on the Protection of the Archaeological Heritage, 1992) defines archaeological heritage as “all remains and objects and any other traces of humankind from past times”. This includes “structures, constructions, groups of buildings, developed sites, moveable objects, monuments of other kinds as well as their context, whether situated on land or under water”.

Architectural Heritage

Architectural heritage is defined in the Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act, 1999 as structures and buildings together with their settings and attendant grounds, fixtures and fittings, groups of such structures and buildings, and sites, which are of architectural, historic, archaeological, artistic, cultural, scientific, social or technical interest.

Cultural Heritage

Cultural Heritage is an expression of the ways of living developed by a community and passed on from generation to generation, including customs, practices, places, objects, artistic expressions and values.

Cultural Heritage is often expressed as either Intangible or Tangible Cultural Heritage (ICOMOS, 2002). Environmental Protection Agency Guidelines (2003), define cultural heritage as including archaeological heritage, architecture, history, landscape and garden design, folklore and tradition, geological features, language and dialect, religion, settlements, inland waterways (rivers), and place names.

13.2 Methodology

13.2.1 Study area

In order to obtain a comprehensive assessment of the Cultural Heritage Environment, a study area within approximately 1km radius of the proposed scheme was examined.

13.2.2 Methods

The methodology used to complete this section of the EIS comprised the following:

- A review of the relevant Legislation and Guidelines;
- A desktop assessment of the proposed development site and study area;
- A survey or inspection of the proposed development site;
- A wading and metal detector survey of three areas of works proposed for the scheme; (Refer to **Appendix 13.2**)
- An underwater archaeological survey of seven areas of works proposed for the scheme; (Refer to **Appendix 13.3**)
- An evaluation of the likely impacts of the proposed development on the archaeological, architectural and cultural heritage of the proposed development site and study area; and
- Proposed mitigation measures to be undertaken to prevent or reduce any potential impacts on the archaeological, architectural and cultural heritage.

Both **Appendix 13.2** (Wading Survey) and **Appendix 13.3** (Dive Survey) were carried out during the course of the compilation of the EIS as a direct response to consultations with the Underwater Archaeological Unit of the National Monuments Service. The design of the scheme had not been finalised in advance of either survey. Following the completion of both, design changes were implemented which are not reflected in the wading survey and dive survey reports. Full and final details of the scheme are included in this chapter and **Chapter 3 Description of the Proposed Development**.

13.2.3 Legislation and Guidelines

In Ireland, the primary means of protecting cultural heritage assets are the National Monument (Amendments) Acts 1930 to 2004, the Heritage Act 1995, the relevant provisions of the National Cultural Institutions Act 1997, the Architectural Heritage (National Inventory) and Historic Monuments (Misc. Provisions) Act 1999 and the Planning and Development Act 2000, as amended. Policies for both the archaeological and architectural heritage are relayed in a series of specific published guidelines. This chapter is prepared having regard to the following guidelines:

Guidelines on the information to be contained in Environmental Impact Statements, 2002 (Environmental Protection Agency) and Draft Revised Guidelines, 2015.

Advice Notes on Current Practice in the Preparation of Environmental Impact Statements, 2003 (Environmental Protection Agency) and Draft Revised Advice Notes, 2015.

Framework & Principles for the Protection of the Archaeological Heritage, 1999 (Department of Arts, Heritage, Gaeltacht & the Islands).

Policy & Guidelines on Archaeological Excavation, 1999 (Department of Arts, Heritage, Gaeltacht & the Islands).

Architectural Heritage Protection, Guidelines for Planning Authorities, 2004. (Department of the Environment, Heritage and Local Government)

Comprehensive guidelines on the treatment of the archaeological and architectural heritage during the planning and design of national road schemes were published by the National Roads Authority in 2005. These were also used as a guide in the compilation of this EIS.

Guidelines for the assessment of Archaeological Heritage Impacts of National Road Schemes, 2005a (NRA).

Guidelines for the assessment of Architectural Heritage Impacts of National Road Schemes, 2005b (NRA).

13.2.4 Desktop Study

The desktop study provided a cultural heritage overview of the proposed development site and study area and used the following sources.

13.2.4.1 Record of Monuments and Places (RMP)

This record was established under Section 12 (1) of the National Monuments (Amendment) Act 1994. It lists all monuments and places believed to be of archaeological importance in the country.

The numbering system consists of two parts: the first part is the county code (CO for Cork) followed by the Ordnance Survey map number (six-inch to the mile scale); the second part is the number of a circle surrounding the site on the RMP map, e.g. CO064-111 refers to circle 111 on OS sheet 64 for County Cork. The circle is intended to show the recorded monument or place and is sometimes referred to as the *zone of archaeological potential or zone of notification* but the circles do not define the exact extent of the monument or place. The diameter of the circle can vary depending on the size and shape of the site but it averages out at *circa* 180m. The RMP for County Cork was published in 1998.

13.2.4.2 Sites and Monuments Database of the Archaeological Survey of Ireland at the National Monuments Service (NMS)

The purpose of the Archaeological Survey of Ireland (ASI) is to compile a baseline inventory of the known archaeological monuments in the State. It contains details of all monuments and places or sites known to the ASI which pre-date 1700, and a selection of monuments which post-date 1700. The large record archive and database resulting from the survey are continually updated. Sites previously listed in the RMP which, following investigation, are now considered to be of no archaeological potential are de-listed from the database and generally described as redundant records. This database, complete with maps, is now available for consultation via the NMS website at www.archaeology.ie

13.2.4.3 Archaeological Inventory

The inventories for each county are follow-ons by the Archaeological Survey of Ireland to the RMPs. They give a written description of each archaeological site in the county. The Archaeological Inventory of County Cork - East Cork, Volume 2 (Power, Byrne, Egan, Lane and Sleeman) was published in 1994 and a follow-up volume, Volume 5 (Ronan, Egan and Byrne), was published in 2009. Information published in the inventory and on the SMR database on the archaeological sites within the study area is included in **Appendix 13.1**.

13.2.5 Consultations

During the compilation of the EIS the following were consulted:

- Ms Mary Sleeman, County Archaeologist for Co Cork;
- Ms Mona Hallinan, Conservation Officer for Co Cork;
- Ms Connie Kelleher, Underwater Archaeology Unit, National Monuments Service; and
- Ms Mairead Weaver, Planning Office for Co Cork, National Monuments Service.

13.2.5.1 Files of the NMS, DAHG

The NMS was consulted to retrieve information on lists of RMP sites that have been afforded added protection such as:

- National Monuments in the ownership or guardianship of the State – None in the study area;
- Monuments subject to Preservation Orders and Temporary Preservation Orders – None in the study area; and
- Monuments listed in the Register of Historic Monuments – None in the study area.

Underwater Archaeology Unit, DAHG

The Underwater Archaeology Unit maintains files on the Ports Piers and Harbours of Ireland. There are references in the files to the watercourses or settlements in the study area.

The National Museum of Ireland Archives

These files were consulted for townlands within the study area.

The topographical files contain the reports, including correspondence, present location and occasionally, illustrations of archaeological material recovered throughout the country. None of the townlands within the scheme have a record of stray finds recovered from them.

County Development Plan for Cork (2014)

The Cork County Development Plan (CDP) (2014) outlines Cork County Council's objectives with regard to the preservation of the archaeological, architectural and cultural heritage of the County. The CDP outlines the Council's objectives regarding the protection of the archaeological heritage, including the protection of monuments listed in the Sites and Monuments Record and Record of Monuments and Places, by preservation *in situ*, or in exceptional cases, preservation by record. It aims to safeguard 'sites and settings, features and objects of archaeological interest generally'. The zones of archaeological potential identified in the RMP are to be protected, as are underwater archaeology and historic towns. The CDP states that the significance of medieval archaeology, industrial and post medieval archaeology, battlefield and siege sites, as well as structures shown on the 1st and 2nd edition Ordnance Survey (OS) 6-inch maps are to be assessed prior to any development. The CDP also states that the maintenance of burial grounds will be encouraged through appropriate maintenance and conservations. The CDP states that where development may have an impact on the archaeological heritage, an archaeological assessment will be required, and appropriate mitigation measures shall be put in place.

The CDP states that preservation *in situ* is the preferred option, and that there must be compelling reasons to justify preservation by record. Development that does not compromise sub-surface archaeological remains will be encouraged, and development that does not have a visual or physical impact on the setting of a monument will be favoured.

According to the CDP, previously unidentified archaeological sites that are uncovered during construction works must be investigated and recorded.

The rich and varied architectural heritage of the County is protected through the inclusion of buildings in the Record of Protected Structures (RPS), as required in the Planning and Development Act 2000 (Part IV). This record includes all structures or parts of structures which are in the opinion of the Council of ‘special, architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest’. This designation is to ensure that changes or alterations to the included buildings or their settings will be carried out in such a way that their existing special character and setting is retained and enhanced. The objectives of the Council for the RPS include:

- The identification of structures for protection according to criteria set out in Architectural Heritage Protection – Guidelines for Planning Authorities (2004, 2011), as well as the extension of the RPS to form a comprehensive schedule for the County.
- The protection of structures and parts of structures, listed in the RPS, as well as their curtilage and attendant grounds.
- Ensuring that development proposals for protected structures are appropriate and of high quality.
- Ensuring best conservation practices are promoted.
- Ensuring high quality architectural design of new development relating to or impacting on structures and their settings included in the RPS.

There are 23 structures included in the RPS within the 1km study area (**Table 13.1**). As part of the proposed drainage scheme, works will be undertaken to two of these structures or surrounding curtilage; Riverstown Bridge (RPS 00394) and Sallybrook Mill (RPS 00390). At Riverstown Bridge the eastern and western arches are to be cleared of vegetation and silt. A reinforced concrete flood defence wall is to be constructed on both the eastern and western river banks to the north of the bridge. This will tie into a flood defence wall extending along the northern side of the road adjoining both sides of the bridge. The works to Sallybrook Mill include the construction of a reinforced concrete flood defence wall approximately 15m west of the mill. The mill is now adjoined to the north by a large warehouse and is within a large industrial complex (Sallybrook Industrial Estate).

Table 13.1: Architectural features included in the County Development Plan Record of Protected Structures within the study area.

RPS	Townland	Name
00477	Lota More	Lota House
01291	Glanmire	Almshouse
01292	Glanmire	Almshouse
01293	Glanmire	Almshouse
00470	Poulacurry South	St Mary’s and All Saints Church
00471	Poulacurry South	Glen Mervyn House
00472	Poulacurry South	Glanmire House (now Colaiste na Piersaigh)
00485	Ballinlanna	Corn mill (The Fountains)

RPS	Townland	Name
01305	Ballinglanna	Gateway
01301	Ballinglanna	Gothic Structure
01015	Poulacurry South	Eastcliffe House, Northern half
01016	Poulacurry South	Eastcliffe House, Southern half
00483	Ballinglanna	Glanmire Bridge
00820	Ballinglanna	Woodlea (6 cottages)
00484	Poulacurry South	Cloth mill and mill race (St Patrick's Mill)
00475	Poulacurry North	Poul na Corr – Hydraulic barn
00394	Riverstown/ Poulacurry North/ Poulacurry South	Riverstown Bridge
00395	Riverstown	Riverstown House
00391	Knocknahorgan	St Joseph's Catholic Church
00400	Brooklodge	Brooklodge House
00389	Riverstown	Glansillagh Mills
00390	Riverstown	Sallybrook Mills
00388	Knocknahorgan	Silversprings Starch Works

The National Inventory of Architectural Heritage (NIAH) for County Cork includes approximately 6,500 items of architectural importance in the County. The structures identified as being of international and national importance are included on the RPS. Other structures of regional importance were considered for inclusion in the record. Cork County Council recognises the important contribution that all historic structures, including those not on the record, make to County Cork's heritage. The Council will seek the enhancement of these elements in recognition of their "quality, character and local distinctiveness" (Cork County Development Plan 2014, Vol 1, p.194) and will *"give regard to and consideration of all structures which are included in the NIAH for County Cork, which are not currently included in the Record of Protected Structures, in development management functions"* (ibid. 195). In addition to these objectives, the Council will seek to enhance all historic structures, features and landscapes not included in the RPS as well as non-structural elements such as designed gardens, garden features, masonry walls, railings, follies, gates, bridges and street furniture.

One of the County Development Plan's objectives is to preserve the character of a place, area, group of structures, or townscape in order to preserve the character of that area. In this regard areas have been designated Architectural Conservation Areas (ACA). There are no ACAs in the study area or adjoining vicinities.

The County Development Plan (2014) outlines how the rich and diverse cultural heritage of the County will be promoted and protected by Cork County Council "as an important economic asset". The Plan includes "language, the arts, creative industries, enjoyment of the natural, historic and built environment, events and festivals, use of tourist attractions, libraries, museums, archives and galleries, industrial heritage, the diversity of the faith communities and places of worship, local cultural traditions and sport and recreation" as culture that helps to define the perception of the County and provides a sense of identity. The CDP acknowledges the importance of folklore, oral cultural heritage, historic heritage sites, including battle sites, historic rights of way and Irish place names.

13.2.5.2 National Inventory of Architectural Heritage (NIAH)

The National Inventory of Architectural Heritage was set up under the Convention for the Protection of the Architectural Heritage of Europe or the Granada Convention of 1985. It was established on a statutory basis under Section 2 of the Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act 1999. The work of the NIAH involves identifying and recording the architectural heritage of Ireland, from 1700 to the present day, in a systematic and consistent manner. It is divided into two parts; The Building Survey and Historic Garden Survey (www.buildingsofireland.ie). The main function of both is to identify and evaluate the State's architectural heritage in a uniform and consistent manner, so as to aid to its protection and conservation. The NIAH carried out a survey of the buildings of County Cork between 2006 and 2011. Under Section 53 of the Planning and Development Act 2000, all structures considered of regional, national or international Importance within the survey are recommended for inclusion in the Record of Protected Structures by the Minister for Arts, Heritage, Regional, Rural and Gaeltacht Affairs. If this is not adopted by the local authority, the reasons must be communicated to the Department. The Building and Historic Garden Survey for County Cork is available online.

A total of 46 buildings and structures included in the NIAH are within the 1km study area (**Table 13.2**). A number of these are also included in the RPS of the County Development Plan (2014). A number of gardens included in the garden survey are within the study area including Castle Jane House and Castle Jane Villa, Glenville now Ballinglanna House, Riverstown House and Sarsfield's Court.

Table 13.2: Architectural features listed in the NIAH within the study area

No	Name	Location
20860004	Barnavara House	Barnavara Rd, Glanmire
20860005	Poulacurry House	Glanmire
20860006	Glenkeen House	Church Hill, Glanmire
20860007	Glenkeen Lodge	Church Hill, Glanmire
20860008	The Cottage	Church Hill, Glanmire
20860009	Glen Mervyn House	Glanmire
20860010	St Mary's and All Saints Church	Church Hill, Glanmire
20860011	Church Hill former school	Glanmire
20860012	The Cottages	3 Cork Road
20860013	The Cottages	2 Cork Road
20860014	The Cottages	1 Cork Road
20860015	The Old Post Office	Cork Road
20860017	Glen Mervyn House gates and railings	Cork Road
209063226	Saint Stephen's Hospital	Glanmire
20906323	Saint Stephen's Hospital	Unit 8 Glanmire
20906324	Saint Stephen's Hospital	Glanmire
20906325	Saint Stephen's Hospital	Glanmire
20906326	Saint Stephen's Hospital	Unit 7 Glanmire
20906327	Saint Stephen's Hospital	Glanmire
20906328	Saint Stephen's Hospital	Glanmire
20906329	Saint Stephen's Hospital	Glanmire
20906330	Saint Stephen's Hospital	Glanmire
20906331	Saint Stephen's Hospital	Glanmire
20907505	Glanmire Bridge	Glanmire
20907506	Woodlea	Glanmire

No	Name	Location
20907507	Eastcliffe	Glanmire
20907508	Eastcliffe /Glanmire Chiropractic Clinic	Glanmire
20907509	Ballinglanna House	Glanmire
20907510	Former Mill	Ballinglanna, Glanmire
20907512	Post box	Glanmire
20907513	Glanmire Rectory	Glanmire
20906332	Sallybrook House	Sallybrook
20906335	Riverstown Community Centre R.A.C.A Ltd	Riverstown
20906414	Riverstown House	Riverstown
20906415	Riverstown Bridge	Riverstown
20906416	Three-bay, two-storey house	Riverstown
20906417	Copperalley Bridge	Brooklodge, Riverstown
20907502	Former coach house	Riverstown
20907504	Saint Patrick's Mill	Ballinglanna, Riverstown
20906409	The Hermitage	Hermitage
20906413	Kilroan House	Brooklodge
20906334	St Joseph's Roman Catholic Church	Knocknahorgan
20864023	Country house	Lotamore
20864024	Church/chapel	Lotamore
20864025	Folly	Lotamore
20864026	Country house	Lotamore

13.2.5.3 Database of Irish Excavation Reports (www.excavations.ie)

This web site provides a database of summary accounts of archaeological excavations and investigations undertaken in Ireland between 1970 and 2015. Until 2010, these accounts were also published in book form. The database was queried for any investigations undertaken in the proposed development site and study area. A number of archaeological investigations were undertaken in the study area, including a wading and metal detector survey of sections of three watercourses affected by the proposed works (**Appendix 13.2**) and a dive survey of the Glashaboy River (**Appendix 13.3**). These and other investigations undertaken are discussed below.

13.2.5.4 Site-specific publications

All available published information on the study area was consulted. This included historical journals, local history publications etc., all of which are listed in the bibliography.

13.2.5.5 Cartographic Sources

The following maps were consulted:

- The 1811 Grand Jury map of Cork compiled by Neville Bath in the 1790s and published in 1811 at a scale of three quarters of an inch to one mile.
- Ordnance Survey (OS) 6-inch maps: the three editions of the 6-inch to one mile scale maps were consulted, the first edition published in 1841-1844, the second edition published circa 1902, and the third editions published in 1935, 1939 and 1950 onto which the RMP was superimposed in 1998.

- The 25-inch to one mile scale map, from which the second edition 6-inch map was derived in 1902 was also consulted.

13.2.5.6 Aerial Photographs

Ordnance Survey of Ireland online aerial photographs (dated 1995, 2000 and 2005) (www.osi.ie) and Google maps online aerial photographs are available for viewing (www.google.ie/maps). These were examined to identify any previously unrecorded features of archaeological/cultural heritage significance that may only be visible from the air. No archaeological features were apparent on the photographs.

13.2.6 Site Inspection

The primary purpose of a site inspection is to assess the physical environment in which the drainage scheme will be undertaken and identify any possible features of cultural heritage significance which have not been previously recorded. Current land use, local topography and environmental conditions are assessed to gain an overall picture of the area.

The proposed development site was visited on a number of occasions, initially on the 5th April 2016, the 11th July and most recently on the 8th August 2016.

13.3 Receiving Environment

The Glashaboy River rises to the north of the village of Carrignavar in the townland of Glashaboy North. It flows roughly southwards passing along the east side of Carrignavar and on its south side is joined by another south-flowing stream coming from the west side of the village. The river continues south-eastward towards Sallybrook and then turns generally south through Riverstown and Glanmire before discharging into the Lee estuary at Dunkettle in the inner reaches of Cork Harbour at Lough Mahon.

The river is quite a wide, fast-flowing watercourse by the time it reaches the village of Sallybrook at the northern end of the scheme, having converged with Bleach Hill Stream a short distance north of the village. Between Sallybrook and Riverstown two other small streams join the Glashaboy; Cois na Gleann and Springmount Streams both from the west. To the east of Riverstown a fast flowing stream, the Glenmore, which rises approximately 7km to the west in Cloneen townland, converges with the Butlerstown Stream which itself rises south of Watergrasshill approximately 9km to the northwest. The Butlerstown Stream converges with the Glashaboy in Ballinglanna townland at the south of Riverstown to form a wide, fast-flowing watercourse. The river continues south to Glanmire where it opens up into a wide, tidal estuary and discharges into the Lee at Dunkettle.

13.3.1 Cultural Heritage and the Existing Environment

The Glashaboy River and its tributaries were the focus of much of the industrial activity in the broader Glanmire area in the 18th and 19th centuries. Water power was harnessed to operate flour mills, a paper mill (which later became a woollen mill), a bleach and cloth mill, a pike mill, a fuling (or tuck) mill and a distillery. Elements of the physical remains of many of these industries survive, albeit in an incomplete state. In the second half of the 20th century Glanmire expanded into a commuter town to Cork city, located approximately 5km to the southwest. It has merged with the adjoining villages of Riverstown and Sallybrook to form a large, almost continuous, suburban settlement spanning both banks of the Glashaboy and its tributaries. The M8 Cork-Dublin motorway runs roughly north from Dunkettle and this has largely defined the eastern extent of the suburban expansion, while it is contained to the west by higher ground.

The drainage scheme and associated study area spans the townlands of Lotamore, Dunkettle, Poulacurry South, Poulacurry North, Ballinglanna, Riverstown, Knocknahorgan, Ballincrossig, Brooklodge Upper, Brooklodge Lower, Hermitage and Corbally North in the civil parishes of Rathcooney, Caherlag, Ballydeloher and Templeusque and the Baronies of Cork and Barrymore.

There are 26 no. recorded archaeological sites listed in the RMP and SMR database for the 1km study area (**Figures 13.1a, 13.1b** and **Table 13.3**). There are 23 no. protected structures listed in the RPS of the Cork County Development Plan (2014) within the study area (**Table 13.1**) and 46 buildings and structures included in the NIAH (**Table 13.2**). A small number of these sites and monuments are included in all three (the SMR database, the RPS and NIAH). These are Riverstown Bridge (CO064-111, RPS 00394 and 20906415), Glanmire Bridge (CO075-048, RPS00483 and 20907505), St Mary's and All Saints Church (CO074-104, RPS 00470 and 20860010), Riverstown House (CO064-051, RPS00395 and 20906414), Lotamore country house (CO074-026, RPS 00477 and 20864023) St Patrick's Mills in Poulacurry South (CO075-001, RPS 00484 and 20907504) and The Fountains mill in Ballinglanna (CO075-002001-, RPS 00485 and 20907510). A number are included in two of the listings including Sallybrook Mills (CO063-069 and RPS 00390) Glansillagh Mills (CO063-094, RPS 00389) and Silverspring Starch Works in Knocknahorgan (CO063-093 and RPS 00388).

Table 13.3: Archaeological sites included on the RMP and SMR database within the study area (Figs. 1a and 1b)

RMP	Townland	Site Type
CO064-044	Sarsfieldscourt	Castle
CO063-092	Knocknahorgan	Ringfort
CO063-093	Knocknahorgan	Cloth mill
CO063-094	Riverstown	Cloth mill
CO063-069	Riverstown	Paper mill
CO064-047	Hermitage	Standing stone
CO064-048	Hermitage	Standing stone
CO064-049	Hermitage	Sweathouse
CO064-052	Brooklodge	Fulling mill

RMP	Townland	Site Type
CO064-050	Riverstown	Ornamental lake
CO064-051	Riverstown	Country house
CO064-055	Brooklodge	Castle
CO064-056	Brooklodge	Fish-pond
CO064-111	Riverstown Poulacurry North Poulacurry South	Bridge
CO064-142	Riverstown	Lime kiln
CO074-071	Poulacurry South	Mound
CO074-104	Poulacurry South	Church of Ireland church
CO075-001	Poulacurry South	Cloth mill
CO075-002001-	Ballinglanna	Corn mill
CO075-002002-	Ballinglanna	Lime kiln
CO075-003	Ballinglanna	Distillery
CO075-069	Ballinglanna	Coach house
CO075- 048	Ballinglanna Poulacurry South	Bridge
CO075-094001-	Ballinglanna	Architectural fragment
CO075-094002-	Ballinglanna	Architectural fragment
CO-074-026	Lotamore	Country house

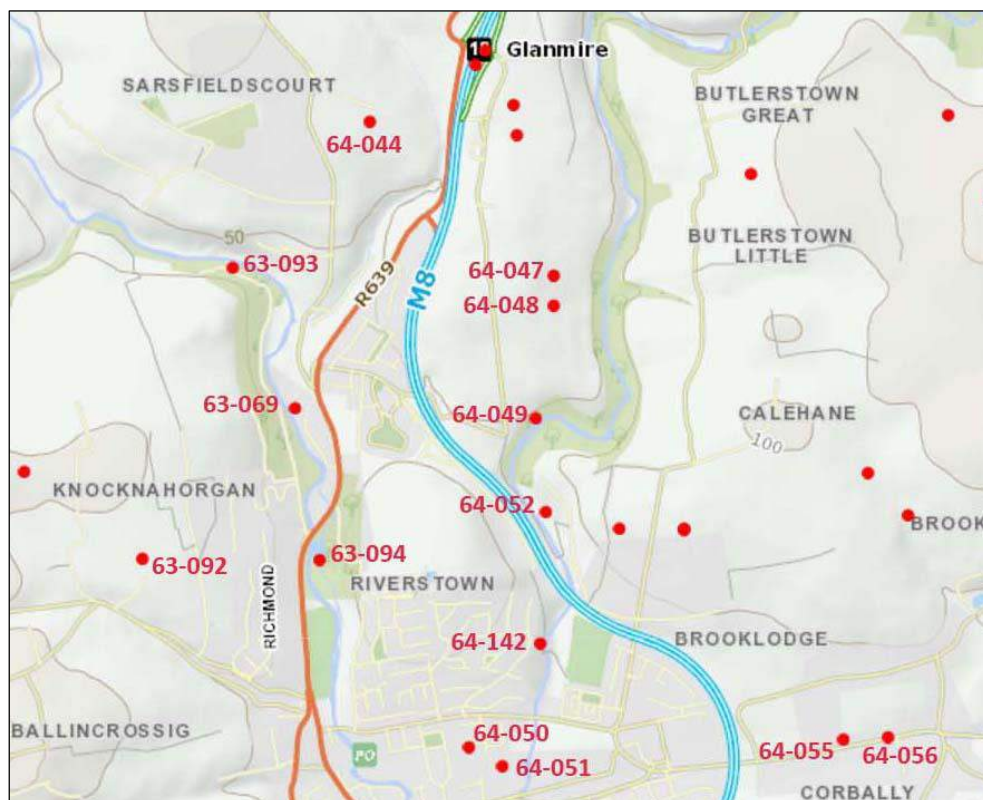


Figure 13.1a: Archaeological sites included in the RMP and SMR database within the northern end of the study area (from www.archaeology.ie)



Figure 13.1b: Archaeological sites included in the RMP and SMR database within the southern end of the study area (from www.archaeology.ie)

The following is a chronological account of the cultural heritage of the study area. It provides an archaeological and historical overview of human activity in the study area from the prehistoric period to modern times. Much of the information on the archaeological sites is derived from the Archaeological Inventory of Co Cork (Power et al 1994 and Ronan et al 2009). The full published account is included in **Appendix 13.1**. The archaeological timescale can be divided into two major periods, each with a number of sub-sections:

- The prehistoric period: Mesolithic - (circa 7000 to 4000 BC); Neolithic - (circa 4000 to 2400 BC); Bronze Age (circa 2400 to 500 BC) – Iron Age (circa 500 BC to AD 400)
- The medieval period: Early medieval 5th – 12th century, high medieval 12th century – circa 1400, late medieval circa 1400 – 16th century.

The pace of landscape change in Ireland accelerated in the second half of the 20th century, and many archaeological sites have been levelled by activities associated with modern development, such as housing and infrastructural improvements, and by the intensification in agricultural and industrial practices. Prior to this, the landscape changed at a slower pace, but, despite the relatively slow pace of this change, significant alterations to the landscape are in evidence since the earliest human occupation of the island.

These changes and alterations to the landscape mean that the present day archaeological landscape is not fully representative of the human occupation of the island of Ireland, which has spanned circa nine thousand years. Archaeological sites survive today as upstanding structures, earthwork monuments or subsurface remains.

13.3.1.1 Pre-historic Period

The prehistoric period is poorly represented in the study area where only two known archaeological sites date to this period. Both are standing stones in Hermitage (CO064-047 and CO064-048) at the northwest of the study area. They probably date to the Bronze Age and may have functioned as burial markers or boundary or route way markers within the landscape. Within the broader landscape beyond the study area there are, however, a number of early prehistoric sites including possible Mesolithic and Neolithic activity at Curraghprevin near Rathcormac, revealed during construction of the M8 motorway. Further north close to Fermoy a Neolithic house was excavated also during construction of the M8 and to the south in Cork Harbour late Neolithic/ Early Bronze Age activity was revealed on Fota Island and on the Mahon peninsula at Ballinure. There is extensive evidence of later prehistoric activity within the broader landscape also particularly in the form of fulachta fia or Bronze Age cooking sites. The townland of Crushyree south of Watergrasshill contains six recorded fulachta fia and the adjoining townland of Killalough contains two, both of which were excavated during construction of the M8. A Bronze Age house and Bronze Age burials were excavated in the adjoining townland of Killydonoghoe just north of Glanmire also during construction of the M8.

13.3.1.2 Medieval Period

The early medieval period is similarly poorly represented in the study area with only a single known monument dating to this period a ringfort in Knocknahorgan (CO063-092) at the northwest of the study area. The broader landscape is, in contrast, rich in contemporary monuments. Numerous ringforts are recorded in many nearby townlands such as Ballynaroona near Glounthaune, Blossongrove and Ballinbrittig both west of Riverstown with five and six recorded ringforts, respectively, in each. There is an early ecclesiastical enclosure in Kilrussane near Watergrasshill, a number of Ogham stones in Ballynaborthagh west of Watergrasshill, a horizontal wheeled mill in the aforementioned Crushyree and a corn drying kiln in Ballinvinny North between Glanmire and Watergrasshill. The latter was excavated during construction of the M8.

Two castle sites probably date to the later medieval period although no remains of either now survive. The remains of a castle in Brooklodge (CO064-055) were destroyed when a road was constructed through the site at the turn of the 20th century. The castle in Sarsfieldscourt (CO064-044) was probably a semi-fortified house dating to the mid-17th century (Healy 1988, 68). Architectural fragments incorporated into buildings in Ballinglanna (CO075-094001- and CO075-094002-) may be of medieval origin probably from the window of a tower house, although there is no evidence of a tower house at the site.

13.3.1.3 Post medieval Period

The majority of the archaeological sites within the study area date to the post medieval period and relate to the industrial activity that flourished in the catchment of the Glashaboy River much of it powered by the energy harnessed from the river and its tributaries.

There are a large number of industrial remains in the study area including flour mills, a paper mill (which later became a woollen mill), a bleach and cloth mill, a pike mill, a fulling (or tuck) mill and a distillery. These buildings survive today in various states of repair and some are no longer extant; most are shown in their original form or close to their original form on the 1840s OS 6-inch maps with alterations to them apparent on later editions of the OS maps (from the early and mid-20th century). These alterations frequently included changes in use as well as changes to the upstanding remains. Many are included in the RMP and SMR database or NIAH inventory, and several are protected structures listed in the Cork County Development Plan (2014).

Sallybrook Mill in Riverstown (CO063-069 and RPS 00390) was named as a paper mill on the 1842 OS 6-inch map and Sallybrook (Woollen) Mill on the 1902 OS 25-inch map and 1936 OS 6-inch map. This was one of at least 11 paper mills in operation in Cork city and hinterland by the middle of the 19th century. The paper milling industry was focused on the catchment area of the Glashaboy River and was at the centre of the Munster paper industry during the 18th and 19th centuries (Rynne 2006, 307). Its surviving remains now comprise some of the buildings in Sallybrook Industrial Estate. According to the Archaeological Inventory of County Cork (Power 1994) the mill wheel was removed in 1968 and was on the east side of the structure.

St Patrick's Mills (CO075-001 and RPS 00484) in Poulacurry South was named as a cloth mill on the 1842 OS map and a beetling mill on the 1902 map. The earliest part of the complex is a four-storey building on the west side of the complex and has a date plaque of 1796. The later part of the complex is of mid-/late-19th century date (Power 1994). Rynne describes the complex as a large bleach works owned by William Thorley in 1863 at which both steam calenders and beetling engines were used for finishing linen and this was quite rare outside Ulster (Rynne 2006, 220).

The flour mill in Ballinglanna (CO075-002001- and RPS 00485) is named Flour Mill on the 1842 OS map and The Fountains Flour Mill (disused) on the 1902 OS map. The complex was damaged by fire in the 1960s (Power 1994).

The cloth mill in Riverstown (CO063-094 and RPS00389) was named Bleach and Cloth Mill on the 1842 OS map, Pike Mill on the 1902 map and Glansillagh Mill on the 1935 OS map. This multi-period complex was damaged by a fire in the 1980s (Power 1994). Rynne (1999, 98) refers to Riverstown scutching mill as part of William Thorley's Glanmire and Riverstown Bleachworks which was described in the 1850s as one of the most extensive in the south of Ireland. Although it is not clear from Rynnes reference that this is the complex referred to this is the only cloth mill in Riverstown townland.

The Cloth Mill in Knocknahorgan (CO063-093 and RPS 00388) is named Bleach and Cloth Mill on the 1842 OS map and 'Silversprings Starch Works' on subsequent editions. It is a large complex with a late 19th early 20th century residential house at its centre (Power 1994).

The Fulling Mill in Brooklodge (CO064-052) is named Tuck Mill on the 1842 OS map and is unnamed on subsequent editions.

The distillery in Ballinglanna (CO075-003) is named Distillery on the 1842 OS and Brewery on the 1902 edition reflecting its change of use. Archaeological testing at the site revealed limited subsurface remains possibly associated with the distillery (Purcell 2016).

Three historic bridges in the study area are included in the RMP/SMR database, RPS of the County Development Plan (2014) or NIAH. These provided important transport links required to facilitate the industrial growth in the area. Riverstown Bridge (CO064-11, RPS 00394 and 20906415) and Glanmire Bridge (CO075-048, RPS 00483 and 20907505) are included in the RMP/SMR, RPS and NIAH while Copperalley Bridge (20906417) is included in the NIAH. Riverstown Bridge is a road bridge across the Glashaboy River built in the mid-18th century. It comprises five semi-circular arches with roughly cut voussoirs and low pointed breakwaters (Power 1994 and NIAH). Similarly, Glanmire Bridge is a road bridge across the Glashaboy River downstream of the latter and built in the late 18th century. It is a hump-backed bridge of three semi-circular arches with dressed voussoirs and pointed breakwaters (Power 1994 and NIAH). Copperalley Bridge is a road bridge across the Butlerstown River built circa 1780. It is a triple-arch humpback road bridge with segmental arches cut stone voussoirs (NIAH).

In addition to the industrial activity that developed in the area in the late 18th and 19th centuries the Glashaboy catchment became a favoured location for the wealthier citizens of Cork city to build more spacious country houses outside the confines of the cramped city's medieval core. They joined the ranks of the wealthy farming community and built large country houses frequently with associated demesnes. Many included landscaped gardens and woodlands, often enclosed by high walls and belts of trees and associated buildings such as gate lodges, ornamental towers, ice houses and lime kilns. Many of these structures and landscapes remain the dominant man-made feature of the post-medieval landscape in Ireland (Reeves-Smith, 1997, 552).

13.3.1.4 Historical Mapping

The first edition of the OS maps, compiled in the 1840s, depict the features of these demesnes in great detail; subsequent maps generally depict their contraction within the landscape. There are a number of country houses and associated features within the Study area which are included in the RMP/SMR database, RPS of the County Development Plan (2014) or NIAH. These include Riverstown House (CO064-051, RPS 00395 and 20906414) and early 18th century house and associated ornamental lake (CO064-050), Lota House (CO074-026, RPS 00477 and 20864023) a mid-18th century Davis Duckart designed house with associated folly (20864025) and later church (20864024).



Figure 13.2: Extract from Grand Jury map of Cork (1811) showing the study area

The Grand Jury map of 1811 (**Figure 13.2**) names and shows a small settlement at both Glanmire and Riverstown in the southern end of the study area. Sallybrook village is neither named nor depicted and the northern end of the study area in general is sparsely informed with no specific features name or depicted in the Sallybrook area. The road network, general topography and a small number of buildings are named and depicted on the map, however, the scale is such that it does not depict individual townlands. The buildings named and shown appear to be the significant houses and industrial buildings of the area. Two mills within the study area are shown but no further details of the milling activity are given. A mill is shown in the vicinity of the cloth mill in Poulacurry South (CO075-001 and RPS 00484) now known as St Patrick's Mill to the south of Riverstown. A second mill is named further to the north near Springhill. This is probably a Flour Mill in Ballincrossig townland depicted on the first edition of the OS 6-inch map from the early 1840s to the west of Riverstown but now no longer extant.

A number of country houses are shown including Lota House (CO074-026 and RPS 00477) at the south of the study area on the western bank of the Glashaboy and numerous houses on the eastern bank of the Glashaboy such as Glintown House, which is no longer extant, and further south Richmond and Woodville and further south again Dunkettle House, which is outside the study area. Riverstown House (CO064-051 and RPS 00395) is shown to the west of the Butlerstown River to the northeast of Riverstown.

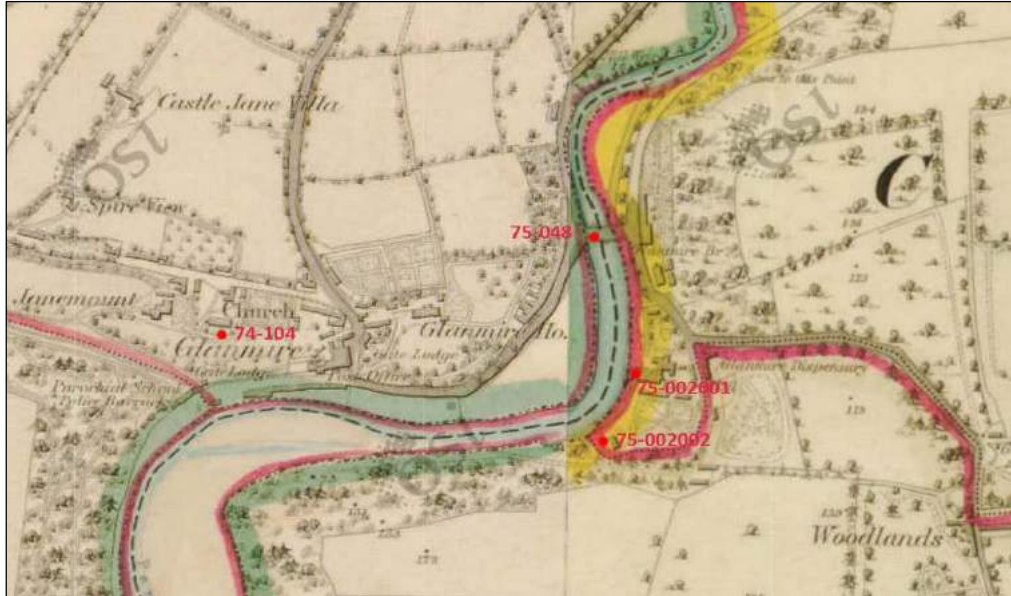


Figure 13.3a: Extract from OS 6-inch map (1842) Glanmire

The first edition of the OS 6-inch maps from the early 1840s depicts a rural landscape set along the meandering Glashaboy River and its tributaries. The village of Glanmire is named and depicted at the southern end of the study area on the western bank of the river at a broad bend (**Figure 13.3a**).

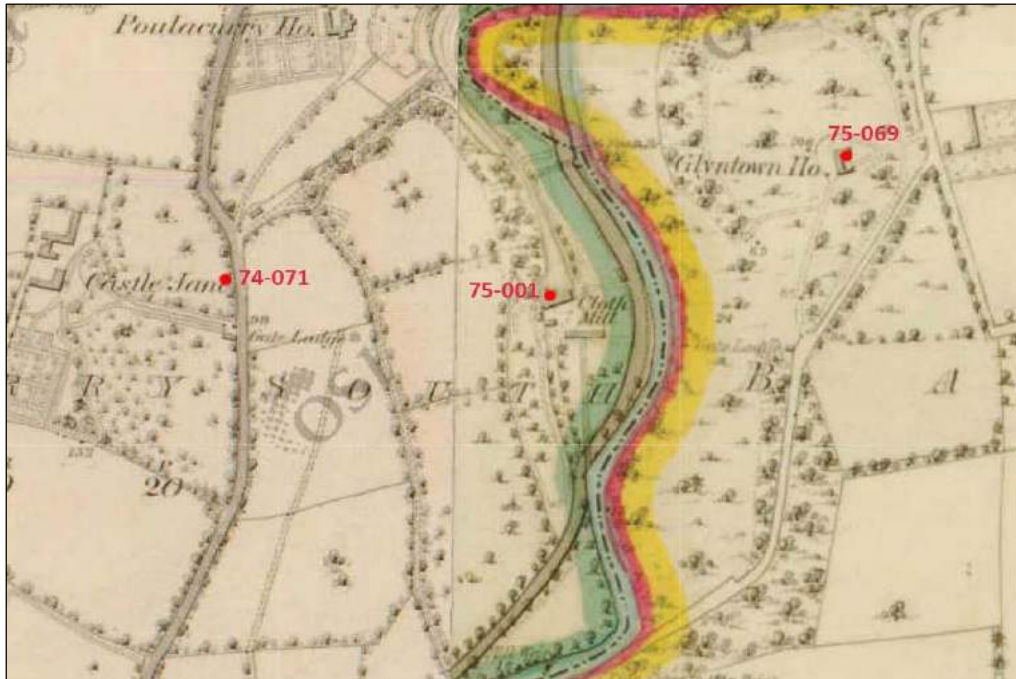


Figure 13.3b: Extract from OS 6-inch map (1842) Poulacurry South

A small number of buildings are situated on the eastern bank accessed by Glanmire Bridge including a large flour mill (CO075-002001-) adjacent to Glanmire dispensary (now called The Fountains). A large cloth mill (CO075-001) is named and depicted some distance north of Glanmire (**Figure 13.3b**) on the western bank of the Glashaboy (now called St Patrick's Mills).

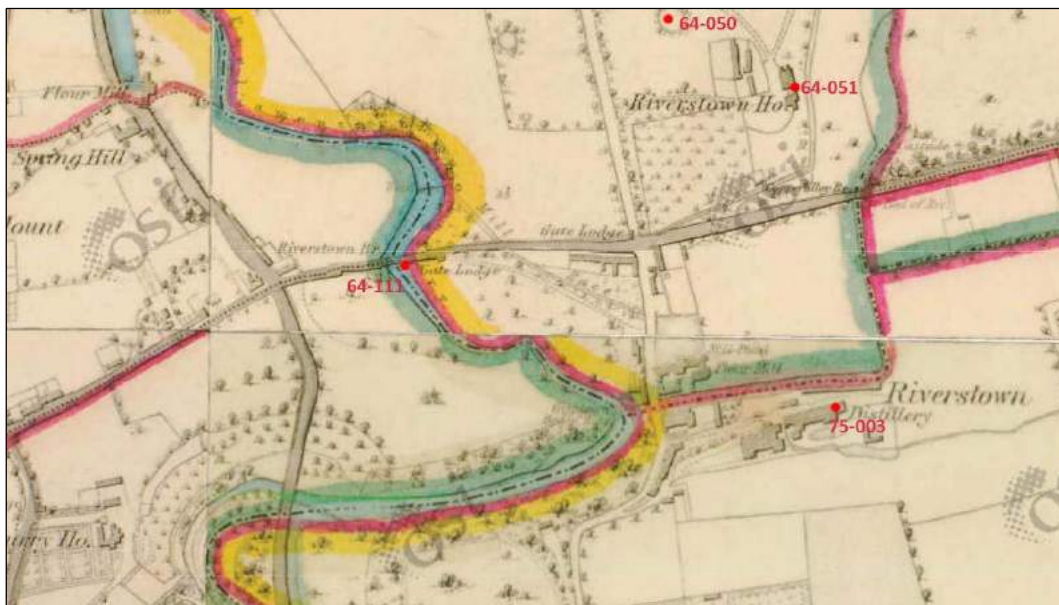


Figure 13.3c Extract from OS 6-inch map (1842) Riverstown

A number of country houses are named and depicted in the landscape beyond the village. The village of Riverstown is depicted towards the centre of the study area situated at the confluence of the Butlerstown River with the Glashaboy (**Figure 13.3c**). The industrial elements of the village are the distillery (CO075-003) and

flour mill situated on opposing banks of the Butlerstown and this area is named Riverstown on the map. The residential component of the village is more dispersed and further to the north and northwest separated into two sections by Riverstown Bridge (CO064-111). To the north close to the entrance to Riverstown House (CO064-051) there is a small cluster of buildings fronting the road and further west across the bridge a larger more dispersed settlement lines the roads running north and west. A Flour Mill is named at the northern end of this settlement adjacent to Spring Hill country house and west of Riverstown with a large mill pond to its north on the western bank of the Glashaboy. This appears to be the mill named on the Grand Jury map of 1811. Sallybrook village is depicted at the northern end of the study area (**Figure 13.3d**). It is shown as a linear settlement largely on the western side of the R639 road and at the northern end extending along a local road.

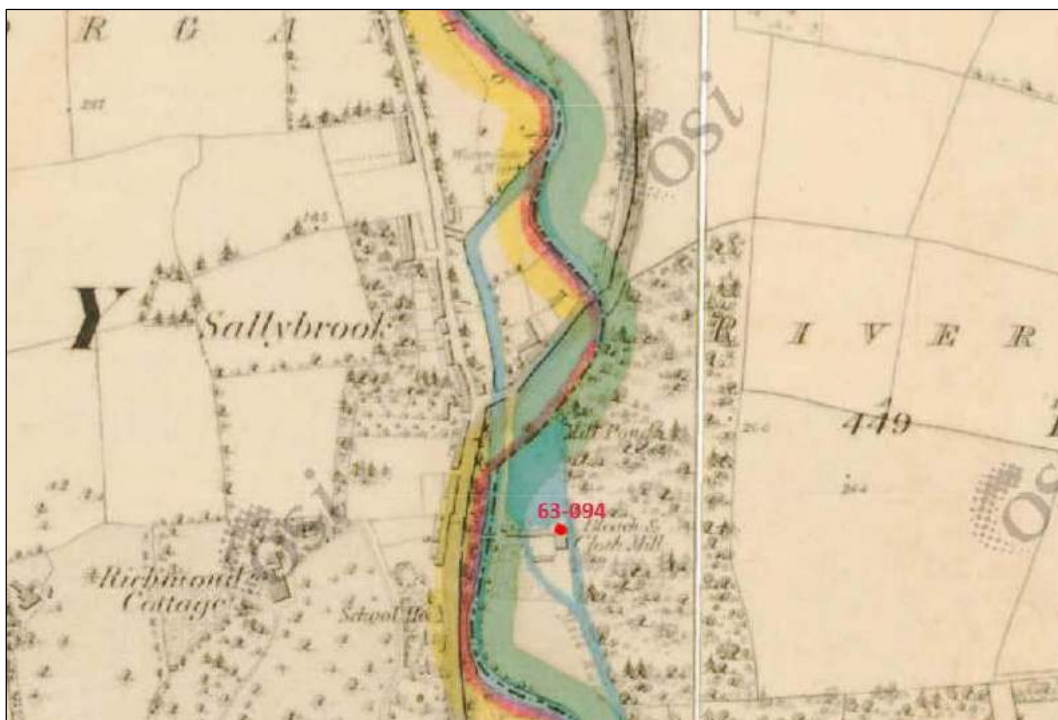


Figure 13.3d Extract from OS 6-inch map (1842) Sallybrook village

The Glashaboy lies to the east of the village and a bleach and cloth mill (CO063-094) lies on its eastern bank towards the centre of the village. A paper mill (CO063-069) and the associated miller's houses, Sallybrook House, lie at the northern end of the village on the river's eastern bank (**Figure 13.3e**). To the north of Sallybrook the landscape is rural dotted with unnamed generally isolated buildings and occasionally named country houses and associated features.

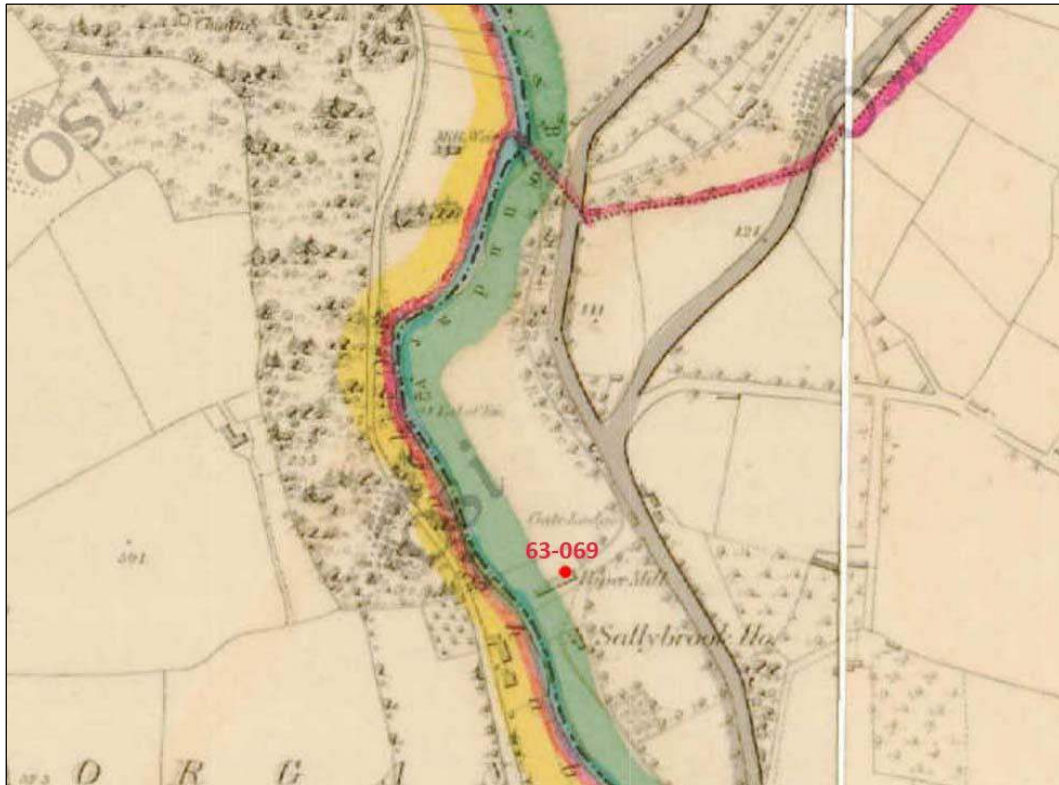


Figure 13.3e: Extract from OS 6-inch map (1842) Sallybrook Paper Mill

The 25 inch OS compiled at the turn of the century depicts modest changes to the study area, Riverstown village has grown slightly while at the northern end of the study area, Sallybrook village has contracted slightly. The industrial activity in the area is still apparent although a number of the mills are now labelled disused including the flour mills (CO075-002001-) in Glanmire (labelled The Fountains) (**Figure 13.4a**) and Riverstown, on the Butlerstown River, and the former flour mill to the west of Riverstown adjacent to Spring Hill which is labelled disused corn mill on this map. Changes to the uses of some of the industrial buildings are reflected on the map. The former distillery in Riverstown (CO075-003) is now labelled a brewery, the former cloth mill (CO075-001) to the north of Glanmire in Poulacurry South a beetling mill (**Figure 13.4b**) and in Sallybrook the former bleach and cloth mill (CO063-094) is now named as a pike mill (**Figure 13.4c**), while the paper mill (CO063-069) associated with Sallybrook House is now a woollen mill called Sallybrook Mill (**Figure 13.4d**). The rural tone of the landscape is unchanged still dotted with country houses and smaller farm houses.

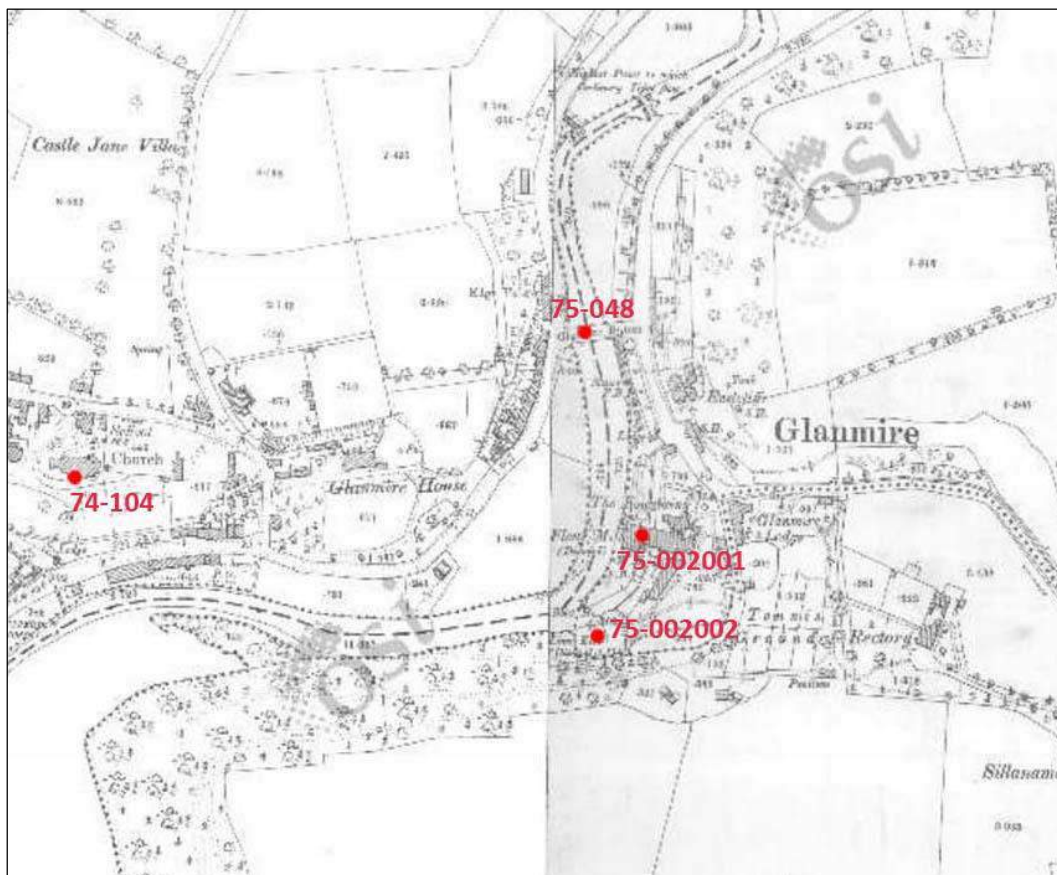


Figure 13.4a: Extract from OS 25-inch map (1902) Glanmire

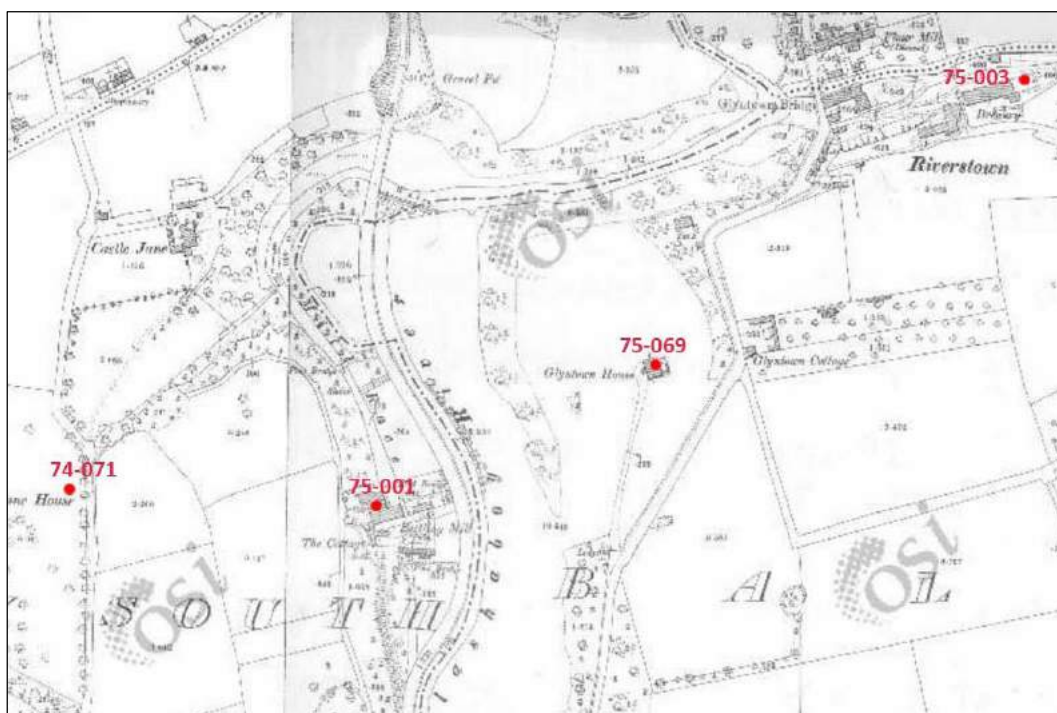


Figure 13.4b: Extract from OS 25-inch map (1902) Riverstown

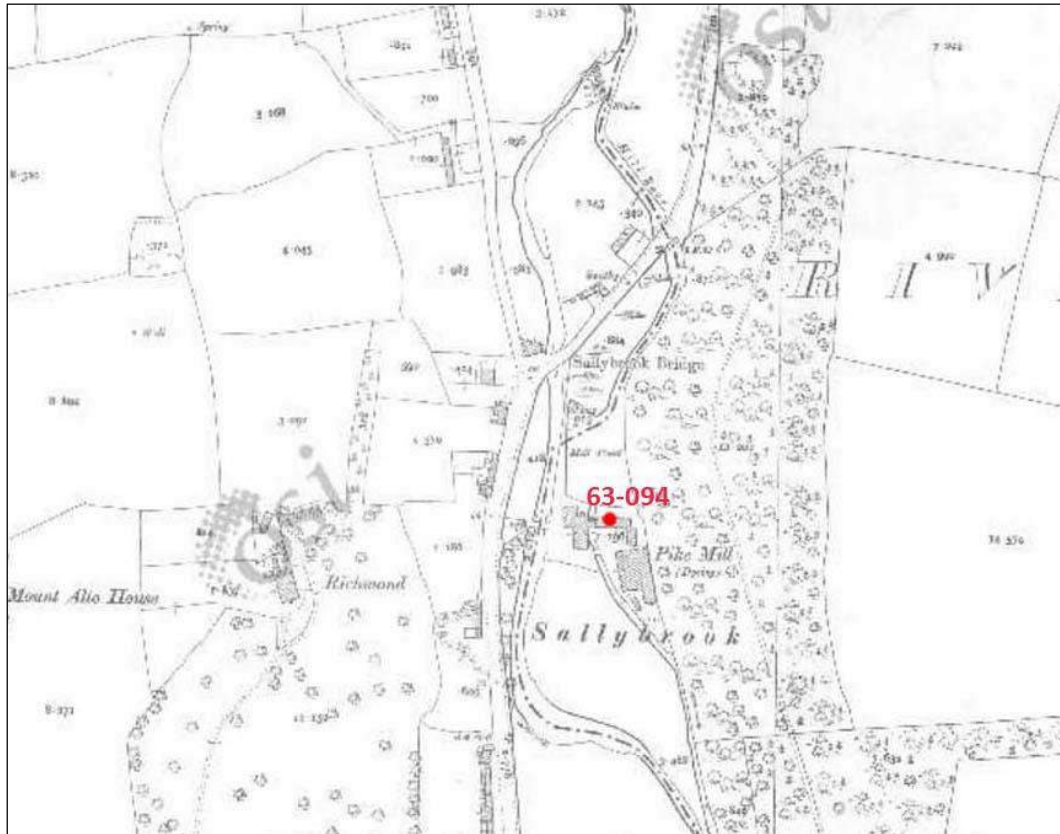


Figure 13.4c: Extract from OS 25-inch map (1902) Sallybrook village

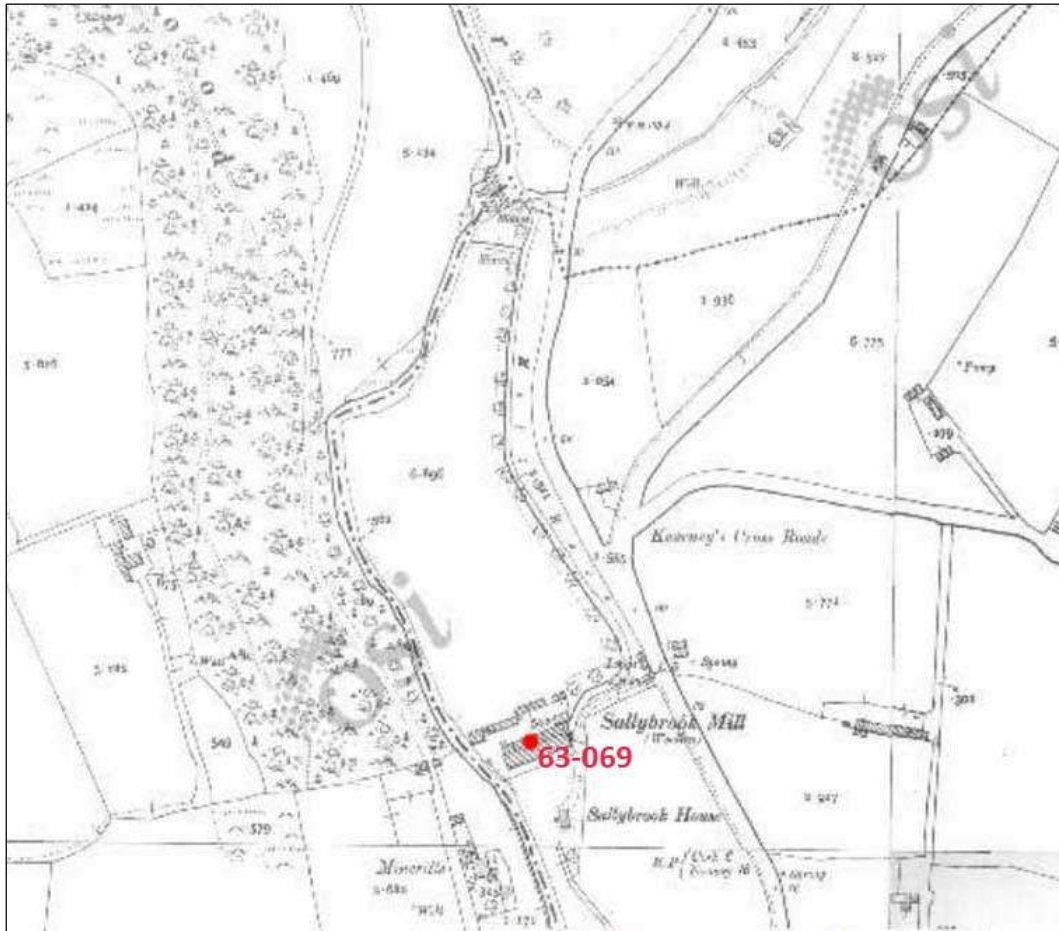


Figure 13.4d Extract from OS 25-inch map (1902) Sallybrook Mill

The third edition OS map towards the middle of the 20th century depicts relatively minor changes to the study area. The landscape remains rural with settlement focused on the three villages in the study area and farm houses and country houses dotting the broader landscape. The industrial infrastructure remains in-tact with mill races, sluice gates etc. still named but many of the buildings themselves are not labelled except those in Sallybrook at the northern end of the study area where Glansillagh Mills (waterproof goods) (CO063-094) (**Figure 13.5a**) and Sallybrook Mills (woollen) (CO063-069) (**Figure 13.5b**) are both labelled.

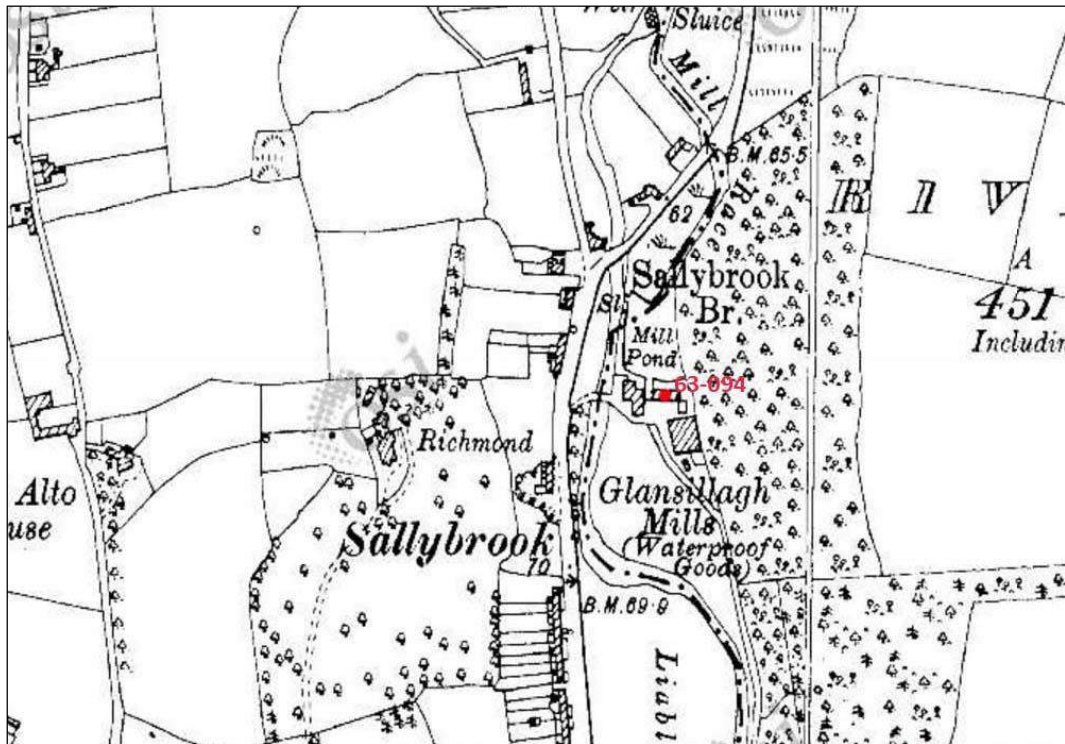


Figure 13.5a: Extract from OS 6-inch map (1934) Sallybrook village



Figure 13.5b: Extract from OS 6-inch map (1934) Sallybrook Mill

The industrial building in Glanmire and Riverstown are generally not labelled but most are depicted suggesting they are still in use. The flour mill on the northern bank of the Butlerstown River north of the distillery (CO075-003) is no longer shown while the corn mill to the west of Riverstown, at Spring Hill, is described as ‘in ruins’ (**Figure 13.5c**).

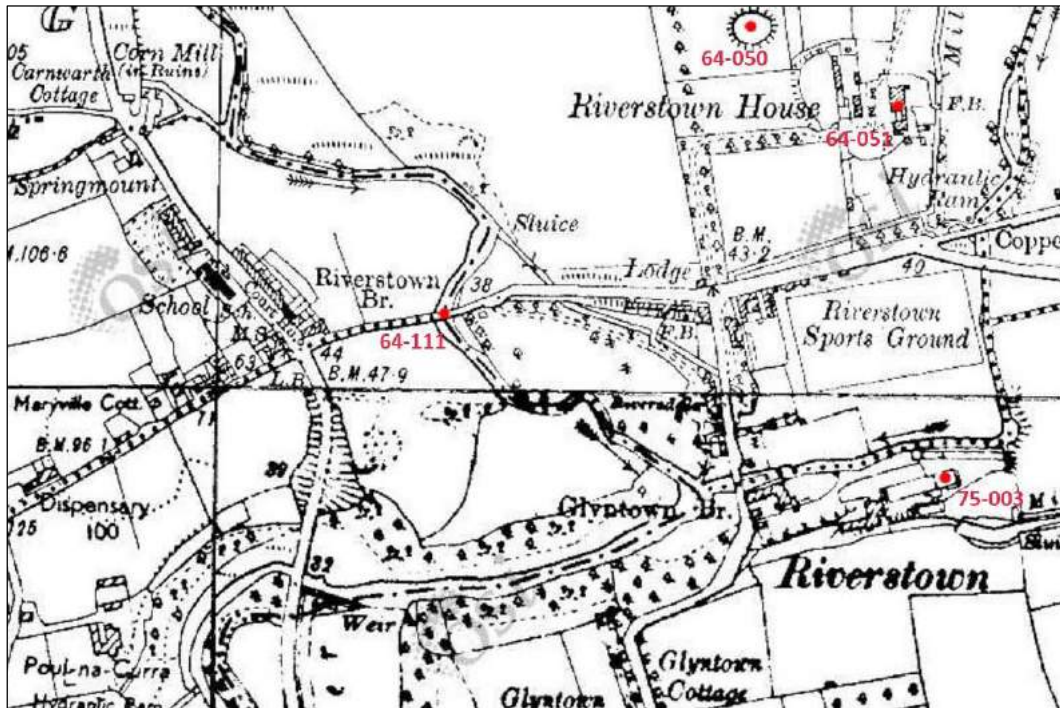


Figure 13.5c Extract from OS 6-inch map (1934) Riverstown

The function of many of the industrial buildings in the study area changed over time and as many are named according to their function this can cause one building to be referred to by several names. To avoid confusion, the names by which the key buildings are referred to in the text and appendices are outlined below.

- Sallybrook Mill (CO063-069 and RPS 00390) in Riverstown was named as a ‘Paper Mill’ on the 1842 OS map and ‘Sallybrook Woollen Mill’ on later editions. It is now located within Sallybrook Industrial Estate.
- Glansillagh Mills (CO063-094 and RPS00389) in Riverstown was named as a ‘Bleach and Cloth Mill’ on the 1842 OS map as a ‘Pike Mill’ on the 1904 OS map and as ‘Glansillagh Mills (Waterproof Goods)’ on the 1935 ed.
- Spring Hill Flour Mill in Ballincrossig was named ‘Flour Mill’ on 1842 OS map, ‘Corn Mill (Disused)’ on the 1904 map and ‘Corn Mill (in Ruins)’ on the 1935 edition. It is no longer extant.
- Riverstown Distillery (CO075-003) in Riverstown was named ‘Distillery’ on the 1842 OS map and ‘Brewery’ on the 1902 map and was unnamed on the 1934 OS map but is depicted.
- Riverstown Flour Mill was named ‘Flour Mill’ on the 1842 OS map, as ‘Flour Mill (Disused)’ on the 1902 map and not depicted on the 1935 map.

- St Patrick's Mills (CO075-001 and RPS 00484) in Poulacurry South was named 'Cloth Mill' on the 1842 OS map, 'Beetling Mill' on the 1902 map and unnamed but depicted on the 1935 map. It is known locally as St Patrick's Mills.
- The Fountains Mill (CO075-002001- and RPS 00485) in Ballinglanna was named as a 'Flour Mill' on the 1842 OS map, 'Flour Mill (Disused)' on the 1902 map with the associated dwelling house named 'The Fountains' and is unnamed on the 1935 map. It is locally known as 'The Fountains'.

13.3.1.5 Aerial Photographs

Aerial photographs from the late 20th century and early 21st show the developing suburban landscape expanding to the west and particularly the east of the river. The M8 road defines the eastern expansion which is particularly focused around the village of Riverstown. Some of the industrial buildings survived this expansion but some were removed and many of the remainder are now disused or in ruins. The Fountains remains in Glanmire and the Beetling Mill (now St Patrick's Mills) to the north of Glanmire while the flour mill to the west of Riverstown and all of its associated infrastructure have been removed. In Sallybrook parts of Glansillagh Mills and Sallybrook Mills remain upstanding. Most of the country houses and their associated demesne and grounds did not survive the suburban expansion. Their open grounds became the focus of some of the new housing estates such as Castle Jane in Poulacurry South where a large housing estate is now located. There are, however, notable exceptions such as Riverstown House and Lota Lodge (now Vienna Woods Hotel) and some elements of the estates such as gate lodges survive.

The Irish landscape is divided into over 62,000 townlands, a system of landholding that is unique in Western Europe for its scale and antiquity (O'Connor 2001, 7). Many townlands are pre-Anglo Norman in origin and Irish historical documents consistently use townland names throughout the historic period to describe areas and locate events accurately in their geographical context. The townland names and boundaries were standardised in the nineteenth century when the Ordnance Survey began to produce large-scale maps of the country. The townland boundaries recorded by the Ordnance Survey, therefore, may well be aligned on older land divisions dating to early historic times and may physically overlie archaeological evidence for such early forms of land division. Many townland boundaries are aligned on watercourses and this is the case in the study area. The Irish names of the townlands within the study area outlined below as well as translations of these names (www.logainm.ie). Riverstown or Baile Roisín, 'baile' meaning townland/ town/ homestead. Sarsfieldscourt or Cúirt an tSáirséalaigh. 'Eirneataíste' meaning Hermitage. Brooklodge or Cill Ruáin, with 'cill' meaning church. 'Poulacurry' or 'Poll' an Churraigh meaning the hole/ pool/ stream of the marsh. Dunkettle or Dún Citil with 'dún' meaning fort. Ballinglanna or 'Baile' and 'Ghleanna' meaning the townland/ town/ homestead of the glen. Knocknahorgan or Cnoc Uí Charragáin, 'cnoc' meaning hill.

Other place names in the study area such as Bleach Hill Stream probably relate to cloth making activities associated with the area.

While no mill is shown in the immediate area on the mid-19th century 6-inch map the Bleach and Cloth Mill in Sallybrook lies approximately 1km to the south.

13.3.2 Archaeological Investigations

A number of archaeological investigations have been undertaken in the study area, some of which have been discussed above.

A small number of other investigations were undertaken in the study area or nearby. Two archaeological investigations were undertaken at Pulacurry South neither of which revealed features of archaeological potential. One in 2004 adjacent to St Mary's and All Saints church (CO074-104) (Purcell 2004) and another in 2005 close to a mound (CO074-071) (Sutton 2005).

An archaeological excavation was undertaken just outside the 1km study area in Brooklodge in 1999. A corn drying kiln was identified and excavated in advance of the construction of the Ballincollig Little Island gas pipeline in 1999 (Clinton 1999). Just north of the study area extensive excavations were undertaken during and in advance of construction of the M8 motorway revealing an array of sites dating from the prehistoric period to the early modern (Hanley and Hurley 2013).

13.3.2.1 Wading and Metal Detector Survey

As part of this project, a wading and metal detector survey of portions of three of the watercourses to be impacted was undertaken under licence number 16D54 and 16R82. The three watercourses were Bleach Hill Stream, Sarsfieldscourt, the Glenmore Stream at Ballinglanna and Riverstown and an unnamed channel at Sallybrook House, Riverstown. The watercourses were waded and the banks were walked and inspected in an attempt to ascertain if any archaeological and cultural heritage features survived. In as much as was possible, the line of the original stream channels was followed as well as the existing channels. A small weir and associated random rubble culvert were noted in the Glenmore Stream along the townland boundary between Ballinglanna and Riverstown. No other feature of archaeological or cultural heritage significance was noted. The full survey is included in **Appendix 13.2**.

It is noted that **Appendix 13.2** (Wading Survey) was carried out during the course of the compilation of the EIS as a direct response to consultations with the Underwater Archaeological Unit of the National Monuments Service. The design of the scheme had not been finalised in advance of the survey. Following the completion of the survey, design changes were implemented which are not reflected in the wading survey report. Full and final details of the scheme are included in this chapter and **Chapter 3 Description of the Proposed Development**.

13.3.2.2 Dive Survey

A dive survey was also undertaken as part of the project by Julianna O'Donoghue under licence numbers 16E316, 16D0057 and 16R0102.

Seven areas (Survey Areas 1-7) were investigated along the Glashaboy watercourse and 20 cultural heritage sites were recorded in these areas, these were numbered CHS No. 01 to CHS No. 20. A summary of the results of the survey & proposed mitigation are outlined below and the full survey is included in **Appendix 13.3**.

It is noted that **Appendix 13.3** (Dive Survey) was carried out during the course of the compilation of the EIS as a direct response to consultations with the Underwater Archaeological Unit of the National Monuments Service. The design of the scheme had not been finalised in advance of the survey. Following the completion of the survey, design changes were implemented which are not reflected in the dive survey report. Full and final details of the scheme are included in this chapter and **Chapter 3 Description of the Proposed Development**.

Survey Area 1 commenced at the north end of the proposed works area along the Glashaboy and ended south of the weir associated with Glansillagh Mills (CO063-094) in the townlands of Riverstown and Knocknahorgan. Six cultural heritage sites were recorded in this area.

CHS No. 01 was an ex situ mass of bonded brick with another similar feature 20m further to the south. In between single bricks were noted on the river bed one of which was stamped 'Youghal Brick Co. Ltd. Youghal'. There will be no impact on the feature and no mitigation is required.

CHS No. 02 was a robust boundary wall on the western river bank opposite Sallybrook Mill (CO063-069). There will be no impact on the feature and no mitigation is required.

CHS No. 03 was a revetment wall along the eastern bank of the river. It was of uncoursed sandstone rubble construction and in poor condition and was considered to be part of the curtilage of Sallybrook House and Sallybrook Mill. It may be negatively impacted by proposed construction works. Mitigation by full archaeological recording of the sections to be impacted is proposed.

CHS No. 04 was a revetment wall at a bend in the river along its western bank. It was of random rubble construction and survived to a maximum height of 1.7m. The wall was in poor condition and had been damaged by tree roots and water erosion. There will be no impact on the feature and no mitigation is proposed.

CHS No. 05 was the tailrace of Sallybrook Mill indicated on the first and second editions of the OS 6-inch maps. The tailrace appeared to have been backfilled and no evidence of it was identified. Subsurface remains of the tailrace may be impacted by the proposed construction works. Mitigation is proposed via licenced archaeological monitoring by an experienced underwater archaeologist.

CHS No. 06 was the weir and sluice of Glansillagh Mill. The weir was 18.7m long extending north-northwest south-southeast diagonally across the river. The weir had low vertical sides and a moderately sloping glacis 2m wide. The northern elevation was 0.28m high and constructed of dressed limestone blocks. The glacis masonry was constructed of small tightly set well matched stones.

The weir ran into the western river bank at the northwest corner and abutted the sluice gate on the eastern side. Modifications were undertaken to this area which have negatively impacted the aesthetics of the structures. There will be no impact on the weir, but the walling on the east bank leading into the sluice of the mill race may be impacted. Mitigation by avoidance or if unavoidable the proposed flood defence works should be faced with sympathetic material to minimise potential negative aesthetic visual impacts.

Survey Area 2 was a small section of the headrace of Glansillagh Mills (CO063-094) in the grounds of Grandon's Garage beside the R639 in Riverstown.

CHS No. 07 was the headrace of Glansillagh Mills (CO063-094). The banks consisted of gabion walls with boulders at the southeast end. The banks may have been removed or concealed behind these. There will be no impact on the feature and no mitigation is proposed.

Survey Area 3 extended from the field north of Hazelwood Avenue and Bridge to Riverstown Bridge (CO064-111) in Riverstown, Ballincrossig and Poulacurry North townlands.

CHS No. 08 was a revetment wall on the east bank of the river extending along much of Survey Area 3 reaching an average height of 1.7m.

In places it was replaced with gabion walls, concrete walls or railway sleepers. Stone paving was present at the base of the wall at the northern limits of this survey area. There will be no impact at the northern end of the survey area and no mitigation is required. At the southern end the wall may be impacted by the construction of the proposed flood defence wall adjacent to Riverstown Bridge. Mitigation by licensed archaeological monitoring by an experienced underwater archaeologist is proposed.

CHS No. 09 was a revetment wall along the west bank of the river surviving in three sections. It reached a maximum height of 1.5m and was constructed of uncoursed rubble sandstone and in poor repair. There will be no impact on the feature and no mitigation is proposed.

CHS No. 10 was a tailrace from the four/corn mill at Spring Hill which was along the western river bank. There was no flow of water when the survey was undertaken. The race was 4m wide with earthen overgrown banks. Subsurface remains or features of the tail race may be impacted by the flood defence wall and embankment. Mitigation by licensed archaeological monitoring by an experienced underwater archaeologist is proposed.

CHS No. 11 was an intra-riverine feature comprising well set and matched stones set on edge immediately south of the headrace of Riverstown Mill which was shown on the 1842 OS 6-inch map. This feature projects from the eastern river bank and was described as possibly a river access slip or revetment or the remains of the weir which is shown on the 1842 map but not subsequent editions. A substantial 3m high revetment wall lines the river bank upstream of the headrace. The proposed flood defence wall may impact the revetment wall on the approach to the headrace and on the remains of the weir itself.

Mitigation by avoidance, if unavoidable the proposed flood defence wall should be faced with sympathetic material to minimise potential negative aesthetic visual impacts and licensed archaeological monitoring by an experienced underwater archaeologist is proposed.

CHS No. 12 was Riverstown Bridge, a five-arch hump back road bridge. The river revetment walls upstream of the bridge may be impacted by the construction of the flood defence wall and drainage outfalls on both sides of the river. The eastern upstream limits of the bridge may be impacted by the construction of the proposed flood defence wall. The proposed regrading works, concrete reinforced walls and pumping station extend into the zone of notification (ZON) on the western side of the bridge. The removal of existing silt build-up from under the bridge arch may impact the structure. Mitigation by licensed archaeological monitoring by an experienced underwater archaeologist with regard to the flood defence walls along the eastern and western river banks (C01_L05 and C01_L06) is proposed. Mitigation by licensed archaeological testing in advance of construction for all works with the ZON of Riverstown Bridge (C01_L06; and C01_L07; C01_P01; C01_R02 is proposed; C01_C03 and C01_C04). Riverstown Bridge will also be.

Survey Area 4 was St Patrick's Mill (CO075-001) in Poulacurry South.

CHS No. 13 was the tailrace of St Patrick's Mill, the underground section of the race was not investigated. Two separate mill races exit the mill and converge into a single race which flows south for approximately 100m before crossing under the R639 and into the Glashaboy. The eastern race issued from the mill in a 2.5m wide semi-circular arch of twenty-six voussoirs. The western race was a twin culvert of random rubble capped with large stone lintels which was subject to modern repairs at the exit and the eastern channel of the culvert had collapsed. There will be no impact on the feature and no mitigation is proposed.

Survey Area 5 was The Grove area in Poulacurry South. It was to the south of a mill weir that was associated with the flour mill and later corn mill in Ballinglanna (CO075-002001-) which was named The Fountains on the 2nd edition OS 6-inch map.

CHS No. 14 was a revetment wall along the eastern river bank at the northern end of the survey area. It survives to a height of 1.3m and appeared to have extended along the entire survey area but had collapsed at the southern end. There will be no impact on the feature and no mitigation is proposed.

CHS No. 15 was a revetment wall along the entire western river bank and extended beyond the survey area. The wall was 2.5m high of rubble stone with mortar bonding which was collapsed in sections and damaged by tree roots and erosion. Concrete repairs and underpinning were apparent along the section of wall adjacent to the R639 road. The wall may be impacted by the construction of the proposed flood defence wall and pumping station. Licensed archaeological monitoring undertaken by an experienced underwater archaeologist with regard to these construction works (C01_L08 and C01_P02) is proposed.

Survey Area 6 was located adjacent to Ballinglanna flour mill (CO075-002001-) or The Fountains in Glanmire village.

CHS No. 16 was a revetment wall on the western river bank which extended for most of the survey area. It was a roughly coursed sandstone wall measuring up to 2m in height. There will be no impact on the feature and no mitigation is proposed.

CHS No. 17 was a substantial revetment wall on the eastern river bank between the mill building and the tail race but it may have continued further to the north. The wall was 3m in height and constructed of dressed limestone blocks. Some damage by tree roots was apparent as well as some repairs to the wall. There will be no impact on the feature and no mitigation is proposed.

CHS No. 18 was the tailrace for The Fountains mill. The tailrace discharged into the eastern bank of the river at a bend at the end of the revetment wall CHS No. 17. A concrete slip supports or abuts the end of the revetment wall which may be a replacement of an earlier 19th century slip. The south-eastern bank of the race has collapsed. There will be no impact on the feature and no mitigation is proposed.

Survey Area 7 is at the southern end of the proposed works area where the river was initially quite narrow but opens into the expansive Glashaboy Estuary.

CHS No. 19 was a revetment wall on the eastern river bank built of roughly coursed stone. It survived to a height of 1.3m at the northern end of this survey area and up to 4m at the southern end. There will be no impact on the feature and no mitigation is proposed.

CHS No. 20 was a revetment wall on the western river bank. The wall survived to a height of 1.8m with the earthen bank exposed in places where the wall is absent. Boulders and concrete walling have replaced some sections of the wall and there is vegetation covering much of it. This section was locally known as Sand Quay but no traces of a formal quay were recorded here. A narrow strip of ground shown on the 1842 OS map may indicate the original quay. A narrow grassy verge 3m wide between Barry's Terrace and the river with a short section of stone wall 1.6m high at the northern end may reflect the remains of this quay. There will be no impact on the feature and no mitigation is proposed.

The metal detector survey of the seven survey areas produced no finds of archaeological interest.

13.3.3 Site Inspection

The primary purpose of the site inspection is to assess the physical environment in which the development is proposed. The proposed development site was inspected on a number of occasions, initially on the 5th April 2016, the 11th July and most recently on the 8th August 2016 in dry, generally sunny weather conditions.

Each area of impact was inspected and is described below. The watercourses are numbered to correspond with the numbering in the drainage scheme as follows:

- Channel 01 Glashaboy River;
- Channel 02 The Fountains mill race;

- Channel 03 St Patrick's Mill mill race;
- Channel 04 Butlerstown Stream;
- Channel 05 Glenmore Stream;
- Channel 06 Springmount Stream;
- Channel 07 Cois na Gleann Stream;
- Channel 08 Glansillagh Mill mill race (in Grandon's property);
- Channel 09 Bleach Hill Stream; and
- Channel 10 Sallybrook Stream.

Bleach Hill Stream in Sarsfieldscourt townland (C09 0 – 144) (Appendix 13.4, Plates 1 and 2)

Bleach Hill Stream (channel 09) runs southwest within a natural earthen channel divided into two sections by a culverted portion which runs under the access road to Cúil Chluthair. The bed of the stream is very stony as are the sides. The western bank is defined by a near vertical slope while the eastern bank slopes steeply. A wading and metal detector survey were undertaken on the stream and no finds or features of archaeological significance were identified. Some pieces of modern metal were identified in the metal detector survey.

The Glashaboy River, Riverstown townland (C01 5700 – 4900) (upstream of and through the Sallybrook Industrial Estate and Grandon's Garage) (Appendix 13.4, Plates 3 – 8)

The Glashaboy River (channel 01) is wide, meandering and fast flowing, generally with earthen banks flanked by mature trees. Rock armour has been placed against sections of the earthen banks and a low embankment runs along the eastern river bank. Sallybrook Mill lies to the east of the river with a paved open yard to the front (south) and modern warehouses adjoining it to the rear. Sallybrook House lies a short distance further to the south. There is a weir on the river in the Grandon's property and a mill race (channel 08) opens from the river immediately upstream of the weir which runs into Glansillagh Mills to the southeast. The remains of a sluice gate survive where the mill race opens. The upstream section of the mill race is within an open random rubble-lined channel before entering a culvert which continues for approximately 50m along most of its course through Grandon's property. It emerges as an open channel at the southeast of Grandon's property close to the R639 road. The channel widens towards the road and is quite deep. The sides are lined with stone gabions and a section of rock armour at the southeast end adjoining a residential property to the south of Grandon's. The mill race runs under the R639 road in two rectangular culverts. To the south of the road the mill race meanders through low lying ground in a wide channel which is quite overgrown before reaching the remains of Glansillagh Mills.

The northern section of the works area of the Glashaboy was subject to a dive survey as well as the headrace of Glansillagh Mills where it runs through Grandon's property.

Six cultural heritage sites were noted along the banks of the river in this survey area while the headrace to the mill constituted a separate survey area. The six cultural heritage sites were CHS No. 01 sections of exsitu brick masonry, CHS No. 02 a boundary wall on the western river bank, CHS No. 03 a revetment wall on the eastern bank, CHS No. 04 a revetment wall on the western river bank, CHS No. 05 the tailrace of Sallybrook Mill which is no longer extant and CHS No. 06 the weir and sluice to Glansillagh Mills. Three of these features CHS No. 03, CHS No. 05 and CHS No. 06 may be impacted by works associated with the proposed scheme.

The headrace of Glansillagh Mills was designated CHS No. 07 and will not be impacted by the proposed scheme.

Unnamed channel south of Sallybrook House, Riverstown townland (C01 5310 – 5387) (Appendix 13.4, Plate 9)

The watercourse runs in an earth-cut, L-shaped channel around the southern and eastern sides of Sallybrook House and drains into the eastern side of the Glashaboy River approximately 20m southwest of the house. It is crossed by a modern timber foot-bridge which provides access to the house. The channel begins to the northeast of Sallybrook House where it emerges from a culvert running through the Pat O'Donnell & Co. property. It is culverted through all of this property except for a small open section of approximately 5m at the northeast where it emerges from under the R639 road into the Pat O'Donnell & Co. property.

The channel bed is mostly stony with some silty patches particularly where rubbish has built up. The rubbish is generally plastic with occasional modern metal objects. The sides are evenly cut and slope quite steeply and its appearance is consistent with a fairly recently constructed channel from the mid/late 20th century. A wading and metal detector survey were undertaken on the channel and no finds or features of archaeological significance were identified. Some pieces of modern metal were identified in the metal detector survey.

Cois na Gleann Stream, Ballincrossig townland (C07 74 – 102) (Appendix 13.4, Plates 10 – 12)

Cois na Gleann Stream (channel 07) is culverted running under two roads, first a local road from the R639 to Barnavara Hill and then immediately adjoining it to the east the R639 which is below the former. As the stream enters the culvert it is fast flowing in a stony channel with a poured concrete wall forming the northern bank and a stone and earthen vertical bank to the south. Between the two roads a small section of the stream is open. It is contained within a rectangular walled open structure forming a small well which is accessible by a number of steps. This feature is considered of cultural heritage significance within the local area. When the stream emerges from the culvert at the east of the R639 it runs along the northern side of a field where it is within an earthen channel flanked by semi-mature trees. A short distance to the east the stream converges with the Glashaboy River.

Field adjoining R639, north of Glanmire Shopping Centre, Ballincrossig townland (C01 3996 – 4061) (Appendix 13.4, Plates 13 – 15)

The Cois na Gleann Stream runs along the northern end of this rectangular field which lies to the east of the R639 road separated from it by a random rubble wall and in places a low earthen bank. The Glashaboy River flows along the eastern side of the field flanked by mature and semi-mature trees. Hazelwood Avenue and Bridge lie to the south separated from the field by a partially grass-covered earthen bank, some of which appears to have been of recent construction. The field is in low rough pasture cut by a number of tyre ruts and pedestrian pathways. It appears to have been most recently used for grazing horses. On the eastern bank of the river just north of Hazelwood Avenue there is a green area adjoining a playing court where a flood relief channel will be constructed. No features of archaeological potential were identified.

Hazelwood Avenue & Bridge and Hazelwood Centre (C01 3981 – 3790) (Appendix 13.4, Plates 16 – 20)

The river flows under Hazelwood Avenue and bridge in a wide channel. The flow is fast and the river quite deep. The bridge is a modern concrete construction and the road adjoining it to the east and west is associated with the suburban development to the east in the late 20th century. It is proposed to construct a relief channel & culvert to the east of the existing bridge under the road which will tie into the river through channels to the north and south. The northern relief channel will be within the green area mentioned above, the southern relief channel will be within an overgrown area on the southern side of the road to the east of the river.

Downstream of the bridge the river is fast flowing in an earthen tree-lined channel with a stony bed. There is a section of rock armour on the western river bank running for a short distance downstream of the bridge. A low earthen embankment runs along a section of the western bank within the car park of the Glanmire Shopping Centre. The bridge in the Glanmire Shopping Centre is also a modern concrete structure. Downstream of this bridge the river banks are generally earthen with mature trees, however, a large section of the eastern bank, adjoining the Supervalu building comprises stone gabions with a modern metal fence above.

Revetment walls, CHS No. 08, were identified on this stretch of the river during the dive survey. These varied from random rubble walls to sections of gabion walls, concrete walls and sleepers. The southern end of CHS No. 08 adjacent to Riverstown Bridge may be impacted by proposed works; the northern end will not be impacted.

Springmount Stream, Ballincrossig and Poulacurry North townlands (C06 88 – 101) (Appendix 13.4, Plates 20 – 23)

Springmount Stream (channel 06) runs under the R639 within a culvert. Upstream and to the west of the culvert it runs in an open channel in private property adjoining a private access road. Downstream and to the east of the culvert it runs in an open channel to the south of buildings in Glanmire Shopping Centre and north of Meadowbrook Estate in an area of overgrowth. In this area the northern bank is concrete and the southern bank earthen flanked by trees.

The channel appears to be the tailrace to Spring Hill flour and later corn mill which stood in this vicinity possibly in the 18th, 19th and early 20th centuries and shown on contemporary cartographic sources. No other possible features associated with the mill were noted. The area has been extensively redeveloped by the construction of the shopping centre and housing estate in the late 20th century. The channel which was dry upon inspection in August continued east for a short distance before opening into the Glashaboy River northeast of Meadowbrook. This section of it was visible from the river during the dive survey and it was designated CHS No. 10. It was approximately 4m wide with earthen sides and no flow of water apparent. Subsurface remains associated with the mill may be impacted by the proposed works.

Glashaboy River at Meadowbrook Estate, between Poulacurry North and Riverstown townlands, from the confluence of Springmount Stream to Riverstown Bridge (C01 3438 – 3782) (Appendix 13.4, Plates 24 – 28)

Meadowbrook Estate is located on the south-western bank of the Glashaboy at a pronounced bend in the river running east and southeast at the northern end of the estate before turning south at the eastern end of the estate. The river is wide and fast flowing with earthen and stone lined banks with mature and semi-mature trees flanking them. Both the eastern and western river banks are stone lined forming a revetment wall upstream of Riverstown Bridge. The wall on the western bank is stepped immediately upriver of the bridge. The eastern bank upstream of Riverstown Bridge is earthen with a random rubble retaining wall present further upstream as the eastern bank rises to form a vertical face. Within Meadowbrook Estate a modern wall runs parallel to the river adjoining a road through the estate. A road and green area with some mature trees flank this modern wall. The revetment walls were designated CHS No. 08 on this stretch of the river during the dive survey. These varied from random rubble walls to sections of gabion walls, concrete walls and sleepers. The southern end of CHS No. 08 adjacent to Riverstown Bridge may be impacted by proposed works.

Riverstown Bridge is a five arch bridge with the main flow of water through the three central arches. The western arch was dry on all site visits. The eastern arch was dry when visited in April and July but in August the flow had been restored by the removal of material from the arch. Random rubble parapet walls run along both sides of the bridge; the southern wall survives to a greater height than the northern one. A pedestrian footbridge has been added to the northern elevation of the bridge supported by concrete piers. The existing parapet wall separates this from the traffic carriageway and a metal railing runs along the outside of it. To the west of the bridge there is an open green area and footpath adjoining the road and to the east a modern dwelling. This property is separated from the road and footpath by a random rubble wall, heavily patched with concrete.

The bridge was designated CHS No. 12 in the dive survey report and will be impacted by the proposed works.

Butlerstown Stream between Ballinglanna and Riverstown townlands (C04 12 – 620) and Riverstown House (Appendix 13.4, Plates 29 – 32)

The Butlerstown Stream (channel 04) is fast flowing and relatively deep with earthen banks flanked generally by mature trees and vegetation.

In the grounds of Sarsfields GAA Club the stream is flanked by an earthen embankment which is partially overgrown. The stream is crossed by three bridges within the study area, the Glyntown Bridge close to its confluence with the Glashaboy River, further upstream an unnamed single arch random rubble bridge crosses the river close to the entrance to Sarsfields GAA club and a short distance upstream of this Copperalley Bridge a triple arch random rubble bridge in the grounds of Riverstown House.

The stream runs to the east of Riverstown House to the east of an area of lawn. The stream is within a stony earthen channel flanked on the eastern side by mature trees and generally open on the western side.

Glenmore Stream between Ballinglanna and Brooklodge Upper townlands (C05 0 – 672) (Appendix 13.4, Plates 33 – 35)

The Glenmore Stream (channel 05) is fast flowing running to the south of a local road along most of its course within the study area. The banks are generally earthen with mature and semi mature trees along them. The stream is crossed by a modern road bridge to Copper Valley Vue and a short distance upstream the stream runs under the Brooklodge Grove Road in three adjoining culverts. The two downstream culverts are concrete rectangular structures and the upstream one is of random rubble construction with a segmental arch. This culvert was dry when the site was visited in the summer and carried a small flow of water when the site was visited in April. The concrete culverts are separated from the random rubble culvert by a small weir approximately 1.2m wide and 0.15m deep running north-south across the channel. The weir and random rubble culvert are considered of cultural heritage significance. The stream was waded and metal detected at this location and no finds and no other features were revealed. Further east the river continues along the northern side of the road separated from it by a low modern wall until the road runs under the M8 road. The stream is culverted running under the M8 and re-emerges to the east of a local road at Brooklodge Grove.

Glashaboy River downstream of Riverstown Bridge to Glanmire Bridge, Poulacurry South, Riverstown and Ballinglanna townlands (C01 1860 – 3440) (Appendix 13.4, Plates 36 – 43)

The Glashaboy is quite fast flowing downstream of Riverstown Bridge within a relatively narrow meandering channel. The channel is stone lined along much of its course and the bed is very stony. Mature trees line most of the banks within a large open park. At the confluence with the Butlerstown Stream the channel widens to form a large deep pool and downstream of this the channel remains quite wide. Further downstream there is a large weir just before the river turns dramatically south and a mill race to St Patricks Mill opens from the western side of the weir. At this southern bend the eastern bank is faced with cut ashlar and random rubble. The river then runs to the east of the R639 road for several hundred metres with open ground flanking the eastern bank. The river turns southeast away from the R639 a short distance upstream of Glanmire Bridge and runs to the west of and beside a local road running northeast to Riverstown. Shortly downstream of this the millrace to The Fountains opens from the eastern bank of the river.

The remains of a weir are visible at low water upstream of the mill race opening. The river turns southwest at The Grove and runs beside the R639 again and under Glanmire Bridge. The tidal reach of the river extends to just beyond this bridge.

Revetment walls lining the eastern (CHS No. 14) and western (CHS No. 15) banks were noted in the dive survey along this stretch of the river. Portions of CHS No. 14 may be impacted by the proposed works.

Mill Race to St Patrick's Mill in Poulacurry South (C03 1 – 626) (Appendix 13.4, Plates 44 – 47)

St Patrick's mill race (channel 03) is quite a wide channel with earthen banks generally quite overgrown with mature trees and undergrowth. The channel runs under the R639 shortly after it opens from the Glashaboy in two random rubble culverts. The channel widens approaching St Patrick's Mill and the earthen banks are of random rubble before entering a culvert under the mill. The culvert is partially open within the building and is of random rubble construction surfaced with large wooden boards which have been lifted by floodwaters. The mill complex is a large collection of buildings on both sides of the mill race, with the mill house lying to the west of the complex.

The tailrace of the mill was investigated during the dive survey and was designated CHS No. 13. It will not be impacted by the proposed works.

Mill Race to The Fountains Mill in Ballinglanna (C02 0 – 434) (Appendix 13.4, Plates 48 – 50)

The Fountains mill race (channel 02) opens from the east bank of the river upstream of Glanmire Bridge. Traces of masonry in the river upstream of the mill race suggest the location of the weir shown on the three editions of the OS 6-inch map at this location. The mill race opens from the eastern river bank and runs within a wide channel which was almost dry during inspection in the summer. A low bank of stone at the opening to the mill race restricted the flow when the river level was itself low. The channel is earth cut but very stony suggesting its stone walls collapsed. It is flanked by mature trees and quite overgrown.

The Fountains is a six-bay, three-storey dwelling house with a three-bay curving projection at the eastern end. The house is north facing with the mill lying immediately to the south and the millrace to the west.

Glashaboy River from Glanmire Bridge south (C01 0 – 1860) (Appendix 13.4, Plates 51 – 53)

The Glashaboy River (channel 01) flows south from Glanmire Bridge through the village of Glanmire. The village developed on a broad curve of the river which becomes a wide estuarine mud flat to the south of the village. The village lies on the low ground flanking the western river bank cut by the R639 road with the eastern bank remaining tree covered and undeveloped. On the western bank individual property boundaries extend to the river bank. To the south of the village the R639 road runs along the western river bank with woodland along the eastern bank. At this point the river is a wide tidal mud flat and a low random rubble wall flanks the eastern side of the road.

13.3.4 Characteristics of Proposed Development

The proposed development is a drainage scheme, to be implemented in the Glanmire/Sallybrook area of County Cork. The area in question is one in which the archaeological, architectural and cultural heritage is well-documented.

The purpose of the scheme would be to protect the area from damaging flood events, which have a negative impact on many of the historical structures in the area, which are designated for protection. The scheme will therefore have mostly positive impacts on cultural heritage in the area.

The proposed drainage scheme will include the construction of flood defence walls along the river banks; construction and replacement of culverts; removal and replacement of bridges; pumping stations, construction of embankments; conveyance improvements (river channel widening and deepening), and localised regrading of ground levels.

There is potential for impacts on heritage due to excavation works, where undocumented artefactual remains may be located. Any archaeological material that remains subsurface may be impacted. The construction of walls may have impacts on the visual amenity of certain buildings of historical interest.

Works to existing bridges may improve the visual amenity of these due to the clearance of debris, and the subsequent improved conveyance of the river and its tributaries may increase the overall visual amenity of the area. Works to Riverstown Bridge will include the construction of flood defence walls in the vicinity or curtilage of the structure and the regrading of the footpath which will reduce the visual amenity of the bridge.

13.4 Evaluation of Impacts

13.4.1 Construction Impacts

As the proposed drainage scheme will extend over a number of different locations and comprise different elements, each is evaluated below. Channel maintenance works, however, are proposed throughout the scheme at the areas outlined below. The impact of the channel maintenance works is assessed collectively for the entire scheme below.

The Glashaboy River (C01 942 – 5815)

The works will comprise of channel maintenance, as and when necessary, over a distance of 4873m from the downstream end of the proposed flood defence wall at Barry's Terrace (C01 942) to the confluence of the Bleach Hill Stream and Glashaboy River (C01 5815).

Bleach Hill Stream: Cúil Chluthair, Sarsfieldscourt townland (C090 – 144)

Works will comprise of channel maintenance, as and when necessary, over a distance of 144m from the confluence of the Bleach Hill Stream and the Glashaboy River to the upstream end of the proposed 2.6m wide by 2.4m high rectangular culvert.

Sallybrook Stream (C10 0 – 158)

Culvert maintenance, as and when necessary, over a distance of 158m from the outfall into the Glashaboy River (C01 5285) to the tie into the culvert under the R639 (C10 158).

Glansillagh Mill mill race in Grandon's Garage (Mill Race 3 C08 0 – 881)

Works will comprise of channel maintenance, as and when necessary, over a distance of 881m from the confluence of the Glashaboy River and mill race 3 (C08 000) and the bifurcation of the Glashaboy River and mill race 03 (C08 881).

Cois na Gleann Stream in Knocknahorgan and Ballincrossig townlands (C07 0 – 101)

Works will comprise of channel maintenance, as and when necessary, over a distance of 100m from the confluence of the Cois na Gleann Stream and Glashaboy River to the upstream end of the replacement culvert.

Springmount Stream, Ballincrossig and Poulacurry North townlands (C06 0 – 133).

Works will comprise of channel maintenance, as and when necessary, over a distance of 104m from the confluence of Springmount Stream and the Glashaboy River and the tie in with the proposed culvert.

Butlerstown Stream between Ballinglanna and Riverstown townlands (C04 0 – 640)

The works will comprise of channel maintenance, as and when necessary, over a distance of 640m from the confluence of the Butlerstown Stream and Glashaboy River (C04 000) to chainage 640 on the Butlerstown Stream.

Glenmore Stream between Ballinglanna and Brooklodge Upper townlands (C05 0 – 1042)

The works will comprise of channel maintenance, as and when necessary, over a distance of 1042m from the confluence of the Glenmore Stream and the Butlerstown Stream (C05 000) to chainage 1042 on the Glenmore Stream.

St Patrick's Mill and Mill Race in Poulacurry South (Mill Race 2 C03 1 – 630)

Works will comprise of channel maintenance, as and when necessary, over a distance of 630m along the length of Mill Race 2.

The Fountains Mill and Mill Race in Ballinglanna (Mill Race 1 C02 0 – 434)

Works will comprise of channel maintenance, as and when necessary, over a distance of 434m along the length of Mill Race 1.

Channel maintenance operations are defined as follows by the OPW (2011):
'channel maintenance normally involves removing the build-up of foreign or natural material that impedes the free flow of water.'

Predominately this consists of the removal of water-entrained silt and associated vegetation from the bed of the channel by suitably rigged hydraulic excavators. In most cases, no alterations to the bank are required and in some cases the channel is not disturbed at all if no build-up of material is present.'

This work does not include dredging or extensive excavation of river beds/banks. Such works particularly in the vicinity of protected structures and recorded archaeological monuments could have a negative impact on remains of cultural heritage significance. Similarly, such works may have a negative impact on unrecorded archaeological deposits within the riverine setting.

Bleach Hill Stream: Cúil Chluthair, Sarsfieldscourt townland (C09 135 – 144)

Works will comprise of the replacement of the existing twin culvert under the road with a new rectangular culvert at proposed works chainage 0 to 9m. The construction will involve excavation in the stream. The stream water will be diverted in a temporary conduit during construction. All drainage outfalls will be fitted with non-return valves.

The stream appears to run in its original channel which has been disturbed in the vicinity of the existing culverts but elsewhere appears to be largely undisturbed. The wading and metal detector surveys revealed no features or finds of archaeological potential, however, subsurface remains may survive in the stream bed and banks.

The Glashaboy River, Riverstown townland (C01 5423 – 5711) (upstream of and through the Sallybrook Industrial Estate and Grandon's Garage)

Works will comprise of the modification of the existing embankment with a flood defence embankment to a height up to 1.6m above existing ground levels. The embankment will be built to the east of the existing to preserve the existing treeline.

Removal of the existing embankment and construction of the new will require ground reduction which will impact any potential archaeological material that may survive below the ground surface.

Two features of cultural heritage significance were identified in this area during the dive survey. CHS No. 01 was a deposit of ex situ bonded brick in the river. CHS No. 02 was a boundary wall on the western river bank. Neither feature will be impacted by the proposed works.

The Glashaboy River, Riverstown townland (C01 4881 – 5423)

Works will comprise of the construction of a reinforced concrete flood defence wall ranging in heights from 0.5m to 1.7 above existing ground level. The flood defence wall will tie into the proposed flood defence embankment at the upstream end. All drainage outfalls will be fitted with non-return valves. Flood defence wall to have a concrete fair finish on both sides.

Construction of the flood defence wall will require ground reduction which will impact any potential archaeological material that may survive below the ground surface. The wall will be constructed approximately 15m west of Sallybrook Mill and will be partially visible from the building obscuring the view of the river.

Four features of cultural heritage significance were identified in this area during the dive survey.

CHS No. 03 was a revetment wall on the eastern river bank which may be negatively impacted by the proposed construction of the flood defence wall. CHS No. 04 was a revetment wall on the western river bank which will not be impacted by the proposed works. CHS No. 05 was the tailrace of Sallybrook Mill, no physical remains of the tailrace were identified however subsurface remains of the feature may be impacted by the proposed construction of the flood defence wall. CHS No. 06 was the weir and sluice of Glansillagh Mills. The weir will not be impacted by the proposed works but a section of walling on the east bank that formed a feeder or training wall into the sluice may be impacted by the construction of the proposed flood defence wall.

Glansillagh Mill mill race in Grandon's Garage (Mill Race 3 C08 857)

Works will comprise of the construction of a flow control structure to restrict flow into the mill race where the mill race enters the culvert in Grandon's open yard.

The headrace to Glansillagh Mill was identified as CHS No. 07 in the dive survey report and will not be impacted by the proposed works.

Surface water pumping station Riverstown townland (C01 5285)

Works will comprise of the proposed construction of a local surface water pumping station, collector drain, manhole and rising main to be installed during a flood event. All outlets to be fitted with non-return valves.

Sallybrook Stream, Riverstown townland (C10 0 - 167)

Works will comprise of the extinguishing of the existing channel with fill and flow to be diverted through a new culvert which will tie into the existing culvert which crossed under the R639. The construction process will involve excavation in the existing channel. The water will be diverted in a temporary conduit during construction.

The channel appears to have been constructed in the second half of the 20th century and is not associated with the original workings of Sallybrook Mill. The wading and metal detector surveys revealed no features or finds of archaeological potential.

Cois na Gleann Stream, Ballincrossig townland (C07 75 – 101)

Works will comprise of the replacement of the existing culvert with a new 2.75m wide by 0.9m high rectangular culvert at proposed works chainage 0 to 26m. A proposed retaining wall will be constructed approximately 0.8m above the R639 road level at chainage 89. This will be accompanied by road regrading on the R639 to facilitate the construction of the culvert under the R615 and R639 roads. The existing well structure adjacent to the R639 is to be removed.

Works will involve excavation and the stream water will be temporarily diverted during construction. The construction of the existing culvert and the roads would have caused significant disturbance to any sub-surface archaeological deposits that may have survived in the area. The well is of cultural heritage significance and will be removed by the proposed works.

Field adjoining R639, north of Glanmire Shopping Centre, Ballincrossig townland (C01 3996 – 4061)

Works will comprise of the construction of a reinforced concrete flood defence wall to a height of 1.2m above existing road levels at proposed works chainage 0 to 159m. All drainage outfalls are to be fitted with non-return valves. Flood defence wall to have sandstone finish on dry side only.

Construction of the flood defence wall will require ground reduction which will impact any potential archaeological material that may survive below the ground surface.

River banks near Hazelwood Avenue Bridge and new culvert under road and relief channels (C01 3950 – 4015)

Works will comprise of the construction of a new rectangular 5.5m wide by 1.75m high flood relief culvert under Hazelwood Avenue to the east of the existing bridge. A flood relief channel 5.5m wide with engineered grassed slopes will be constructed to the north and south of the new channel to tie back into the river. Fencing will be provided around open channel for safety reasons.

The construction of the existing road and bridge across the river would have caused significant disturbance to any sub-surface archaeological deposits that may have survived in the area, however, as the extent of this disturbance is uncertain limited subsurface archaeological deposits may survive.

Two features of cultural heritage significance were identified in this area during the dive survey. CHS No. 08 a revetment wall on the eastern river bank and CHS No. 09 a revetment wall on the western river bank. CHS No. 08 may be impacted by the proposed construction of the flood defence wall further to the south adjacent to Riverstown Bridge. CHS No. 09 will not be impacted by the proposed scheme.

Downstream of Hazelwood Avenue bridge to Glanmire Shopping Centre Bridge (C01 3910 – 3981)

Works will comprise of the construction of a reinforced concrete flood defence wall to a height of 0.9m above existing ground levels. The wall will tie into high ground at both ends. All drainage outfalls will be fitted with non-return valves. Flood defence wall to have sandstone finish on the northern side of the wall.

Construction of the flood defence wall will require ground reduction which will impact any potential archaeological material that may survive below the ground surface.

Hazelwood Shopping Centre Bridge (C01 3889 – 3932)

Works will comprise of the replacement of the existing bridge with a new 12m clear span reinforced concrete bridge. The proposed bridge soffit level will be approximately 1.85m above the existing bridge soffit. The existing ground will be regraded to facilitate the construction of the proposed bridge and ground levels tied into existing ground levels on both sides.

A proposed reinforced concrete flood defence wall will be constructed to the west of the river typically 0.9m above existing ground levels. A sandstone finished wall will extend above the flood defence wall typically 0.5m to provide a barrier along the side of the ramp. The proposed wall will tie into the existing wall on the upstream end. All drainage outfalls to be fitted with non-return valves. Flood defence wall to have a concrete fair finish on both sides where visible and with the bridge parapets on the downstream end.

The construction of the existing road and bridge across the river is likely to have disturbed sub-surface archaeological deposits that may have survived in the area, however, localised areas of in situ material may survive.

Downstream of Hazelwood Shopping Centre Bridge (C01 3800 – 3888)

Works will comprise of the construction of a new flood defence wall typically 1.5m above existing ground level in the funeral home car park. The wall will tie into the proposed bridge at the upstream end and high ground at the downstream end. All drainage outfalls to be fitted with non-return valves. Flood defence wall to have concrete fair finish on both sides. A proposed local surface water pumping station, collector drain, manhole and rising main is proposed to be installed for operation during a flood event at chainage 3804. All outlets to be fitted with non-return valves.

Construction of the new wall will potentially require ground reduction which will impact any potential archaeological material that may survive below the ground surface.

One feature of cultural heritage significance was identified in this area during the dive survey. CHS No. 10 was the tailrace of a flour/ corn mill at Spring Hill issuing into the western river bank. The construction of the proposed wall may impact subsurface remain of the tailrace.

Springmount Stream, Ballincrossig and Poulacurry North townlands (C06 0 – 101)

Works will comprise of the replacement of the existing twin 0.4m diameter culverts with a new 1.75m wide by 0.9m high rectangular culvert. Localised road regrading to facilitate the construction of the replacement Springmount Stream culvert across the R639 road. Proposed reinforced concrete retaining wall to be constructed typically 0.85m above existing wall levels at chainage 0 to 48. Wall to have a concrete sandstone finish on the exposed side.

The construction of the existing culvert and the roads would have caused significant disturbance to any subsurface archaeological deposits that may have survived in the area, however, Spring Hill flour mill was present immediately east of this location, as shown on cartographic sources, and associated sub surface deposits may survive. The tailrace of the mill was designated CHS No. 10 in the dive survey report. The proposed flood defence works may impact subsurface remain of the tailrace or associated features.

Springmount Stream, Ballincrossig and Poulacurry North townlands (C06 0 – 87)

Works will comprise of the construction of a reinforced concrete flood defence wall typically 1.1m above existing ground level. All drainage outfalls to be fitted with non-return valves. Flood defence wall to have a concrete fair finish.

Spring Hill flour and later a corn mill were present immediately east of this location shown on cartographic sources and associated subsurface deposits may survive. The tailrace of the mill was designated CHS No. 10 in the dive survey report. The proposed flood defence wall will require ground reduction which may impact subsurface remain of the tailrace or associated features.

Glashaboy River at Meadowbrook Estate, between Poulacurry North and Riverstown townlands, from the confluence of Springmount Stream to Riverstown Bridge (C01 3440 – 3743)

Works will comprise of the construction of a reinforced concrete flood defence wall along the southern and western river bank to be built to a level typically between 1m and 2m above existing ground levels. All drainage outfalls will be fitted with non-return valves. The wall will have a concrete fair finish on both sides with tree cover on the dry side. A retaining wall (to retain the regraded footpath) will then protrude from the west of this flood defence wall and run along the outside of the footpath which runs beside and north of the parapet wall of Riverstown Bridge. This western section of wall will run for 11m and will be typically 0.5m above existing footpath level. The wall will have a sandstone finish on the exposed side. The existing Riverstown Bridge parapet wall to be modified. Localised regrading of the footpath and re-cambering will divert surface water runoff southwards into the Glashaboy River downstream of the bridge during a flood event. The existing manhole in the bridge arch will be removed and services diverted. Refer to photomontages in **Appendix 7.1** for details. A surface water drain will be constructed on the existing road in Meadowbrook Estate which will tie into a local surface water pumping station, collector drain, manhole and rising main. This will be operated during a flood event at C01 3425. All outlets will be fitted with non-return valves. A proposed foul water pumping station with an overflow line, manhole and rising main to be installed for operation when required to pump foul water trapped in Meadowbrook Estate into the foul network downstream of the estate.

A reinforced concrete flood defence wall will be constructed along the eastern river bank north of Riverstown Bridge to a height of 1.4m above existing ground levels.

All drainage outfalls will be fitted with non-return valves. The wall will have a concrete fair finish on both sides with tree cover on the dry side. The wall will turn east and run along the outside of the footpath which runs beside and north of the parapet wall of the bridge. This eastern section of wall will be typically 1.2m above existing ground levels. All drainage outfalls will be fitted with non-return valves. The wall will have a concrete fair finish with tree cover on the northern side and a sandstone finish on the road side.

The eastern arch of Riverstown Bridge is to be cleared by removing built-up silt and vegetation at C01 3433 - 3440.

The western arch of Riverstown Bridge is to be cleared by removing built-up silt and vegetation at C01 3432 - 3440. The existing manhole in the bridge arch is to be removed and services diverted.

The regrading of the footpath on the bridge will alter the bridge structure. It will also have a negative visual impact on the bridge and will partially obscure the parapet wall of the structure. The modification on the parapet wall will alter the structure and in combination with the footpath regrading would constitute a material alteration to the protected structure. The construction of the flood defence walls will have a negative visual impact on the bridge and its setting. The flood defence wall will not, however, physically impact the bridge. Construction of the flood defence wall will require ground reduction which will impact any potential archaeological material that may survive below the ground surface.

The removal of vegetation and silt from under the western and eastern arches of the bridge will require ground reduction which may impact any potential archaeological material that survives below the ground surface. The re-opening of the eastern and western arches may improve conveyance at the bridge which may have a positive impact on the bridge structure.

Two features of cultural heritage significance were identified in this area during the dive survey. CHS No. 11 was the weir and headrace for Riverstown Mill which may be impacted by the construction of the proposed flood defence wall. CHS No. 12 was Riverstown Bridge which may be impacted by the proposed works.

Butlerstown Stream in Riverstown and Ballinglanna townlands (C04 33 – 150)

Works will comprise of the modification of an existing boundary wall on the northern bank of the river to allow overland flow to pass through it.

Glenmore Stream between Ballinglanna and Brooklodge Upper townlands (C05 468 – 841)

Works will comprise of minimal landscaping and regrading of ground levels, to facilitate overland flow on Brooklodge Grove back into the Glenmore Stream at chainage 468. Further upstream works will comprise the deepening of the channel by 0.4m for a distance of 40m downstream of Copper Valley Vue and the replacement of the existing culvert with a new 10m wide by 1.9m high rectangular culvert.

The entrance to Copper Valley Vue will be regraded to facilitate the construction of the proposed replacement culvert. Brooklodge Grove road is also to be regraded to facilitate the construction of the proposed replacement culvert. The channel is to be widened by an average of 3m and deepened by 0.4m over a distance of 20m downstream of the proposed culvert replacement at Copper Valley Vue. Upstream of the entrance to Copper Valley Vue the channel is to be widened by 5m and deepened by approximately 0.3m over a distance of 61m from the proposed culvert under the entrance to Copper Valley Vue to the proposed culvert under Brooklodge Grove (600 – 656). The three existing culverts will be replaced by a new rectangular culvert 10m wide by 1.95m high at Brooklodge Grove.

Immediately upstream of the Brooklodge Grove culvert the channel is to be deepened by 0.25m at the inlet to facilitate the installation of the proposed replacement culvert. To the north and east of the replacement culvert (662 – 677) a proposed reinforced concrete flood defence wall is to be constructed to a flood defence level typically 1.2m above existing ground levels. All drainage outfalls to be fitted with non-return valves. Sandstone cladding to the dry side only. Upstream the existing wall is to be strengthened. All drainage outfalls to be fitted with non-return valves. Sandstone cladding to the dry side only. A surface water pumping station to operate during a flood event is to be constructed in the parking/turning area of Copper Valley Vue in the vicinity of chainage C05_655.

The weir and random rubble culvert will be removed by the construction works. Construction of the culverts and associated works will require ground reduction which will impact any potential archaeological material that may survive below the ground surface.

Approximately 300m east of Copper Valley Vue and to the east of the M8 underpass it is proposed to strengthen the existing wall between the Glenmore River and the road at Brooklodge Grove by re-grouting the wall. The wall will be extended to the upstream of its existing eastern limit. It is also proposed to replace the existing culvert with a larger capacity culvert under the road and associated road regrading works will be required to facilitate the culvert replacement.

Glashaboy River at The Grove, Poulacurry South (C01 1954 – 2035)

Works will comprise of the construction of a reinforced concrete flood defence wall to a typical height of 1.2m above existing ground level. All drainage outfalls to be fitted with non-return valves. A local surface water pumping station, collector drain, manhole and rising mains to be installed for operation during a flood event. All outlets to be fitted with non-return valves. Ground to be regraded to formalise access track along the length of the river from C01 2010 to C01 2264.

Two features of cultural heritage significance were identified in this area during the dive survey. CHS No. 14 was a revetment wall on the eastern river bank which will not be impacted by the proposed works. CHS No. 15 was a revetment on the western river bank. The construction of the proposed flood defence wall and pumping station may impact the wall.

13.4.2 Operational Impacts

No negative operational impacts on archaeology, architecture and cultural heritage are expected as a result of the construction of the scheme.

13.4.3 Potential Cumulative Impacts

The construction of flood defence walls adjacent to a number of buildings listed in the RPS and NIAH and recorded monuments listed in the RMP will reduce the visual amenity of the watercourses within the suburban environment.

13.5 Mitigation Measures

13.5.1 Construction Mitigation Measures

Future channel maintenance to the watercourses throughout the scheme will require archaeological monitoring during the course of those works.

Construction work on the drainage scheme will require extensive ground disturbance in numerous locations. Some of these areas have been previously disturbed, however, in situ localised subsurface deposits may survive in places. Of the twenty features of cultural heritage significance identified during the dive survey of the Glashaboy River eight may be impacted by the works associated with the proposed scheme. These are CHS No. 03, CHS No. 05, CHS No. 06, CHS No. 08, CHS No. 10, CHS No. 11, CHS No. 12 and CHS No. 15. At six of these (CHS No. 05, CHS No. 08, CHS No. 10, CHS No. 11, CHS No. 12 and CHS No. 15.) subsurface archaeological deposits may survive. In areas where in situ subsurface deposits may be present licensed archaeological monitoring of ground works will be carried out. In areas where intra-riverine archaeological deposits may survive licensed archaeological monitoring will be carried out by an experienced underwater archaeologist. These areas are outlined below:

- The Glenmore Stream between Ballinglanna and Brooklodge Upper townlands (C05 528 – 677) construction of new culverts and associated works;
- Bleach Hill Stream, Cúil Chluthair, Sarsfieldscourt townland (C09 135 – 144) construction of new culvert;
- The Glashaboy River, Riverstown townland (C01 5433 – 5708 construction works for new embankment;
- The Glashaboy River, Riverstown townland (C01 5294 – 4884) construction of flood defence wall. This includes area of CHS No. 05;
- Cois na Gleann Stream Ballincrossig townland (C0789 – 101) construction of one single culvert to replace existing two reaches of culvert separated by a short reach of open channel, road regrading, retaining wall and associated works;
- Field adjoining R639, north of Hazelwood Shopping Centre, Ballincrossig townland (C01 3996 – 4061) construction of flood defence wall;

- River banks near Hazelwood Avenue and Bridge and new culvert under road (C01 3938 – 4050) construction of new flood relief culvert and associated channels. This includes area of CHS No. 08;
- Downstream of Hazelwood Avenue bridge to Hazelwood Shopping Centre Bridge (C01 3910 – 3977) construction of flood defence wall;
- Hazelwood Shopping Centre bridge (C01 3880 – 3932) replacement of existing bridge with new bridge structure and associated regarding;
- Downstream of Hazelwood Shopping Centre bridge (C01 3800 – 3888) construction of new flood defence wall. This includes area of CHS No. 10;
- Springmount Stream, Ballincrossig and Poulacurry North townlands (C06 75 – 101) replacement of the existing twin culverts with a new culvert and associated regrading and retaining wall construction;
- Springmount Stream, Ballincrossig and Poulacurry North townlands (C06 0 – 87) construction of new flood defence wall. This includes area of CHS No. 10.
- Glashaboy River at Meadowbrook Estate, between Poulacurry North and Riverstown townlands, from the confluence of Springmount Stream to Riverstown Bridge (C01 3438 – 3803) construction of flood defence walls, local surface water pumping station, construction of an overflow foul water pumping station, raising of the pedestrian path on the northern face of Riverstown bridge, modification of Riverstown Bridge parapet wall and addition of handrail. Recambering and regrading of the L3010, and removal of silt and vegetation from under the western and eastern arches of Riverstown Bridge, a protected structure. This includes areas of CHS No. 10, CHS No. 11 and CHS No. 12;
- Glenmore Stream between Ballinglanna and Brooklodge Upper townlands (C05 528 – 677) channel widening and deepening, culvert replacement and construction of a flood defence wall;
- Glashaboy River at The Grove in Poulacurry South (C01 1954 – 2035) construction of flood defence wall. This includes the area of CHS No. 15;
- Any archaeological features identified during archaeological monitoring will be fully resolved to professional standards of archaeological practice. Such material will be preserved in situ or preserved by record, as appropriate, as outlined in Policy and Guidelines on Archaeological Excavation – Department of Arts, Heritage, Gaeltacht and the Islands;
- Four features of cultural heritage significance identified during the dive survey require additional archaeological mitigation. These are:
 - CHS No. 03 Compilation of an archaeological record of the river revetment wall which will be impacted.
 - CHS No. 06 Avoidance of works in the area of the weir and sluice of Glansillagh Mills. If works are unavoidable the proposed flood defence should be faced with sympathetic material to minimise potential negative visual impacts.

- CHS No. 11 Avoidance of works in the area of the weir and headrace of Riverstown Mill. If works are unavoidable the proposed flood defence should be faced with sympathetic material to minimise potential negative visual impacts.
- CHS No. 12 Archaeological testing in advance of works at Riverstown Bridge which lie within the zone of notification of the monument. Compilation of an archaeological survey of the bridge in advance of proposed construction works.

Three features of cultural heritage significance identified in Cois na Gleann Stream and the Glenmore Stream will be removed by construction works. It is recommended that these be recorded prior to their removal during construction. These are:

- The well structure in Cois na Gleann stream (C07 74 – 102);
- The random rubble culvert the Glenmore stream (C05 660 – 680); and
- The weir in the Glenmore Stream (C05 660 – 680).

Works are proposed in the vicinity of two structures included in the RPS in Cork County Development Plan (2014). The two are also included in the RMP/ SMR database. These are:

- Riverstown Bridge (RPS 00394 and CO064-111);
- Sallybrook (Paper) Mill (RPS 00390 and CO063-069).

The works to Riverstown Bridge include removal of silt and vegetation from under the eastern and western arches. When the site was visited in August much of this material had been removed from the eastern arch. Reinforced concrete flood defence walls will be constructed along both the northern river banks which will tie into flood defence walls to be built running east and west beside the footpath to the north of the bridge. Archaeological monitoring of the works to the bridge will be undertaken.

The works to Sallybrook Mill include the construction of a reinforced concrete flood defence wall approximately 15m west of the mill. The mill is now adjoined to the north by a large warehouse and is within a large industrial complex (Sallybrook Industrial Estate). The concrete flood defence wall will be visible from the mill, however, given the industrial nature of the surrounding ground the visual impact will be minimal.

13.5.2 Operational Mitigation Measures

No operation mitigation measures are required.

13.6 Residual Impacts

No residual impacts on the archaeological, architectural and cultural heritage are foreseen if the proposed mitigation is undertaken.

13.7 References

- Archaeological Survey of Ireland Database (in progress), Sites and Monuments Record Database (www.archaeology.ie).
- Aalen, F.H.A. & Whelan, K (1997). 'Fields', in Aalen, F.H.A. et al. (editors) The Atlas of Rural Ireland. Cork University Press.
- Cadogan, T (1998) Lewis' Cork: A topographical dictionary of the Parishes, towns and villages of Cork City and County (First published in 1837.) The Collins Press, Cork.
- Clinton, M. 1999 Brooklodge, Cork in excavations.ie 1999:080 www.excavations.ie.
- Department of Arts, Heritage, Gaeltacht & the Islands (1999). Framework & Principles for the Protection of the Archaeological Heritage.
- Department of Arts, Heritage, Gaeltacht & the Islands (1999). Policy & Guidelines on Archaeological Excavation.
- Department of the Environment, Heritage and Local Government (2004). Architectural Heritage Protection, Guidelines for Planning Authorities.
- Department of the Environment, Heritage and Local Government (2006). Wind Farm Planning Guidelines.
- Dúchas National Monuments and Historic Properties Service (1998). Record of Monuments and Places, County Cork, Volumes 1 and 2.
- EPA 2002 Guidelines on Information to be contained in an Environmental Impact Statement EPA March 2002.
- EPA 2003 Advice Notes on Current Practice (in preparation of Environmental Impact Statements) EPA, September 2003.
- Feehan, J. (2003). Farming in Ireland, Walsh Printers, Ireland.
- Flanagan, D. and L. (1994). Irish Place Names Bantry, County Cork.
- Hanley, K. and Hurley, M. F. 2013 Generations, the archaeology of five national roads schemes in County Cork. National Roads Authority, Dublin.
- Healy, J. N. 1988 The Castles of County Cork. Mercier Press, Cork.
- Heritage Unit Cork County Council 2013 Heritage Bridges of County Cork Heritage Unit of Cork County Council.
- Heritage Unit Cork County Council 2014 Heritage Houses of County Cork Heritage Unit of Cork County Council.
- General Alphabetical Index to The Townlands and Town, Parishes and Baronies of Ireland (2000) (original 1861), Genealogical Publishing Co. Inc.
- National Roads Authority (2005a). Guidelines for the assessment of Archaeological Heritage Impacts of National Road Schemes.
- National Roads Authority (2005b). Guidelines for the assessment of Architectural Heritage Impacts of National Road Schemes.

O'Connor, P. J. 2001 Atlas of Irish Place-Names. Oireacht na Mumhan Books, Co Limerick.

Office of Public Works 2011 Arterial Drainage Maintenance & High Risk Channel Designation Programme 2011-2015. Environmental Section, Engineering Services, Office of Public Works.

O'Flanagan, P. and Buttimer, C.G. (editors) Cork History and Society. Geography Publications.

Pochin Mould, D. D. C (1991). Discovering Cork. Brandon Books, Co. Kerry.

Power, P (1923). Placenames and Antiquities. Proceedings of the Royal Irish Academy Vol. 34C.

Power, D., Byrne, E., Egan, U., Lane, S. and Sleeman, M (1994). Archaeological Inventory of County Cork Vol 2, East and South Cork. The Stationery Office, Dublin.

Purcell, A. 2016 Archaeological Testing at Ballinglanna, Riverstown. Unpublished report by Lane Purcell Archaeology.

Purcell, J. 2004 Poulacurry South, Glanmire, Cork 2004:0269
www.excavations.ie.

Reeves-Smith, T (1997) The Natural History of Demesnes in Foster, W. eds. Nature in Ireland, A Scientific and Cultural History, Lilliput Press, Dublin.

Ronan, S., Egan, U., Byrne, E., et al. (2009). Archaeological Inventory of County Cork, Volume 5. The Stationery Office, Dublin.

Rynne, C (1993). The Archaeology of Cork City and Harbour from the Earliest Times to Industrialisation. Collins Press.

Rynne, C. 1999 The Industrial Archaeology of Cork city and its environs. The Stationery Office, Dublin.

Rynne, C. 2006 Industrial Ireland 1750 – 1930. The Collins Press.

Stout, M (1997). The Irish Ringfort. Four Courts Press, Dublin.

Sutton D. 2005 Castlejayne, Poulacurry South, Cork 2005:283
www.excavations.ie.

Sweetman, D (2000). The Man-Made Heritage: The Legislative and Institutional Framework in Buttimer, N., Rynne, and Guerin, H. (editors) The Heritage of Ireland. The Collins Press, Cork.

14 Roads and Traffic

14.1 Introduction

This chapter of the EIS consists of an appraisal of the proposed drainage scheme under the heading of roads and traffic. This chapter initially sets out the methodology followed, describes the receiving environment and summarises the main characteristics of the proposed drainage scheme which are of relevance for roads and traffic. The likely significant impacts of the proposed scheme on roads and traffic are described. Measures are proposed, where necessary to mitigate likely significant impacts and residual impacts are described.

14.2 Methodology

The methodology for assessing the transport impact of the proposed drainage scheme is as follows:

1. The existing receiving environment is examined, including the local road network, and the national road network in the vicinity of the scheme. A brief description of the character of the receiving environment is also presented;
2. The proposed development is described, with an emphasis on the individual components of the overall scheme;
3. The potential impacts of the scheme are described and classified in terms of their likely significance;
4. Possible mitigation measures are presented; and
5. Residual impacts following implementation of the scheme are discussed.

14.3 Receiving Environment

14.3.1 Existing Road Network

The road network within the study area comprises the regional roads R615 and R639 as well as numerous local and access roads. The R639 links the N8 (Cork to Dunkettle) with the M8 at Watergrasshill (Junction 17), to the north of the works area, and to the south it links to the N8 directly via the Dunkettle Roundabout. Refer to **Figure 14.1** below.

The R639 is a busy route that provides connectivity between Glanmire, the N8 at Dunkettle and the M8 at Junction 18 (and via the exit-only left-slip to the south). The R615 links Glanmire with the north of Cork City at Tinkers Cross. Both routes have numerous junctions with other local and regional routes.

The R639 is a standard, two-lane single carriageway for the majority of its route length, with some localised flaring to facilitate additional lanes at a number of junctions.

Typically the route is 7-8m wide, with a number of areas where the width is slightly less, and some areas to the north where the width is approximately 9m. There are sections of the route with footpaths present on one side, on both sides and there are some sections with no footpath provision. Hard shoulder width varies along the route also.

The R615 Old Youghal Road, in the vicinity of the works area is also a standard two-lane single carriageway, although it is of a lesser standard than the R639. The two routes run almost parallel for a short distance, before converging at St. Joseph's Church, where the R615 joins the R639 at a skew angle (as seen in Figure 14.1 below). Typical width is approximately 6-7m, with no hard shoulder and limited footpath provisions along the route. The route has direct access to a number of residential properties, and is typically of a lesser status of route for traffic than the adjacent R639.

In the vicinity of the works, both routes are in predominantly urbanised areas, with numerous residential, industrial and commercial areas in the environs, as well as a number of schools.

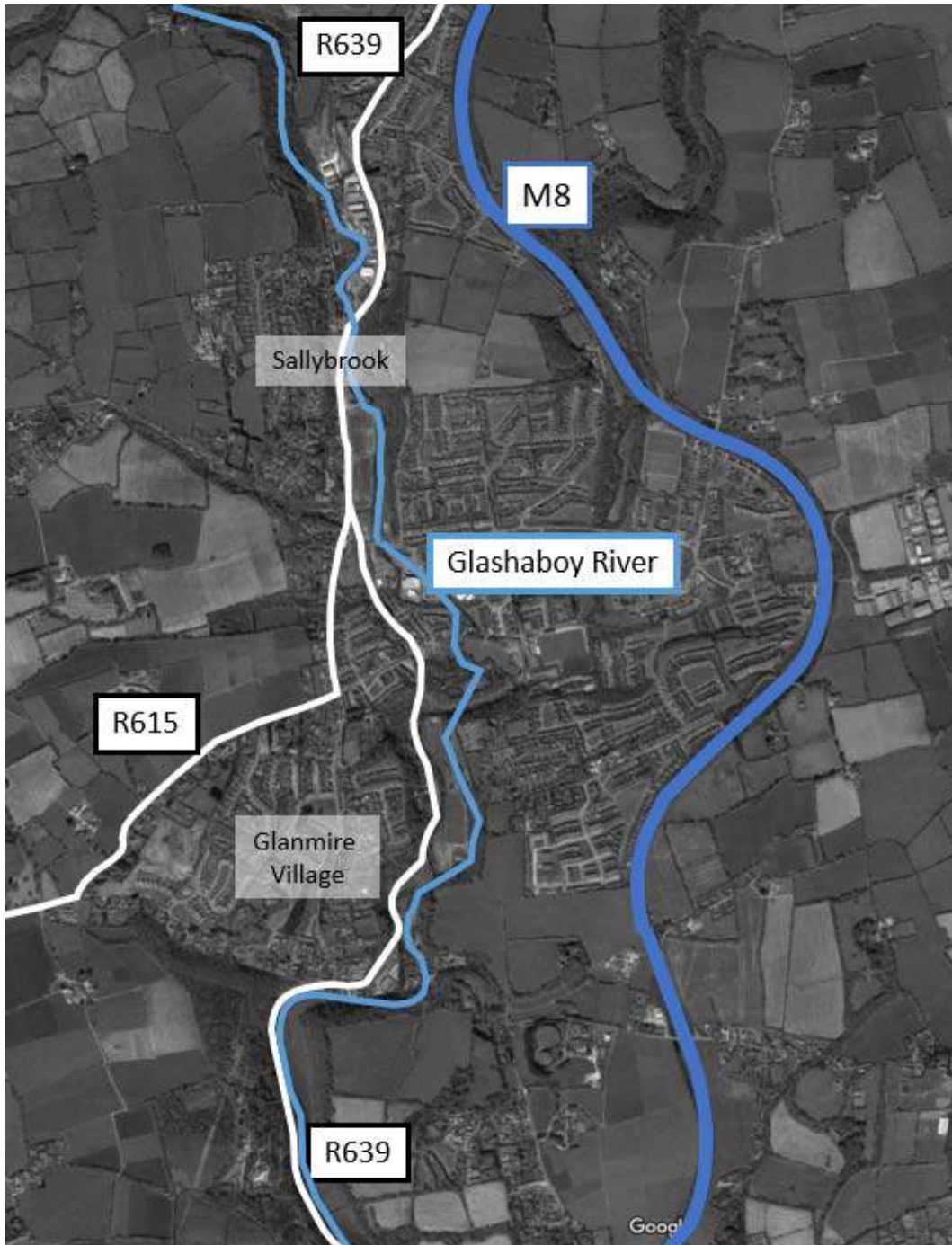


Figure 14.1: Existing Road Network and Glashaboy River Route

14.4 Characteristics of the Proposed Development

The majority of the proposed works under the Glashaboy River (Glanmire/Sallybrook) Drainage Scheme consist of a number of measures which are summarised below:

- Replacement of a number of existing culverts;
- Replacement of Hazelwood Shopping Centre bridge with a larger vehicular bridge;
- 1 new flood relief channel and culvert at Hazelwood Avenue;
- Replacement of existing flood defence walls and construction of new flood defence walls;
- Modification of existing earthen flood defence embankment and construction of new earthen flood defence embankments;
- New surface water pumping stations and foul pumping station;
- Localised in-channel conveyance improvements at culvert/bridge structures;
- Provision of civil works such as road/footpath re-grading at a number of locations;
- Protecting drainage outlets along the line of flood defence works with non-return flap valves;
- Non – flood defence retaining wall; and a
- Flow control structure on a millrace.

The proposed measures above are described in detail in **Chapter 3 Description of the Proposed Development**.

These proposed works are detailed in the scheme drawings in Appendix 3.1. The proposed works areas are further described below in **Table 14.1**.

Table 14.1: Works areas, overview and estimated construction duration

Area of Works	Location	Overview of works	Estimated construction period (weeks)
1	Sallybrook	Culvert replacement along Bleach Hill stream at Cuil Chluthair, direct defences (embankment & flood walls) along Glashaboy River, Infilling of existing ditch along unnamed watercourse and provision of culvert. Flow control structure at Mill race at Grandons Garage and pumping Station	16 – 20 weeks
2	Hazelwood	Culvert replacements at Cois na Gleann Stream (R615 & R639), flood wall along R639 and curving around onto Hazelwood Avenue, across Hazelwood Avenue Bridge. Flood relief channel parallel to river under Hazelwood Avenue, Bridge replacement at Hazelwood Shopping Centre and flood wall along Glashaboy River, Road re-grading and pumping station.	32 – 40 weeks (entire duration)
3	Meadowbrook	Flood Walls along Glashaboy River, culvert replacement and extension along Springmount stream (R639); road re-grading works along	16 – 20 weeks

Area of Works	Location	Overview of works	Estimated construction period (weeks)
		Riverstown Bridge, and the removal of an existing manhole; and pumping stations.	
4-2	Copper Valley Vue Brooklodge Grove	Culvert upgrades, road re-grading and grouting of existing walls, channel modification flood walls along Glenmore Stream, re-grading of small area of land adjacent to Glenmore stream to facilitate overland flow	12 – 16 weeks
4-3	Lidl	Modification to boundary wall along Butlerstown Stream to facilitate overland flow	2 – 3 weeks
5	The Grove	Access track and flood wall along Glashaboy River (parallel to R369)	4 – 6 weeks

Table 14.1 above shows that the scheme will comprise a number of distinct works elements or areas, with a 12-14 week construction period being the most significant, and with other localised works areas of 2-3 weeks construction duration. Note that all of the works elements in **Table 14.1** will not be occurring simultaneously.

14.5 Evaluation of Impacts

The Glashaboy River (Glanmire/Sallybrook) Drainage Scheme as described above and detailed in **Chapter 3 Description of the Proposed Development** is mainly concerned with works to and in the vicinity of the River Glashaboy, and therefore generally will not have any permanent impact on the road network post completion. The potential impacts of the scheme on the road network are as follows:

- Temporary impacts during construction due to the excavation of materials in order to facilitate construction, and the associated movements of excavation vehicles;
- Temporary impacts associated with the importing of construction materials to the works areas, and the relevant movements of delivery and construction vehicles and construction workforce; and
- Temporary impact during construction due to the works elements that are on or adjacent to the existing road network, including culverts, bridges, flood defence walls, pumping stations, etc., which may require full or partial road closures.

14.5.1 Construction Impacts

14.5.1.1 Potential Impact of Construction Related Traffic

The construction phase of the proposed drainage scheme will have a temporary impact on traffic volumes in the Glanmire/Sallybrook area and their environs. The proposals will not result in any residual changes to the existing traffic network once completed; however, temporary effects will result during the construction stage of the scheme.

These impacts will be primarily associated with restriction on access to certain portions of the existing road network due to ongoing works, and additional traffic flows on sections of the existing road network due to haulage of excavated material which is not reused on site, the delivery of materials to site and the movements of workforce traffic.

Construction-related traffic will be used for delivery of materials to site, removal of surplus excavated material from site and transport of employees and plant to/from site and throughout the site. The main materials to be delivered include concrete, clay, stone, pipes and culvert sections. The estimated number of round trips (to/from site) for delivery of materials will vary depending on the element of the works under construction, but is an average of 25 trips per day spread over the anticipated construction period of 18 months. Excavation and backfilling works will comprise the most intensive portion of the scheme, while construction works will be minor in comparison.

The removal of surplus material will comprise principally of material excavated for foundations for walls and embankments and material excavated from culverts and the sediment trap. The estimated number of round trips to/from the site for the removal of surplus material is approximately 3,600 (i.e. 1,800 vehicles) over the anticipated 18-month programme, an average of 10 trips per day.

Imported material for construction purposes (including reinstatement works), including for construction of the numerous sections of flood defence walls will comprise approximately 3,800 round trips (i.e. 1,900 vehicles) over the 18-month program, an average of 11 trips per day.

For the purpose of this assessment, the total trips per day for excavation and for reinstatement and construction have been combined. It is likely that excavation works may occur at the outset of the scheme commencement, depending on the time of year, however for the purposes of a conservative assessment both processes are assumed to be ongoing at the same time. A contingency factor of 20% has been applied to account for any additional or unforeseen trips that may occur periodically. Thus, the total construction trips per day is estimated at 25 HGV's (two-way).

Construction staff numbers are estimated at a typical daily maximum of 30 personnel. During the summer months, when more intensive construction works may be in progress, the number of personnel may increase to an estimated maximum of 50.

As outlined in **Chapter 4**, normal working hours will be in operation during the construction phase, which will be 08:00-19:00 on weekdays, and 09:00-16:00 on Saturdays.

It has been assumed that all 50 personnel arrive before 08:00, all 50 depart after 19:00, and that 25 leave and return during lunch. Therefore, the estimated number of round trips for construction personnel employed on site is approximately 150 round trips per day over the construction period.

Table 14.1 gives a breakdown of the estimated construction workforce traffic.

Table 14.2: Construction Traffic Daily Breakdown

Description of Trip	Total Round Trips (two-way)	Round Trips per Day* (two-way)
Delivery of Materials	4,486	12.5
Removal of Excavated Material	4,322	12.0
Construction Workforce	21,600	150
Total	30,408	175

*Trips per Day calculated based on total works programme of 360 working days

Conclusion: Temporary Minor Impact

Taking into account the large numbers of existing vehicles using the road network in and in the vicinity of the Glanmire/Sallybrook area, it is unlikely that traffic generated during the construction phase will have a significant impact on traffic flow locally. Nevertheless, the construction-related traffic will impact on the local road networks to some extent. As outlined above, the average daily traffic associated with construction works is approximately 85 (round trips).

It is not anticipated that the construction traffic will significantly affect the flow of traffic through the Glanmire/Sallybrook area. The impact of construction traffic will be short term and therefore there will be no residual impact beyond the construction stage.

14.5.2 Construction Materials Sourcing and Transportation

As set out in **Chapter 4**, in so far as is feasible, all construction materials will be sourced from local suppliers if these are available within the Cork area. The selection and specification of construction materials will be informed by local availability of these materials. Within the necessary constraints of performance, durability and cost, construction materials will be sourced from local suppliers and manufacturers, where possible. The co-ordination and logistics of construction traffic will be captured within the construction traffic management plan which will be agreed with CCC and An Garda Síochána.

14.5.2.1 Potential Impacts on Traffic and Transport Infrastructure

The proposed scheme has the potential to impact on the transport infrastructure in the area, most significantly during the construction phase. This impact is likely to occur in the following areas;

- The replacement of an existing culvert beneath the R639 and R615 at Springhill to accommodate the Cois na Gleann stream crossing;
- The replacement of an existing culvert on the R639 at the Springmount Stream crossing;

- The replacement of the internal linking bridge in Hazelwood Shopping Centre with a new precast concrete bridge;
- The construction of a new concrete culvert beneath the Hazelwood road (outside of the Hazelwood Shopping Centre);
- Localised road regrading on the L3010 near Meadowbrook, and construction of a pumping station adjacent;
- Replacement of a culvert beneath the Glenmore Stream at Brooklodge Grove; and
- Other localised works involving construction of flood defence walls, embankments.

Conclusion: Temporary Moderate Impact

The proposed scheme will not result in any permanent removal of any element of the existing road network once completed. There will be no loss of any existing capacity on the road network as a result of the scheme works. Upon completion, the road network will continue to function as presently. There will, however, be minor, short-term impacts on the road network due to certain elements of the network being either partially or fully inaccessible during construction.

14.5.3 Potential impacts due to construction requirements of works (i.e. Road Closures)

It is likely that temporary road closures will be required during the construction phase of the works at the following locations:

- On the access road into Cúil Chluthair;
- On the R639 at the Springhill Stream, Springmount Stream;
- On the R615 at the Springhill Stream;
- On the roadway outside Hazelwood Shopping Centre;
- The internal road network within Hazelwood Shopping Centre;
- On the Old Youghal Road in the vicinity of Meadowbrook;
- On the road network at Brooklodge Grove; and
- Other localised works locations.

Temporary Significant Impact

Localised traffic disruption will occur at locations of proposed works on, or in the immediate vicinity of the road network. These works include the replacement of existing bridges, upgrading of existing culverts and construction of flood defence walls. In many instances it may be possible to complete works elements in phases, thus necessitating a partial road closure only. However, in a number of locations a full road closure may be needed to facilitate the works.

For example, the replacement of the internal bridge within Hazelwood Shopping Centre will require a full closure of this link, while the installation of a new road culvert outside Hazelwood Shopping Centre may also require a full road closure.

Replacement of existing culverts may be possible in phases, which may only necessitate partial road closures. There are also a number of pumping stations to be constructed, although the majority of these are located offline. There is a proposed pumping station which is likely to be constructed in the carriageway on the R639 in the vicinity of Glanmire Bridge, which will also likely require a full road closure due to the narrow carriageway widths. Localised road re-grading may also be possible in phases, again only necessitating partial road closures.

14.5.4 Operational Impacts

Upon completion of the works, there are likely to be minor ongoing operational elements associated with regular channel maintenance. Channel maintenance will be required on an infrequent basis, at a number of locations throughout the scheme. These works will be minor, with minimal requirements for maintenance vehicles and staff, and will have a negligible impact.

14.5.5 Potential Cumulative Impacts

In the vicinity of the scheme, the most significant pending construction scheme on the road network is the N8 Dunkettle Interchange Upgrade Scheme. This scheme will involve the upgrade of the existing interchange to fully free-flowing status. Although the scheme currently has planning permission, and is part of the current capital expenditure programme, there is currently no construction timeframe for this scheme. It is likely that the scheme may commence construction in mid-2018, although there is no current start date.

It is assumed that the Glashaboy drainage scheme will commence in Q3 of 2017, which would result in a completion date in early 2019. The two schemes may therefore overlap slightly. However, the excavation elements of the scheme will occur at the project outset, and as such the more intensive traffic flows associated with this phase of the works will not conflict with the Dunkettle Interchange Upgrade Scheme.

Planning permissions for 103 dwelling units are still outstanding on zoned lands in Glanmire, according to the Blarney Electoral Area LAP (2015). Should these developments go ahead, there is a potential that the impacts of the proposed development would be compounded by the additional construction works, and associated impacts. These impacts could include increased construction related traffic during the works. There is currently no indication when this construction will commence.

14.6 Mitigation Measures

14.6.1.1 Mitigation Measures for Construction-Related Traffic

All construction works will be subject to industry-standard traffic management measures, including the preparation of a Construction Traffic Management Plan which will be undertaken in consultation with Cork County Council and An Garda Síochána, and which will be prepared and agreed in advance of any works commencing, and will include the sourcing of construction materials, agreement of appropriate haul routes, etc.

These traffic management measures will be designed in accordance with the '*Guidance for the Control and Management of Traffic at Roadworks – Second Edition*'.

Consequently, construction-related traffic flows will also be subject to any such traffic management plans, which may include restricted construction working hours, maintaining single-lane or two-way traffic flows and/or suitable diversion routes.

As outlined above, construction working hours will be 08:00-19:00 on weekdays, and 09:00-16:00 on Saturdays. Therefore, construction workforce traffic will arrive and depart at the working areas before the morning peak on the local road network, and after the evening peak.

The construction of the replacement bridge will be carried out by a suitably qualified and experienced contractor who will be supervised to ensure that the works are carried out correctly. This will ensure that the bridge will be constructed safely and ensure the structural integrity of the structure.

Excavation and reinstatement of the culvert trenches will be carried out in consultation with the Local Authority, and will also follow the Department of Transport, Tourism and Sport published document entitled '*Guidelines for Managing Openings in Public Roads*'. These works will be designed and supervised by a suitably qualified and experienced professional to ensure they are carried out correctly.

As with construction-related traffic, the localised traffic disruptions as a result of other proposed works throughout the scheme will be mitigated through the use of industry-standard traffic management measures. These traffic management measures should be designed in accordance with the '*Guidance for the Control and Management of Traffic at Roadworks – Second Edition*'. Where necessary, diversion routes will be developed for affected traffic due to road restrictions or closures.

14.6.1.2 Mitigation Measures for Traffic and Transport Infrastructure During Construction

The construction programme of the scheme will be phased in order to ensure that certain works are not underway simultaneously in proximity to each other where one works element impacts on the mitigation measures associated with an adjacent scheme.

In so far as possible, the Contractor is expected to primarily gain access from the river banks to carry out specific elements of the works.

For example, as outlined in **Chapter 4** the replacement of the internal Hazelwood Shopping Centre bridge will not occur at the same time as the construction of the adjacent culvert outside the shopping centre on Hazelwood Avenue, as this will be a diversion route for traffic displaced by the closure for replacement of the internal bridge (and vice versa).

The adjacent culvert works at Hazelwood Avenue are expected to be constructed in two phases, which will retain vehicular, pedestrian and cyclist access to a limited extent. Due to the generous road width at this location, it may be possible to retain two-way traffic.

Similarly, the culverting works on the R639 and R615 at the Springhill Stream will be phased so as to occur independently of each other in order to enable diversion routes to be incorporated on the local road network.

The timings of potential road closures or restrictions will, where possible, be arranged so as to carry out the most intensive works elements at off-peak. Where possible, and subject to local considerations (including impacts on residents and businesses), 24-hour or night-time working will be included in construction phasing. Consultation will occur with local businesses and residents in advance of any works commencing.

Local access will be maintained throughout the works, by provision of new temporary accesses or by retention of existing accesses where possible.

The majority of the proposed works will be undertaken in phases so that partial traffic flow can be maintained at a minimum at all times and at all locations, wherever possible. Many works elements will be undertaken in multiple phases so as to allow for partial road closures so as to minimise the extent of any full road closures. Depending on the commencement date of the works, it may be possible to schedule the more disruptive elements during the summer months to coincide with school holidays.

Although the impact of temporary construction works are likely to be significant in localised areas, there are numerous diversion routes available within the study area due to the extensive local road network. The R615 and R639 can serve as temporary diversion routes for many of the substantial works elements, while East Cliff Road also offers a localised diversion route via Glanmire Bridge. The L3010, Brooklodge Grove and Hazelwood Avenue also offer numerous potential diversion routes. The works in question will not alter the function or operational capabilities of the road network once completed. Access will be immediately restored upon completion of any works that involve a partial or full road closure.

The road network will continue to function as it does at present once the works are completed, and there will be no permanent loss of access or loss of any elements of the existing road network.

14.6.2 Operational Mitigation Measures

As outlined above, there are minimal operational requirements in terms of traffic flow – channel maintenance will be an infrequent maintenance item, and will comprise negligible traffic flows. Therefore, there are no mitigation measures required for the operational phase of the scheme.

14.7 Residual Impacts

Taking into account the above mentioned mitigation measures, the residual impact of the proposed scheme on the transport infrastructure will be imperceptible.

As outlined above, there will be no permanent impact on the existing road network upon completion of the works. No loss of road operating capacity or loss of access will occur. The impacts of concern will be solely during the construction period, and will be proactively managed to minimise the level of disruption and to ensure that a sufficient standard of access is maintained throughout the scheme extents.

Conclusion: No Significant Residual Impact

15 Material Assets

15.1 Introduction

This chapter describes and assesses the potential impacts of the proposed development on material assets. The existing environment is also described. Mitigation measures are proposed, where required and the predicted residual impacts are described.

The proposed development, the Glashaboy River (Glanmire/Sallybrook) Drainage Scheme, will consist of a series of measures and structures designed to reinforce the river banks and to mitigate flooding risk in the areas of Glanmire and Sallybrook.

Material assets are defined in the EPA Advice notes on current practice in the preparation of EIS's (EPA 2003) as 'resources that are valued and that are intrinsic to specific places, they may be either human or natural origin and the value may arise for either economic or cultural reasons'.

Material Assets discussed are as follows:

- Local Settlement;
- Roads and Transportation Network;
- Commercial and Industrial Development;
- Wastewater Treatment and Water Supply;
- Gas and Electricity Infrastructure;
- Telecommunications Infrastructure;
- Natural Resources and Assimilative Capacity of Air and Water, and
- Waste Management.

15.2 Methodology

This chapter has been prepared having regard to the following documents:

- Advice Notes on Current Practice in the preparation of Environmental Impact Statements (EPA 2003);
- Guidelines on the Information to be contained in Environmental Impact Statements (EPA 2002);
- Advice Notes on Current Practice in the Preparation of Environmental Impact Statements Draft September 2015 (EPA 2015) ;
- Revised Guidelines on the Information to be Contained in Environmental Impact Statements Draft September 2015 (EPA 2015);
- Censuses of Ireland 2006 and 2011;
- Central Statistics Office Quarterly National Household Survey Quarter 2 2016 (www.cso.ie);

- Cork City and County Councils Cork Area Strategic Plan 2001-2020;
- Blarney Electoral Area Local Area Plan 2011 2nd Edition (Cork County Council 2015);
- Cork County Council, Cork County Development Plan 2014;
- Fáilte Ireland Annual Report 2014;
- The Cork Area Strategic Plan – Strategy for Additional Economic and Population Growth – An Update (Indecon, RPOS and Savills HOK, 2008);
- Local Electoral Area Boundary Committee, Committee Report (2013);
- South West Regional Authority Regional Planning Guidelines 2010-2022;
- Waste Management Plan for Cork County 2015-2021.

A desk study was carried out on the existing material assets associated with the site of the proposed development. Projections of resource use were made, for both the construction and operational phases of the development, and the impact assessed.

Where relevant, impacts on particular material assets such as the road network and construction waste disposal facilities are considered in detail elsewhere in this EIS. Refer to **Chapters 4 Construction Activities** and **Chapter 14 Roads and Traffic** of this EIS for further assessment of the impact of the proposed development on these assets. Cultural heritage is dealt with in **Chapter 13 Archaeological, Architectural and Cultural Heritage** of this EIS. Refer to **Chapter 3 Description of the Proposed Development** of this EIS for a detailed description of the site and surrounding areas.

15.3 Receiving Environment

15.3.1 Local Settlement

The receiving environment for the proposed drainage scheme refers to the areas in which works are proposed. These are in the vicinity of the Glashaboy River Catchment. The main settlements within the area are Glanmire and Sallybrook. The location for the scheme is a predominantly urban and built-up zone, mostly residential and commercial, with a number of small commercial estates. For the purposes of this EIS, the population study area will comprise the District Electoral Divisions (DEDs) within which the drainage scheme study area is located. These include Caherlag, Rathcooney, and Riverstown. Refer to **Chapter 3 Description of the Proposed Development** and **Chapter 8 Population and Human Health** of this EIS for further detail of the local settlements of the scheme.

15.3.2 Roads and Transportation Network

Roads and transportation infrastructure in the study area comprises the following:

The primary access routes to the study area is via the M8 and N8, and from a number of regional and local roads.

All roads in the study area, apart from National Primary Routes, are maintained by Egis Lagan Services on behalf of Cork County Council. Any modifications to National Primary Routes would require consultation with the National Roads Authority. A description of the receiving environment in relation to roads and transportation can be found in **Chapter 14 Roads and Traffic**.

15.3.3 Wastewater Treatment and Water Supply

The Blarney Electoral Area LAP 2015 (2nd Edition) states that “*the sewerage scheme starts at Sarsfield Court and gravitates along the valley to a pumping station at Glanmire Bridge. The sewage is pumped to the top of the hill at Dunkettle and from there it gravitates to a pumping station at Little Island where it is connected to the treatment plant at Carrigrennan, Little Island*”. The Blarney LAP also states that the wastewater infrastructure is adequate as the capacity of the treatment plant exceeds current requirements. A wastewater treatment plant is located to the north of the Glanmire Bridge.

15.3.4 Gas and Electricity Infrastructure

The location of the proposed drainage scheme is a built-up area, which has adequate power supply. The gas distribution network supplying gas to the area is extensive, as is electricity supply.

15.3.5 Telecommunications Infrastructure

The Glanmire/Sallybrook area has sufficient provision of telecommunications infrastructure. Telephone and broadband facilities are available, and many homes and businesses are dependent on this supply.

15.3.6 Waste Management

A desktop study has been undertaken as part of this EIS to review the licensed waste facilities in the area of the proposed scheme. Consultation of the EPA database showed that the EPA licensed Green Star waste facility (**Table 15.1**) is located approximately 1km north of Glanmire Bridge.

Table 15.1: EPA Licensed Waste Facilities within the Study Area

Facility Name	Licence No	Location
Starrus Eco Holdings (t/a Green Star)	W0136-03	Sarsfield Court Industrial Estate, Glanmire

Cork County is part of the Southern Waste Management Region, one of three in the State. The *Southern Region Waste Management Plan 2015-2021* (2015), herein referred to as the Plan, outlines the strategy for waste management in the Region.

Cork County Council website includes a list of current ‘Waste Facility Permits – Certificates of Registration’. Consultation of this list showed the following permitted facilities (**Table 15.2**) in proximity to the scheme. Full details and documentation for each facility listed may be found on the waste facility register (www.facilityregister.nwcpo.ie).

Table 15.2 Cork County Council permitted Waste Facilities with Certificates of Registration or Waste Facility Permit in the Study Area

Facility Name	Permit No.	Location	Facility Type	Waste Type
Capwell Industries Ltd.	WFP-CK-09-0028-02	Riverstown, Glanmire	Transfer Station	Tyres, Waste plastic, Wastes not otherwise specified (Polyurethane foam)
Wisetek Solutions Ltd	WFP-CK-09-0036-01	O’Connell Warehousing Unit 17, Brooklodge, Glanmire	Transfer Station	Paper, cardboard, wood, metals, batteries
Starrus Property Holdings Ltd	WFP-CK-10-0047-02	Sarsfield Industrial Est., Glanmire	Transfer Station	Packaging, paper, cardboard
Green Dragon Recycling Ltd.	WFP-CK-10-0060-02	Corbally North, Glanmire	Transfer Station	Metals, wood, plastic, glass, metals, mixed municipal waste.

The Plan (2015) includes details of ‘Licensed Landfill Sites’. There are no licensed landfills operating within the scheme. The closest landfill site to the Study Area is at Bottlehill, (EPA waste licence number W0161-02) approximately 20km north of Douglas however activities at the site have not commenced according to the Plan (2015).

15.4 Characteristics of Proposed Development

The proposed scheme will consist of the implementation of flood defences, in various forms, in the Glashaboy River Catchment. The entire Glashaboy River (Glanmire/Sallybrook) Drainage Scheme consists of a number of measures which are described in detail in **Chapter 4 Construction Activities**.

Of consideration for material assets, the proposed drainage scheme will require the following:

- Service diversions will be required in order to facilitate the construction phase of the development;
- Waste will be generated during construction phase;
- Traffic diversions will be in place;

- There will be movement of materials on and off site during the construction phase; and
- Removal of boundary walls, vegetation and fencing to facilitate access.

15.5 Evaluation of Impacts

The evaluation of impacts on material assets in the area of the proposed scheme is discussed in the sections below. This impact assessment is based on the currently available information and layout of the scheme as planned, however there is a possibility that more information may become available at a later stage.

15.5.1 Construction Impacts

15.5.1.1 Local Settlement

The construction phase of the proposed scheme is 18 months. However, localised works along the length of the proposed scheme will be much shorter in duration. The impacts on local settlement during construction have been largely dealt with in other sections of this EIS, namely **Chapter 8 Population and Human Health**, **Chapter 9 Noise and Vibration**, **Chapter 10 Air Quality and Climate**, and **Chapter 14 Roads and Traffic**.

Please refer to these chapters for construction impacts on local settlement. There will be a requirement to remove some boundary walls, fencing and trees etc. to facilitate access along the river bank for construction of the linear elements of the drainage scheme such as flood walls. However, reinstatement of all boundary walls and fencing will take place once the construction works are completed.

15.5.1.2 Roads and Transport Network

Construction impacts on the roads and transportation network are detailed in **Chapter 14 Roads and Traffic**.

15.5.1.3 Wastewater and Water Supply

There is an existing wastewater treatment plant at Glanmire Bridge. Works are proposed to the north of Glanmire Bridge, on the right bank of the river, in the form of a flood defence wall. The construction compound may be located on lands owned by Cork County Council directly to the north of this site, in Poulacurry South, Rathcooney. See **Figure 15.1** below. The wastewater treatment plant is unlikely to be impacted significantly by the presence of the construction compound or the construction works.

A number of pumping stations will be installed as part of the proposed scheme including a foul and five surface water pumps that will be used in the event of a flood and help alleviate the wastewater and surface water drainage systems. The surface water pumps will prevent pluvial flooding from surface water build up. The foul pump will be installed at the Hazelwood shopping centre where the backup of foul wastewater has occurred during past flood events.

There is potential for disruption to water supply during construction works, however measures will be put in place to ensure that this will not result in significant impacts on the population of the surrounding area. No significant impacts are envisaged.



Source: Bing

Figure 15.1: Possible location of Construction Compounds

15.5.1.4 Gas and Electricity Infrastructure

The scheme has the potential to temporarily impact on the gas distribution network and electricity infrastructure during construction works. However, any outages will be planned and measures put in place to ensure that this will not result in significant impacts on the users. No significant impacts are envisaged.

15.5.1.5 Telecommunications Infrastructure

Telephone and broadband facilities are available in the Glanmire/Sallybrook area. There is the potential for disruptions to services should any construction works inadvertently damage this infrastructure, however no significant impacts are envisaged.

15.5.1.6 Waste Management

Construction works associated with the proposed scheme are likely to generate construction waste from excavation works and general construction activities however the proposed scheme will not impact on waste management operations in the area.

Excavated material will be generated from ground preparation works for foundations for flood defence walls, embankments, regarding and channel widening and deepening works. Where possible excavated material will be used on site. Where material must be removed from site it will be determined whether it is hazardous or non-hazardous material under the Commission Regulation (EU) No. 1357/2014 and categorised according to List of Wastes (LoW) of the revised Waste Framework Directive (2008/98/EC) and of the European Council decision (2014/955/EEC). These classifications will determine the suitable location of disposal.

Refer to **Chapter 4 Construction Activities** for further details on construction waste management.

15.5.1.7 Operational Impacts

The Glanmire/Sallybrook area is a built-up area, with many housing estates, local shopping outlets, and businesses. The impacts on the local settlement once the proposed scheme is operational, are likely to be permanent and positive. The scheme is designed to minimise flood events in the area, which have detrimental and expensive impacts both on homes and businesses.

It is therefore expected that once the scheme is operational, the number of homes affected by flooding events will be reduced, thereby minimising the damage caused by such events, having a permanent positive impact.

For operational impacts on the roads and transport network, please refer to **Chapter 14 Roads and Traffic**.

When flooding events are minimised, this may make the area more desirable for the development of commerce and industry. This would signify a permanent positive impact.

When the proposed scheme is operational, there will be no significant impacts on wastewater, water supply, gas or electricity infrastructure, or telecommunications infrastructure. The proposed scheme includes the installation of surface water pumping stations and a foul pump that will be used in the event of flood to aid the surface and foul water infrastructure in vulnerable areas. These pumps may have some impact on noise when in use but this will be temporary and intermittent during flood events. The pump equipment will also be installed underground to reduce the impact on noise.

Overall, any operational impacts of the proposed scheme on material assets will be positive. The reduction in flooding events will have permanent positive impacts on all material assets likely to be affected by flooding events.

15.5.2 Operational Impacts

No operational impacts on material assets are envisioned.

15.5.3 Potential Cumulative Impacts

Cumulative impacts are those impacts that are compounded by the parallel undertaking of other developments in the same area. There are no proposed developments in the area with the potential to exert significant cumulative impacts on the population of the area.

Planning permissions for 103 dwelling units are still extant on zoned lands in Glanmire, according to the Blarney Electoral Area LAP (2015).

Should these developments go ahead, there is a potential that the impacts of the proposed development would be compounded by the additional construction works, and associated impacts. These impacts could include increased congestion on roads due to construction vehicles, increased noise and vibration during construction works, and increased dust generation.

The N8 Dunkettle Interchange Improvement Scheme has been proposed to improve traffic flows at the Dunkettle roundabout. This scheme will involve the upgrade of the existing interchange to fully free-flowing status. Plans for the scheme were first announced in 2011 and it is currently part of the capital expenditure programme. However there is no construction timeframe for the programme. It is likely that the scheme may commence construction in late 2018.

The aforementioned large-scale construction projects have the potential to generate cumulative impacts in conjunction with the proposed drainage scheme. In the event that such a project were to be undertaken in parallel, the construction impacts, and particularly those relating to the road and transport infrastructure, would need to be taken into account in the preparation of the construction traffic management plan.

15.6 Mitigation Measures

Mitigation measures are required only during the construction phase. Impacts will be temporary in nature and last only for the duration of the construction works.

Standard industry practice for construction works will ensure the safety of the workers and maintain the integrity and operational functions of any service, above or underground. Prior to construction, drainage networks, electrical cabling, gas pipelines, and telecommunications infrastructure will be reported in detail and incorporated into the construction design to as to be avoided where possible. Planned diversions will be implemented after discussion with the relevant bodies and all affected persons including businesses and residents will be notified in advance of any disruptions. Contractors will be provided with all the locations of any services.

Mitigation measures for impacts on roads and transport networks are discussed in **Chapter 14 Roads and Traffic**.

Standard mitigation measures for dealing with waste arising will be employed, including the implementation of a CEMP. Further details of mitigation of construction waste can be found in **Chapter 4 Construction Activities**, and **Chapter 11 Soils, Geology and Hydrogeology**.

15.7 Residual Impacts

The residual impact on waste acceptance facilities will be minimised through mitigation, but is expected to be slight.

The surface water stations and foul water station will reduce the risk flooding of properties due to surface water and foul water when flood waters prevent normal discharge. Similarly, the implementation of the drainage scheme (flood defence walls, conveyance improvements etc.) will reduce the risk of flooding of properties in the area. This will result in a residual positive impact on properties.

15.8 References

Cork County Council (2015) Blarney Electoral Area Local Area Plan 2011, 2nd Edition

Environmental Protection Agency (2015) *Revised Guidelines on the Information to be Contained in Environmental Impact Statements Draft September 2015*

Environmental Protection Agency (2015) *Advice Notes for Preparing Environmental Impact Statements Draft September 2015*

Environmental Protection Agency (2002) *Guidelines on the Information to be contained in Environmental Impact Statements*

Environmental Protection Agency (2003) *Advice Notes on Current Practice in the Preparation of Environmental Impact Statements* Southern Waste Region (2015) *Southern Region Waste Management Plan 2015-2021*.

16 Other Impacts, Interactions and Cumulative Effects

16.1 Introduction

This chapter addresses the cumulative impacts, indirect impacts and main interactions between different aspects of the environment likely to be affected by the Glashaboy River (Glanmire/Sallybrook) Drainage Scheme. This chapter also addresses environmental effects which have not been specifically addressed in the individual chapters of the EIS.

Only topics which could be logically linked to the development have been examined in detail. Accordingly, when a topic is not mentioned, the authors have concluded that no potential for impact exists.

16.2 Methodology

Reference was made to the EPA Documents, *Guidelines on the information to be contained in Environmental Impact Statements*, EPA 2002, and *Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)*, EPA 2003 (EPA guidelines) in the preparation of this chapter of the EIS.

The EPA has more recently published *Revised Guidelines on the Environmental Impact Statements Draft* (EPA, 2015) and *Advice Notes for Preparing Environmental Impact Statements Draft* (EPA, 2015) and both these documents were referred to in preparing this chapter.

The EU has also prepared guidelines, *Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions*, published by the Office for Official Publications of the European Communities in May 1999 (EU guidelines).

At the initial stage in the preparation of the EIS and during the design of the flood defences, the potential for significant cumulative and indirect impacts and interactions was examined and any such potential impacts were identified. Where the potential for significant cumulative and indirect impacts and interactions was identified, such impacts and interaction of impacts were included in the scope and addressed in the baseline and impact assessment studies for each of the relevant environmental media and aspects of the project. The cumulative and indirect impacts and interaction of impacts are presented in the chapters of the EIS which address the most relevant environmental media.

The matrix and expert opinion approaches, as outlined in the EU Guidelines, were used in the identification of the potential for significant cumulative and indirect impacts and interactions. Refer to **Table 16.1** for the matrix of potential interactions. Modelling and carrying capacity analyses were used to evaluate impacts.

16.2.1 Definitions

There are no generally agreed and accepted definitions for indirect impacts, cumulative impacts or inter-relationship of impacts. The EPA Guidelines (2002) define cumulative impact thus: *The addition of many smaller impacts to create one larger more significant impact.*

The EPA Guidelines (2002) do not define indirect impacts. The EPA Guidelines use the term synergistic impacts. Synergistic impact is defined as: *Where the resultant impact is of greater significance than the sum of its constituents.*

In 2015, the EPA published draft EIS guidelines, *Revised Guidelines on the Information to be Contained in Environmental Impact Statements.*

The draft EPA Revised Guidelines (2015) define indirect effects as being “those that arise off site or are caused by other parties that are not under the control of the developer” and secondary effects as “those that arise as a consequence of a project.”

The EU guidelines use slightly different definitions as follows:

Indirect Impacts: Impacts on the environment, which are not a direct result of the project, often produced away from or as a result of a complex pathway (sometimes referred to as second or third level impacts or secondary impacts).

Cumulative Impacts: Impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project.

Impact Interactions: The reactions between impacts whether between the impacts of just one project or between the impacts of other projects in the area.

The term ‘impact interactions’ is equivalent to the term ‘inter-relationship of effects’. The EU guidelines accept that their definitions overlap to a certain extent.

The EU guidelines also refer to ‘Cross-Media Impacts’, in which the impact in one environmental medium may also have an indirect impact on another medium

16.3 Effects in Different Environmental Media

16.3.1 Matrix of Effects

Table 16.1 presents the effects matrix. The effects matrix examines the potential for the topic or issue in the left hand column to interact or have an effect on the environmental media listed in the top row of the matrix.

If there is the potential for an effect during the construction phase, this is indicated by a ‘C’. An ‘O’ indicates the potential for an effect during the operational phase and ‘OC’ indicates the potential for an effect during both phases. If there is considered to be no potential for an effect, this is indicated by ‘-’.

The purpose of the effects matrix is to identify potential effects in different media. Actual effects and their significance are dealt with in the most relevant chapter.

Table 16.1: Potential Interaction of Effects Matrix (C = Construction, O = Operational) (These impacts can be positive or negative)

	Noise and Vibration	Air Quality	Hydrology	Climate	Landscape and Visual	Archaeological Architectural & Cultural Heritage	Population and Human Health	Material Assets	Biodiversity	Soils, Geology and Hydrogeology	Roads and Traffic
Noise and Vibration		-	-	-	-	C	C	-	C	-	-
Air Quality	-		-	-	-	-	C	-	C	-	-
Hydrology	-	-		-	-	-	O	-	C	-	-
Landscape and Visual	-	-	-	-		-	CO	-	-	-	-
Archaeological Architectural & Cultural Heritage	-	-	-	-			-	-	-	-	-
Population and Human Health	-	-	-	-	-	-		-	-	-	-
Material Assets	-	-	-	-	-	-	CO		-	-	-
Biodiversity	-	-	-	-	-	-	-	-		-	-
Soil, Geology and Hydrogeology	-	-	-	-	-	-	C	-	C		C
Traffic	C	C	-	C	-	-	C	C	C	C	

16.4 Potential Interactions and Cumulative Impacts

The potential interactions of construction noise and vibration on population and biodiversity are discussed in **Chapter 6 Biodiversity** and **Chapter 8 Population and Human Health** respectively. Construction vibrational impacts may also potentially impact archaeological, architectural and cultural heritage (**Chapter 13**). Mitigation measures will be implemented to ensure there will be no significant impacts.

The potential air quality impacts (**Chapter 10**) from dust and emissions generated during the construction phase of the drainage scheme may interact with population and human health (see **Chapter 8**), biodiversity (see **Chapter 6**) and local climate (see **Chapter 10**).

The construction activities will generate temporary visual impacts and these impacts will interact with human beings (see **Chapters 7 & 8**). During the operational phase, the public realm will be improved due to the rebuilding and cladding of some walls especially in the Hazelwood area.

The construction phase of the drainage scheme impact the local traffic in the surrounding area (see **Chapter 14**). This construction traffic impact may potentially interact with the local air quality (see **Chapter 10**), noise and vibration from truck movements (**Chapter 9**) and population (**Chapter 8**) due to traffic diversions in the area. Mitigation measures will be put in place during the construction phase to ensure there are no significant effects, refer to **Chapter 4 Construction Activities**.

The proposed works for the Glashaboy River drainage scheme are designed to alleviate flooding in the area which will by their nature change the local hydrology during a flood event (see **Chapter 12 Hydrology**). These hydrological impacts have the potential to interact with people by reducing the flooding risk (**Chapter 8**) and material assets (see **Chapter 15**) through the greater flood protection for roads, services and properties.

The proposed drainage scheme will include works close to or adjacent to some protected structures (such as Riverstown Bridge) which may potentially result in cumulative archaeological, architectural and cultural heritage impacts and visual impacts (see **Chapters 13 and 7**).

The proposed drainage scheme works will potentially impact the biodiversity of the local area (see **Chapter 6**). The construction impacts from noise and vibration (**Chapter 9**) may also impact biodiversity of the local area.

By reducing the risk of flooding, the material assets (**Chapter 15**) of the area will be protected and thus flooding events will have less of an impact on people (**Chapter 8**) in terms of property, roads and services.

Construction works that require works to the soils and geology may potentially impact the biodiversity (**Chapter 6**), landscape (**Chapter 7**) from the construction of embankments and roads (**Chapter 14**) and people (**Chapter 8**) through the transport of material on and off site.

16.5 References

Directive 97/11EC amending Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment, Official Journal of the European Communities, 1997

Planning and Development Regulations, 2001, Statutory Instrument No 600 of 2001, Government Publications Office, Dublin, 2001

Environmental Protection Agency (2015) *Revised Guidelines on the Information to be contained in the Environmental Impact Statements Draft* EPA, Wexford

Environmental Protection Agency (2015) *Advice Notes for Preparing Environmental Impact Statements Draft* EPA, Wexford

Environmental Protection Agency (2002) *Guidelines on the information to be contained in Environmental Impact Statements* EPA, Wexford

Environmental Protection Agency (2003) *Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)* EPA, Wexford

Office for Official Publications of the European Communities (1999) *Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions*

Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment, Official Journal of the European Economic Communities, 1985.

17 Summary of Impacts and Mitigation Measures

17.1 Introduction

Cork County Council and the Office of Public Works intends to ensure that any potential adverse effects of the proposed development on the environment are reduced to a practical minimum. Where unavoidable environmental effects have been identified during the environmental impact assessment process, measures have been proposed to mitigate these effects as much as is reasonably possible.

This chapter summarises the likely residual environmental effects associated with the proposed drainage scheme. The predicted impacts and recommended mitigation measures are comprehensively detailed in the relevant chapters of the EIS, and are summarised in **Table 17.1** below.

Table 17.1: Assessment of Potential Effects and Mitigation Measures

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
CONSTRUCTION PHASE		
Site Clearance and Preparation		
Setting up of site office, contractor facilities including toilets and construction containers Importation of construction equipment Excavation activities Construction waste Excavated material Untidy site	<ul style="list-style-type: none"> A construction environmental management plan (CEMP) will be prepared and implemented with the objective of keeping disruption and nuisance to a minimum. The plan will have regard to the guidance contained in the handbook published by Construction Industry Research and Information Association (CIRIA) in the UK, Environmental Good Practice on Site, 4th Edition, CIRIA 2015. A dust minimisation plan will be formulated for the construction phase of the project In so far as possible, construction materials will be from local sources. As required by the Safety, Health and Welfare at Work (Construction) Regulations 2013, a Health and Safety Plan will be prepared which will address health and safety issues from the design stages through to the completion of the construction and maintenance phases. Waste generated during the construction phase will be carefully managed according to the accepted waste hierarchy which gives precedence to prevention, minimisation, reuse and recycling over disposal with energy recovery. Excavated material will be reused on site where possible and all efforts will be made to keep the volume of material removed from site to a minimum. Material removed from site will be sent to a permitted landfill facility. <p>The following are some of the measures that will be taken to ensure that the site and surroundings are maintained to a high standard of cleanliness:</p> <ul style="list-style-type: none"> A regular program of site tidying will be established to ensure a safe and orderly site, 	Imperceptible No significant residual impact predicted.

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	<ul style="list-style-type: none"> Food waste will be strictly controlled on all parts of the site, Loaded lorries and skips will be covered, Surrounding roads used by trucks to access to and egress from the site will be cleaned regularly using an approved mechanical road sweeper. Roads will be cleaned subject to local authority requirements. Site roads will be cleaned on a daily basis, or more regularly, as required, Road edges and footpaths will be cleaned using a hand broom with controlled damping, Wheelwash facilities will be provided with rumble grids to remove excess mud from wheels. These facilities will be located at all exits from the site, In the event of any fugitive solid waste escaping the site, it will be collected immediately and removed to storage on site, and subsequently disposed of in the normal manner. 	
Visual Impact		
<p>Removal of trees and vegetation and the construction of new flood defence walls</p> <p>Visual impacts on the historical character of the built environment and immediate</p>	<ul style="list-style-type: none"> Existing trees to be retained where possible in the interest of public realm and visual character of the river amenity. River banks will be left intact and vegetated wherever possible. Coppicing and/or selective removal of trees may be considered where required in preference to total vegetation removal. Disturbance to private boundaries, gardens, etc. shall be avoided wherever possible and where impacted shall be reinstated prior to completion of the works. Machinery shall not enter the river unnecessarily. 	<p>Imperceptible</p> <p>No significant residual impact predicted.</p>

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
<p>settings of protected structures;</p> <p>Visual impact from construction of new embankments; and</p> <p>Impact on public realm and residential amenity from the localised noise, dust, vibration, access restrictions and visual disturbance associated with the construction works.</p>	<ul style="list-style-type: none"> • All landscape, footpath, roads etc., disturbed during the course of the works shall be fully reinstated prior to the completion of the construction works. • Japanese Knotweed is particularly common along stretches of the river (e.g. on main entrance road to Hazelwood centre towards sports pitch). Works on river banks should seek to control/eradicate such invasive weeds. Such weeds shall not spread or relocated in the course of the works • Design of Glashaboy River (Glanmire/Sallybrook) Drainage Scheme shall be sympathetic to the riparian character of the woodland river corridor and historical built environment. • In advance of construction a Tree Management Plan and Landscape Plan shall be prepared for the full extent of the works, to include details of tree removal and tree replanting, location, species, size and spacing of trees. This will be carried out by a qualified landscape architect in conjunction with a qualified ecologist and arborist. • Retain existing trees where possible in the interest of residential amenity, public realm and visual character of the river landscape. • River banks will be left intact and vegetated wherever possible. • Where retention of existing trees is not an option, these shall be replaced with new native species as close as possible to the original location, on the dry side of the wall, in the interest of residential and public amenity and visual character of the river landscape. Species to include Alder (<i>Alnus glutinosa</i>), Birch (<i>Betula pubescens</i>), Willow (<i>Salix viminalis</i>), Pedunculate Oak (<i>Quercus petraea</i>), Pine (<i>Pinus sylvestris</i>), Hazel (<i>Corylus avellana</i>) and Holly (<i>Ilex aquifolium</i>). • Galvanised black powder coated finish to be applied to new railings and barriers. 	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	<ul style="list-style-type: none"> • Location of the flood wall requirement to be along the line of an existing wall on river bank for the most part where possible in the interest of minimising intrusion on the existing landscape character (with the exception of Meadowbrook where wall will be set back in order to retain trees). • Installation of 1.2m high timber post/rail fence and hedging along eastern river bank adjacent to Multi Use Games Area in Riverstown in replacement of removed trees (as per Figure 7.1.2.2 in Appendix 7.1) • Sandstone cladding on exposed sections of new walls is of particular importance for the following areas: <ul style="list-style-type: none"> ○ any new sections approaching Riverstown Bridge. Contemporary capping is deemed appropriate to define boundary with protected structure and avoid a pastiche approach; ○ on entrance to (including wall near Mutli Use Games Area) and within the Hazelwood Centre (on sections of exposed walls in public areas, mainly dry side).(as per Figure 7.1.1.2); ○ on exposed side of any reinstated/alterd sections of the existing wall opposite Copper Valley Vue (as per Figure 7.1.6.2); ○ at The Grove: on dry side of new wall along R639 north of Glanmire Bridge (C01_L08 – Works Chainage 0-101); and ○ Ivy (<i>Hedera helix</i> 'Hibernica') shall be planted at 1m gaps along the dry side of fair faced concrete wall running through Meadowbrook (as per Figure 7.1.4.2 in Appendix 7.1). 	
Traffic		
<p>Increase in traffic due to construction activities in the form of HGVs, and workforce and general site traffic.</p> <p>Temporary traffic diversions and road closures</p>	<ul style="list-style-type: none"> • A CEMP (incorporating a traffic management plan) will be prepared and implemented during the construction phase. It will be regularly reviewed and updated where necessary. • Construction related traffic will have designated access and approach routes to minimise disruption to local traffic flow. • Road closures will be kept to a minimum and only where absolutely necessary. Roads will be reopened once works are complete. 	<p>Imperceptible</p> <p>No significant residual impact predicted.</p>

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	<ul style="list-style-type: none"> Construction works carried out in phases will only require partial road closure Clear signage and diversion routes will be put in place for all road disruptions. Local residents will be informed in advance of any planned diversions or road closures. 	
Noise and Vibration		
<p>Principal sources of noise:</p> <p>Earthworks plant and equipment.</p> <p>Construction plant and equipment.</p> <p>Construction traffic.</p>	<ul style="list-style-type: none"> In accordance with best practice, noise aspects during the construction phase will be managed in accordance with BS 5228: Code of practice for noise and vibration control on construction and open sites (Part 1: Noise) (BSI, 2009). Hours will be limited during which noisy site activities are permitted. Channels of communication will be established between the Contractor/Developer and Local Authority. A Site Representative will be appointed responsible for matters relating to noise. Typical levels of noise will be monitored as necessary during critical periods and at sensitive locations. Plant will be selected with low inherent potential for the generation of noise. All site roads will be kept even so as to mitigate the potential for vibration from HGV's Barriers will be erected as necessary around items such as generators or high duty compressors. Noisy plant will be sited as far away from sensitive properties as permitted by site constraints. In terms of minimising vibration levels, the Contractor will be required to select and utilise methods of working and items of plant so that the maximum measured ground vibrations do not exceed a peak particle velocity (PPV) of 8.5mm per second at any occupied property, with a lower PPV limit of 5mm per second applying to properties in poor condition or other sensitive receptors. The Contractor will be required to monitor ground vibrations at selected locations to the approval of the Employer's Representative during the progress of the works. Each vibrograph shall be certified as being in proper working order and shall 	<p>Imperceptible</p> <p>No significant residual impact predicted.</p>

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	<p>unless otherwise approved, record vibrations in three directions simultaneously with print-out showing the amplitude and frequency of the vibrations.</p> <ul style="list-style-type: none">• Vibration measurements shall be taken at the base of buildings, on the side facing the source of vibration. Where feasible, the measurement should be taken on a hard surface on the ground outside the building.• A pre-condition survey will also be undertaken of all properties potentially affected by the works (likely within a 10m radius of works areas). Crack monitoring will be installed on such affected properties and monitored throughout the works.	

Air Emissions		
<p>Dust from excavation and site clearance activities</p> <p>Emissions from exhausts of construction plant and vehicles.</p> <p>Dust from movements on site in dry windy weather.</p> <p>Dust from dry surfaces and stockpiles</p>	<ul style="list-style-type: none"> • A CEMP will be implemented. • A Dust Minimisation Plan will be formulated for the construction phase of the project. The focus of the control procedures will therefore be to reduce the generation of airborne material. The following measures shall be included as a minimum as part of the dust minimisation plan, to reduce dust emissions in the areas surrounding the site during construction: <ul style="list-style-type: none"> • Vehicle speeds in the construction site will be strictly limited. • During very dry periods, dust emissions from heavily trafficked locations will be controlled by spraying surfaces with water. • A mechanical road sweeper will be used to control mud on roads as required. • Topsoil and other potentially dusty material being removed from the site will be transported in covered trucks, where the likelihood of emitting dust is high, and during dry weather conditions the area of removal will be sprayed with a mobile tanker on a regular basis to control dust emissions. • Exhaust emissions from construction plant and equipment operating within the site, including trucks, excavators, diesel generators and compressors, will be controlled by the contractor by insuring that the equipment is well maintained and is operated in accordance to normal good practice. <p>If cement is stored in a silo on site, a filter will be fitted to the silo; alternatively ready-mix concrete might be supplied by truck.</p>	<p>Imperceptible</p> <p>No significant residual impact predicted.</p>
Climate		
<p>Construction vehicles, generators etc., may give rise to CO₂ and NO_x emissions.</p>	<ul style="list-style-type: none"> • There will be minor emissions to the atmosphere during the construction phase. No mitigation measures required. 	<p>Imperceptible</p> <p>No significant residual impact predicted.</p>

Soils, Geology and Hydrogeology		
<p>Potential impact on soil from leaks or spills from fuel, etc.</p> <p>Excavation of soil for wall foundations, embankments, culverts and sediment trap</p> <p>Soil containing Japanese knotweed will be disturbed.</p>	<ul style="list-style-type: none"> The employment of good construction management practices will serve to minimise the risk of pollution of soil and groundwater. A storm water drainage collection system will be installed. Any potential spills or leaks may be controlled to prevent contamination. The removal of material containing Japanese knotweed off site will be kept to a minimum. A site hygiene plan will be put in place at sites where Japanese knotweed is growing. Measures will be taken to prevent the spread of contaminated material (containing Japanese knotweed) to unaffected areas on or off-site. See Biodiversity for invasive species mitigation measures. 	<p>Imperceptible</p> <p>No significant residual impact predicted.</p>
Hydrology		
<p>Potential impact on surface water during heavy precipitation from stormwater runoff which could contain silt, or oils from plant and vehicles.</p>	<ul style="list-style-type: none"> A CEMP will be prepared and implemented for the duration of the construction phase of the project. Measures, as recommended in the CIRIA guidance <i>Control of Water Pollution from Linear Construction Projects</i> will be implemented to minimise the risk of spills and contamination of soils and waters Stormwater runoff within construction compounds will be directed to stormwater system Plant and vehicles serviced regularly to minimise leaks. Fuels and lubricant stored in bunded areas. Refuelling of plant in controlled areas only. Drip trays will be placed underneath any standing machinery to prevent pollution by oil/fuel leaks. Where practicable, refuelling of vehicles and machinery will be carried out on an impermeable surface in one designated area well away from any watercourse or drainage (at least 10m). Emergency spill kits will be available on site and staff trained in their use. Operators will check their vehicles on a daily basis before starting work to confirm the absence of leakages. Any leakages will be reported immediately. Daily checks will be carried out and records kept on a weekly basis and any items that have been repaired/replaced/rejected noted and recorded. 	<p>Imperceptible</p> <p>No significant residual impact predicted.</p>

	<ul style="list-style-type: none"> Any items of plant machinery found to be defective will be removed from site immediately or positioned in a place of safety until such time that it can be removed. All items of plant will be checked prior to use before each shift for signs of wear/damage. All washing out of grout pumps will be carried out in designated areas away from the river, such as in the lined compound area. At no point will grout pumps be washed out at the worksite. 	
Biodiversity		
<p>Temporary physical damage to habitats within the construction footprint or access routes</p> <p>Potential changes to the physical regime e.g. estuarine, fluvial and geomorphological processes, salinity levels, tidal regimes, erosion, deposition, sediment transport and accumulation).</p> <p>Changes in the hydrological regime</p> <p>Changes in water quality and pollution</p> <p>Disturbances to sensitive species such as birds, badgers, bats and otters</p> <p>Disturbance to fisheries</p> <p>Invasive plant species in works areas</p>	<p>Designated Conservation Sites</p> <ul style="list-style-type: none"> Wherever possible works on the flood defence walls will be conducted from the roadside to limit damage to riverine/estuarine and intertidal habitats along the toe of the walls and works. Follow pollution prevention measures as detailed in section 6.8.9. The permanent works (i.e. the flood defence walls) will not encroach into Cork Harbour SPA and Glanmire Wood pNHA. <p>Habitats and Flora</p> <ul style="list-style-type: none"> In-channel working will be minimised, wherever possible; Upon completion of the works channel vegetation will be allowed to re-colonise naturally, however, this will be monitored and if deemed necessary additional planting of suitable aquatic plant species will be undertaken; Upon completion of in-channel works, in-channel sediment features will be reinstated; To ensure the impacts on altered sediment transport processes the following will take place: <i>Review of construction works to capture immediate channel geomorphological response</i> <i>Repeat hydromorphological audit that captures change associated with flood events of significant and known magnitude (key return periods to be agreed with IFI). A hydromorphological audit is required to understand any changes to fisheries habitats and sediment transport. This will be carried out at least after any major flood events following the completion of the scheme</i> 	<p>Neutral</p> <p>No significant residual impact predicted.</p>

Channel maintenance activities	<p><i>and taken into consideration with the fish surveys. Should the hydromorphological audit demonstrate that the magnitude of change to sediment transport processes is significant and there is a net change in extent and quality of in-habitat, further reach-scale remediation will be agreed with fisheries specialist in consultation with IFI and implemented. This could include the installation of in-channel features to maintain the extent and quality of existing spawning gravels (for salmonids and lamprey species) and fine sediment deposits (for adult Brook Lamprey).</i></p> <ul style="list-style-type: none"> • Annual fish population survey for at least three years to capture changes in length-frequency distribution. • Follow pollution prevention measures as detailed in Section 6.8.9 of EIS chapter. • Upon completion of the works the new embankments, and in any other grassland areas disturbed during the construction works, will be re-sown with an appropriate species-rich grass and/or native wildflower seed mix option. • Hedgerow/tree planting will be undertaken to replace any length of hedgerow/treeline lost to accommodate the new drainage scheme. Hedgerows will be replanted as close to the existing alignment and location as possible and will use native, locally sourced species appropriate to the locality <p>Birds</p> <ul style="list-style-type: none"> • All vegetation clearance works and site preparatory works will be conducted outside of the bird nesting season (March to September inclusive). If this is not possible, a breeding bird survey will be undertaken in advance of the works to ensure that there will be no impacts on nesting birds. If nests are found, they will be safeguarded, with an appropriate buffer, until the chicks have successfully fledged. In particular the Kingfisher nesting area will be screened off from proposed works in the vicinity of the Kingfisher embankment, • Hedgerow planting will be undertaken to replace any length of hedgerow/treeline lost to accommodate the new drainage scheme. Hedgerows will be replanted as close to the existing alignment and location as possible and will use native, locally sourced species appropriate to the locality. • Impacts on Kingfisher shall be mitigated through the scheme design, by moving the flood wall to avoid the Kingfisher embankment and place the flood defence wall behind the existing wall and within Hazelbrook housing estate. In order further minimise impacts to Kingfisher. 	
--------------------------------	--	--

	<ul style="list-style-type: none"> • Works to existing walls and bridge structures shall require a breeding bird survey prior to the commencement of works to ensure there will be not impacts on Dipper and Grey wagtail. If nests are found, they will be safeguarded, with an appropriate buffer, until the chicks have successfully fledged. If nesting areas of Dipper and Grey wagtail, as identified in the breeding bird survey, will be damaged or lost through the proposed scheme, enhancement measures to wall and bridge structures shall involve the installation of dipper nest boxes in these areas. This will require consultation with the UCC research department who currently run a Dipper project on the Glashaboy and who have provided information to JBA's ecologists throughout this project. <p>Otter</p> <ul style="list-style-type: none"> • The loss of an otter holt may be necessary at Glenmore and this will require mitigation. A derogation licence will be required from NPWS and will include the provision of an artificial otter holt. • With the exception of the loss of an otter holt at Glenmore,, no works will take place within 20m of the known Otter holts and resting place (National Roads Authority, 2008), with this area appropriately demarcated and fenced if necessary. • Prior to commencement of works, a further survey to identify the presence of any new Otter resting places/holts within 200m of the works areas will be undertaken. If found and likely to be damaged/disturbed by the works an appropriate mitigation strategy will need to be devised and a derogation license will need to be applied for from NPWS. • Night-time working will not be permitted within 20m of the known Otter holts and resting place, or those that may be identified as part of the pre-works Otter survey. If a derogation licence is applied for from NPWS for the disturbance of Otter holts/resting places, night-time work within these locations will be detailed in the licence application and an appropriate mitigation strategy devised. • To minimise the potential for Otters becoming trapped, all excavations will be left open for the minimum possible time, and not over-night. If excavations have to be left open over-night they will be fitted with an escape ramp (no more than 45°) to allow accidentally trapped animals to escape. Materials to cover excavations or create escape ramps will be on site at all times so that all excavation areas can be made safe before leaving site. • All materials stored on site will be stacked securely so as to prevent accidental collapse if investigated by an Otter, or any other large mammals. 	
--	--	--

	<p>Badger</p> <ul style="list-style-type: none"> To minimise the potential for Badgers becoming trapped, all excavations will be left open for the minimum possible time, and not over-night. If excavations have to be left open over-night, they will be fitted with an escape ramp (no more than 45°) to allow accidentally trapped animals to escape. Materials to cover excavations or create escape ramps will be on site at all times so that all excavation areas can be made safe before leaving site. All materials stored on site will be stacked securely so as to prevent accidental collapse if investigated by Badger, or any other large mammals. Prior to commencement, all works areas, site compounds and access routes will be re-surveyed to ensure that new Badger setts have not been established. If found, appropriate mitigation strategies will need to be devised and implemented. <p>Bats</p> <p>In order to mitigate identified construction and operational impacts on bats the following mitigation measures will be implemented: In survey areas where habitats present and currently provide good commuting and some foraging potential for bats, it is best practice to avoid damaging measures. It is proposed that the following measures be put in place to avoid or lessen the degree of construction and operational impacts on bats.</p> <p><i>Mitigation by avoidance</i></p> <ul style="list-style-type: none"> Do not remove trees and shrubs along waterway banks adjacent to the bridge structures, where feasible. Protect this habitat from any potential damage as a result of the proposed development works. Treelines and shrubs should remain in-situ and remain protected from potential management work. Minimise damage to the woodland habitat adjacent to the bridges / culverts and along the rivers. Ensure that all equipment, construction materials are stored on the roadway and not in adjacent habitats to the bridges. 	
--	--	--

	<ul style="list-style-type: none"> Open areas required to facilitate works should be limited, where feasible, to areas where tree and hedgerows are not present. Lighting of such work spaces can also disrupt traditional foraging grounds for bats and therefore should be limited and should not occur during foraging period (30 minutes prior to sunset to 30 minutes after sunrise). <p><i>Priority Mitigation Measures for Bats - Bridges in general</i></p> <ul style="list-style-type: none"> Retain crevices for roosting bats - this applies to any bridge proposed to have works on and identified in this report as suitable for roosting bats. In discussion with engineers, where a selection of crevices should be retained and blocked temporarily until works are finished in relation to the bridge. Once works are finished, the crevices should be unblocked to allow bats to use the structures post-works. However, a bat survey is required prior to such works for these bridges/culvert to ensure that there are no bats present prior to and during works. This survey work should involve a detailed examination of all arches and crevices. The bat specialist should mark any crevices to be retained. Such crevices, once no bats are present should be filled with bubble wrap in order to prevent filling in of such. Crevices that remain open will have to be daily checked prior to filling in not unless the canvas sheeting procedure as recommended below in undertaken Due to the number of open crevices found in some of the bridges, a bat inspection of any bridge is required the night before works are due to be undertaken. In preparation for this survey, two sheets of canvas that will close the arches (post bat survey), are required to be in place (i.e. canvas sheeting to be erected from the top of the bridge and held in place. When the sheeting is unfurled, the length of it should reach the water level. The width of the sheeting should also ensure that entire opening to the 1/2 arches of the bridges (upstream and downstream) are covered to prevent bats accessing the bridge for the duration of the works. Once the bat inspection and survey determines that there are no bats within the bridge, the canvas sheets are to be released. While the canvas sheeting can be opened during the daytime to allow works to be undertaken, it is of paramount importance that each evening, the canvas sheets are released to close the arches during the night for the duration of the works under the arches. Once the works are finalised and a bat inspection is completed, the crevices blocked to be retained are unblocked and the canvas sheets removed. 	
--	--	--

	<ul style="list-style-type: none"> • Bat tubes should be incorporated into new structures, where possible - e.g. into the parapet walls for example. • A further bat inspection is recommended prior to works and also a meeting with on-site engineers to in relation to the bridge. • Works are recommended outside the bat maternity season (typically May to August, but can also be weather dependant). <p><i>Removal of Trees</i></p> <ul style="list-style-type: none"> • Minimise the removal of mature trees, where possible. • If the retention of mature trees on or around bridge structures is not feasible, a limited number shall be removed to facilitate the construction working area. An assessment of the trees according to the PBR value (detailed below within this section) shall be conducted prior to any removal works. • If the trees are to be removed, felling should be undertaken during the months of September, October, February and March during mild weather conditions. Planting will be required to mitigate for tree removal and landscaping plans will be required to be planted "like for like" in relation to tree and shrub species removed. Some restrictions of species may apply however in the vicinity of structures so that structures are not compromised by roots in the future. Consideration should be given towards hawthorn, blackthorn mix with individual ash, alder and birch to form a native tree hedge) and deciduous trees (native tree species include ash, oak, alder, birch) should be planted to buffer the new development area. • An assessment of trees according to their PBR value determines the methodology of felling. Trees with B-value PBR have a medium suitability for roosting bats and require more intensive procedures prior to felling, for example: • Any trees showing crevices, hollows, etc., should be removed while a bat specialist is present to deal with any bats found. Such animals should be retained in a box until dusk and released on-site. Large mature trees will be felled carefully, essentially by gradual dismantling by tree surgeons, under supervision of a bat specialist. Care will be taken when removing branches as removal of loads may cause cracks or crevices to close, crushing any animals within. These cracks should be wedged open prior to load removal. The dead branches should be lowered to the ground using ropes to avoid impacts which may injure or kill bats within. This measure refers to B-value trees. These trees should be marked with spray paint prior to felling in order for them to be felled correctly in relation to method described above. 	
--	--	--

	<ul style="list-style-type: none"> • A bat expert will survey all trees due for removal prior to construction works commencing once there is a consensus on what trees are to be removed and there is a clear access to all of the trees on-site. • Any ivy covered trees which require felling will be left to lie for 24 hours after cutting to allow any bats beneath the cover to escape. <p><i>Alternative roosting sites - Bat Boxes</i></p> <ul style="list-style-type: none"> • If trees are proposed to be felled then, a bat box scheme is required to mitigate for this. The number of bat boxes is calculated according to the number of trees to be felled and their PBR value. Bat box locations (exact trees for erection of bat boxes) should be undertaken by bat specialist prior to construction works are undertaken. 'Schwegler' woodcrete bat box designs are recommended. • For every three B-value trees to be felled - one bat box is required. • For every five C-value trees to be felled - one bat box is required. • To ensure that bats use the bat boxes, it is very important to site them carefully and this should be undertaken by a bat specialist. Some general points to follow include: • Straight limb trees (or telegraph pole) with no crowding branches or other obstructions for at least 3 metres above and below position of bat box. • Diameter of tree should be wide and strong enough to hold the required number of boxes. • Locate bat boxes in areas where bats are known to forage or adjacent to suitable foraging areas. Locations should be sheltered from prevailing winds. • Bat boxes should be erected at a height of 4-5 metres to reduce the potential of vandalism and predation of resident bats. • It is recommended to erect a number of bat boxes on one tree at an array of aspects. South facing boxes will receive the warmth of the sun, which is necessary for maternity colonies. In large bat box schemes, it is generally recommended to have 	
--	--	--

	<p>three bat boxes arranged at the same height facing North, South-East and South-West. This ensures a range of temperatures are available all day. If the South facing boxes become warm, bats can safely remove to the cooler North facing box.</p> <ul style="list-style-type: none"> • Locations for bat boxes should be selected to ensure that the lighting plan for the proposed site does not impact on the bat boxes. • Acceptance of boxes by bats is less predictable than those for birds. Therefore, it is essential to monitor their use over a period of time. Those boxes that remain unused within two years of date of erection should be re-located. Bat boxes should also be checked in wintertime for general wear and tear and to remove droppings from the previous summer use. • Bat boxes should be inspected, by bat licence holder (bat specialist), at least once within 12 months of erection at appropriate season in order to monitor bat use and the species using boxes. This should be followed up with another inspection within 24 months of setting up. At this point, any bat boxes not used should be re-located to a new site. Any bats found should be counted and identified to species level. All data collected should be submitted to Bat Conservation Ireland. • As the Glenmore stream, east of the M8 motorway along Brooklodge Grove, was not surveyed for bats due to its late addition to the scheme, this area will require surveying prior to the commencement of the works, in particular the existing wall and trees in the vicinity of the works. If PRBs are found in this area, the mitigation measures outlined above shall be implemented <p>Fisheries</p> <p>In order to mitigate identified construction and operational impacts on fisheries the following mitigation measures will be implemented:</p> <ul style="list-style-type: none"> • IFI Guidance on the Protection of Fisheries During Construction Works in and adjacent to Water (2016) should be followed and consultation with IFI will be carried out prior to works. • In-channel working will be minimised, wherever possible. Where in-channel working is unavoidable, works should be preferentially done in the dry wherever possible, through the use of temporary coffer dams and dewatering, following a fish rescue from any wetted channel area within the coffer dam. Fish rescues should be undertaken by an appropriately experienced fisheries contractor in possession of the relevant permits and consents from the regulator. • In-channel working during the salmonid spawning season (November to March inclusive) will not occur. 	
--	--	--

	<ul style="list-style-type: none"> • During the construction phase it will be ensured that fish can migrate past areas of in-channel working. • Where piling is required, a presumption against the use of percussive piling should be made. Where possible, a press-in piling technique should be used, with a presumption to use vibration piling, using a variable moment vibrator, where press-in techniques are not appropriate due to ground conditions. • Any pumps used for over-pumping/de-watering must be fitted with appropriate screens. • Method statement to be drafted and approved with IFI for in-channel works relating to fitting of all non-return drainage outlets to new flood defence walls. • Undertake a redd survey on the Hazelwood stretch immediately prior to mobilisation relating to bridge replacement (C01_B03) and flood relief channel creation (C01_C01 and C01_C02) works to identify if evidence of spawning is in proximity of works. Works to be delayed for a period to be agreed with IFI if redds found during survey. • Hard engineering of the river bed will be avoided. • Any riverbed materials removed or disrupted as part of the works will be replaced and any areas where new bed materials will be installed (i.e. wall footings, bed armour to prevent scour), will be designed to replicate natural bed conditions. Existing bed material will be used to cover new bed materials, wherever possible. Bed material removed from the river will be stored on the bankside. The storage facility will be such that there will be no loss of sediments from the material stored and no external contamination (e.g. a bunded plastic sheet or sealed plastic container). Once excavations are complete, and any new material has been introduced, the stored material will be replaced over the bed. Once normal flows are restored after demobilisation, the replaced material will be redistributed by the currents. These measures will ensure no net loss of material and no significant changes to bed sediment morphology or composition. • Follow pollution prevention measures as detailed in section 6.8.9 of EIS chapter. • Ensure that all culverts and trash screens are designed and installed in line with published best practice on fish passage (e.g. CIRIA 2010; Armstrong et al 2010; Turnpenny & O'Keefe 2005). 	
--	---	--

	<ul style="list-style-type: none"> • Inclusion of daylight chimneys/tubes in the culverting of the un-named watercourse in the Sallybrook stretch to reduce the behavioural impact of the culverting. • Inclusion of cost effective fish passage measures at the wooden weir on the bottom end of the Springmount Stream to enable upstream migration and exploitation of habitat (albeit limited) • Annual fish population survey for at least three years (see previous section above) • A hydromorphological audit is required (see previous section above) <p>Non-native Invasive Species</p> <p>In order to mitigate the possible spread of non-native invasive species, the mitigation measures will be implemented:</p> <ul style="list-style-type: none"> • Where feasible, avoid working in areas where Japanese Knotweed is present; all areas within 7m of visible above-ground growth will be avoided and clearly demarcated. • If work is required in areas infested with Japanese Knotweed (including any area within 7m of visible above-ground growth) an appropriate Japanese Knotweed Mitigation Strategy will need to be devised and implanted to prevent spread. Refer to Appendix 4.1 for further details. • Prior to commencement, all works areas, site compounds and access routes will be re-surveyed to ensure that stands of non-native invasive species have not become established. If found, appropriate mitigation strategies will need to be devised and implemented. • An overall site specific Invasive Species Management Plan will be developed to address any areas that may affect the proposed scheme prior to the commencement of works. • All contractors and staff shall adhere to Biosecurity Protocols for invasive species. 	
--	--	--

	<p>Construction and Environment Management Plan</p> <ul style="list-style-type: none"> Chapter 4 of this EIS details the main constraints required to be contained in the Construction and Environmental Management Plan (CEMP) during the construction phase and will be included in the tender documents for the construction of the proposed scheme. A detailed and site specific CEMP will be provided to the competent authority by the contractor prior to works commencing. This shall be completed in consultation with a suitably qualified ecologist. All works will be monitored by a suitably qualified ecologist who will report to the Heritage Officer of Cork County Council. Reporting format and programme to be agreed with Cork County Council. <p>Pollution Prevention Measures</p> <ul style="list-style-type: none"> Appropriate mitigation measures will be implemented prior to the construction phase to ensure that water quality of the Glashaboy River is not adversely affected through pollution incidents and silt mobilisation. This mitigation will include: Appropriate sediment control measures will be employed. Any chemical, fuel and oil stores will be located on an impervious base within a secured bund with a storage capacity 110% of the stored volume. Biodegradable oils and fuels will be used where possible. Drip trays will be placed underneath any standing machinery to prevent pollution by oil/fuel leaks. Where practicable, refuelling of vehicles and machinery will be carried out on an impermeable surface in one designated area well away from any watercourse or drainage (at least 10m). Emergency spill kits will be available on site and staff trained in their use. Operators will check their vehicles on a daily basis before starting work to confirm the absence of leakages. Any leakages will be reported immediately. 	
--	---	--

	<ul style="list-style-type: none"> • Daily checks will be carried out and records kept on a weekly basis and any items that have been repaired/replaced/rejected noted and recorded. • Any items of plant machinery found to be defective will be removed from site immediately or positioned in a place of safety until such time that it can be removed. All items of plant will be checked prior to use before each shift for signs of wear/damage. • All washing out of grout pumps will be carried out in designated areas away from the river, such as in the lined compound area. At no point will grout pumps be washed out at the worksite. <p>Tree Removal</p> <ul style="list-style-type: none"> • The plans for tree removal for the construction of the scheme are shown in Appendix 3.1 of EIS. Hedgerow/tree planting will be undertaken to replace any length of hedgerow/treeline/individual trees lost to accommodate the new flood scheme. Hedgerows and trees will be replanted as close to the existing alignment and location where feasible and will use native, locally sourced species appropriate to the locality. • A tree management plan will be designed prior to the works by a landscaper in consultation with an arborist and a suitably qualified ecologist. This plan will include an assessment and recommendations to offset tree loss overall, as a result of the scheme and will be agreed with the planning authority. • A number of trees may require removal at Sallybrook within Riparian Woodland. This area is disturbed and it appears that an embankment may have been installed in recent times. This has compromised some of the trees and therefore these require removal as they are considered a hazard to the scheme. This area is also covered in Japanese Knotweed and therefore, measures and controls must be in place to ensure that the works do not cause the spread of Japanese Knotweed. <p>See also bat mitigation above regarding tree removal.</p>	
--	--	--

Archaeological Architectural and Cultural Heritage		
<p>Ground disturbance at numerous locations</p> <p>Potential disturbance to potentially surviving subsurface archaeological deposits.</p> <p>Removal of features of cultural significance</p>	<ul style="list-style-type: none"> • Features of cultural heritage significance identified that will be removed by construction works will be recorded prior to their removal during construction. These are: • Archaeological monitoring will be carried out where direct works will be undertaken to structures included in the RPS in Cork County Development Plan (2014). • In areas where in situ subsurface deposits may be present licensed archaeological monitoring of ground works will be carried out. In areas where intra-riverine archaeological deposits may survive licensed archaeological monitoring will be carried out by an experienced underwater archaeologist. • Any archaeological features identified during archaeological monitoring will be fully resolved to professional standards of archaeological practice. Such material will be preserved in situ or preserved by record, as appropriate, as outlined in Policy and Guidelines on Archaeological Excavation – Department of Arts, Heritage, Gaeltacht and the Islands. • Where features will be removed it is recommended that these be recorded prior to removal during construction. 	<p>Imperceptible to slight effects</p> <p>Slight effects where features are to be removed.</p>
Population and Human Beings		
<p>Traffic disturbances</p> <p>Noise and vibration effects</p> <p>Dust generation</p> <p>Visual impacts</p> <p>Potential loss of cultural heritage</p>	<ul style="list-style-type: none"> • See Roads and Traffic • See Noise and Vibration • See Air Emissions • See Visual Impact • See Archaeological Architectural and Cultural Heritage 	<p>Imperceptible</p> <p>No significant negative residual impact predicted.</p> <p>Positive residual impact due to lower risk of flooding to residential, commercial properties, amenities etc.</p>

Use of Natural Resources		
<p>Construction phase will require potable water, power, fuel, materials such as steel and concrete.</p> <p>Generation of waste and excavated material.</p> <p>Potential temporary impact on services.</p>	<ul style="list-style-type: none"> Equipment will be serviced regularly to ensure efficient operation. Materials will be carefully stored and handled to avoid waste and damage. Water use will be controlled to avoid waste. Excavated material will be kept to a minimum. Material will be re-used on site where possible. See Soils, Geology and Hydrogeology. Affected residents or businesses will be notified prior to any disturbances and impacts will be kept to a minimum. 	<p>Imperceptible</p> <p>No significant residual impact predicted.</p>
OPERATIONAL PHASE		
Visual Impact		
<p>Impact on overall character of wooded river corridor after trees/vegetation removal throughout the study area,</p> <p>Localised visual impact on residential and public amenity</p>	<p>The following mitigation measures are included for the post construction stage of the scheme:</p> <ul style="list-style-type: none"> Where retention of existing trees is not an option, these shall be replaced with new native species as close as possible to the original location, on the dry side of the wall. Where shrubs and vegetation are removed, new plants of appropriate species shall be planted in replacement. 	<p>Slight Negative</p> <p>Overall the impacts on residential and public amenity are considered to be slight negative once new planting matures and screening begins to establish.</p>

<p>after the removal of trees at within Meadowbrook, at Riverstown Bridge, Hazelwood and at the entrance to Copper Valley Vue and on dwellings around Sallybrook.</p> <p>Visual impact from new fair face concrete walls, generally reducing to as planting matures, and where ivy establishes in select locations diminishing visibility of the wall.</p> <p>Visual impacts on the historical character of the built environment and immediate settings of protected structures,</p> <p>Visual impact from new embankments.</p> <p>Improvement of appearance of existing and visually fragmented boundary in Riverstown.</p> <p>Enhancement of public realm by means of replacing the</p>	<ul style="list-style-type: none"> • Where fair faced concrete is used, Ivy (<i>Hedera helix 'Hibernica'</i>) shall be planted at 1m gaps along the wall face where feasible. Areas where this is deemed necessary are as follows: • All trees retained in proximity (i.e. within root protection area (RPA) as per BS 5837) shall be subject of a detailed post-construction tree survey carried out a qualified Arborist. Any works recommended shall be undertaken and the survey shall be made available to the Client. 	<p>Considering the scale of the project, on adhering to mitigation measures outlined, the proposed Glashaboy River Drainage Scheme will not have an appreciable impact on the integrity or landscape planning aspects of the Glashaboy River corridor, with impacts reducing as existing and new planting matures.</p> <p>Positive impacts arise due to the reduced risk of flooding in the area</p>
--	---	--

existing bridge at the Hazelwood Shopping Centre.		
Protection of Glanmire and Riverstown townscapes and built heritage from future flooding.		
Traffic		
Potential impact during channel maintenance works	<ul style="list-style-type: none"> Impacts due to channel maintenance works cannot be foreseen. A traffic management plan will be put in place where works are foreseen to cause disruption. 	Not significant
Noise and Vibration		
Use of surface water pumps and foul pump.	<ul style="list-style-type: none"> Pumps will be used during flood events. 	Imperceptible effect and temporary effect.
Air Emissions		
	No mitigation measures are deemed necessary.	Not significant
Climate		
	No mitigation measures are deemed necessary.	Not significant

Soils, Geology, Surface Water and Groundwater		
Reduced infestation of Japanese knotweed allowing re-vegetation of previously infested areas.	<ul style="list-style-type: none"> • Soils are less vulnerable to soil erosion during flooding. • No mitigation measures necessary. 	Positive effect
Biodiversity		
Channel maintenance activities	As there are no specific design details for channel maintenance specific mitigation measures cannot be determined at this stage. However, an ecological impact assessment and as a minimum Screening for Appropriate Assessment will be necessary at project design stage of channel maintenance. Consultation with IFI and NPWS will also be required and any derogation licences required as a result of the ecology assessment will be obtained.	Not significant
Archaeological, Architectural and Cultural Heritage		
Disturbance due to channel maintenance activities	<ul style="list-style-type: none"> • Future channel maintenance to the watercourses throughout the scheme will require archaeological monitoring during the course of those works. • Channel maintenance works will be kept to a minimum. 	Not significant and temporary
Human Beings		
Improved resilience of the local area to flood events	<ul style="list-style-type: none"> • Reduced flooding of residential areas, businesses. 	Positive effect
Use of Natural Resources		
Power will be required for the pumps during flood events	<ul style="list-style-type: none"> • No mitigation measures are necessary. 	Imperceptible effect

