Douglas Flood Relief Scheme

(including Togher culvert)

Environmental Impact Statement

May 2017

Cork County Council
Comhairle Contae Chorcaí

ARUP

Cork County Council

Douglas Flood Relief Scheme (including Togher Culvert)

Environmental Impact Statement

EIS

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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 proposed Douglas Flood Relief Scheme (including Togher Culvert) is contained in one volume and consists of:

Non-Technical Summary

EIS (main text)

Appendices

List of Contributors

This Environmental Impact Statement (EIS) is based on an appraisal of the environmental effects of the proposed Douglas Flood Relief Scheme (including Togher Culvert) 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;
- Dixon Brosnan – Biodiversity, Information for Screening for Appropriate Assessment

1 Introduction

1.1 Project Overview

1.1.1 Introduction

Cork County Council, in collaboration with the Office of Public Works (the funding authority for the scheme), intends to undertake engineering works along the Ballybrack Stream, Grange Stream and Tramore River with the objective of minimising the risk of flooding in the areas of Douglas and Togher in County and the City of Cork. Numerous significant flood events have occurred in the Douglas and Togher areas, necessitating the proposal to introduce flood relief works. Cork County Council is the lead authority for the purposes of Section 85 of the Local Government Act 2001.

The proposed Douglas Flood Relief Scheme (including Togher Culvert) will include the construction of direct flood defences and conveyance improvement measures along the Ballybrack Stream, Grange Stream and Tramore River. The direct defences proposed include flood walls and embankments with the conveyance improvements consisting of channel widening, channel deepening and the introduction of or replacement of culverts. The overall location of the proposed scheme is presented in **Figure 1.1 Site Location - Overview**. **Figures 1.2a** and **1.2b** below show key plans of the proposed flood defence works in Douglas and Togher respectively. The details of the proposed scheme are presented in the application drawings. Refer to the Proposed Scheme Drawings in **Appendix 3.1** for further details.

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 proposed Douglas Flood Relief Scheme (including Togher Culvert) is referred to as the "proposed scheme" in this chapter and throughout the EIS.

Copies of the application documents and the Environmental Impact Statement, of which this is a non-technical summary, will be available for inspection or purchase at the offices of Cork County Council, County Hall, Carrigrohane Road, Cork between the hours of 9am and 4pm from the 18th May 2017 to the 29th June 2017, at Douglas Library, Douglas Village Shopping Centre, Douglas, Co. Cork between the hours of 10am and 5:30pm on working days (Tuesday to Saturday) from the 18th May 2017 to the 29th June 2017 (inclusive of both dates) and from the offices of An Bord Pleanála, 64 Marlborough Street, Dublin 1 between the hours of 9:15am and 5:30 pm on working days from the 18th May 2017 to the 29th June 2017 (inclusive of both dates).

The application documents and EIS will also be available online at the scheme website (www.douglasfrs.ie).

1.1.2 Study Area

The study area for the proposed scheme is located within the overall River Lee catchment area in County Cork. Specifically, the proposed scheme will be located within the Tramore River catchment area which is a sub catchment of the River Lee catchment area. Refer to **Figure 1.1 Site Location - Overview**.

The Tramore River rises in the southwest of Togher and flows eastwards into the Douglas River estuary, which discharges into Lough Mahon. A number of tributaries join the Tramore River, the largest of which is the Ballybrack Stream, which flows north through Douglas before joining the Tramore River in a culverted section at Douglas Village Shopping Centre. Note, the Douglas River is more commonly known as the Ballybrack Stream, and will be referred to as such in this report. The Grange Stream is a tributary of the Ballybrack Stream.

Construction works for the proposed scheme will take place in four separate areas along the Tramore River, Ballybrack Stream and Grange Stream as follows:

Area 1: Ballybrack Stream through Douglas

Area 2: Tramore River through St Patrick's Mills, Douglas

Area 3: Grange Stream (tributary of Ballybrack Stream) through Donnybrook Commercial Centre

Area 4: Tramore River through Togher

The works will take place over an approximate channel length in each area listed above as follows:

Area 1: 620m

Area 2: 80m

Area 3: 480m

Area 4: 810m

The general study area is shown in **Figure 1.1**. For some environmental disciplines (such as ecology), the study area was more extensive. For other disciplines, the study area was much smaller.

Figures 1.2a and **1.2b** show key plans of the proposed flood defence works in Douglas and Togher respectively. All areas are located south of the N40 Cork City South Ring Road. In Douglas, the northern extent of the proposed scheme is at St Patricks Mills and the southern extent is as far as the Donnybrook Commercial Centre. In Togher, the northern extent is at the Greenwood Estate, and the southern extent is at the Lehenaghmore Industrial Estate.

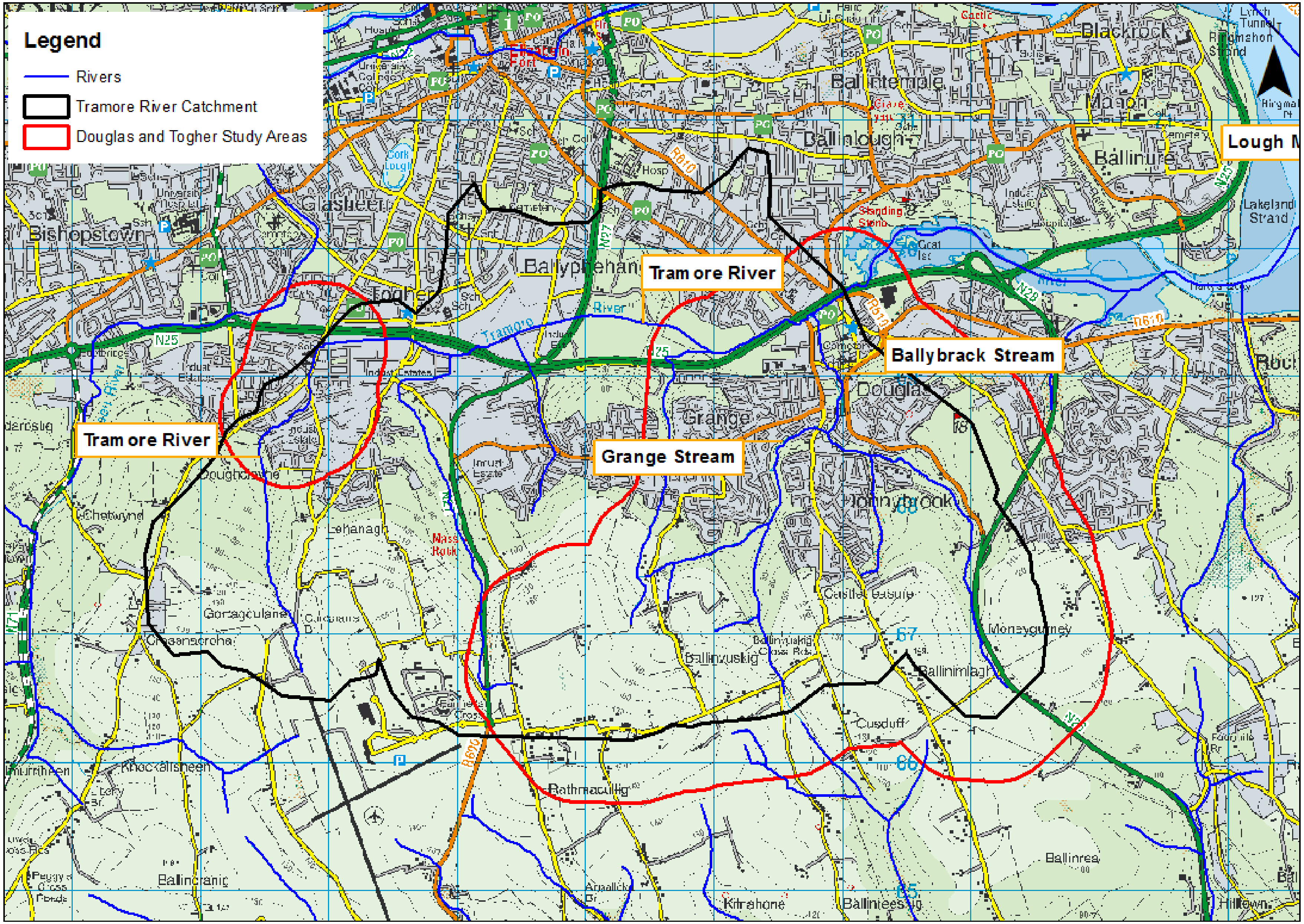

Figure 1.1: Site Location – Overview. Douglas Flood Relief Scheme (including Togher Culvert) Study Areas.

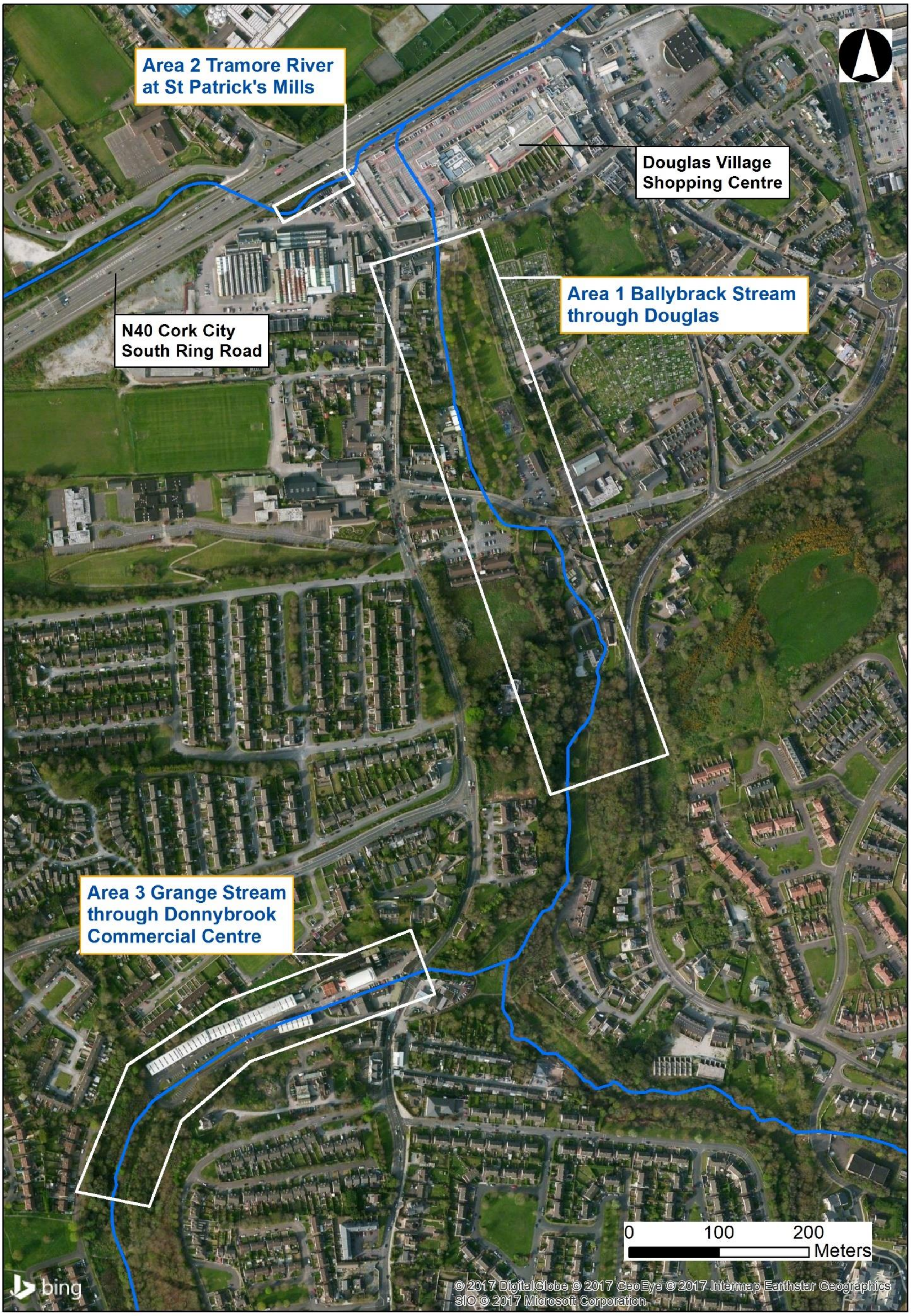

Figure 1.2a: Douglas Key Plan

Figure 1.2b: Togher Key Plan

1.2 Environmental Impact Statement Methodology

1.2.1 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 Douglas Flood Relief Scheme (including Togher Culvert), the combined length of river channel on which works are proposed for Douglas and Togher is less than 2 km but the contributing sub-catchment of the proposed works exceeds 100 hectares. An Environmental Impact Statement (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.

1.2.2 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.

1.2.3 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 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.

1.2.4 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) Environmental Protection Agency;
- 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.

1.3 Difficulties Encountered during the Study

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

1.4 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 in addition, 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 Douglas and Togher.

Information leaflets and consultation letters were also sent out to many stakeholders during the consultation process. The following organisations were also consulted:

- Inland Fisheries Ireland;
- Cork County Council;
- An Comhairle Ealaíon (The Arts Council);
- An Taisce;

- Fáilte Ireland;
- HSE Southern Regional Health Forum;
- Transport Infrastructure Ireland (TII);
- Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs including National Monuments Service (NMS) and National Parks and Wildlife Service (NPWS); and
- The Heritage Council.

Further details on the early stage consultations can be found in the Constraints Report on the project website (www.douglasfrs.ie)

The first Public Information Day (PID) was held in Douglas Community Centre on Wednesday 26th February 2014. Members of the public were invited to attend and make their views and comments known to the Arup design team. The purpose of the PID was to present the Study Area to the general public and to outline the process involved in the preparation of the Douglas FRS. The information gathered via the PID was also used to inform the Constraints Study. The PID was attended and staffed by members of Arup's engineering and environmental teams and representatives of Cork County Council and the Office of Public Works, who were available to answer questions from the members of the public who attended, and to explain the Study Area and the flood relief scheme process, while also accepting information from the attendees.

The second PID was held in Nemo Rangers GAA Club on Wednesday 8th October 2014 and members of the public were again invited to make their views and comments known to the Arup design team. On both days, 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.

A third PID was held on 4th April 2017 at Douglas Community Centre to present and explain the developed scheme and the statutory approval process to the public and affected residents.

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

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.

1.5 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 Scheme and Alternatives Considered

2.1 Introduction

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

2.2 Need for the Proposed Scheme

The Office of Public Works (OPW) in partnership with both Cork City and Cork County Councils carried out a Catchment Flood Risk Assessment and Management (CFRAM) Study for the Lee Catchment which includes the Tramore River Catchment. The CFRAM, which was published in February 2010, recommended flood relief measures for the Togher area. However, the Douglas area was badly affected by flooding in June 2012. As a result of the particularly destructive and disruptive flooding events of recent years, the need to increase flood defences has been identified. A history of flooding in the Douglas and Togher areas is provided in Table 2.1 below.

Table 2.1: History of Flooding Events in the Douglas and Togher areas

Date of Flood Event	Mechanism	Areas Affected
December 2015	Fluvial	Togher
28 June 2012	Fluvial	Togher, Douglas village
27 November 2002	Fluvial	Togher
21 November 2002	Fluvial	Togher, Douglas village
3 December 2001	Fluvial	Togher
30 November 2000	Fluvial	Togher
5 November 2000	Fluvial	Togher, Douglas
1998	Fluvial	Togher
17 March 1947	Fluvial	Douglas
24 December 1895	Fluvial	Douglas
19 November 1892	Fluvial	Douglas
Historic recurring	Fluvial/Tidal	Tramore River downstream of current Cork landfill site, Douglas

The flood event in June 2012 was particularly significant, extending throughout Douglas and Togher. There was significant damage caused to residences in the Ravensdale area, as well as at Douglas village centre (including the Douglas Village Shopping Centre), the St Patricks Mills centre, Donnybrook Commercial centre and commercial properties in Togher. There was also significant damage to community and amenity facilities the above areas.

The maximum flood extent for the 2012 flood event in the Douglas area is presented in **Figure 2.1**, while a comparison of the maximum flood extent for this flood event with the maximum modelled flood event is presented in **Figure 2.2**.

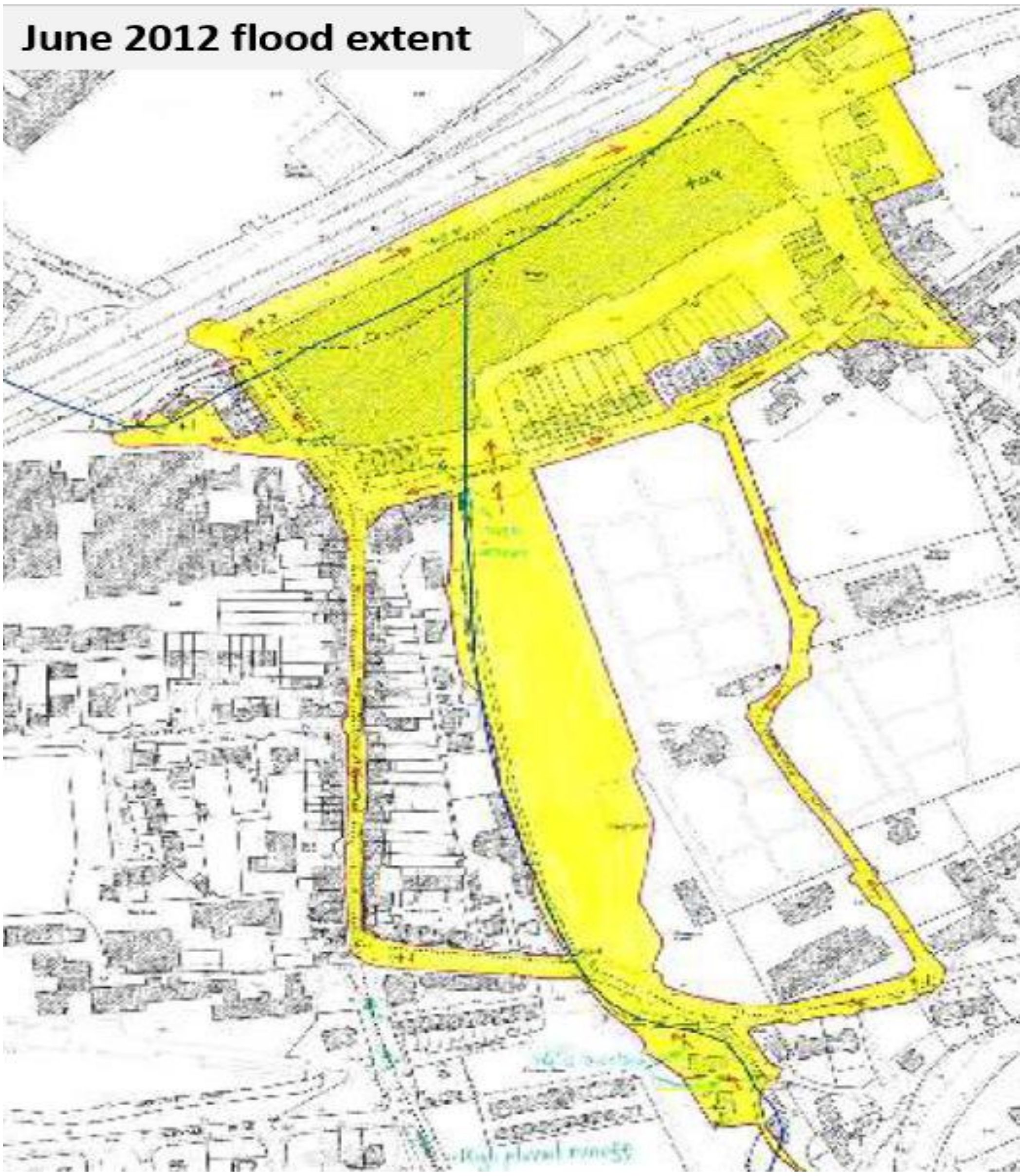

Figure 2.1: Maximum flood extent for the June 2012 flood event. Area 2 (Tramore River through St Patrick's Mills, Douglas) and Area 1 (Ballybrack Stream through Douglas) are located to the north west and the south of this figure, respectively. The N40 (South Ring Road) runs along the northern boundary of the figure. Source: South Western CFRAM consultants.

Figure 2.2: June 2012 flood extent calibration plot (maximum flood extent vs maximum modelled flood event). Area 2 (Tramore River through St Patrick's Mills, Douglas) and Area 1 (Ballybrack Stream through Douglas) are located to the north west and the south of this figure, respectively. The N40 (South Ring Road) runs along the northern boundary of the figure. Source: Cork County Council.

The flooding extended throughout Douglas village. The location of the culvert trash screen at Church Road and photographs of this trash screen under normal conditions prior to the 2012 flood event and following this flood event are presented in **Figures 2.3, 2.4** and **2.5**, respectively. Post flood photographs outside the Irish Countrywomen's Association (ICA) Hall and at a commercial premises in Douglas East are also presented in **Figures 2.6** and **2.7**. **Figure 2.7** illustrates the high water mark from the 2012 flood event.

The residents of Ravensdale were heavily impacted by the 2012 flood event, with a number of properties in this area severely flooded. **Figure 2.8** presents the likely flood routes of the Ballybrack Stream in the vicinity of Ravensdale during this event.

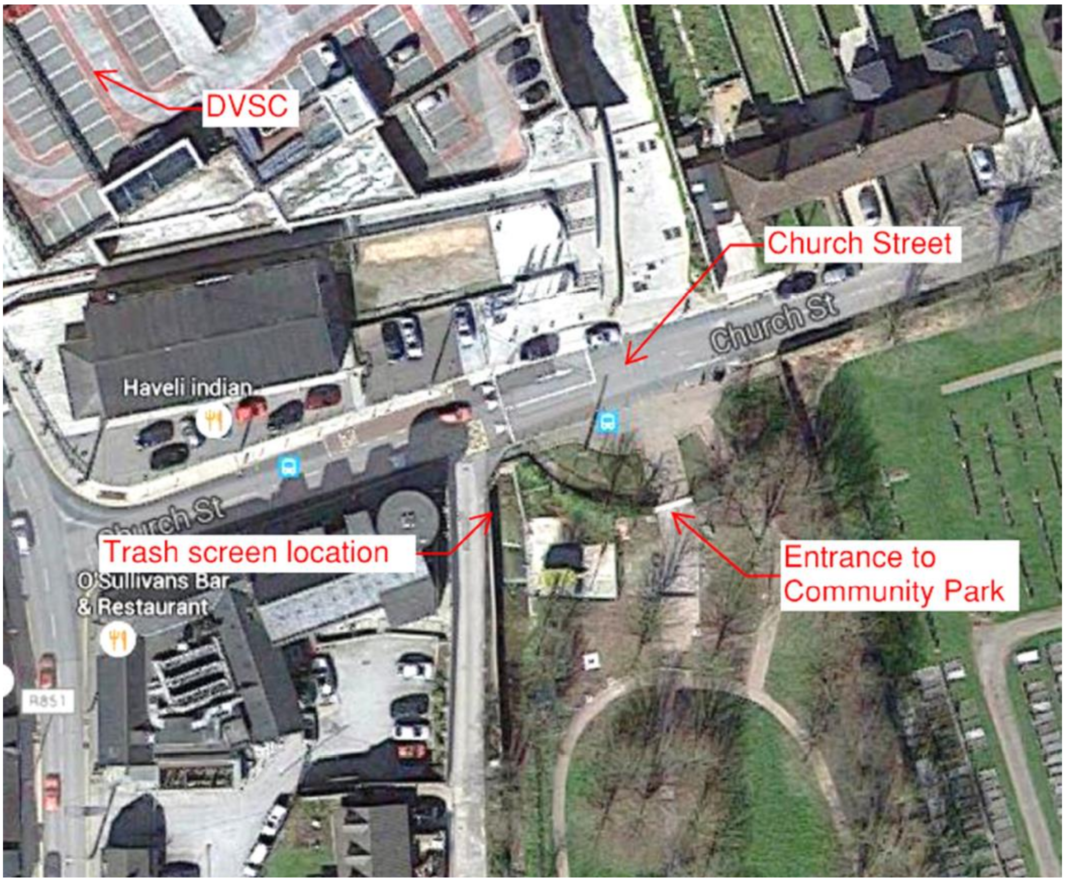

Figure 2.3: Location of culvert trash screen at Church Road

Figure 2.4: Church Road culvert trash screen – normal conditions. Source: OPW

Figure 2.5: Church Road culvert trash screen – post 2012 flood event. Source: OPW

Figure 2.6: Post 2012 flood event – wall knocked down outside ICA Hall

Figure 2.7: Post 2012 flood event high water mark from outside commercial property in Douglas East. Source: OPW

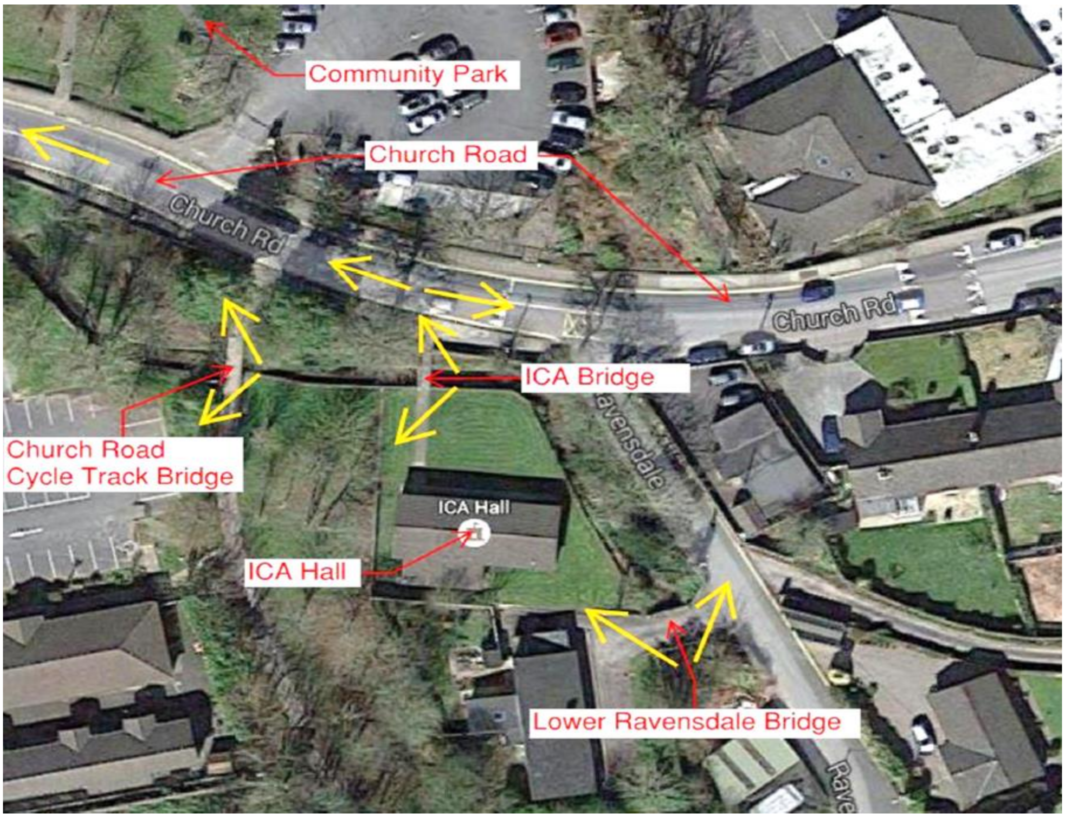

Figure 2.8: 2012 flood event – likely flood routes of the Ballybrack Stream in the vicinity of Ravensdale. The yellow arrows indicate the likely flood routes.

The area nearby St. Patrick's Mills as well as Douglas village centre and Douglas Village Shopping Centre were also severely affected by flooding during the 2012 flood event. Refer to **Figures 2.9, 2.10** and **2.11**. These areas were not accessible during the height of the flood.

Figure 2.9: Post 2012 flood event outside Douglas Village Shopping Centre. Source: Cork County Council

Figure 2.10: Post 2012 flood event inside Douglas Village Shopping Centre. Source: Cork County Council

Figure 2.11: Post 2012 flood event in Douglas Village Centre. Source: Cork County Council

Donnybrook Commercial Centre was also flooded in June 2012. Constrictions within the Grange Stream culvert in the Commercial Centre and blockages due to debris resulted in the culvert becoming surcharged, causing large volumes of water to discharge through a manhole in the centre. Photographs of the aftermath of the 2012 flood event in this area are presented in **Figures 2.12, 2.13** and **2.14**.

Figure 2.12: Post 2012 flood event at Donnybrook Commercial Centre showing debris at manhole. Source: Donnybrook Commercial Centre

Figure 2.13: Post 2012 flood event at Donnybrook Commercial Centre. Source: Donnybrook Commercial Centre

Figure 2.14: Post 2012 flood event at Donnybrook Commercial Centre. Source: Donnybrook Commercial Centre

The Togher area also suffered from extensive flooding following a period of extremely heavy rainfall in 2012. Greenwood Estate was one of the locations in Togher that was worst affected by this event, with significant flooding occurring in this area. Photographs of the aftermath of the 2012 flood event in the Togher area are presented in **Figures 2.15, 2.16** and **2.17**.

Figure 2.15: Post 2012 flood event in Togher Area. Source: Cork County Council

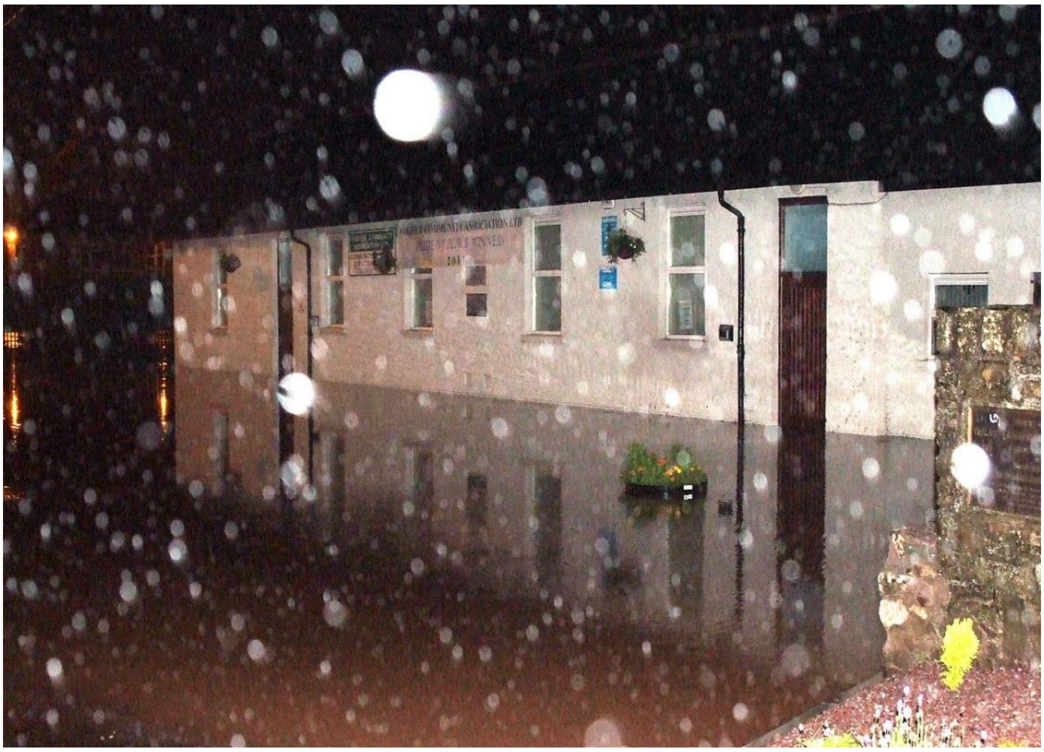

Figure 2.16: Post 2012 flood event in Togher Area – outside Togher Community Centre. Source: Cork County Council

Figure 2.17: Post 2012 flood event in Togher Area – inside Spar Express shop. Source: Cork County Council

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 Tramore 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.
- Changes in land use, including afforestation and land drainage.

There is an evident need to implement measures to reduce the current frequency and risk of flooding, which is compounded by the potential for increased flood risk in the future. This is therefore considered an essential development that would provide much-needed flood alleviation for the Douglas and Togher areas.

As a result of the findings of the CFRAM study and the recent flood events in the area, Cork County Council, in association with the OPW, commissioned Arup to develop a Flood Relief Scheme for Douglas and Togher. The purpose of the scheme was to assess and develop a viable, cost effective and sustainable drainage scheme to alleviate flooding in the Douglas and Togher areas. The flood relief 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 Ballybrack Stream;
- Upgrade of a section of the Grange Stream culvert in Donnybrook Commercial Centre;
- Upgrade of Togher Culvert
- Other measures to improve conveyance through the Tramore River in Togher and through the Ballybrack and Grange Streams.

2.3 Scheme Design Process

The development of the proposed scheme was a process requiring an extensive assessment of different options for flood relief scheme design. The process included the assessment of the validity 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 studies:

- Constraints Study
- Hydrology Study
- Hydraulic Modelling Study
- Site Investigations
- Flood Risk Assessment Study
- Options Assessment Study
- Information required for Appropriate Assessment Screening
- Environmental Impact Statement

Input was required from each preliminary assessment in order to finalise the design for the scheme that is being considered as part of this EIS.

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.douglasfrs.ie.

2.5 Consideration of Alternatives

2.5.1 Options Assessment

As part of the assessment of the options, an options report was produced, indicating the criteria on which the final design for the scheme would be selected. The assessment was undertaken in conjunction with the Multi-Criteria Analysis (MCA) methodology guidelines published by the OPW in relation to scheme design and options reporting for flood relief schemes (OPW, 2013). The report considered all valid alternatives, and determined the preferred design for the scheme.

2.5.2 Options Assessment Process

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 (MCA), allowing a preferred flood relief option to be selected.

A summary of the options assessment report 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.

2.5.2.1 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;
- Do minimum
- Non-structural Measures:
    - o Flood forecasting/flood warning system
    - o Sustainable urban drainage systems (SUDS)
    - o Planning control/land use management

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 Douglas/Togher and has therefore been ruled out at the initial screening stage.

The '**Do Minimum**' scenario is not suitable for this scheme where flooding occurs frequently after rainfall events.

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. Flood forecasting or flood warning systems are more suitable for larger catchments that have less flash-flood type flood events.

Sustainable urban drainage systems (SUDS) play a role in the management of flood risk through attenuation of surface runoff from impermeable surfaces.
Douglas is a heavily urbanised area with little space for the construction of attenuation or other SUDS features into the landscape. This option has therefore not been carried forward.

2.5.2.2 Potentially viable flood risk management measures

The constraints identified in the initial Constraints Report informed the selection of the flood relief measures. The range of engineering measures considered for this FRS included the following:

- o Public awareness

- Structural measures (e.g. defence walls, culverts)
- Flow diversion (e.g. river diversion or flood flow bypass channel)
- Flood containment through construction of flood defences
- Increase conveyance of channel (upstream and/or through and/or downstream of the town)
- Combination of direct defences and conveyance improvements
- Sediment/debris control

A detailed description of the works involved in the scheme is described in **Chapter 3 Scheme Description.**

2.5.2.3 Development of Shortlisted options

2.5.2.4 Area 1 Ballybrack Stream through Douglas

Option 1 – Direct defences only with the construction of direct defences along both sides of the Ballybrack Stream including new reinforced concrete defence walls and bridge parapets and regrading of the river bank at Douglas Community Park;

Option 2 – Conveyance improvements only with the widening and deepening of the Ballybrack Stream channel through Douglas as well as removal of constrictions at several hydraulic structures (bridges, culverts, etc.);

Option 3 – Combination of direct defences (flood defence walls, culvert replacement, trash screen replacement) and conveyance improvements (river widening and deepening, bridge removal, bridge replacement, regrading).

2.5.2.5 Area 2 Tramore River through Saint Patrick's Mills

Option 1 – Direct defences only are proposed. A new 1.2m high flood defence wall along the right bank of the Tramore River with stone cladding on the dry side only. New reinforced concrete bridge parapets at 1.2m high.

2.5.2.6 Area 3 Grange Stream (tributary of Ballybrack Stream) through Donnybrook Commercial Centre

Conveyance improvements and replacement of a section of the existing culvert are the only viable option in this area. This option includes the regrading of the existing channel bed in the Commercial Centre to remove two existing trash screen structures that, due to a build-up of material, act as weirs.

2.5.2.7 Area 4 Tramore River through Togher

Option 1 - Replacement of existing culvert with a new culvert along Togher Road;

Option 2 - Replacement of existing culvert with a new culvert parallel to Togher Road (to the west);

Option 3 - Replacement of existing culvert with an Open Channel with engineered banks parallel with Togher Road. This option incorporates five separate culvert crossings along the route of the open channel in order to maintain vehicular and pedestrian access to existing properties and roads from Togher Road.

2.5.2.8 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 County Council and Arup.

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.

2.5.2.9 Public Consultation

Public consultation was carried out throughout each stage of the development of the scheme. Two public information days were held during the early stages of the project (26th February 2014 and 8th October 2014). These consultations were held at the early Constraints Stage and at the Emerging Preferred Options Stage. On both occasions consultees and members of the public were invited to submit their views on the emerging options of the proposed scheme.

Cork County Council and members of the design team have also engaged in direct consultation with relevant stakeholders, residents and affected landowners. The feedback from this consultation process was carefully considered in the development of the preferred scheme.

Cork County Council intend to acquire the land in private ownership necessary for the construction of the scheme by agreement with landowners wherever feasible, and have commenced the liaison and negotiation process with all affected landowners. Feedback received from affected landowners and residents to date concerning their properties generally relates to the extent of the flood defences, landscaping and screening, wall finishes, access and egress, construction impacts and timeframes, easements and land take. Cork County Council and the design team will continue to actively engage with all affected residents throughout the land-take negotiations, development of the detailed design and construction phases to adequately address the concerns outlined above.

A further public information day was held on the 4th of April 2017 to present and explain the developed scheme and the statutory approval process to the public and affected residents. Cork County Council have taken on board comments from Ravensdale residents regarding the finishes to the flood defence walls in the area which now include for stone cladding on both sides of the flood defence walls.

2.6 References

Office of Public Works (2013) *National CFRAM Programme Guidance Note 28 – Options Appraisal and Multi-Criteria Analysis Framework.*

3 Description of the Proposed Scheme

3.1 Introduction

As discussed in **Chapter 1 Introduction**, Cork County Council intends to undertake engineering works along the Ballybrack Stream, Grange Stream and Tramore River with the objective of minimising the risk of flooding in the areas of Douglas and Togher in County Cork. Numerous significant flood events have occurred in the Douglas and Togher areas, necessitating the proposal to introduce flood relief works.

The proposed Douglas Flood Relief Scheme (including Togher Culvert) will include the construction of direct flood defences and conveyance improvements along the Ballybrack Stream, Grange Stream and Tramore River. The proposed direct defences include flood walls and embankments with the conveyance improvements consisting of channel widening, channel deepening and the introduction of or replacement of culverts.

For ease of reference, the proposed Douglas Flood Relief Scheme (including Togher Culvert) is referred to as the “proposed scheme” in this chapter and throughout the EIS.

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

3.2 Main Elements of the Proposed Flood Relief Scheme

As described previously in **Chapter 1 Introduction**, construction works for the proposed scheme will take place in four separate areas along the Tramore River, Ballybrack Stream and Grange Stream in Douglas and Togher as follows:

Area 1: Ballybrack Stream through Douglas.

Area 2: Tramore River through St Patrick’s Mills, Douglas

Area 3: Grange Stream (tributary of Ballybrack Stream) through Donnybrook Commercial Centre

Area 4: Tramore River through Togher

The proposed scheme for Douglas (Areas 1 to 3) is designed to provide protection to properties in the study area from the 1 in 100 year fluvial/1 in 200 year tidal flood events. An allowance for freeboard has also been incorporated into the design. This standard is in line with the OPW’s national standard for constructing flood defence schemes in Ireland.

The proposed scheme for Togher (Area 4) consists of a replacement culvert which has been designed to meet with OPW Section 50 requirements. It is therefore designed to accommodate the 1 in 100 year fluvial flood plus an allowance for climate change and freeboard.

The works will take place over an approximate channel length in each area listed above as follows:

Area 1: 620m

Area 2: 80m

Area 3: 480m

Area 4: 810m

The overall location of the proposed scheme is presented in **Figure 1.1 Site Location – Overview** and in **Figures 1.2a** and **1.2b** in **Chapter 1 Introduction**. The drawings for the proposed scheme are presented in **Appendix 3.1**.

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

- Construction of new flood defence walls and/or replacement of existing walls with new flood defence walls
- Replacement of and/or extension of existing culverts
- Removal of and/or replacement of bridges
- Removal of existing trash screens and construction of new trash screens
- Local channel widening, deepening, realignment and regrading of river channel and bank stabilisation
- Construction of new earthen flood defence embankments
- Construction of 2 no. underground surface water pumping stations
- Relocation of 2 no ESB substations/kiosks close to their existing locations
- Provision of civil works such as road/footpath re-grading at a number of locations
- Removal of vegetation and trees to facilitate construction works
- Protecting drainage outlets along the line of flood defence works with non-return valves;
- Local diversion of services where necessary to facilitate construction
- Landscaping and tree planting
- Once construction is completed, ongoing maintenance of the river channel, trash screens etc.

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. Landscaping and replanting will also be carried out on completion in agreement with landowners.

As mentioned above, it will be necessary to remove trees within the works footprint to facilitate the construction of the flood relief scheme. The trees in the area were surveyed by an arborist (tree specialist) and by an ecologist for potential bat roosts. Trees which are directly within the footprint of the construction works will be removed and are presented in **Appendix 3.2** of this EIS. There are also some trees whose roots may be indirectly impacted due to the requirement for adjacent works within the root protection area and may subsequently require removal depending on the extent of impact. Every effort will be made to retain these trees where possible. For impact assessment purposes, these trees are assumed to be removed in the EIS.

The drawings **C-000-030** to **C-000-033** (**Appendix 3.2**) indicate the trees to be removed and those which may need to be removed due to indirect impacts. Further details on the proposed scheme in the four areas are presented in the sections below.

The principal design objective of the proposed scheme is:

"*to complete these flood defence works to the Floods Directive Standards, including for climate change, and to address Environmental, Social and Health and Safety concerns*."

The design has been developed in such a manner as to support the achievement of this objective. The design flood defence levels have been developed as an output of the Lee Catchment CFRAMS. The defence level corresponds to the modelled 200-year combined event (tidal region), and 100-year flow (fluvial zone) taking account of climate change modelling and freeboard. These conditions represent the requirements of the EU Floods Directive which has been transposed into Irish law, as Statutory Instrument (SI) 122 of 2010.

3.3 Drawing Index

The planning drawings for the proposed flood relief scheme are presented in **Appendix 3.1** of this EIS. Refer to **C-000-002** for the full drawing index. Refer to **C-000-003** for Key Plan.

Drawings No's **C-000-004** to **C-000-006** detail the existing flood extents and proposed flood benefit areas for the proposed scheme. The location of the cross-section drawings (denoted as CXX e.g. C10) and the corresponding drawing number (shown as C-000-0XX e.g. C-000-015) are shown on each plan drawing where relevant.

The proposed construction works will generally be limited to the areas outlined in red on the drawings. Landscaping and reinstatement works for landowners may take place outside these areas with their agreement. Traffic management setups will be required outside these areas on the approaches to the works areas. Temporary access routes will be required outside of the construction works areas at some locations so that construction workers and construction vehicles can access certain areas. The access routes will be reinstated to their original condition on completion of the works. For example, access will be temporarily required along the existing cycle path in Ballybrack in order to construct the coarse screen at Ballybrack Woods.

A number of trees will require removal to facilitate the construction of the proposed scheme. These are presented in **Drawings C-000-030** to **C-000-033** in **Appendix 3.2** of this EIS. The proposed semi-mature tree replanting is show on **Drawings C-000-020** to **C-000-023** in **Appendix 3.1.** The proposed scheme is described from upstream to downstream where possible. Refer also to the overall location of the proposed scheme in **Figure 1.1 Site Location – Overview** and the Key Plans for Togher and Douglas in **Figures 1.2a** and **1.2b respectively** in **Chapter 1.**

The figures presented in this chapter, the plan layout drawings presented in **Appendix 3.1** and the photomontages presented in **Appendix 7.1** are as follows:

Area 1: Ballybrack Stream through Douglas. This area includes Ravensdale through which the Ballybrack Stream flows. Refer to **Figures 3.1** to **3.4** in this chapter, **Drawings C-000-011, C-000-012**, cross-sections in **Drawings C-000-015** to **C-000-017,** and the tree replanting areas in **Drawing C-000-022** in **Appendix 3.1** and **Figures 7.1.0, 7.1.3.1, 7.1.3.2, 7.1.4.1, 7.1.4.2, 7.1.5.1** and **7.1.5.2** in **Appendix 7.1**.

Area 2: Tramore River through St Patrick's Mills. Refer to **Figures 3.5** to **3.7** in this chapter, **Drawing C-000-010** the cross-section in **Drawing C-000-015** and the in **Appendix 3.1** and **Figures 7.1.0, 7.1.2.1** and **7.1.2.2** in **Appendix 7.1**.

Area 3: Grange Stream (tributary of Ballybrack Stream) through Donnybrook Commercial Centre. Refer to **Figures 3.8** to **3.10** in this chapter, **Drawings C-000-013, C-000-014,** the cross section in **Drawing C-000-017** and the tree replanting areas in **Drawing C-000-023** in **Appendix 3.1**.

Area 4: (Togher culvert) Tramore River between Lehenaghmore Industrial Estate and Greenwood Estate in Togher. Refer to **Figures 3.11** to **3.13** in this chapter, Drawings **C-000-007** to **C-000-009**, the cross section in **Drawing C-000-015** and details in **Drawings C-000-018** and **C-000-019** and the tree replanting areas in **Drawing C-000-020 and C-000-021** in **Appendix 3.1** and **Figures 7.1.0, 7.1.1.1** and **7.1.1.2** in **Appendix 7.1**.

3.4 Area 1 – Ballybrack Stream through Douglas

3.4.1 Area 1 - Existing Area

This area comprises the section of Ballybrack stream from between Ballybrack Woods to the south and downstream as far as the culvert beneath Church Street in Douglas village to the north. The Ballybrack Stream passes through the Ballybrack woods and flows northwards through the residential area of Ravensdale. It passes beneath a number of small bridges (Upper, Middle and Lower Ravensdale bridges) which provide access to residences along the western bank of the stream. The stream then flows around the Irish Countrywomen's Association (ICA) hall, beneath the pedestrian access bridge to the ICA hall and beneath the Church Road cycle track bridge. Refer to **Figure 3.1**. In the area of the Ballybrack Woods, the stream is an open channel with relatively natural banks. As it flows northwards, some sections of banks have been replaced with walls or gabions in the residential area of Ravensdale.

Just downstream of the ICA hall, the stream has a concrete base and is culverted beneath Church Road. It then flows via open earthen banks through Douglas Community Park to Church Street where it is culverted until it emerges near St Patricks Mills (Area 2). In the Community Park, the stream is separated from the rest of the park by a high wrought iron fence. Refer to **Figures 1.2a,** and **Figures 3.1** to **3.4**.

While less than 400 metres from Douglas Village, Ballybrack has a quieter and less densely built-up character than Douglas Village, while still having a typical sub-urban form. The land use of the area is more residential, with an identifiable centre along Church Road including a mix of commercial units, schools and clubs, churches and cemeteries, a nursing home, and large areas of open space including Ballybrack Woods and Douglas Community Park, located opposite one another and joined by a designated cycle/walkway extending into both spaces. Refer to **Figure 3.4**. There is a playground, multi-use playing courts, outdoor gym and community centre within Douglas Community Park. The cycle/walkway runs relatively parallel to the stream in the Community Park and crosses over Church Road via a designated pedestrian/cycle zone (referred to as table top ramp). The cycle/walkway then crosses over the Ballybrack stream via a small bridge (referred to in **Figure 3.1** as Church Road cycle bridge) and then weaves southwards (west of the residential area of Ravensdale) up into the Ballybrack Woods. The cycle/walkway then crosses over the Ballybrack stream again in the woods (referred to as Ballybrack Woods cycle track bridge in **Figure 3.1**).

The area in the vicinity of the ICA hall includes a small river amenity/park area and is accessed from the road via the Church Road cycle track/walkway bridge and/or Church Road itself. Refer to **Figure 3.3**. It is surrounded by predominantly mixed broadleaf tree lines with some dispersed conifers. The northern side of the river bank within the ICA curtilage comprises dense and overgrown vegetation and mature trees, before the channel returns to alongside the public cycle/walkway within Ballybrack woods.

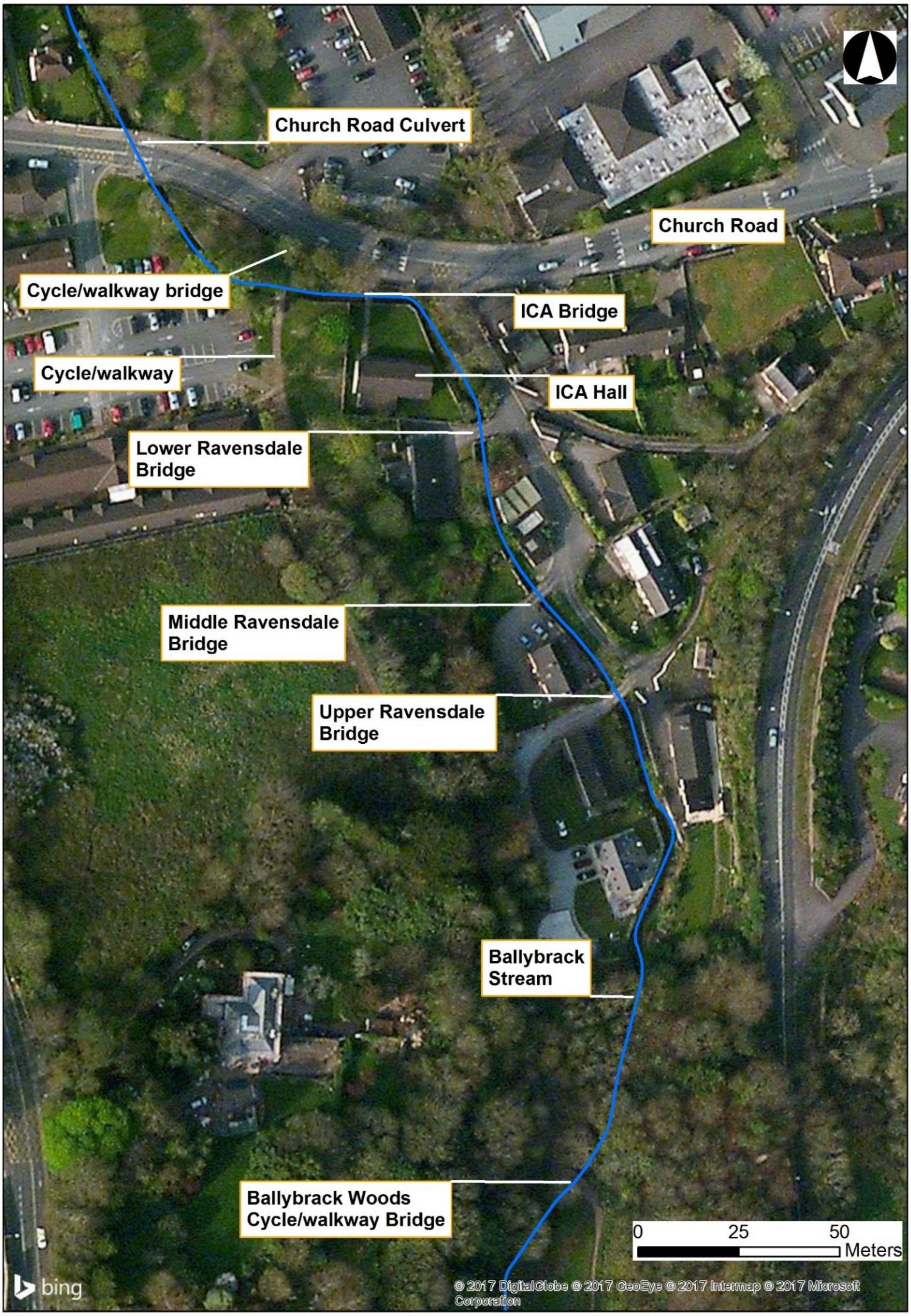

Figure 3.1: Key Plan Area 1 upper reaches between Ballybrack Woods, through Ravensdale as far as Church Road. Ballybrack Stream shown in blue. Source: Bing.

Figure 3.2: Key Plan Area 1 lower reach - Douglas Community Park Source: Bing.

Figure 3.3: View of amenity area around Ballybrack Stream at the entrance to Ballybrack woods, with Church Road in the background over existing culvert. Looking east from public car park. ICA hall to the right of the picture.

Figure 3.4: Douglas Community Park, looking southwards. Ballybrack stream is located to the left of the picture (left of the wrought iron fence)

3.4.2 Area 1 – Proposed Works

3.4.2.1 Introduction

Refer to **Figures 3.1** to **3.4** in this chapter, **Drawings C-000-011, C-000-012** and the cross-sections in **Drawings C-000-015** to **C-000-017** in **Appendix 3.1** and **Figures 7.1.0, 7.1.3.2, 7.1.4.2** and **7.1.5.2** in **Appendix 7.1**.

The main aspects of the proposed flood relief scheme in Area 1 comprise construction works as detailed below. Further details are provided in the sections following.

- Construction of a new coarse screen in Ballybrack woods in order to capture any large debris;
- Construction of new flood defence walls and/or replacement of existing walls with new flood defence walls in the Ravensdale area. Sections of the flood defence walls in Ravendsale, approximately 120m total channel length will be of concrete u-shape channel construction;
- Upper and Middle Ravensdale bridges to be retained. New bridge parapets (low wall along the bridge) to be constructed on these bridges;
- Local channel widening and channel realignment of the Ballybrack stream in the Ravensdale area;
- Removal of Lower Ravensdale vehicular bridge and replacement with new vehicular bridge and new access road to residences on the western bank. Existing road to be regraded to tie into proposed bridge;
- Removal of ICA pedestrian bridge. Construction of new alternative pedestrian access to the ICA Hall;
- Removal of Church Road cycle track bridge. Construction of new combined cycle/pedestrian track in this area;
- Replacement of Church Road culvert;
- Channel widening and deepening of the Ballybrack stream through the Community Park. Right river bank (eastern side) to be raised slightly in same area (small embankment);
- Local bank stabilisation works of left bank (western side) in Douglas Community Park;
- Relocation of existing c. 2 m X 2 m ESB substation located adjacent to the Ballybrack Stream in the northern part of Douglas Community Park to within 10 m of its current position to facilitate the construction works;
- Relocation of existing c. 1.5 m X 1.5 m ESB substation located adjacent to the left bank channel of the Ballybrack Stream to within 5 m of its current position to facilitate the construction works;
- Existing footpath in Douglas community Park to be realigned and regraded;
- Removal of vegetation and trees to facilitate the construction works;

- Protecting drainage outlets along the line of flood defence works with non-return valves;
- Once construction is completed, ongoing maintenance of the river channel, trash screens etc.
- Local diversion of services where necessary to facilitate construction
- Landscaping and tree planting
- It is proposed that there will be a local underground surface water pumping station, collector drain, manhole and rising main to be installed for operation during a flood event at Church Road in Area 1. All outlets will be fitted with non-return valves. The proposed pumping station will require regular maintenance. Refer to **Drawing C-000-011** in **Appendix 3.1**.

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. Landscaping and replanting will also be carried out on completion in agreement with landowners.

The design includes for the following measures to minimise impacts on aquatic habitats and fisheries.

- Stone slabs (circa 600mm square x 100mm deep) will be tightly packed to form the base of concrete u-channels in the Ballybrack Stream. This will provide a mixed substrate and will diversify flow patterns in areas where gravel would be scoured out by flood events.
- A low flow channel will be established in the area to be widened and deepened within the Ballybrack Stream. Rock armour will be used to define the extent of the low flow channel.
- Rock armour will be placed in front of gabions in the lower section of the Douglas Community Park. Varying the line of rock armour will provide staggered deflectors within the channel
- To maintain the gradient and prevent excessive scouring of the river bed the invert of the proposed culvert at Church Road will be buried between 300mm and 500mm in depth. Large rocks will be incorporated into scour protection at the upstream face of the Church Road culvert and concrete u-channels.
- A natural substrate will be provided within any sections of watercourses impacted by in-stream works where it is feasible to do so. Re-use of the original gravels from the affected watercourse will be incorporated into the works. Large rocks will be incorporated into the river bed to create greater heterogeneity within the channel.

3.4.2.2 Coarse Trash screen

At Ballybrack Woods, it is proposed to construct a new coarse screen. Refer to **Drawing C-000-012** and the cross section **C12** in **Drawing C-000-17** in **Appendix 3.1**. The purpose of the coarse trash screen will be to prevent large debris from flowing downstream, which could cause a blockage in the culverted sections of the watercourse.

The coarse trash screen will be designed in accordance with the UK Environment Agency Trash and Security Screen Guide 2009 and CIRIA C689 "Culvert Design and Operation Guide". The coarse screen in Ballybrack Woods will consist of galvanised steel posts and will be designed with a bar spacing of 0.3m to stop large debris and allow smaller debris to flow downstream. The coarse screen will be designed to ensure that the stream will overtop the screen without flooding the adjacent area if the screen becomes blocked. On-going maintenance will be part of the operational phase of the scheme. This will include clearing debris from the coarse trash screen.

3.4.2.3 Flood defence walls

Sections of the existing walls/gabions/vegetated banks of the Ballybrack Stream between Ravensdale and Church Road will be replaced with reinforced concrete flood defence walls in order to reduce the risk of flooding to the surrounding area. The walls will generally be constructed to 1.2m above existing ground levels to provide protection to guarding height for pedestrians. Stone cladding will be provided on both sides of the proposed walls.

In general, the walls/gabions/vegetated banks on both banks from upstream of Upper Ravensdale bridge as far as Church Road will be replaced with the exception of a section of the right (eastern) bank upstream of Upper Ravensdale Bridge which does not require replacement. Sections of the flood defence walls in Ravendsale, approximately 120m total channel length will be concrete u-shape channel construction. Refer to **Drawing C-000-012** and the cross sections in **Drawings C-000-015** to **C-000-017** in **Appendix 3.1** and **Figures 7.1.3.2, 7.1.4.2** and **7.1.5.2** in **Appendix 7.1**.

3.4.2.4 Conveyance improvements

Along the length of the Ballybrack Stream, certain sections of the channel constrict the flow and increase upstream flood levels. Also, a number of existing bridges/culverts in the vicinity of Ravensdale have caused blockage issues in the past. Conveyance improvements will result in an appreciable reduction in water levels and blockage risk. The scheme will include conveyance improvements at the following locations:

- Local channel widening and channel realignment of the Ballybrack stream in the Ravensdale area. Refer to **Drawing C-000-012** and the cross sections in **Drawings C-000-016** and **C-000-017** in **Appendix 3.1**.

- Channel widening and deepening of the Ballybrack stream through the Community Park. The right river bank (eastern side) is to be raised slightly in the same area (small embankment). The existing fence located along the right bank of the channel will be relocated to prevent access to the watercourse. The new bank will be constructed at a slope of 1 in 2 (vertical to horizontal). Refer to **Drawing C-000-011** and the cross sections in **Drawings C-000-015** and **C-000-016** in **Appendix 3.1**.
- Removal of ICA pedestrian bridge and Church Road cycle track bridge. A new combined cycle/pedestrian track will be constructed adjacent to the flood defence wall between Church Road and an existing section of the cycle/pedestrian track outside the ICA Hall in order to maintain access. The pedestrian section will extend to the east of the cycle track to provide access to the ICA hall via a proposed pedestrian gate. Refer to **Drawing C-000-012** and the cross sections in **Drawings C-000-016** in **Appendix 3.1**.
- Removal of Lower Ravensdale vehicular bridge and replacement with new reinforced concrete bridge, approximately 13m downstream of the location of the existing bridge. The soffit level of the replacement bridge will be approximately 0.3m above the existing bridge soffit level. The purpose of the bridge replacement is to increase the conveyance capacity of the Ballybrack Stream. The existing road will be regraded to tie into the proposed bridge and a new access road will be constructed. A new turning area will be provided for the houses accessed via Lower Ravensdale Bridge. Refer to **Drawing C-000-012** and the cross sections in **Drawing C-000-016** in **Appendix 3.1**.
- Upper and Middle Ravensdale bridges to be retained. New bridge parapets (low wall along the bridge) are to be constructed on these bridges. Refer to **Drawing C-000-012** and the cross sections in **Drawings C-000-016** and **C-000-017** in **Appendix 3.1**.

3.4.2.5 Culverts

It is proposed to replace the existing culvert at Church Road with a new culvert in order to improve conveyance at this location. The existing tabletop ramp will be extended and a new pedestrian crossing provided. Refer to **Drawing C-000-011** and the cross section in **Drawing C-000-016** in **Appendix 3.1**.

3.4.2.6 Embankments

The existing embankment along the left bank which forms the boundary with the adjacent residential property (at the southern end of the community park) will be reconstructed into a formal flood defence embankment A low earthen flood defence embankment will be constructed along the right bank (at the northern end of the community park) above existing ground levels. The existing walkway will be reconstructed at the top of this embankment. Refer to the cross sections in **Drawing C-000-015 in Appendix 3.1**.

The purpose of the flood defence embankments is to minimise the risk of overtopping of the river banks and subsequent flooding that would occur. The height of the embankment has been chosen based on the hydraulic analysis of the Ballybrack Stream for the 1 in 100 year flood event (including an allowance for freeboard).

3.4.2.7 Bank stabilisation works

Considerable scour is evident along the existing banks of the Ballybrack Stream in Douglas Community Park. To improve the stability of the banks, approximately 180m of gabions are to be constructed along the left bank where the existing bank consists of a sections of steep vegetated slope and dry loose stone walls. Upstream of this section where the existing left bank is comprised of a concrete wall, localised scour protection will be provided as required.

The right bank of the stream, downstream of the proposed channel widening, will be stabilised by regrading the existing bank to a slope of 1 in 2 (vertical to horizontal) over a distance of approximately 90m. Erosion protection measures will be provided to the base of the channel slope.

3.5 Area 2 – Tramore River through St Patrick’s Mills

3.5.1 Area 2 – Existing Area

The study area comprises an open channel of the Tramore River running alongside a car park boundary of the former St Patrick’s Mills building (also referred to as Douglas Woollen Mills). Refer to **Figure 1.2a** and **Figure 3.5**. At this point, the Tramore River has just emerged from a bridge under the N40 and N40 slip road. The banks on both sides of the river are highly modified with concrete retaining walls on both sides. The river passes under the West Douglas Road (R851) bridge before flowing parallel to the N40 and Douglas Village Shopping Centre. Refer to **Figure 3.6**. Immediately upstream of the bridge, a building directly adjoins the bank. Refer to **Figure 3.7**.

The mills and car park are set within a tight complex of small former light industrial type units (reminiscent of the area’s textile industries), with an entrance to the Woollen Mills on West Douglas Road (R851) opposite Douglas Village Shopping Centre in the centre of Douglas Village. The units are occupied by a wide variety of uses, predominantly mixed retail, service and light industry. The complex is bordered by the N40 to the north-east and the West Douglas Road (R851) to the east, and lies adjacent to a busy junction between the two roads. Refer to **Figures 3.6** and **3.7** below.

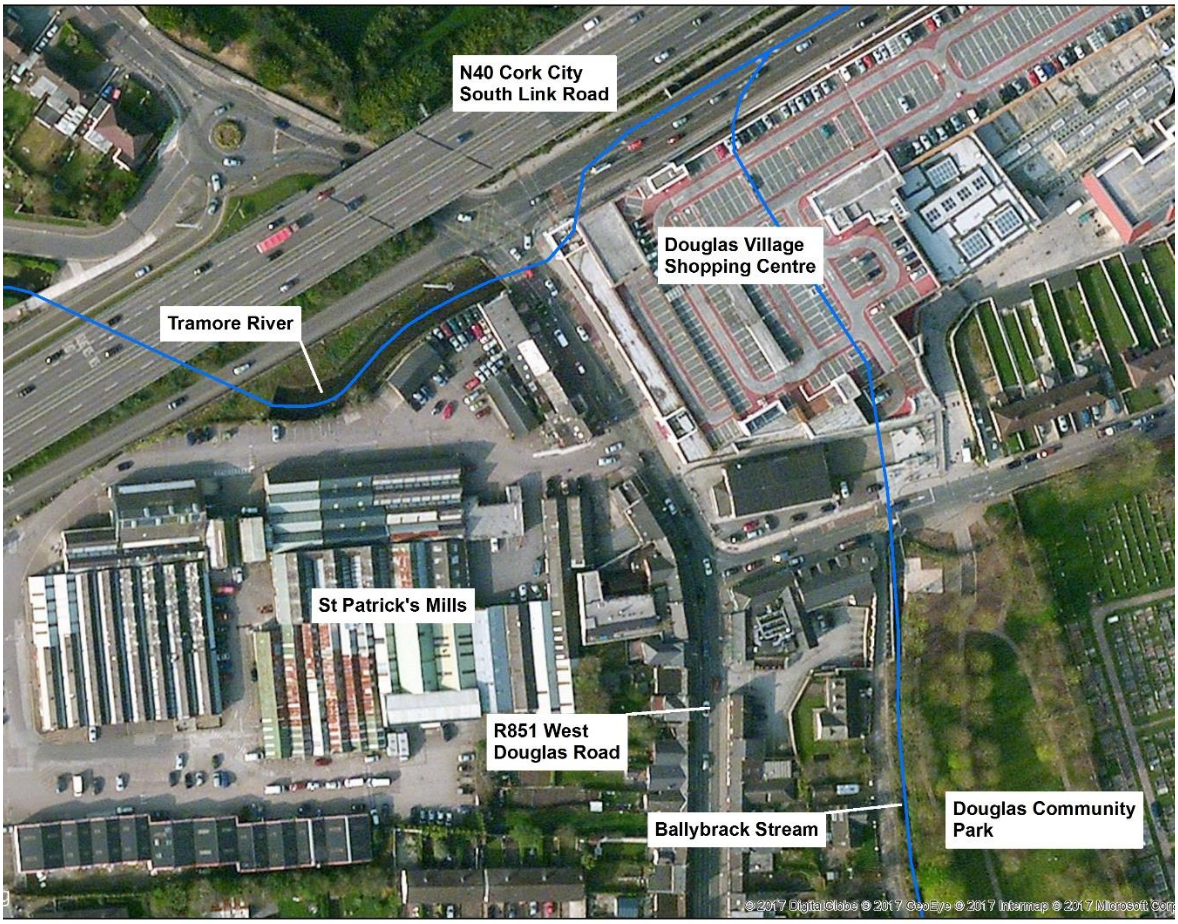

Figure 3.5: Area 2 – St Patrick's Mills in Douglas village.

Figure 3.6: View of Tramore River from R851 (West Douglas Road) taken from the R851 bridge over the river (looking upstream and southwest), adjacent to St Patrick's Mills on the left and a slip road to the N40 on the right.

Figure 3.7: View of R851 bridge over the Tramore River and view of right bank. Note location of building directly on the river bank.

3.5.2 Area 2 – Proposed Works

Refer to **Figures 3.5** to **3.7** in this chapter, **Drawing C-000-010** and the cross-section in **Drawing C-000-015** in **Appendix 3.1** and **Figures 7.1.0** and **7.1.2.2** in **Appendix 7.1**.

The main aspects of the proposed flood relief scheme in Area 2 St Patrick's Mills comprise construction works entailing the following.

- New flood defence wall on the right bank of the Tramore River in order to reduce the risk of flooding in the surrounding area. The proposed reinforced concrete wall will have a limestone masonry finish on the dry side (St Patrick's Mills side).
- Construction of a new parapet wall over the R851 (West Douglas Street) bridge in order to reduce the risk of overtopping of flood waters at that location. The works to the R851 bridge parapet will include the removal of the existing metal railing and the construction of a new reinforced concrete parapet to a height of 1.2m above the level of the existing footpath. These works are required to ensure that flood waters remain in the channel at this location. Refer to **Drawing C-000-010** and the cross section in **Drawing C-000-015** in **Appendix 3.1**.
- It is proposed that there will be a local underground surface water pumping station, collector drain, manhole and rising main to be installed for operation during a flood event at St. Patrick's Mills in Area 2. All outlets will be fitted with non-return valves. The proposed pumping station will require regular maintenance. Refer to **Drawing C-000-010** in **Appendix 3.1**.
- Local diversion of services where necessary to facilitate construction.

3.6 Area 3 – Grange Stream (tributary of Ballybrack Stream) through Donnybrook Commercial Centre

3.6.1 Area 3 – Existing Area

The Grange Stream passes through Donnybrook Commercial Centre. Refer to **Figure 1.2a** and **Figure 3.8**. The stream runs through an area of dense trees and vegetation just upstream of the commercial centre. As it enters the commercial centre, there is an old trash screen within the river channel. Considerable amounts of sediment have deposited just upstream of the trash screen whilst just downstream, the water level drops significantly. Refer to **Figure 3.8**. Within the commercial centre itself, the Grange stream is highly modified and mostly culverted. The open sections are linear with either vertical concrete walls or steep grassy banks. There is a coarse trash screen just upstream of the culvert. The commercial centre site is very contained and largely hidden from view apart from the imposing mill structure that can be seen from the main road. A mix of commercial units, a day care centre and religious facilities are located within the complex and along the length of the Grange Stream in this area.

The commercial centre site is surrounded by dense clusters of mature deciduous trees, adding to the sense of enclosure and restricted views from within and towards the site. Refer to **Figures 3.8** to **3.10**.

Figure 3.8: Donnybrook Commercial Centre (Area 3) showing the Grange Stream.

Figure 3.9: View of existing coarse trash screen at northern end of the Commercial Centre. There is a considerable difference in levels upstream and downstream of the screen

Figure 3.10: View north-east through Donnybrook Commercial Centre and Grange Stream.

Figure 3.10 shows the north-eastern view through Donnybrook Commercial Centre, with the existing open channel (Grange Stream) running down the central car park area of the complex, the mixed use units visible on the left, and the protected red brick mill structure in the distance.

3.6.2 Area 3 – Proposed Works

Refer to **Figures 3.8** to **3.10** in this chapter, **Drawings C-000-013, C-000-014** and the cross section in **Drawing C-000-017** in **Appendix 3.1**.

The main aspects of the proposed flood relief scheme in Area 3 Grange Stream through Donnybrook Commercial Centre comprises construction works entailing the following:

- Permanent removal of one existing trash screen upstream of commercial centre;
- Replacement of a second existing trash screen within commercial centre;
- Replacement of existing section of culvert with new culvert;
- Regrading and removal of sediment and reinforcement of channel banks.
- Local diversion of services where necessary to facilitate construction.

The proposed works will consist of the removal of the existing trash screen upstream of the commercial centre and regrading the existing open channel for a distance of approximately 100m upstream of the centre. A new coarse screen is proposed at this location (steel posts at 300mm centres). The channel banks will be reinforced with rock armour/gabions/similar as required.

The existing trash screen within the commercial centre, in the section of open channel between the existing culverts, will be removed and the channel regraded upstream. The channel banks will be reinforced with rock armour/gabions as required.

Further downstream, an existing section of the culvert will be replaced with a new 2.4m wide by 1.8m high reinforced concrete culvert in order to improve conveyance in the culvert. Refer to **Drawings C-00-0013** and cross sections in **C-00-017**.

3.7 Area 4 – Tramore River through Togher (Togher Culvert)

Refer to **Figures 3.11** to **3.13** in this chapter, **Drawings C-000-007** to **C-000-009** and the cross section in **Drawing C-000-015** in **Appendix 3.1** and **Figures 7.1.0, 7.1.1.1** and **7.1.1.2** in **Appendix 7.1**.

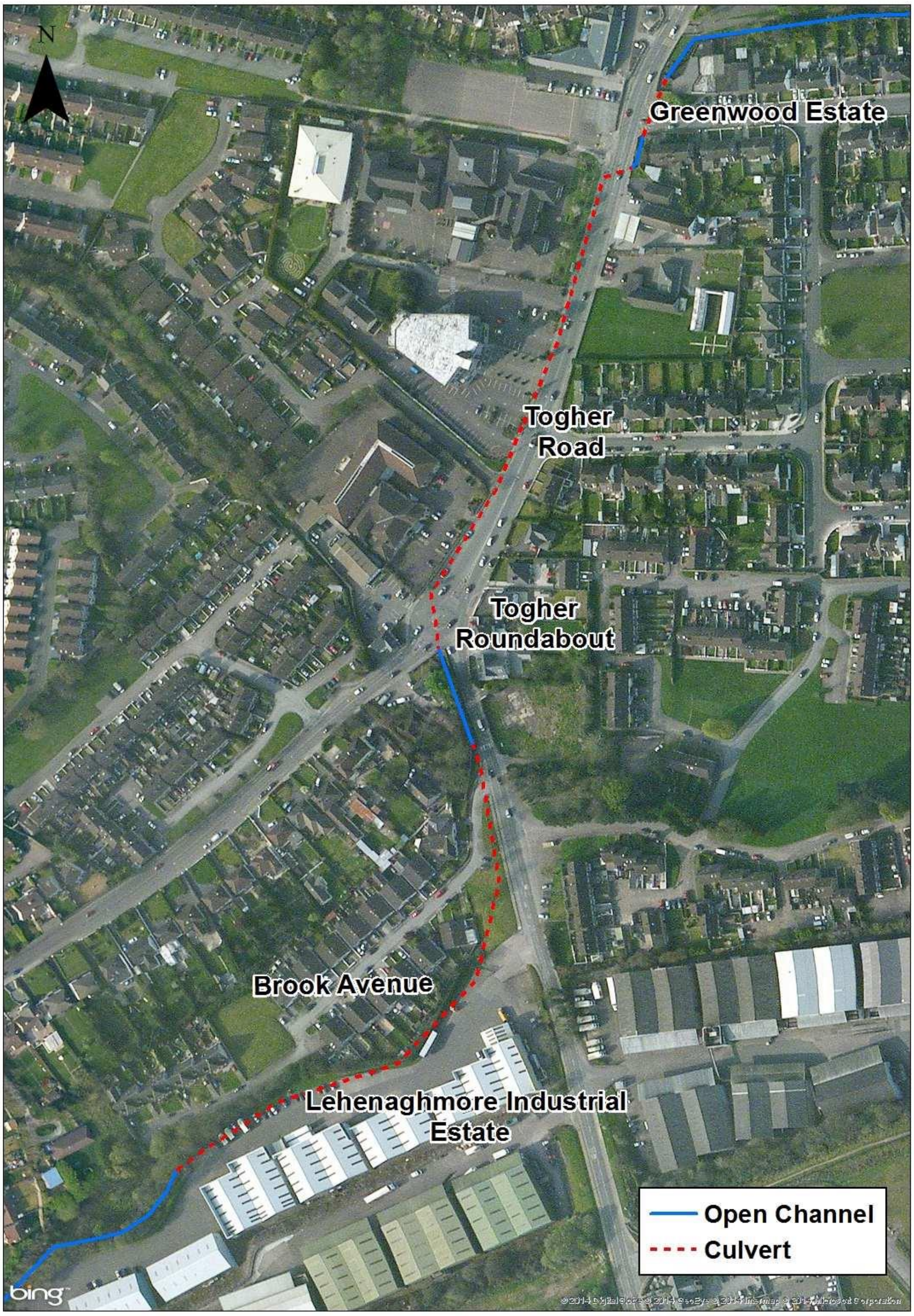

Figure 3.11: Area 4 Togher showing existing culvert.

3.7.1 Area 4 – Existing Area

This area comprises the Tramore River between Lehenaghmore Industrial Estate and Greenwood Estate in Togher, refer to **Figure 3.11**. The surrounding area is mixed residential and industrial development. The residential area of Brook Avenue is located adjacent to Lehenaghmore Industrial Estate whilst Greenwood Estate is located off the Togher Road south of the N40.

There are a number of residential, educational, commercial and religious facilities adjacent to or in the vicinity of the Togher road. The area has a typical suburban form; open and with low-density settlement patterns. Refer to **Figure 3.11.**

The majority of the Tramore River is culverted in this area and extends from the Lehenaghmore Industrial Estate to Greenwood Estate. Refer to **Figure 3.11**. The culvert consists of three lengths of culvert (approximately 300m and 263m and 30m long respectively). There are two open sections between the culvert lengths; the first (approximately 50m in length) is south of Brook Avenue, parallel to the road as far as the Togher Cross roundabout and the second (approximately 15m in length) is just upstream of Greenwood Estate, parallel to the Togher Road. The Tramore River exits the culvert at Greenwood Estate, just south of the N40. From here, it flows westwards along an open channel, parallel to the N40. There is a trash screen located just upstream of the culvert at Lehenaghmore Industrial Estate. Refer to **Figure 3.11**.

3.7.2 Area 4 – Proposed Works

Refer to **Figures 3.11** to **3.13** in this chapter, Drawings **C-000-007** to **C-000-009** and the cross sections in **Drawings C-000-015** and **C-000-019** in **Appendix 3.1** and **Figures 7.1.0** and **7.1.1.2** in **Appendix 7.1**.

The main aspects of the proposed flood relief scheme in Area 4 Togher comprises construction works entailing the following:

- Replacement of existing trash screen with new trash screen at Lehenaghmore Industrial Estate
- Realignment of a section of river channel immediately upstream of the proposed new trash screen to facilitate tie-in with new culvert.
- Replacement and extension of existing culvert with new culvert between Lehenaghmore Industrial Estate and downstream of Greenwood Estate.
- Regrading of Lehenaghmore Road to divert overland flow towards the Tramore River.
- Localised regrading of the existing footpath and ramp in the vicinity of the entrance to the Greenwood Estate to divert overland flow towards the Tramore River.
- Local diversion of services where necessary to facilitate construction.

3.7.2.1 Trash screen replacement

The new trash screen at Lehenaghmore Industrial Estate will be designed in accordance with the UK Environment Agency Trash and Security Screen Guide 2009 and CIRIA C689 “Culvert Design and Operation Guide”. The trash screen will have minimum bar spacing of no less than 150mm in accordance with the Environment Agency guidance document. A screen bypass will be incorporated into the design to ensure that out of bank flow does not occur should the screen become blocked. On-going maintenance will be part of the operational phase of the scheme. This will include clearing debris from the coarse trash screen. Refer to **Drawing C-000-019** in **Appendix 3.1.**

Figure 3.12: View of Togher Road (looking north), including the Church of the Way of the Cross. The proposed flood defence scheme culvert runs under and along the western pavement of Togher Road.

Figure 3.13: Existing trash screen at Lehenaghmore Industrial Estate

3.7.2.2 Conveyance improvements

Conveyance improvements will result in an appreciable reduction in water levels and blockage risk. The most upstream point of the proposed flood relief scheme works on the Tramore River will be in the Lehenaghmore Industrial Estate. Refer to **Drawing C-000-007** in **Appendix 3.1**. A section of the Tramore River that leads into the proposed trash screen will be realigned in order to tie in with the new trash screen. It will also be necessary to remove some trees along certain sections of the Togher culvert in Area 4.

The Lehenaghmore Road will undergo regrading to fall to the west from the entrance to the Lehenaghmore Industrial estate to the Togher Cross roundabout. This is to facilitate capturing pluvial flows on the road and directing them into the new culvert via gullies.

It is proposed to construct a new boundary wall on the left hand side of the new culvert (where the existing open channel is located) on Lehenaghmore Road over a distance of approximately 30m to the Togher Cross roundabout as the existing open channel currently forms a boundary between the road and the properties at this location. The existing footpath will also be regraded to tie into the proposed road regrading at this location.

Regrading is also proposed on Togher Road, adjacent to the existing sections of open channel at the entrance to the Greenwood Estate. The footpaths will be regraded to drain towards the river with the existing kerbs lowered to create an overland flow route from Togher Road to the Tramore River. The height of the existing ramp at the entrance to the estate will be increased to divert overland flow away from the estate.

Downstream of Griffin Pianos on the Togher Road, it is proposed to widen the left bank of the Tramore River channel by 1m. Refer to **Drawing C-000-008.** The widening will be achieved by constructing a new channel wall 1m behind the existing channel wall. This widening is to ensure flow remains in the channel. A 1.2m high pedestrian guardrail will be constructed on top of the wall to protect against pedestrians entering the channel.

3.7.2.3 Culverts

It is proposed to replace and extend the existing culvert in Togher between Lehenaghmore Industrial Estate and downstream of Greenwood Estate. The following culvert works are proposed along the Tramore River in Togher:

- Replacement section of existing culvert at Lehenaghmore Industrial Estate and Lehenaghmore Road with a new reinforced concrete culvert (internal dimensions 3m wide x 1.4m high);
- Replacement of existing open channel at Lehenaghmore Road with a new reinforced concrete culvert (internal dimensions 3m wide x 1.4m high);
- Replacement of existing culvert at Togher Road from Togher Cross to Griffin Pianos with a new reinforced concrete culvert (internal dimensions 3m wide x 1.4m high);
- Replacement of existing open channel at Griffins Pianos on Togher Road with a new reinforced concrete culvert (internal dimensions 3m wide x 1.4m high).

4 Construction Activities

4.1 Introduction

This chapter describes the construction activities and sequencing for the proposed flood relief scheme and outlines the general mitigation measures which have been incorporated into the design and which will be implemented during the construction phase to ensure the potential impacts of the construction activities on the environment are avoided, prevented or reduced.

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 Summary of Construction Works

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

- Construction of new flood defence walls and/or replacement of existing walls with new flood defence walls;
- Replacement of and/or extension of existing culverts;
- Removal of and/or replacement of bridges;
- Removal of existing trash screens and construction of new coarse screens;
- Local channel widening, deepening, realignment and regrading of river channel;
- Construction of new earthen flood defence embankments;
- Provision of civil works such as road/footpath re-grading at a number of locations;
- Removal of vegetation and trees to facilitate construction works;
- Protecting drainage outlets along the line of flood defence works with non-return flap valves;
- Landscaping and tree planting;
- Reinstatement of boundary walls and fences and landscaping and replanting of trees on completion in agreement with landowners; and
- Once construction is completed, ongoing maintenance of the river channel, trash screens etc.

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

4.3 Outline Construction methodology

4.3.1 Enabling works and site clearance

The proposed scheme will be a linear development along the various watercourses. The proposed construction works will be limited to the areas outlined in red on the drawings with the exception of some temporary access routes and site accesses which will be required at some locations so that construction workers and construction vehicles can access certain areas and Landscaping and reinstatement works for landowners may take place outside these areas with their agreement. For example, access will be temporarily required along the existing cycle path in Ballybrack in order to construct the coarse screen at Ballybrack Woods. These access routes are shown on **Drawing No's C-000-040** to **C-000-042** in **Appendix 3.3** of this EIS.

Similar enabling works will be required at each of the areas and are detailed below. Works specific to individual working areas are detailed separately where necessary.

- Construction of the temporary site access.
- Once access is achieved the Contractor will install secure hoarding approximately 2.4m high around each of the working areas that will remain in-situ during the construction of the works in each area.
- Vegetation, tree and topsoil removal to take place as necessary.

A construction compound will be installed to accommodate site offices and welfare facilities. Refer to **Section 4.5.6** for further details.

4.3.2 Culverts

The construction of the culverts in Togher, Church Road and Donnybrook Commercial Centre will generally be undertaken by excavating and removing the existing culverts before craning in precast culvert units. The precast units come in standard lengths and will be joined on site. Temporary over pumping or piping of the watercourses or temporary diversion channels / culverts (where space allows) will be required to facilitate the construction of the culvert sections. Thus the works will be carried out in the dry.

In general, the new culverts will be constructed on the footprint of the existing river channel/existing culvert or in some cases offline. Short lengths of the culvert in Togher will be cast on site at the location of bends and tie-ins of large diameter existing surface water sewers. The foundations will be excavated down to formation level and blinding concrete 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. Boundary walls/fences reinstatement and landscaping and replanting reinstatement will take place in agreement with landowners.

Specific traffic management measures will be required along the sections of culvert which are located beneath the public road such as along Togher Road in Togher and along Church Road in Douglas in order to minimise impacts on traffic. Every effort will be made to carry out the works as quickly as possible in order to minimise impacts on the residents in the area. It is envisaged that traffic measures such as a stop-go system, temporary one-way traffic systems or similar will be implemented to allow the trenches for the culverts and utility diversions to be constructed and at the same time to manage traffic. Full road closures will be required however on Church Road, Togher Road at the northern tie-in and Togher Road at the existing open channel section south of Togher cross. They will be for a short duration only and will take place during the summer months or at other suitable times, i.e. long weekends or mid-term school holidays to minimise the impact on traffic in the area.

4.3.3 Reinforced Concrete Flood Walls and Bridge Parapets

The reinforced concrete flood walls and bridge parapets will be constructed using industry standard techniques including excavation of foundations, fixing of steel reinforcement, pouring concrete and reinstatement of the works area.

In general, the construction of the reinforced concrete walls will be undertaken from the bank of the river for the majority of the scheme. In some locations however, in particular upper Ravensdale, due to a constricted working area or access issues, temporary over pumping or piping of the watercourses or temporary diversion channels / culverts (where space allows) will be required to facilitate the construction of the walls from within the river channel. Thus these works will be carried out in the dry. The form of wall construction will have to be a concrete U-shaped channel for a significant portion of the channel in Ravensdale, for approximately 120 meters due to the close proximity of the properties, poor ground conditions and need to maintain access to properties. The construction of a U-shaped wall will take up a much reduced construction footprint. The bed of the channel will be constructed a minimum of 500mm below the existing channel bed and a low flow channel will be constructed using the excavated channel bed material and suitably sized gravels and boulders.

At St Patricks Mills, close to the existing bridge, access to the bank will be constrained due to the presence of a building directly adjacent to the bank (Refer to **Figure 3.6**). In this location, it is envisaged that works will be carried out from a temporary working platform on a scaffold attached to the bank over the river.

It is acknowledged that specific traffic management measures will be required in the Ravensdale area due to the extent of construction works and due to the restricted access in this location. Every effort will be made to carry out the works as quickly as possible in order to minimise impacts on the residents of Ravensdale.

It is expected that any utility diversions required for the construction of the walls will be completed prior to excavating the foundations. In Ravensdale, adjacent to the ICA Hall, there is a 1200mm diameter watermain running from west to east. This watermain will not be diverted, but will be adequately protected, with the reinforced concrete wall designed to span over the pipe ensuring that the load is adequately dispersed and not transferred directly to it.

4.3.4 Bridge Replacement

The replacement of Lower Ravensdale Bridge will involve the demolition of the existing bridge, excavation of foundations for the proposed bridge, craning in a pre-cast concrete bridge and reinstatement of the area impacted by the works.

It is expected that any utility diversions required for the replacement of the bridge will be completed prior to the demolition of the existing bridge.

The Lower Ravensdale Bridge is the only access route to the existing properties to the west of Ballybrack Stream. The new bridge will be located to the north of the existing bridge therefore the new bridge can be constructed whilst maintaining access via the existing bridge. Once the new bridge has been constructed then the existing bridge can be removed.

As noted above, every effort will be made to carry out the works as quickly as possible in order to minimise impacts on the residents of Ravensdale.

4.3.5 Embankments

The embankments in Douglas Community Park will be constructed by stripping the topsoil within the embankments footprint and placing low permeability clay soils to the required flood defence level. Topsoil will be placed on top of the embankment and seeded. The existing walkway adjacent to the right bank of the stream will be reconstructed at the top of the embankment. All material excavated during construction that is not suitable for use elsewhere in the project will be disposed of off-site. It may be necessary to import the clay soils required to construct the embankment if suitable soil is not available from elsewhere in the project. The construction of the embankments can be undertaken from the river bank with no in channel works required.

It is expected that any utility diversions necessary to facilitate the construction of the embankment will be completed prior to the construction of the embankment. There is an existing c. 2 m x 2 m ESB substation located adjacent to the Ballybrack Stream in the northern part of the Community Park that will need to be moved slightly to within 10 m of its current position in the park to construct the embankment. A smaller ESB substation of c. 1.5 m X 1.5 m located adjacent to the left bank channel of the Ballybrack Stream will also be moved slightly to within 5 m of its current position. Diversions will be carried out in consultation with ESB Networks.

4.3.6 Channel Widening and Deepening

The proposed channel widening and deepening in Ravensdale and Douglas Community Park will generally be undertaken from the bank of the watercourse using an excavator. As above, temporary over pumping or piping of the watercourses or temporary diversion channels / culverts (where space allows) will be required to facilitate the construction works. Thus the works will be carried out in the dry.

As above, any utility diversions required to widen and deepen the watercourse will be completed prior to the widening and deepening works commencing.

4.3.7 Trash Screen

In Togher, the trash screen in Lehenaghmore Industrial Estate will be constructed adjacent to the existing watercourse. This method of construction will minimise the in-channel works required to construct the screen and therefore will have a minimal impact on the Tramore River. Construction of the trash screen will involve excavating to formation level, fixing steel reinforcement, pouring concrete, installing the steel trash screen and construction of the proposed channel diversion.

A coarse trash screen is proposed upstream of the Ballybrack Woods cycle track bridge. In the Donnybrook Commercial Centre, it is also proposed to remove the existing two coarse screens and install a new coarse screen.

4.3.8 Site Investigation

Two site investigations to inform the detailed design of the proposed scheme have been carried out in May 2015 and summer 2016. The results of these works are discussed further in **Chapter 11 Soils, Geology and Hydrogeology**.

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, screens, sharp bends, culvert inlets, blockages from trees etc.

Other measures will include regular inspections of flood walls and embankments, regular scheduled maintenance of the river channel and pruning or removal of trees (if there is potential for flood blockages), 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 cherry-picker, depending on access.
- The structures including coarse trash screens, 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, Inland Fisheries Ireland (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.

4.4 Duration, Phasing and Employment

Subject to statutory consent, construction of the proposed scheme will commence mid-2018. An overall construction duration of approximately 18 months is envisaged with an estimated completion date of late 2019/early 2020. Specific activities (such as Lower Ravensdale bridge and Church Road bridge replacement) will be completed over a much shorter duration. As noted previously, every effort will be made to carry out the works as quickly as possible in order to minimise impacts on neighbouring residents. The expected construction duration for each area are summarised in **Table 4.1** below.

Table 4.1: Summary of Proposed Flood Defence Measures

Area	Location	Estimated construction period (cumulative months)
1	**Ballybrack Stream through Douglas**	**18 months overall**[1]
1a	Upper Ravensdale	6 months
2	St Patrick's Mills, Douglas	2 months
3a	Donnybrook Commercial Centre - lower	3 months
3b	Grange Stream above commercial centre	2 months
4	Togher	12-15 months

In-stream works (including preparatory work) shall normally be undertaken between May and September (inclusive) and in consultation with IFI (except in exceptional circumstances and in agreement with IFI). 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. As a result, some in-stream activities may require two summer seasons for final completion. Therefore an 18 month construction window is envisaged.

In Douglas and Donnybrook as the majority of the works are in stream and immediately adjacent, the bulk of the works will be carried out during May to September inclusive.

[1] To allow for two construction windows in accordance with IFI and NPWS requirements.

St Patricks Mills will likely be constructed before or after these areas are not subject to the May to September window.

In Togher the works will likely take 12-15 months given the nature and scale of the culvert replacement works and the need for extensive associated service diversions. The lower section of the culvert, from the outfall at the northern end of the scheme to the entrance to the national schools, will be carried out during the school holidays. A full road closure will likely be required where the culvert crosses the road at the entrance to Greenwood Estate, again this will be carried out during the summer months.

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 commencement of works.

Christmas non-working time is from the beginning of the second week of December to the end of the first week of January to avoid impacts on residents/businesses in the vicinity. However off-road works may continue during this period.

The timing of construction activities, core working hours and the rate of progress of construction works are a balance between efficiency of construction and minimising the impact on the operations of neighbouring facilities, residents and road users.

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.

It is envisaged that the average number of construction personnel on site will be circa 26 personnel with an approximate 50/50 split between Douglas and Togher. This will vary depending on the construction activities required and seasonal constraints and will likely peak during the summer months when up to 40 construction personnel are envisaged.

The permissible noise levels are detailed in **Chapter 9 Noise and Vibration** where “daytime” noise limits are defined as 7am to 7pm, and lower permissible noise levels are stipulated outside these hours.

The removal of waste material off site by road and regular deliveries to site will be generally confined to daytime hours but outside of peak traffic hours, from 10am to 4pm.

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 in exceptional circumstances to undertake certain types of activities outside of normal construction core working hours. 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. The planning of such works will have regard to nearby sensitive receptors.

4.5 Construction Site Layout

4.5.1 Construction Access

It is anticipated, where possible, that access to the works area will be gained from the dry (land) side of the channel to minimise impact on the watercourse. In some locations however, due to a constricted working area or access issues, temporary over pumping or piping of the watercourses or temporary diversion channels / culverts (where space allows) will be required to facilitate the construction of the works from within the river channel. Thus these works will be carried out in the dry. In the case of St Patricks Mills, it is envisaged that a small section of works will be carried out from a temporary working platform on a scaffold attached to the bank over the river.

The proposed construction works will generally be limited to the areas outlined in red on the drawings. Accommodation works for landowners may take place outside these areas with their agreement. Traffic management setups will be required outside these areas on the approaches to the works areas. In general, the public will be excluded from entering these areas during the construction period for reasons of health and safety, however, it is acknowledged that some works will be located within residential areas such as in Ravensdale and the Pond Bank off Church Street, where vehicular and pedestrian access will be maintained to the residential properties and therefore construction access to these properties will need be discussed and agreed with residents prior to construction works commencing. Temporary access routes will be required outside of the construction works areas at some locations so that construction workers and construction vehicles can access certain areas. For example, access will be temporarily required along the existing cycle path in Ballybrack in order to construct the coarse screen at Ballybrack Woods. These access routes are shown on **Drawing No's C-000-040, C-000-041** and **C-000-042** in **Appendix 3.3** of this EIS.

On the L2454 Togher Road works will affect the lower section from Southern Fruits to Togher Cross. Access will be maintained to Southern Fruits, Brook Avenue, Palmbury Orchard and the properties on the eastern side adjacent to Togher cross. There will be an impact however due to the stop/go traffic management system.

A number of premises and residential properties adjoining the west side of Togher Road (L2452) from Togher Cross northbound, which the construction works and traffic management will have an impact in terms of access and egress. These include a convenience Supermarket, a residential care home facility, Robinscourt Housing estate, Togher Church and Le Chéile care facility, and Togher National Schools. However vehicular access will be maintained throughout the duration of the works. It noted the Church has two separate car parks with the Le Chéile facility accessed only via the northern car park. Both car parks will be kept operational for the duration of the works. The works do not pass directly in front of the entrance to Togher Music School, Togher Community Centre or the entrance road to Westside estate, however, the traffic management will extend past these areas when the northern half of the works are being constructed.

Access and egress to the properties on the east side of Togher Road, including Greenwood Estate will be impacted given that the traffic management system that will be set-up on Togher Road. Access to the sports pitch and public walkway at the northern end opposite Togher Community Centre will be maintained via a temporary construction access.

A temporary access will be constructed for Donnybrook Commercial Centre as shown on **Drawing C-000-042** for the duration of the works to facilitate vehicular access to the approximately 25 commercial units affected by the culvert replacement works.

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

4.5.2 Utilities

Temporary planned utility diversions will be required in most of the working areas during the construction phase. The works are in built up areas which are serviced with utilities such as gas, water, electricity, telecoms, foul and surface water drainage etc. The most likely impacts will be due to the planned utility diversions. It is possible that a short term disruption to some services may occur when the diversion is being undertaken. However, it is not considered that these disruptions will result in significant negative impacts on customers. All utility diversions, will be carried out in consultation with the relevant utility company. The Contractor will be required to submit diversion proposals to the relevant utility company for their approval prior to works being carried out. Refer to **Chapter 15 Material Assets** for further details on utilities.

4.5.3 Hoarding

Where possible, a site boundary in the form of hoarding or fencing or similar where appropriate (approx. 2.4m), will be established around working areas before any significant construction activity commences.

Construction site hoarding is used to provide a secure site boundary to what can be a dangerous environment for people who have not received the proper training and are unfamiliar with construction operations.

Hoarding works will be of the same nature as that carried out for similar operations at most construction sites.

Site hoarding also performs an important function in relation to minimising some of the potential environmental impacts associated with construction, namely:

- Noise;
- Visual impact; and
- Dust minimisation.

Excavation for mounting posts for hoarding will be carried out by a mini-digger, and the posts will be set in concrete. The size and nature of the posts and hoarding will be dependent on the requirements for any acoustic mitigation as well as Contractor preference.

4.5.4 Site Lighting

Temporary construction lighting will generally be provided by tower mounted 1000W metal halide floodlights, which will be angled downwards to minimise spillage of light from the site. These will be powered by mains supplies in general. Lighting will be provided on the exterior of hoarding for walkways for public safety where required. Specific lighting requirements which are close to residential properties will be discussed with the residents in advance.

4.5.5 In-stream works

Works within the watercourse channels are anticipated at a number of locations such as along the Ballybrack Stream in Ravensdale, Church Road and in the Community Park. In-stream works will also be carried out to facilitate construction of new culverts such as along the Grange stream and along the Tramore River.

As mentioned previously, it is anticipated, where possible, that access to the works area will be gained from the dry (land) side of the channel to minimise impact on the watercourse however, in some locations, due to a constricted working area or access issues, temporary over pumping or piping of the watercourses or temporary diversion channels / culverts (where space allows) will be required to facilitate the construction of the works from within the river channel. Thus these works will be carried out in the dry.

Detailed silt control methods will be required for all in-stream works. All such 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 method statements will be drawn up which deal specifically with the works proposed in consultation with the supervising ecologist and with NPWS and IFI prior to the commencement of works

All concrete works will be carried out in dry conditions and no in-stream pouring of concrete will be carried out. The temporary works will require temporarily damming the watercourse upstream of the culvert/works and over pumping flows to the same watercourse, installation of the culvert and removal of temporary damming of the watercourse. Refer to **Chapters 6 (Biodiversity)** and **12 Hydrology** below for further details on water quality management.

In-stream works associated with the proposed 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 with in accordance with the IFI 2016 *Guidelines on protection of fisheries during construction works in and adjacent to waters within the approved period* and in consultation with IFI.

In-stream works (including preparatory work) shall normally be undertaken between May and September (inclusive) and in consultation with IFI (except in exceptional circumstances and in agreement with IFI). This restriction does not apply to tidal waters on the Tramore River.

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. As a result, some in-stream activities may require two summer seasons for final completion

Input from a qualified fisheries/aquatic ecologist with experience in the design of in-stream structures is required for 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. All culverts, walls and trash screens 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.

4.5.6 Construction Compounds

There is an existing Cork City Council compound in the Togher area adjacent to the N40 national primary road (South Ring Road) that has been identified as a potential construction compound for the scheme, refer to **Figure 4.1**. Additional areas may be considered where necessary as minor construction compounds in the immediate vicinity of the works. The final selection of the compound(s) will be made by the Contractor appointed to construct the works in consultation with Cork County Council and the project ecologist.

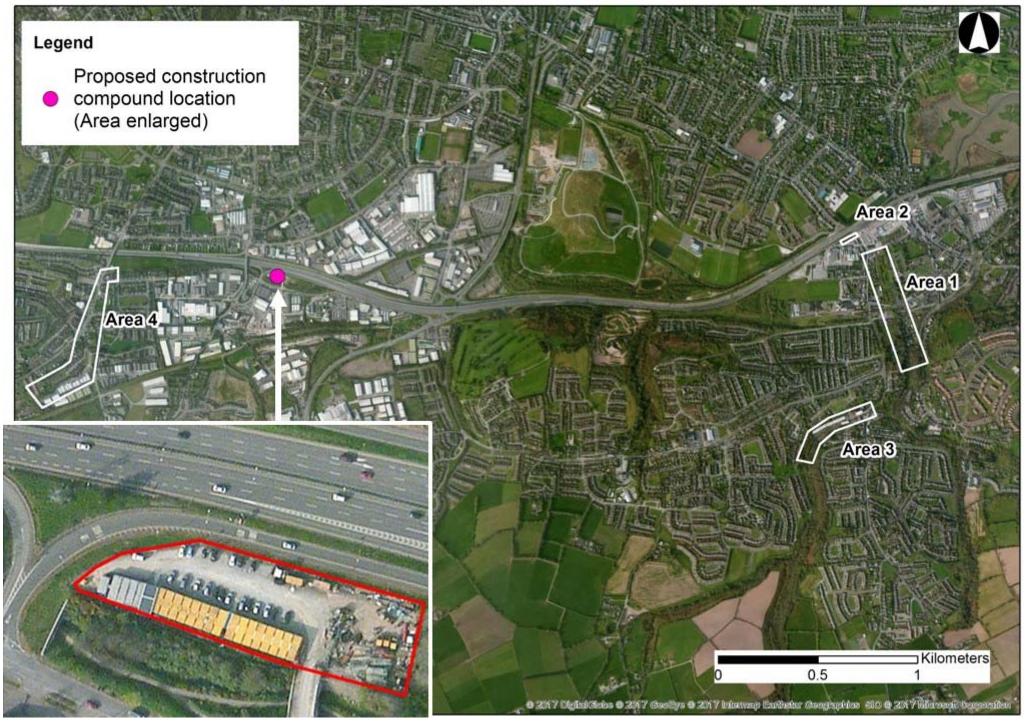

Figure 4.1: Location of proposed construction compound (including enlarged image of site) and proposed works areas (Area 1-4) | Source: Bing Maps.

4.5.7 Construction Compound 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 of the inspections.

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

Refer to **Section 4.6.2** for further details on water quality management and site drainage.

4.5.8 Construction Traffic

A detailed construction traffic management plan will be prepared and agreed with Cork County Council by the Main Contractor in advance of any works taking place on site. Refer to **Chapter 14** for further details on same.

As discussed previously, works will be carried out on the public road in Togher and Douglas. Alternative access routes will be agreed with Cork County Council and An Garda Siochána. Every effort will be made to carry out the works as quickly as possible in order to minimise impacts on the residents in the area. It is envisaged that traffic measures such as a stop-go system, temporary one-way traffic systems or similar will be implemented to allow the construction works and utility diversions to be constructed and at the same time to manage traffic. It is expected that the majority of the intense works on the public road will be programmed to be carried out in the summer months to avoid school traffic etc. such as outside the primary school on the Togher Road. It is not anticipated at this stage that full road closures will be required, however, if they are required, they will be for a very short duration only and will take place at night or other suitable times to minimise the impact on traffic in the area.

Traffic movement at the site will be planned to ensure traffic movements to and from site are managed efficiently and in accordance with Health and Safety requirements. In addition, any impacts on the local environment including local residents, road users and pedestrians will be minimised.

The following provisions will be adhered to as a minimum;

- All trucks entering and exiting the site will be covered with tarpaulin;
- Adequate parking will be provided to avoid queuing at the site entrances and prevent disruption to neighbouring businesses;
- Deliveries of materials will be planned and programmed to ensure that the materials are delivered only as they are required on site. Works requiring multiple vehicle deliveries to site, such as concrete pours, will be planned so as to ensure there will no queuing on the public roadways. Deliveries will be limited to outside of peak hours;
- Trucks will not be allowed to park on the public road either outside the site or on any of the approach roads leading to the site;
- All trucks entering the site will be restricted to suitable speed limit and will be directed to the relevant area by the site manager;
- Trucks required to wait on site will switch off engines to avoid unnecessary fuel usage and noise;
- All trucks exiting the site will be required to pass through a wheel wash. All water from the wheel wash will be collected, treated to remove silt or other contaminants, and discharged via an approved discharge licence to a local water course or drainage network. A lance will be provided to clean down the bodies and sides of the truck prior to leaving site; and
- Roads outside the site will be visually inspected on a daily basis and power swept and washed as and when required.

4.5.9 Cranage

Some of the construction works will require the use of standard mobile cranes on site in order to install the pre-cast bridge and culverts.

The cranes will generally be required for the moving of building materials on site such as concrete pipes, formwork for concrete, reinforcement, precast concrete, plant and general building materials. Heavy machinery movements will be restricted to outside of peak hours.

4.6 Construction Environmental Management Plan

4.6.1 General

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

A construction environmental management plan (CEMP) will be prepared by the Contractor 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 conditions attached to the statutory consent issued by An Bord Pleanála. The main aspects of the CEMP are outlined below. Implementation of the CEMP will ensure disruption and nuisance are kept to a minimum.

The CEMP 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 CEMP will be developed in accordance with industry best practice and will be effective for the duration of the construction works.

Cork County Council 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 works are carried out in accordance with industry best practice 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.

4.6.2 Soil, Surface Water and Groundwater Management

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, will be implemented to minimise the risk of spills and contamination of soils and waters. Refer to the Hydrology and Biodiversity chapters for further details on same.

4.6.3 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. Refer to **Chapter 10 Air Quality** for further details on same.

4.6.4 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.

4.6.5 Noise and Vibration Emissions

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 and 2:2009+A1:2014 (British Standards, 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). Refer to **Chapter 9, Noise and Vibration** for further details on same.

4.6.6 Invasive Species

Invasive plant species, particularly Japanese knotweed is known to be within some of the proposed works areas. Special consideration will need to be taken by the contractor when working within these areas so as to avoid spreading the material to unaffected areas and downstream. Refer to **Appendix 4.1** and **Chapter 6 Biodiversity** for details on same.

4.6.7 Construction Waste Methodology

The expected volume of material to be excavated to construct the works is as follows in **Table 4.3**.

Table 4.3: Estimate volumes of material excavated from each proposed works area (1-4).

Works Areas	Estimate volume of excavated material
Area 1: Douglas Community Park	2,050m^3
Area 1: Ravensdale	5,100m^3
Area 2: St Patrick’s Mills	60m^3
Area 3: Donnybrook Commercial Centre	2,250m^3
Area 4: Togher	9,000m^3
Total excavated volume:	18,460m^3

Where possible this material will be used on site, however, it is anticipated that the majority of this material will be disposed of in a suitably licenced facility off site. Refer to **Chapter 11 Soils, Geology and Hydrogeology** for the management of soil and excavated material during construction.

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 (2015) issued by the Environmental Protection Agency and the Southern Region Waste Management Plan 2015-2021 issued by the Southern Waste Region.

All waste removed from the site will be collected only by contractors with valid waste collection certificate or permit under the Waste Management (Facility Permit and Registration) Regulations 2007 as amended or a waste licence under the Waste Management Act 1996 as amended.

Hazardous waste generation will be minimised, and such waste will be recovered where feasible, and only disposed of if recovery is not feasible.

The management of hazardous waste will be in line with the National Hazardous Waste Management Plan (2014-2020) and managed in accordance the Waste Management Act 1996 as amended and other relevant legislation.

4.6.7.1 Waste Arising

In general, construction waste materials may include general construction debris, scrap timber and steel, machinery oils and chemical cleaning solutions.

It is anticipated that the vast majority of the excavated material, will need to be disposed of offsite. In the unlikely event of any evidence of soil contamination being found during work on site, the appropriate remediation measures will be employed. Significant sections of the banks of Ballybrack Stream are infested with Japanese knotweed and all of the material excavated in this areas will need to be disposed to a licenced waste facility under permit from the NPWS. The treatment of knotweed infested soil and associated biosecurity measures to prevent the spread of knotweed are described in **Appendix 4.1**.

Any work of this nature would be carried out in consultation with the Environment 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 where economically viable.

4.6.7.2 Waste Management Plan

The contractor will be required to develop, implement and maintain a Waste Management Plan (WMP) 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 WMP 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 WMP will include documented procedures for dealing with waste management including liaison with third parties, statutory undertakers and other companies.

The WMP 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 WMP:

- 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.

4.6.7.3 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 or licensed waste facilities.

4.7 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 Cork County Council and An Garda Siochána.

Removal of surplus materials off site will be managed in accordance with the construction traffic management measures outlined in **Chapter 14 Roads and Traffic** to ensure that there will be no queuing of trucks on the public roadways in the area.

All surplus excavation material will be removed off site by an authorised waste contractor to an appropriately licensed/permitted waste facility (refer to **Chapter 11 Soils, Geology and Hydrogeology** for further information).

The Main Contractor will be required to establish and implement a detailed Construction and Demolition Waste Management Plan, as part of the detailed CEMP.

4.8 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, i.e. "the Client" of a project to appoint a "Project Supervisor Design Process" (PSDP) and "Project Supervisor Construction Stage" (PSCS). Cork County Council has appointed Arup as Project Supervisor Design Process in accordance with the current legislation.

The PSDP will assemble the Safety File and issue it to the client at the completion of the project. 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.

Appropriate site personnel will be trained as first aiders and fire marshals. In addition, appropriate staff will be trained in environmental issues and spill response procedures. Tanks and drums of potentially polluting materials will be stored in secure containers or compounds which will be locked when not in use. Secure valves will be provided on oil and fuel storage facilities. Equipment and vehicles will be locked, have keys removed and be stored in secure compounds.

The Main Contractor will be required to maintain an emergency response plan which will cover all risks i.e. fire, flood, collapse etc.

In preparing this plan the Contractor will be required to liaise with the emergency response services.

4.9 Community Liaison During Construction

Effective community liaison is essential in order to help ensure the smooth running of construction activities and in relation to residents and public welfare. Important key issues in ensuring good relations are:

- Availability of information for the public during the construction phase, (particularly nearby sensitive receptors);
- Having the correct points of contact and being responsive; and
- The need for good housekeeping in all aspects of the operations.

Due to the nature of construction works it is essential to operate 'Good Neighbour' policy in so far as possible. Key aspects of this policy include:

- Early implementation of the policy, i.e. from the commencement of construction;
- Reduction of nuisance factors;
- Access to amenity areas, walkways and cycle paths and for neighbouring premises;
- Clear and concise information; and
- Undertaking timely liaison with stakeholders.

With regard to liaison, the Main Contractor will be required to prepare a Community Liaison Plan, which will include details of how the local community, road users and affected residents will be notified in advance of the scheduling of major works, any temporary traffic diversions and the progress of the construction works.

This plan will typically include details of the following:

- Contractor's community relations policy;

- Personnel nominated to manage public relations;
- A methodology for processing observations, queries and complaints from the general public, relevant authorities, the media, emergency services and the like; and
- The strategy for project wide liaison with all relevant parties.

A full time Community Liaison Officer will be appointed by the Main Contractor and will be responsible for managing such tasks as the following:

- Briefing neighbours on progress and issues as necessary;
- Liaison with Cork County Council and emergency services as appropriate;
- Liaison with An Garda Síochána, particularly in relation to traffic movements and permits where necessary;
- Contact details for the Liaison Manager will be posted on all construction site notice boards and on any other information or correspondence, which may be distributed from time to time;

Cork County Council's construction supervision team will also take an active role in community liaison and will work in close collaboration with the Community Liaison Officer.

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 and boundary walls, fences and all roads reinstated as necessary. Construction site fencing will be removed and landscaping/replanting will be completed.

4.11 References

British Standard BS 5228 – 1: 2009 +A1 2014: Code of Practice for Noise and Vibration Control on Construction and Open Sites – Noise and the

Construction Industry Research and Information Association (CIRIA), Environmental Good Practice on Site Guide (2015) 4th Edition (CIRIA 2015), UK.

Environment Agency (2013) Managing Japanese knotweed on development sites - The Knotweed Code of Practice (2006) UK Environmental Agency (officially withdrawn July 2016)

Environmental Protection Agency (2015) National Waste Prevention Programme

Invasive Species Ireland (2008) Best Practice Management Guidelines Japanese knotweed Fallopia japonica

Inland Fisheries Ireland (2016) Guidelines on protection of fisheries during construction works in and adjacent to waters.

Kelly, J., Maguire, C.M., Cosgrove, P.J. (2008) The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads, Transport Infrastructure Ireland

Masters-Williams, H., Heap, A., Kitts, H., Greenshaw, L., Davis, S., Fisher, P., Hendrie, M., Owens, D. (2001) Control of Water Pollution from Construction Sites - Guidance for consultants and contractors, Construction Industry Research and Information Association (CIRIA)

Murnane, E., Heap, A., Swain, A. (2006) Control of water pollution from linear construction projects – Technical guidance (C648D), CIRIA

National Construction and Demolition Waste Council (NCDWC) (2006) Best Practice Guidelines on the Preparation of Waste Management Plans for Construction & Demolition Projects

National Roads Authority (now TII) (2014) Good Practice Guideline for the Treatment of Noise during the planning of National Road Schemes, Transport Infrastructure Ireland

Southern Waste Region (2015) Southern Region Waste Management Plan 2015-2021

5 Planning and Policy

5.1 Introduction

This chapter outlines the statutory land use development and planning policy context of the proposed flood relief scheme. The scheme is examined in the context of the 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. See **Section 5.3.2** below for further details of the CFRAM. The design of this proposed scheme is a direct and coordinated measure proposed in line with the requirements of the Floods Directive.

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 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, a number of public information days (PIDs) were held in relation to the proposed scheme, as follows:

- PID 1 – Constraints Stage – 26th February 2014 – Douglas Community Centre;
- PID 2 – Emerging Preferred Option – 08th October 2014 – Nemo Rangers sports club (South Douglas road);
- PID 3 – Developed Preferred Option – 04th April 2017 - Douglas Community Centre.

5.3 Irish National Policy Guidance

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 design of the proposed scheme has been developed on the basis of the CFRAM. See below for further information.

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.

The Study Area is located within the South West CFRAM Study. The objectives of the South Western River Basin District CFRAM Study are as follows:

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

Conformance of the Project to the National CFRAM Programme

The proposed scheme 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 level. This project focuses on the Ballybrack Stream /Lee Catchment Area, and is therefore in conformance with the provisions of the National CFRAM programme.

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 requires Regional Authorities to draw up Regional Planning Guidelines in respect of their region and to review the Guidelines at intervals not exceeding six years. The Regional Planning Guidelines constitute 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 and set out that regional flood risk appraisal and management policy recommendations are necessary to set a policy framework for development at the local level.

The Guidelines 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 of 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 spans county borders, 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 - 2022

The Cork County Development Plan 2014 sets out the County strategy in relation to flooding. The Development Plan references the Flood Risk Assessment Management Study being conducted for the Douglas Area, and the approach to flood risk management. This is in line with the Guidelines for Planning Authorities issued by the Minister for the Environment.

The objectives of the County Development Plan seek to prioritise the sustainable development of suburbs and to increase their capacity to attract new investment in employment, services and public transport.

Development Plan Objective CS 3-1 states that the strategic aim for the Cork East-West Environs, covering Douglas, is: *"Consolidate employment at existing employment locations and planned for employment locations (Cork Science and Innovation Park) with improved supporting infrastructure, and in particular public transport improvements to provide linkages to local residential populations and Cork City."*

Development Plan Objective CS 3-1 states that the strategic aim for the Cork North-South Environs, covering Togher, is: *"Growth in population and employment so that the Cork Gateway can compete effectively for investment and jobs. Develop to complement & consolidate the development of the city as a whole and providing enhanced potential to rebalance the City through new development in the north."*

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. The need for flood alleviation measures in Douglas and Togher has been identified (see **Chapter 2 Need for the Scheme and Alternatives Considered** for a history of flooding in the area) and as such it is clear that the flood alleviation measures proposed in this scheme will contribute to achieving the overall objectives of the County Development Plan.

5.5.1.1 Carrigaline Electoral Area Local Area Plan 2015

The *Carrigaline Electoral Area Local Area Plan 2015 (2nd Edition)* is the current LAP that incorporates Douglas and Togher. It was first adopted in 2011 and the second edition was published in 2015. LAPs are currently under review and a Draft Ballincollig Carrigaline Municipal District LAP (2016) has been produced and public consultation held. See section 5.5.1.4 below for details.

The 2015 LAP sets out land use zonings and other specific objectives for lands within the Electoral Area, including the 'Cork City-South Environs' in which the proposed scheme is located.

The '*Zoning Map Cork City Environs 1'* includes the lands for the proposed Togher Culvert (refer to **Appendix 5.1** of this report), as the following categories:

- *'Areas susceptible to flooding – Zone A',*
- *'Areas susceptible to flooding - Zone B',*
- *'Walkways',*
- *''Residential',*
- *'Open Space/Sports Recreation/Amenity'*
- *"Existing built up area".*

Zoning in the Scheme for lands in the vicinity of the Douglas River is indicated on '*Zoning Map - Cork City Environs 2'* (refer to **Appendix 5.1** of this report):

- *'Areas susceptible to flooding – Zone A',*
- *'Areas susceptible to flooding - Zone B',*
- *'Walkways',*
- *''Residential',*
- *'Open Space/Sports Recreation/Amenity'*
- *'Special Policy Area X-03(a)' - Douglas Town Centre*
- *'Special Policy Area X-03(b)' - Douglas Golf Course.*

Key Planning Proposals for Douglas and for the Tramore Valley *(Carrigaline Electoral Area Local Area Plan 2011***)** are as follows:

"Douglas:

- *Planning Proposal 2.4.12 – It is envisaged that Douglas will evolve into a fully functional mixed use higher order urban centre in terms of both its development density and its retail offer with generally enhanced public transport, accessibility and parking demand management.*
- *Planning Proposal 2.4.13 – In order to achieve this, a holistic view of Douglas is required. It is proposed that during the lifetime of this plan that priority will be given to the completion of a Land Use and Transportation Study (LUTS) for the Douglas Area."*

"Tramore Valley:

- *Planning Proposal 2.4.14: - Although priority must be given to Douglas, it is envisaged that during the lifetime of this plan, and taking into account market conditions, it is intended to prepare an Integrated Area Plan (IAP) for the Tramore Valley. This IAP will consider proposals for the redevelopment of low density brownfield sites for high density mixed use development which will include business and residential uses and high levels of residential amenity. Consideration will also be given to transportation and parking management. It is envisaged that the area will become more pedestrian and cyclist friendly with connectivity throughout."*

A specific objective (Specific Zoning Objective 'X-03: Douglas') of the LAP is to undertake a Landuse and Transportation Study for the Douglas Area. The Plan (page 41) states that:

> *"Lands within the clearly defined undaries (X-03 (a) and X-03(b)) will be subject to a Land Use and Transportation Study (LUTS)…"*

Specific objective 'X-02: Tramore Valley' of the Plan (Page 41) states that:

> *"….the lands within this broad indicative boundary will be subject to an Integrated Area Plan…"*

Conformance of the Project to the Carrigaline Local Area Plan 2015

Many of the areas identified for development, especially Douglas, are 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. Riverside walkways, parks and other amenities (including sporting facilities and open space) at risk of flooding are to be protected and enhanced. Overall the objectives are to develop, enhance and consolidate the settlements in the area covered by the Carrigaline LAP, which requires that zones be protected from flooding. The proposed FRS will mitigate the risk of flooding and thereby contribute to achieving the goals of the LAP.

Cork County Council have reviewed the LAPs for the county. Douglas and Togher are included under the Draft Ballincollig Carrigaline Municipal District LAP (2016), see section 5.5.1.4 below.

5.5.1.2 Douglas Land Use and Transportation Strategy (DLUTS)

The DLUTS was completed in August 2013 and comprises development proposals for Douglas for a 20 year period covering land use, transportation and urban design.

The goals of the DLUTS are to:

- *"provide a framework for future planning decisions,*
- *optimise the traffic and transport network,*
- *provide a guide to the investment in transport infrastructure,*
- *identify the capacity of the town centre for additional retail and other development,*
- *inform the future use of two areas zoned 'Special Policy Areas' ('Douglas Town Centre - X-03a', and the lands described as Douglas Golf Course – X-03b) in the Carrigaline Electoral Area Local Plan (2011)."*

A number of traffic and transportation proposals are outlined in the strategy, including the following:

- *"a proposed East West Link Bridge linking Donnybrook Hill to the Carrigaline Road.*
- *38km of walking and cycling routes including Mangala/Ballybrack Stream, Tramore Valley Park and City connectivity."*

Land use proposals in the DLUTS with regard to community facilities, recreation and amenities include:

- *"Existing Schools and Douglas Golf Course to remain in present locations,*
- *Urgent need for multi-purpose leisure facility for sports and community clubs,*
- *Urgent need for additional playing fields in Douglas,*
- *Provide walkways/cycleways to connect Donnybrook along Mangala/Ballybrack Stream,*
- *Provide improvement to community park amenity area and provide pedestrian/cycle linkage to City Tramore Valley Park."*

DLUTS Land Use Policy LU-02 is "to consolidate the town centre into 5 precincts comprising the Woollen Mills, Douglas Village Shopping Centre, Cinema Site, Barry's Fields and Douglas Court Shopping centre. The priority is to fill existing retail vacancy, and there will be a plan-led approach to town centre development which will provide for an additional 25,000sqm floor space by 2032, and approximately 175 residential units…"

Regarding 'Community Facilities and Recreation', the DLUTS states "there is a requirement for a multi-purpose leisure facility in Douglas to cater for sports clubs, community organisations and leisure. This facility should be located in or near to the Town Centre to serve the community as a whole. The preferred location for this facility is adjacent to the existing GAA playing pitches and schools for ease of access for the users. Road access to the lands to the west of the GAA playing pitches will require careful assessment." (refer to Section 8.4.2.1 of the DLUTS).

DLUTS Land Use Policy LU-05 states that "the DLUTS Study Area is the preferred location for the provision of a multi-purpose leisure facility in Douglas to cater for sports clubs, community organizations sand leisure activities. In addition, playing fields, parks and walkways/cycleways that provide a link to the Tramore Valley Park over the N40 and access to Vernon Mount walkway through to Grange, providing an alternative link for Grange and Frankfield residents to get to Douglas Town Centre without using a vehicle…."

Conformance of the Project to the DLUTS

The main tenets of the DLUTS are to support and encourage commercial and residential development alongside the provision and protection of community facilities, amenities and transportation links. The proposed scheme conforms to these objectives by committing to protect existing and future property and infrastructural developments from the risk of flooding.

5.5.1.3 Proposed Amendment to the Carrigaline Electoral Area Local Area Plan 2011- Amendment No. 2 Douglas LUTS (November 2013)

Following on from the DLUTS, Cork County Council proposed an Amendment to the *Carrigaline Electoral Area Local Area Plan 2011* for public consultation. The Proposed Amendment *The Carrigaline Electoral Area Local Area Plan 2011- Amendment No. 2 Douglas LUTS (Nov. 2013)* states that "*in terms of zoning provisions, the plan is amended by the changes to the zoning of the area known as X-)3(a) and (b), Douglas Town Centre and Douglas Golf Course, respectively".*

The purpose of the proposed amendment was to incorporate the recommendations of the DLUTS into the Local Area Plan for the Carrigaline Electoral Area. The amendment was approved and its provisions have been incorporated into the Draft 2016 Ballincollig Carrigaline Municipal District LAP 2016 (see Section 5.5.1.4 below).

Section 1.4.42 of the amendment to the LAP states that *"DLUTS has recommended that X-03b zone be retained as an open space and recreation zone for use by the Douglas Golf Course"*.

Section 1.4.44 of the amendment to the LAP states that the DLUTS *"has identified a number of town centre zonings that are distinct precincts which have established retail uses, where mixed use development can, and should, take place. It is forecast that by 2032, these precincts can accommodate an additional 175 residential units and up to 25,000m2 of mixed use (offices and retail) development. These precincts are shown on Zoning Map 3 as TC-01 to TC-05"*.

Table 1.10 of the amendment to the LAP includes the redevelopment of the following Retail Priority Areas:

- Cinema Site (TC-04)
- St. Patrick's Woollen Mills (TC-01)
- Douglas Court (TC-05)
- Barry's Field (TC-03).

The amended LAP Zoning Map (2013) is appended to this report (refer to **Appendix 5.1**). The land use zonings displayed on this map were adopted, along with the other amendments, and remain unchanged to date. They are representative of the current land use zonings.

The amendments to the Carrigaline Electoral Area LAP (2011), in the general vicinity of the Study Area, include, but are not limited to, the following policies and specific zoning objectives:

Urban Design Policy UD4 relates to the Cinema Site and states *that "there is an opportunity to prepare an Overall Planning and Development Scheme which would involve all landowners.*

Urban Design Policy UD5 relates to the redevelopment of St. Patrick's Woollen Mills.

Specific Zoning Objective No. TC-01 – St. Patrick's Woollen Mills recommends the redevelopment of the whole site, to include mixed use development including offices, retail and residential uses. However, Policy TC-01 states that the redevelopment should only result in an increase of 25% to the floor space of the existing buildings. The policy states that the site can cater for an additional 70 dwellings, and that car parking for new development should follow the revised parking standards of the County Development Plan.

Specific Zoning Objective TC-02 - Barry's Field recommends the development of the site i.e. "*a mixed use development of 4,000sqm*" to include office and commercial development. The construction of a new municipal car park of at least 200 bays is considered.

Specific Zoning Objective TC-04 - Cinema Site recommends the overall planning and development of the entire site and includes "*the provision of a comprehensive mixed-use development with an additional 5,500sqm of non-residential floor space and 70 residential units*". The development of the site "*will incorporate the cinema, the car park, vacant land and the old TSB site and the filling station site…It is desirable to enable the relocation of the filling station and rehabilitation of the site for the construction of a landmark building….Future buildings should form and edge along the relief road on the north of the site…*".

Specific Zoning Objective TC-05 – Douglas Court recommends that "*an Overall Planning or Development Scheme is prepared for the entire site which can be implemented on a phased basis. This shall include the provision of a mixed-use development with an additional 7,500sqm non-residential floor space….*".

Specific Zoning Objective U-07 – "*Provision of new road and bridge between Grange Road and the Carrigaline Road over the Ballybrack River Valley*" (refer to LAP Zoning Map amended 2013 (Proposals for X-03(a) & X-03(b)) in **Appendix A3** of this report).

Specific Zoning Objective O-12 – *Douglas Golf Course.* The amendment (page 9) states that DLUTS has recommended that the X-03b zone be retained as an open space and recreation zone for use by the Douglas Golf Course.

Specific Zoning Objective O-13 – *Open Space and Recreation Area. Provision of a multi-purpose leisure facility in Douglas to cater for sports clubs, community organizations and leisure activities. In addition, playing fields parks and walkways/cycleways that provide a link to the Tramore Valley Park over the N40 and access to Vernon Mount walkway through to Grange, should be provided* (refer to LAP Zoning Map amended 2013 (Proposals for X-03(a) & X-03(b)) in Appendix A3 of this report).

Specific Zoning Objective O-14 – *Douglas Community Park – Improved access to the community park from the north and south should be provided. Within the park, improved lighting, landscaping and security measures should also be provided* (refer to LAP Zoning Map amended 2013 (Proposals for X-03(a) & X-03(b)) in Appendix A3 of this report).

Specific Zoning Objective O-15 **–** *Active open space for informal public recreation to be landscaped and planted.* (refer to LAP Zoning Map amended 2013 (Proposals for X-03(a**)** & X-03(b)) in Appendix A3 of this report).

Transportation Policy – Walking and Cycling WC2 is to provide a high quality off-road walk and cycleway linking Grange and Frankfield with the village centre of Douglas and should provide a connection to the Tramore Valley Park via an overpass bridge on the N40.

Transportation Policy – Walking and Cycling WC3 is to provide a high quality off-road walk and cycleway along the Ballybrack River from the Community Park to the Donnybrook Hill Area.

Conformance of the Project to Amendment no. 2 to the Carrigaline LAP

The proposed scheme supports the amendment to the DLUTS by providing protection from flooding in areas that are identified as strategically important for redevelopment within the Douglas area, such as St. Patrick's Woollen Mills. The flood relief measures proposed for the Douglas Community Park will contribute to the improvement of the public safety and amenity value of the park, in line with the policies outlined in the amendment. The proposed scheme will also support the objectives to provide cycleways along the Ballybrack stream by ensuring that these are not at risk of flooding**.**

5.5.1.4 Ballincollig Carrigaline Municipal District Local Area Plan 2016 (Draft)

The Draft Ballincollig Carrigaline Municipal District LAP will replace the current Carrigaline LAP. It was published in draft format for public consultation in 2016 and is expected to be formally adopted in the latter part of 2017. Following the restructuring of local government in 2014, the Town Councils were abolished and the electoral structure of the County was divided into municipal districts, of which Ballincollig Carrigaline is most relevant to the proposed scheme.

The public consultation for this LAP closed on 16 January 2017. Volume 2 Environmental Reports, sets out a Strategic Flood Risk Assessment (SFRA) for flood risk within the LAP area. The Strategy is to inform land-use planning and decisions in the LAP and other plans. Section 3.2.9 of the SFRA notes that Douglas (City South Environs) was badly affected by floods in 2012 and as a result the flood relief scheme has commenced.

The Draft 2016 LAP sets out land use zonings and other specific objectives for lands within the municipal district, including the 'Cork City-South Environs' in which the proposed scheme is located. The Draft LAP has largely built on the current Carrigaline LAP, with the addition of the commitments to the DLUTS as described above.

Section 3.5.2.7 of the Draft Plan states that "*Parts of the South City Environs have been identified as being at risk of flooding, the areas at risk follow the path of the Tramore River and its tributaries through the built-up areas.*"

Section 3.5.2.8 then further states that *"Douglas was badly affected by flooding in 2012. As a result, Cork County Council, acting as Agents for the OPW, has now commenced works on a Flood Relief Scheme for Douglas."*

The Plan identified both Togher and Douglas Village as Regeneration Areas.

Specific Development Objectives for the South Environs relevant to the proposed scheme are as follows:

- SE-GO-06 "*Flooding – all proposals for development within the areas identified as being at risk of flooding will need to comply, as appropriate, with the provisions of the Ministerial Guidelines – 'The Planning System and Flood Risk Management'.*"
- SE-RA-01 "*Togher Village. Area around Togher Cross with development centring on the disused Doughcloyne hotel complex. Potential for a mixed use neighbourhood centre and a new Primary Health Care Centre to serve the western portion of the City South Environs.*"
- SE-RA-02 "*Douglas. Southern portion of West Douglas Street located within the West Douglas Street conservation area. Potential to address appearance, streetscape, and urban fabric of the area.*"

Conformance of the Project to the Draft Plan 2016

The Draft Plan mentions the recent flooding events in Douglas, as well as making specific reference to the proposed scheme itself and the requirement for its completion. The Draft Plan makes provision for the development of housing and infrastructure as per the DLUTS, and specifically references the need for strategic flood prevention planning. The proposed scheme conforms to the Draft Plan by providing protection from flooding and removing the obstacle of flooding to the provisions for development contained in the Draft Plan.

5.6 Conclusions

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

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 at all levels assessed.

5.7 References

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

Cork County Council Cork County Development Plan 2014-2022

Cork County Council Carrigaline Electoral Area Local Area Plan 2015 (2nd Edition)

Cork County Council (2016) Draft Ballincollig Carrigaline Municipal District Local Area Plan

Cork County Council (2014) Adopted Amendment to the Carrigaline Electoral Area Local Area Plan 2011 – Amendment No 2: Douglas Land Use and Transportation Strategy

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

Dixon Brosnan Environmental Consultants have conducted an appraisal of the potential impacts of the Douglas Flood Relief Scheme (including Togher culvert) on terrestrial and aquatic flora and fauna. This chapter describes and evaluates the habitats, with their representative flora and fauna, and addresses the potential ecological impacts of the development. Mitigation measures are proposed where necessary and any residual impacts are described.

6.2 Methodology

6.2.1 Introduction

This appraisal is based on surveys of the proposed works area and a review of desktop data. This section of the EIS was prepared in accordance with the following guidance 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)
- 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).
- Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment (EU Commission, 2013).

This report was prepared by Carl Dixon MSc (Ecological Monitoring) and Ian McDermott MSc (Ecological Monitoring).

6.2.2 Desktop Review

The purpose of the desktop study was to identify features of ecological value occurring within the proposed development site and those occurring in close proximity to it. A desktop review also allows the key ecological issues to be identified early in the appraisal process and facilitates the planning of surveys. Sources of information utilised for this report include the following:

- National Parks & Wildlife Service (NPWS) - www.npws.ie;
- Environmental Protection Agency (EPA) – www.epa.ie;
- National Biodiversity Data Centre – www.biodiversityireland.ie;

- County Cork Biodiversity Action Plan 2009-2014 (Cork County Council, 2009);
- Bat Conservation Ireland - http://www.batconservationireland.org;
- Best Practice Guidance for Habitat Survey and Mapping (Heritage Council, 2011);
- Guidance on integrating climate changes and biodiversity into environmental impact assessment (EU Commission, 2013);
- Guidelines for Assessment of Ecological Impacts of National Road Schemes (National Roads Authority, 2009);
- Aerial photography (Google Earth).

6.2.3 Consultation

Following an initial consultation with Inland Fisheries Ireland (IFI) in April 2014, a fish stock survey was requested. An electrofishing survey was carried out and a report on same is included as **Appendix 6.1** of this report. A second meeting was held with IFI in September 2014 to discuss constraints relating to fisheries. Subsequently an onsite meeting was held with Michael McPartland of Inland Fisheries Ireland on 15th August, 2016 to agree measures in relation to fisheries protection. A further meeting was held with Michael McPartland of Inland Fisheries Ireland on 4th May, 2017 to finalise details. During meetings and in subsequent correspondence it was requested that the EIS provides an assessment of the potential impacts on fish and fish habitat, maintain adequate low flow channels and ensure that the design of the proposed scheme minimises impacts on fish habitat and minimises impacts on fish movement within the affected watercourses.

6.2.4 Surveys Overview

The following surveys were carried out at the site:

- Habitat mapping and flora surveys were carried out over several visits in the period from May 2016 to April 2017. See **Figures 6.2 to 6.7** in **Appendix 6.2**.
- Surveys for birds were carried out in the period from May 2016 to October 2016 and in April 2017.
- A survey for mammals focusing on otters and badgers was carried out over several visits in the period from June 2016 to September 2016 and in April 2017.
- Bat surveys were carried out over several visits from June to September 2016.
- A survey for invasive species, including mapping with GPS coordinates, was carried out in 2015. Further observations in 2016 and 2017 were also recorded (See **Appendix 4.1**).
- A fish stock survey using electrofishing equipment was carried out in September 2014 (See **Appendix 6.1**).

6.3 Receiving Environment

6.3.1 General Landscape

The proposed flood relief scheme areas will be located in Togher along the Tramore River and in Douglas along the Grange Stream and Ballybrack Stream. The Grange and Ballybrack streams are tributaries to the Tramore River, which flows to Lough Mahon in Cork Harbour. Refer to **Figure 1.1.** The proposed works area in Togher is approximately 2.8km south of Cork city centre. The proposed works area in Douglas is to the south and within Douglas village and approximately 3.4km southeast of Cork city centre. All of these waterways flow through heavily urbanised areas with residential housing estates, industrial estates, shopping centres, sports facilities and public parks. An overview of the proposed works areas (1 to 4) is shown in **Chapter 3 Description of the Proposed Scheme:**

- **Figures 3.1** and **3.2** – Area 1: Ballybrack Stream through Douglas.
- **Figure 3.5** – Area 2: Tramore River through St Patrick's Mills, Douglas
- **Figure 3.8** – Area 3: Grange Stream (tributary of Ballybrack Stream) through Donnybrook Commercial Centre
- **Figure 3.11** – Area 4: Tramore River through Togher

Construction activities are described in detail in **Chapter 4 Construction Activities.**

6.3.2 Designated Conservation Areas

The closest Natura 2000 site to the proposed works are the Cork Harbour SPA (Site code 004030) and Great Island Channel SAC (Site code 001058). There are also a number of pNHA sites within a 10km radius, the closest of which is Douglas River Estuary (Site code 001046). There is a direct hydrological connection between the proposed works and designated sites within Cork Harbour (Cork Harbour SPA, Great Island Channel SAC, Douglas River Estuary pNHA, Dunkettle Shore pNHA). A list of the Natura 2000 sites within 10km of the proposed development area is given below in **Table 6.1**.

Table 6.1: Designated areas and their location relative to the proposed works area

Site Name	Designation	Code	Distance from Togher works area	Distance from Douglas works area	Distance from closest works area
Special Protection Area (SPA)					
Cork Harbour	SPA	004030	3.8km E	0.4km E	0.4km E
Special Area of Conservation (SAC)					
Great Island Channel	SAC / pNHA	001058	10.5km E	6.9km E	6.9km E
Proposed Natural Heritage Area (pNHA)					
Lee Valley	pNHA	000094	2.9km NW	6.0km WNW	2.9km NW
Shournagh Valley	pNHA	000103	6.0km NW	9.4km NW	6.0km NW

Site Name	Designation	Code	Distance from Togher works area	Distance from Douglas works area	Distance from closest works area
Blarney Castle Woods	pNHA	001039	7.5km NW	10.3km NW	7.5km NW
Douglas River Estuary	pNHA	001046	3.9km E	0.5km E	0.5km E
Glanmire Wood	pNHA	001054	7.4km NE	4.5km NNE	4.5km NNE
Lough Beg (Cork)	pNHA	001066	12.5km SE	9.2km SE	9.2km SE
Rockfarm Quarry, Little Island	pNHA	001074	9.5km ENE	5.9km NE	5.9km NE
Cork Lough	pNHA	001081	1.2km N	3.3km NW	1.2km N
Dunkettle Shore	pNHA	001082	7.2km NE	4.0km N	4.0km N
Ballincollig Cave	pNHA	001249	7.0km W	10.7km W	7.0km W
Blarney Lake	pNHA	001798	7.3km NNW	10.3km NW	7.3km NNW
Ardamadane Wood	pNHA	001799	8.0km NNW	10.5km NW	8.0km NNW
Blarney Bog	pNHA	001857	6.3km N	8.5km NW	6.3km N

Important areas for birds within Cork Harbour are interrelated, with bird populations moving between different areas at different times. The closest Natura 2000 sites are the Cork Harbour SPA, which is located 0.4km downstream of the proposed works and the Great Island Channel SAC, which is located 6.9km away to the east. The closest pNHA is Douglas River Estuary, which is located 0.5km downstream of the proposed site works at its closest point. These designated sites are part of a network of sites which support important bird numbers and habitats within Cork Harbour and are considered relevant to this proposed development. These designated sites are shown below in **Figure 6.1.**

The remaining designated sites are located a considerable distance from the proposed development. Given the distances involved and/or the lack of direct hydrological connections, no potential impact on any of the remaining designated sites has been identified.

Likely significant impacts on Natura 2000 sites have been ruled out (refer to the separate ‘Screening Report for Appropriate Assessment’ in **Appendix 6.5** for further details). The authors of this report also concluded that, following a comprehensive evaluation of the potential direct, indirect and cumulative impacts on the qualifying interests and conservation objectives, the proposed development will not have an adverse effect on the integrity of Natura 2000 sites.

6.3.3 Ramsar Sites

The Convention on Wetlands, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. A key commitment of Ramsar Contracting Parties is to identify and place suitable wetlands onto the List of Wetlands of International Importance. Cork Harbour is listed as a Ramsar site, which is a non-statutory designation.

6.3.4 Habitats

Terrestrial habitat mapping was carried out in line with the methodology outlined in the Heritage Council Publication *Best Practice Guidance for Habitat Survey and Mapping* (Heritage Council, 2011). All habitats within the study area were classified to level 3 of the classification scheme outlined in *A Guide to Habitats in Ireland* (Fossit, 2000) and cross-referenced with habitats listed under Annex I of the Habitats Directive.

Habitat maps are included as **Figures 6.2- 6.7** in **Appendix 6.2** and the habitats recorded on site are described below in **Table 6.2.** The ecological value of habitats is defined by the classification scheme outlined in *Guidelines for Assessment of Ecological Impacts of National Road Schemes* (National Roads Authority, 2009) which is included in **Appendix 6.3.**

Table 6.2: Terrestrial habitat value

Habitat	Description/ Habitats Directive Annex I Status	Ecological value (NRA guidelines)
Treelines WL2	A short but well developed treeline with a diverse mix of species occurs along part of the boundary of the Ballybrack River adjacent to the ICA Hall. It includes Beech, Ash, Western Red Cedar, Hawthorn, Elder and Holly. The western boundary of the Ballybrack Stream, as it flows through the Douglas Community Park, is vegetated and supports a mixture of trees including Sycamore and Ash, Elder and Alder. The trees do not form a continuous treeline. There is a short section of treeline adjoining an area of open channel adjoining the Togher Road. It includes one large mature Horse Chestnut as well as Ash, Elm, Lime, Hawthorn and Cherry Laurel. Ground layer species include Bramble and Hart's tongue fern. There is a patchy treeline along the pedestrian/cycle path which runs south from Douglas village into broadleaved woodland. Trees noted include Birch, Horse Chestnut, Sycamore and Ash. Some Cherry Laurel was also noted. Upstream of the Donnybrook Commercial Park there is a section of riparian treeline. Species include Alder, Ash and Lime. Further information on trees is provided in the Tree Survey report which is attached as **Appendix 6.4.**	Local importance (Higher value)
Hedgerow WL1	A hedge of Western Red Cedar and *Griselinia sp*. runs along the northern boundary of the Lehenaghmore Industrial Estate boundary.	Local importance (Low value)
Dry meadow and grassy verge GS2	Although distributed sporadically within the survey area, the largest single block of this habitat type occurs along the Grange Stream within the Donnybrook Commercial Centre. The grassland at this location is moderately diverse with a mixture of typical species including Oxeye Daisy, Figwort, Meadow Vetchling, Field Sorrel, Yorkshire Fog, False Oat Grass and Sweet Vernal Grass.	Local importance (Low value)

Habitat	Description/ Habitats Directive Annex I Status	Ecological value (NRA guidelines)
	Dry meadow and grassy verge GS2 corresponds to the Habitats Directive Annex I habitat: 'lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*) (6510)'. However, the dry meadow and grassy verge habitat within the site is of poor quality, is highly modified, is very common locally and does not represent a valuable example of this Annex 1 habitat type.	
BL1 Stonewalls and other stonework	There are sections of stonewall at various locations either in close proximity to rivers or forming part of the bankside structure. Materials vary and include natural stone, concrete or gabions. Some typical species were noted such as Maidenhair Spleenwort, Ivy Leaved Toadflax and Hart's tongue fern. However, none of the stone walls recorded on site are of high value from an ecological perspective.	Local importance (Low value)
Wet willow-alder-ash woodland WN6	This habitat occurs adjacent to the river at the most upstream section of the Togher culvert north of the Lehenaghmore Industrial Estate. The trees are not mature with a dominance by closely spaced Willow and Alder. The ground flora is dominated by dense Bramble, Nettle with Winter Heliotrope and Hogweed and biodiversity is generally low.	Local importance (Higher value)
Mixed Broadleaved woodland WD1	The Wet willow-alder-ash woodland WN6 north of the Lehenaghmore Industrial Estate blends into broadleaved woodland on a steep escarpment. The trees are generally semi-mature. Species noted include Sycamore, Alder, Willow, Ash, Elder, Hawthorn. Wild Clematis and ivy are common and the ground layer includes Male Fern, Bramble and Hart's tongue fern. Due in part to the dominance of Wild Clematis and Ivy and low light levels on this north facing slope, biodiversity is relatively low. A section of broadleaved woodland occurs at the upstream boundary of the works on the Ballybrack Stream. This woodland area has a relatively natural woodland structure but with a mixture of native and non-native species. Cherry laurel is dominant in places and blocks light and suppresses ground flora. Species noted include Beech, Sycamore, Alder, Holly, Ash, Sweet Chestnut, Oak, Lime and Plane. Ground flora is limited due to the heavy shade. Upstream of the Donnybrook Commercial Park there is an area of broadleaved woodland which extents for approximately 1km along the Grange stream. Along this length there are areas of beech woodland with some more natural areas with Oak, Ash, Hazel, Willow and Holly. Works on the stream will impact on the lower section of this woodland which has been more highly modified. The riparian zone consists of a mixture of mature Alder and Horse Chestnut with large areas also dominated by closely spaced immature alder and willow. Spoil heaps indicate relatively recent disturbance.	Local importance (Higher value)

Habitat	Description/ Habitats Directive Annex I Status	Ecological value (NRA guidelines)
	Herbaceous species noted include Harts tongue fern, Woodrush, Nettle, Lesser Celandine, Male fern, Herb Robert and Ivy. The invasive species Japanese Knotweed, Winter Heliotrope and Buddleia were also recorded. Wetter areas support Golden Saxifrage, Rush species and Fools Watercress. Upstream of the Donnybrook Commercial Centre is an area of broad leaved woodland which extends upstream along the Grange Stream. This is a high-quality woodland in parts with a mixture of Beech, Hazel, Hawthorn Ash, Alder, Oak and Birch. Ground flora includes Wood Sorrel, Wood Avens, Ivy, Ramsom, Lesser Celendine, and Pignut. Wetter, low lying areas support Golden Saxifrage and Water Parsnip. The woodland provides supports a range for bird species including Treecreeper, and Jay and for Red Squirrel (Carl Dixon pers. observation). This woodland is considered a high value resource in a local context. It is noted that the habitats within the works area are dominated by treelines and immature trees with only minor areas of woodland directly affected.	
Amenity grassland GA2	Small areas of this habitat type occur within the study area. It is generally species poor and supports few herbaceous species. Examples include a small park adjacent to the Togher Road with a small number of semi-mature ash trees and along the Togher River north of Greenwood Estate.	Local importance (Low value)
Scattered trees and parkland WD5	Occurs most prominently in the Douglas Community Park where ornamental trees have been planted with a wide spacing in amenity grassland. Species noted include Field Maple, Norway Maple, Ash, Lime, Aspen, Birch, Rowan, Horse Chestnut, Oak and Sycamore. Most of the trees are semi-mature. A smaller area occurs at Westbrook Gardens, north of the Douglas Community Park. Trees noted here include Horse Chestnut, Alder, Ash, Poplar, Elder, Sycamore, Rowen, Lime, Red Oak, Birch, Norway Maple, Beech, Western Red Cedar and Atlantic Cedar.	Local importance (Low value)
Buildings and artificial surfaces BL3	Includes car parks, buildings, paths and roads. Of minimal ecological value.	Local importance (Low value)
Immature woodland WS2	Occurs upstream of Donnybrook Commercial Centre along a section of the riverbank. Consists of native trees including Willow and Alder.	Local importance (Higher value)

6.3.5 Flora

The National Parks and Wildlife Service (NPWS) does not record any rare or threatened plants as present in the 10km grid square W66. Some 238 flowering plants are listed by the National Biodiversity Data Centre (NBDC) as present in the grid square W66. Round-leaved cranes-bill (*Geranium rotundifolium*) is listed as endangered and is the only flowering plant with a threat assessment. No rare species were recorded during site surveys.

6.3.6 Invasive species

Non-native plants are defined as those plants which have been introduced outside of their native range by humans and their activities, either purposefully or accidentally. Invasive non-native species are so-called as they typically display one or more of the following characteristics or features: (1) prolific reproduction through seed dispersal and/or re-growth from plant fragments; (2) rapid growth patterns; and, (3) resistance to standard weed control methods.

Where a non-native species displays invasive qualities and is not managed it can potentially: (1) out compete native vegetation, affecting plant community structure and habitat for wildlife; (2) cause damage to infrastructure including road carriageways, footpaths, walls and foundations; and, (3) have an adverse effect on landscape quality.

Detailed surveys for invasive species were carried out in May 2015 for the Douglas and Glashaboy Flood Relief Schemes. An additional area of Japanese Knotweed was recorded upstream of the Donnybrook Commercial Centre in March 2017; this area was not included within the original survey in 2015. The location of Japanese Knotweed within the scheme and Donnybrook Commercial Centre are included in **Appendix 4.1**. Additional individual plants were also recorded in the Douglas Community Park in April 2017. Alien species, which were recorded within the proposed works area but which are not considered highly problematic, include Sycamore, Three-Cornered Leek, Buddleia, Winter Heliotrope, Wild Clematis, Cotoneaster and Cherry Laurel.

Sycamore, Cherry Laurel and Cotoneaster are on the “Amber List: Recorded Species” (which under the right conditions could represent a significant impact on native species or habitats) on the invasive species list compiled by Invasive Species Ireland as part of a joint initiative by the Northern Ireland Environment Agency and NPWS. Buddleia, Wild Clematis, Three Cornered Leek and Winter Heliotrope are on the “Amber List: Uncertain Risk” (their ecological impact remains uncertain due to lack of data showing impact or lack of impact). These species can be managed relatively easily via standard herbicide based control programmes. It is noted that Sycamore is generally not included in treatment programmes as it is widely naturalised.

Japanese Knotweed, which was recorded within part of the works area is listed on both the “Most Unwanted: Established Threat” and on the “High Risk: Recorded Species” list compiled by Invasive Species Ireland in a joint initiative by the Northern Ireland Environment Agency and NPWS.

Japanese knotweed is a highly invasive, non-native species which was originally introduced as an ornamental plant but has since spread along transport routes and rivers to become a severe problem. From an ecological viewpoint, it out-competes native species by forming dense stands which suppress growth of other species. It grows extremely vigorously and can penetrate through small faults in tarmac and concrete and thus can damage footpaths, roads and flood defence structures. As it can survive in poor quality soils, including spoil, it often thrives in brownfield sites and in urban areas. The key features of the plant are summarised below:

- Produces fleshy red tinged asparagus like shoots when it first breaks through the ground in an established stand.
- Has large, heart or spade-shaped green leaves which are approximately the size of your hand.
- Has leaves arranged in a zig-zag pattern along the stem.
- Grows up to 3m in height.
- Yellow / cream flowers in late summer (Typically they start forming from late July onwards).
- Hollow bamboo like stems which have distinctive ring like nodules at regular intervals along it.
- Brown stems remain in winter once it has died back.
- Extensive rhizome system (roots) (7m radius x 3m depth approximately)
- Orange centred rhizome.
- Spreads entirely via the movement of plant and rhizome fragments.

The plant has woody underground rhizomes which can extend 7m laterally from a parent plant. The leaves and stems die back during winter, but growth is extremely rapid during spring. The plants spread mainly through fragments of rhizomes (as little as 0.7g of material or the size of a small fingernail is sufficient) and through cut stems. Stem material cannot regenerate once it has dried, but rhizome material may be viable for up to 20 years in the soil. Thus control of this species is very difficult.

Japanese knotweed is the most common knotweed. There are however, a total of four species present in Ireland, namely Japanese knotweed *Fallopia japonica*, Giant knotweed *Fallopia sachalinensis*, Bohemian knotweed *Fallopia japonicus x bohemica* and Himalayan Knotweed *Persicaria wallichii*.

All of these knotweed species are considered invasive aliens and are listed under Regulations 49 and 50 of the European Communities (Birds and Natural Habitats) Regulations 2011. The same control measures apply to all of these species.

Herbicide treatment of Japanese Knotweed within the proposed works area has been carried out in proximity to the Ballybrack River within and upstream of the Douglas Community Park. This area was sprayed twice during 2015 as part of a specialised management programme in line with the relevant guidelines.

Observations by Dixon.Brosnan in October 2016 and April 2017 indicate that regrowth has occurred but is less vigorous. The treatment programme will be continued via two treatments in 2016/2017. Refer to **Appendix 4.1** for further details regarding outline non-native species management plan.

6.3.7 Aquatic habitats

The Tramore River is a small river, approximately 7.5km in length, which discharges to Cork Harbour via the Douglas River estuary. Most of its $21km^2$ catchment area lies within urban/suburban areas on the outskirts of Cork City and the river has been extensively culverted in Togher. The main channel runs west to east with a low gradient and is joined by a number of tributaries flowing from higher agricultural grassland to the north. The Grange Stream flows into Douglas where it is known as the Ballybrack Stream. Due to its urban location, water quality issues have occurred in the past with respect to the Tramore River and are an ongoing concern. The Ballybrack Stream is extensively culverted within Douglas Village. An overview of the catchment is provided in **Chapter 12 Hydrology, Figure 12.2.**

All habitats within the study area were classified to level 3 of the classification scheme outlined in *A Guide to Habitats in Ireland* (Fossit, 2000) and cross-referenced with habitats listed under Annex I of the Habitats Directive. The habitats recorded on site are described below in **Table 6.3.**

Table 6.3: Aquatic habitats

Aquatic Habitat	Description/ Habitats Directive Annex I Status	Ecological value (NRA guidelines)
Tramore River Depositing Lowland River FW1/Tidal River CW2	The Tramore river is a small river and due to a low gradient has a relatively sluggish flow along most of its length. It has been extensively culverted. Emergent vegetation is common along its banks including Yellow Flag, Common Reed and native Willow. The substrate is generally soft, with occasional weirs and riffle sections with rock substrate. Some areas of concrete riverbed also occur. The river has been extensively culverted. An electrofishing survey of sections of the Tramore River was carried out by Dixon.Brosnan in 2014 (See **Appendix 6.1).** It recorded Brown Trout, European Eel and Three-Spined Stickleback within the main channel. Moderate numbers of Brown Trout were recorded where there was sufficient bankside cover; however long sections which were open and shallow were largely devoid of fish. It is considered improbable that Atlantic Salmon (listed on Annex II of the Habitats Directive) occur in the Tramore River due to poor water quality, limited channel size, lack of holding pools, barriers to migration and limited spawning habitat.	Local Importance (Higher value)

Aquatic Habitat	**Description/ Habitats Directive Annex I Status**	**Ecological value (NRA guidelines)**
	All three Lamprey species are listed on Annex II of the Habitats Directive. The presence of migratory lamprey species (Sea Lamprey and River Lamprey) is unlikely due to barriers to migration and limited spawning habitat. Brook lamprey could potentially occur within suitable areas of habitat. Although areas of silt suitable for juvenile lamprey were noted, no lamprey were recorded during the fish stock survey. Conditions are unsuitable for other Annex II species (i.e. freshwater pearl mussel or crayfish) or Annex 1 habitats (i.e. Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation). Works at St Patrick's Mills will occur adjacent to a tidal section of the river. Grey mullet and Flounder both occur in the lower tidal sections of the Tramore River which is characterised by softer substrate with some areas of gravel. Fluctuating silt levels are typical of the tidal sections of rivers.	
Ballybrack River Depositing Lowland River FW1	The Ballybrack Stream is formed by the confluence of the Grange and Moneygurney Streams. It has a relatively natural flow pattern with areas of gravel suitable for salmonid spawning and a well-developed riparian zone. It supports a population of brown trout. As one of Cork's few urban streams in good condition it is considered by Inland Fisheries Ireland to be an important community resource (M. McPartland IFI, pers. comm.) The section of the Ballybrack Stream to be affected lies within and upstream of the Douglas Community Park. Within the park the channel is narrow and relatively deep with a natural flow pattern. Adult Brown Trout are concentrated in small pools, particularly where there is cover from vegetation or undercut banks. There is a concrete apron at the northern boundary of the park followed by a large concrete culvert. Upstream of the Douglas Community Park the river is initially confined within stone walls and a large section of the riverbed is concreted. Habitat quality improves further upstream where a more natural riffle-glide sequence with gravel substrate is evident. Due to substantial culverting in the lower reaches, the Ballybrack Stream is unlikely to support migratory species such as Salmon, River Lamprey and Sea Lamprey which are listed on Annex II of the Habitats Directive. Although unlikely due to the limited size of the Ballybrack Stream, Brook Lamprey could theoretically occur, however no	Local Importance (Higher value)

Aquatic Habitat	**Description/ Habitats Directive Annex I Status**	**Ecological value (NRA guidelines)**
	significant areas of habitat for lamprey occur within the proposed works area. Due to the presence of culverts in the lower reaches Sea Trout are not expected to occur. Due to the limited size of the stream and underlying geology, crayfish and freshwater pearl mussel will not occur. The Annex 1 habitat Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation does not occur within the works area.	
Grange Stream Depositing Lowland River FW1	The Grange stream is a small watercourse which runs through a narrow and wooded valley before joining the Ballybrack Stream. Due to its limited size and depth and culverting along part of its length, it has limited fisheries potential. The area to be affected by works includes an open length of channel within a car park at the Donnybrook Commercial Centre. This section is isolated by culverting downstream and a vertical drop upstream (coarse screen) and has been heavily modified and straightened. Upstream of the Donnybrook Commercial Centre, the Grange Stream has a more natural riffle-glide structure as it flows through woodland. However silt levels are high with some excessive algal growth and sewage fungus noted. Upstream of the works area is a small tributary, flowing from the west, which is piped from a housing estate and joins the main channel. This stream has obvious signs of nutrient enrichment including sewage fungus and may be contributing to water quality deterioration in the main channel. There are a number of other piped discharges to this stream which may also be impacting on water quality. Whilst the presence of fish species such as Eel and Brown Trout from small deeper pockets of water further upstream cannot be entirely excluded, the areas to be affected are generally shallow and are likely to have very low flow levels during dry weather. Sewage fungus was also recorded within the proposed works area upstream of the Donnybrook Commercial Centre.Thus this small stream is of limited ecological value due to its limited size, water quality impairment and obstacles to free movement of fish.	Local Importance (Lower value)

6.3.7.1 Water Quality Data

Biological Monitoring Data

There is no biological data available for the Tramore River, Grange and Ballybrack Streams (i.e. EPA Q values) as these streams are not included in the standard EPA water monitoring programme. However, the Tramore River is believed to have suffered a degree of water quality impairment in the past.

The Kinsale Road Landfill is located at the Tramore Valley Park, off the Kinsale Road and the Tramore River flows around the southern section of the site before flowing through Douglas. Information from three sampling events at three locations in 2015 is generally indicative of satisfactory water quality with only one slightly elevated BOD reading (4.3 mg/l). A high degree of variation was recorded in pH levels, however results do not indicate significant water quality issues. Further detail is provided in **Chapter 12 Hydrology.**

Table 6.4: Surface water quality results (summarised). Source: Kinsale Road Landfill AER (2015) under the EPA waste licence No. W0012-03.

Sampling Point	Sampling Date	pH	BOD (mg/l)
EM2	11/03/2015	7.67	1
	08/09/2015	8.06	1.7
	01/12/2015	7.71	1.2
EM10	11/03/2015	7.71	2.5
	08/09/2015	8.33	2.9
	01/12/2015	7.53	1.6
EM11	11/03/2015	7.22	4.3
	08/09/2015	8.41	1.1
	01/12/2015	8.11	1.2

In estuarine waterways the EPA rates water quality as Unpolluted, Intermediate, Potentially Eutrophic and Eutrophic. The former two are considered to be indicative of acceptable estuarine water quality, while the latter two water quality ratings are considered as unsatisfactory. **Table 6.5** displays the results for Lough Mahon into which the relevant watercourses ultimately discharge.

Table 6.5: EPA Water Quality Status

Area	Water quality status
Lough Mahon	Estuarine & coastal water quality – Intermediate

Source: EPA Envision map system

Water Framework Directive

The Water Framework Directive (WFD) is a key initiative aimed at improving water quality throughout the EU. It applies to rivers, lakes, groundwater, and coastal waters. The Directive requires an integrated approach to managing water quality on a river basin basis; with the aim of maintaining and improving water quality. The Directive requires that management plans be prepared on a river basin basis and specifies a structured approach to developing those plans. It requires that a programme of measures for improving water quality be brought into effect.

Specifically, the WFD aims to: protect/enhance all waters (surface, ground and coastal waters); achieve "good status" for all waters, manage water bodies based on river basins (or catchments); involve the public; and streamline legislation.

The WFD assesses the water quality of rivers and ranks their status as follows: High, Good, Moderate, Poor, Bad and Yet To Be Determined. The Water Framework Directive also determines the "Risk" level of a river as follows: 1a – At risk of not achieving Good Status, 1b – Probably at risk of not achieving Good Status, 2a – Expected to achieve Good Status and 2b – strongly expected to achieve Good Status. Relevant data for surface waters within the study area, where available, are given in **Table 6.6.**

Table 6.6: WFD data

Watercourse	Status	Risk
Lough Mahon	Good	1a – At risk of not achieving Good Status
SW_Coastalt2_Tramore_1Lower (Includes the lower sections of the Tramore River and the Ballybrack Stream)	Moderate	1a – At risk of not achieving Good Status

(Source: EPA Envision online map database**)**

6.3.8 Mammals

6.3.8.1 Otter

Otters, along with their breeding and resting places, are protected under the provisions of the Wildlife Act 1976, as amended. Otters have additional protection because of their inclusion in Annex II and Annex IV of the Habitats Directive, as transposed into Irish law.

Otters are also listed as requiring strict protection in Appendix II of the Berne Convention on the Conservation of European Wildlife and Natural Habitats and are included in the Convention on International Trade of Endangered Species (CITES). Given that the proposed works will occur along watercourses this species could be theoretically affected by the proposed works.

The NBDC notes that Otter have been recorded within grid square W66. A 2013 report (Atkins/Cork County Council, 2013) notes that signs of otter were recorded at nine locations along the Ballybrack Stream during a survey by the Irish Wildlife Trust. Using genetic evidence, it was concluded that six otters use the Ballybrack Stream. The report notes that it appears that otters can use the culverted structures through Douglas (north of Church Road) and that Douglas Village does not prevent Otters from the Ballybrack Stream entering the estuary.

A survey for otters was carried out within 150m of the proposed works area. Otters are commonly distributed along fish bearing watercourses and coastal habitats in Ireland. Signs of otters are readily identifiable, and include spraints, tracks, holts, resting areas, slides and feeding signs. Although periodic usage of the watercourses within the overall study area may occur, no signs of otter were recorded within the proposed works area. However as noted above otters do occur within the catchment and are likely to move through or feed within the proposed works areas.

6.3.8.2 Bats

All bat species in Ireland are protected under the Wildlife Act 1976, as amended. Bats are also protected under Annex IV of the EU Habitats Directive. Ireland is also a signatory to the Bonn convention (Convention on the conservation of migratory species of wild animals, Bonn 1979) and the Bern convention, 1982 (The Convention on the Conservation of European Wildlife and Natural Habitats), and it has a commitment to the “Eurobats” agreement (Agreement on the Conservation of Bats in Europe, 1991).

The Bat Conservation Ireland National Bat Database, available through the NBDC website, list the presence of four bat species for the 10km^2 grid square W66 (Daubenton’s Bat, Leisler’s, Common Pipistrelle and Soprano Pipistrelle). Bat Conservation Ireland also records Natterer's Bat and Brown Long-Eared bat within 10km of the proposed works.

A bat survey of the Ballybrack Stream valley was carried out in 2013 (Bat Survey of Ballybrack River Valley, Douglas (Buckley, 2013). The survey recorded four species of bat namely Soprano Pipistrelle, Common Pipistrelle, Leisler’s Bat and an unidentified Myotis bat species which was probably Daubenton’s Bat. Activity was concentrated along the Ballybrack Stream particularly within woodland. The survey report does not include any records from within the proposed works area and most of the recorded activity occurred in woodland upstream of the proposed works area. Further survey work was undertaken in June, July and August 2013 by a UCC student. This survey also recorded Soprano Pipistrelle, Common Pipistrelle, Leisler’s Bat and Daubenton’s Bat along the Ballybrack River valley. (Atkins/Cork County Council, 2013).

Dixon.Brosnan carried out night-time bat activity surveys using standard heterodyne/frequency division bat monitors (Batbox Duet) in the period from May to September 2016. All surveys were carried out from 30 minutes prior to dust and lasted for approximately three hours. Conditions were favourable with dry, warm conditions. The surveys consisted of a mixture of emergence surveys and general activity surveys. Emergence surveys were carried out where there were large trees present with the potential to support bat roosts. The survey recorded Common Pipistrelle, Soprano Pipistrelle and Leister's Bat feeding activity within the study area as indicated below in **Table 6.7.**

Table 6.7: Bat activity survey results

Location	Survey Results
Douglas mills **(Emergence/Activity Survey)**	One Soprano Pipistrelle circling and feeding close to the upstream culvert. Although there was feeding activity in proximity to the culvert, no bat emergence was recorded. Sporadic overflying of downstream section of the site by Soprano Pipistrelle.
Donnybrook Commercial Centre **(Activity survey)**	Some Common Pipistrelle activity on the woodland edge along the site (1-2 bats). No activity was recorded along the stream channel which runs through the commercial centre. It is noted that subsequent to bat surveys being completed, an additional area of the Grange Stream upstream of the commercial centre was included in the flood relief scheme. Not all of this area was therefore surveyed. It is likely to provide some feeding habitat for common bat species and is part of a much larger woodland area which extends approximately 1km further upstream.
Douglas Community Park to upstream boundary of the proposed development **(Emergence/Activity Survey)**	Common and Soprano Pipistrelle feeding activity (3 bats) was observed. Concentrated close to the ICA Hall building and associated grassland with sporadic activity along the river channel. No evidence of emergence was noted for any of the mature trees adjoining the river.
Ballybrack Woods **(Emergence/Activity Survey)**	Soprano Pipistrelle (uncertain number) was recorded feeding upstream of the proposed works area. No evidence of emergence was noted for any of the trees within the woodland areas.
Upstream boundary of Togher Culvert **(Emergence/Activity Survey)**	Pipistrelle (unidentified species) recorded feeding along woodland edge. Approximately 2-3 individuals. One Leisler's bat was recorded overflying the site. No evidence of emergence was noted for any of the trees within the woodland areas.

Location	Survey Results
Open sections of Tramore River (Togher) **(Emergence/Activity Survey)**	No bat activity recorded.

The surveys found that bat activity was low to moderate, with Common and Soprano Pipistrelle the predominant species. Only small numbers of individuals were recorded. The results indicate that the habitats within the proposed works area are of local value for feeding bats.

Although some mature trees are present within the study area no specific bat roosts or emergence points were recorded. A detailed tree survey was carried out within the works area and is included as **Appendix 6.4** of this EIS. The Tree survey report noted that there is a paucity of mature and veteran trees within the survey area which have the potential to be of high value as bat roosts. The trees identified as being of significant potential value as bat roosts were as follows: two older beech trees close to the ICA Hall in Douglas (Tree no. 812 and 813) and a sycamore (Tree no. 863), and a veteran Ash (Tree no. 873) adjoining the Lehenaghmore Industrial Estate. An Alder (Tree no. 838) in a woodland area at the upstream boundary of the works area on the Ballybrack Stream) had attached bat boxes. It will be not be possible to retain the trees in Douglas (812,813). It is intended that the trees adjoining the Lehenaghmore Industrial Estate (863,873) and the tree with bat boxes close to the Ballybrack Stream (838) will be retained.

No bats were specifically recorded emerging from these trees, however specific mitigation measures will be employed with respect to all trees.

6.3.8.3 Other mammals

Other protected mammal species listed in the NBDC databases for grid square W66 include Wood Mouse, Sika Deer, Hedgehog, Irish Hare, Badger and Irish stoat. Red Squirrel is known to occur within the Ballybrack woodland (Atkins/Cork County Council, 2013, Carl Dixon pers. Observation 2017). Several invasive mammals have also been recorded including Feral Ferret and American Mink. No protected mammals were recorded during site surveys although some common species including Brown Rat, Rabbit and Fox were recorded.

6.3.9 Reptiles and Amphibians

According to records held by the NBDC, Common Frog and Smooth Newt have been recorded in square W66. Common Lizard has not been recorded in W66. Common Frog is listed in Annex V of the EU Habitats Directive and is protected under the Wildlife Act 1976, as amended. No suitable habitat for these species will be affected by the proposed works.

6.3.10 Birds

A total of 99 birds have been recorded in grid square W66 according to the NBDC database. Annex I bird species which have been recorded include Kingfisher, European Nightjar, Little Egret, Peregrine Falcon, Ruff and Golden Plover. Red list species include Northern Shoveler, European Nightjar, Yellowhammer, Herring gull, Black-headed gull, Curlew, Golden plover, Redshank, Barn Owl, and Lapwing.

6.3.10.1 Bird Surveys

Bird surveys were carried out by Dixon.Brosnan during the period from June to October 2016 in conjunction with habitat surveys. Additional observations were made in April 2017. The bird species noted within the study area consist of a mix of common terrestrial bird species which typically occur in a suburban landscape and more specialised species associated with aquatic habitats. A nest box (probably for Dipper) was noted along the river close to the ICA hall. It is uncertain as to whether this has been used in the past and it was not in use in April 2017.

Common bird species recorded during site surveys included Bullfinch, Hooded Crow, Rook, Jackdaw, Magpie, Woodpigeon, Swallow, Dunnock, Great Tit, Long Tailed Tit, Song Thrush, Blue Tit, Greenfinch, Goldfinch, Wren, Robin, Pied Wagtail and Blackbird.

Bird species which were recorded and which are associated with aquatic habitats were as follows: Little Egret, Grey Heron, Grey Wagtail, Mallard and Dipper. Kingfisher was not recorded within the study area. Cormorant was recorded over flying the study area.

Certain bird species are listed by BirdWatch Ireland as Birds of Conservation Concern in Ireland (Lynas et al., 2007). Red List bird species are of high conservation concern, and Amber List species are of medium conservation concern. One Red Listed species was recorded (Grey Wagtail) and three amber listed species were recorded (Swallow, Greenfinch and Robin). Little Egret is listed on Annex 1 of the Birds Directive.

Overall, the study area is of local value for a range of terrestrial bird species that are relatively common in the Irish countryside. The presence of watercourses provides additional habitat for more specialised species.

6.3.11 Invertebrates

Records from the All-Ireland Non-marine Molluscan Database and EPA river biologists' data available through the NBDC website, show that 54 species of non-marine mollusc have been recorded from grid square W66.

No non-marine molluscs which are classified as endangered have been recorded from grid square W66. Moss Bladder, Copse Snail and Tree snail are listed as 'vulnerable'. The recorded species Silky Snail, Gobular Pea Mussel and Common Whorl Snail are listed as 'near threatened'.

Out of a total of 21 species recorded in grid square W66 in the Water Beetles of Ireland database and the EPA River Biologists' Database, none are listed as 'critically endangered', 'endangered' or 'vulnerable' in the Irish Red Data list for water beetles.

Including records held by Moths Ireland, the Butterflies of Ireland Dataset at the National Biodiversity Data Centre, records held by the National Parks and Wildlife Service and records published in the Distribution Atlas of Butterflies in Ireland 1979, 22 species of butterfly and 300 species of moth have been recorded from grid square W66.

Five species of butterfly which have been recorded in grid square W66 have threat assessments and one has an EU Annex status. Wall is listed as 'endangered'; Marsh fritillary is listed as 'vulnerable' and is also an Annex II species; Dark green Fritillary is listed as 'vulnerable', and both Wood White and Gatekeeper are listed as 'near threatened'. None of the recorded moths have any formal threat assessment.

A total of nine species of odonates (dragonflies and damselflies) have been recorded from grid square W66 in the Dragonfly Ireland dataset available through the NBDC website. None are listed as 'critically endangered', or 'endangered' in the Irish Red Data list for dragonflies and damselflies. Scarce blue-tailed is listed as 'vulnerable' and is present in W66.

A search of National Biodiversity Data Centre records showed that, of the 33 species of Irish mayflies, only one species, *Serratella ignita*, has been recorded in square W66. This species is not listed as being 'endangered' in the Irish red data list for mayflies.

It is noted that the habitats to be affected are not of high ecological value and the presence of specialised or uncommon invertebrate species is considered unlikely. In this context, no specialised surveys for invertebrates was considered necessary.

6.4 Characteristics of the Proposed Scheme

The proposed works will impact on existing structures including river bank walls, culverts, bridges and roads and will impact on bankside vegetation. Excavation of soil and river bank material will be required for foundations, regrading, river widening and deepening, and trash screen construction. Channel realignment will require excavation and regrading of the existing channel. Excavated material will be reused on-site or in the wider flood relief works areas where possible, for example in embankments. A detailed description of the scheme is presented in **Chapter 3 Description of the Proposed Scheme** and the proposed scheme drawings are in **Appendix 3.1**. The main aspects of the proposed flood relief scheme comprise construction works entailing the following:

- Construction of new flood defence walls and/or replacement of existing walls with new flood defence walls
- Replacement of and/or extension of existing culverts
- Removal of and/or replacement of bridges

- Removal of existing trash screens and construction of new trash screens
- Local channel widening, deepening, realignment and regrading of river channel and bank stabilisation
- Construction of new earthen flood defence embankments
- Construction of 2 no. underground surface water pumping stations
- Relocation of 2 no ESB substations/kiosks close to their existing locations
- Provision of civil works such as road/footpath re-grading at a number of locations
- Removal of vegetation and trees to facilitate construction works
- Protecting drainage outlets along the line of flood defence works with non-return valves;
- Local diversion of services where necessary to facilitate construction
- Landscaping and tree planting
- Once construction is completed, ongoing maintenance of the river channel, trash screens etc.

6.5 Evaluation of Impacts

During construction, potential impacts could arise from impacts on water quality from excess siltation or inadvertent spills of hydrocarbons and impacts from the spread of invasive species. There will be a net loss of riparian habitat including a number of trees and there will be some loss of open channel habitat. There will be increased noise and disturbance during construction. These potential impacts are assessed in more detail below.

6.5.1 Impact Appraisal

When describing changes/activities and impacts on ecosystem structure and function, important elements to consider include magnitude, duration and probability of occurrence (IEEM, 2006).

Magnitude refers to the 'size' or ‘amount’ of an impact, determined on a quantitative basis if possible. Duration refers to the time for which the impact is expected to last prior to recovery or replacement of the resource or feature. This should be defined in relation to ecological characteristics (for example species’ lifecycles) rather than human timeframes. Appropriate criteria for the assessment of magnitude and duration for this project are provided in **Tables 6.8 and 6.9** below.

Table 6.8: Criteria for Determining the Magnitude of Ecological Impacts

Magnitude	Examples
Very High	e.g. The proposal (either on its own or with other proposals) will result in – The total loss of or very major alteration to key elements/features of the baseline conditions such that post-development/character/composition/attributes will be fundamentally changed and may be lost from the site altogether.
High	e.g. The proposal (either on its own or with other proposals) will result in – Major alterations to key elements/features of the baseline (predevelopment) conditions such that post-development/character/composition/attributes will be fundamentally changed.
Medium	e.g. The proposal (either on its own or with other proposal) will result in – The loss of or alteration to one or more key elements/features of the baseline conditions such that post-development/character/composition/attributes of baseline would be partially changed.
Low	e.g. The proposal (either on its own or with other proposals) will result in – A minor shift away from baseline conditions. Change arising from the loss/alteration will be discernible but underlying character/composition/attributes of baseline conditions would be similar to predevelopment circumstances/patterns.
Negligible	e.g. The proposal (either on its own or with other proposals) will result in – A very slight change from baseline condition. Change barely distinguished approximating to the "no change" situation.

Table 6.9: Criteria for assessment of duration.

Duration	Criteria
Permanent	Effects continuing beyond one human generation (c.25 years) are expected. There is likely to be a substantial improvement after this period, whereby these would be described as "very long term effects."
Temporary	Long term-(15-25 years) Medium (5-15 years) Short term (0-5 years)

It is important to consider the likelihood that a change/activity will occur as predicted and also the degree of confidence in the assessment of the impact on ecological structure and function. The following scale (IEEM, 2006) is often utilised in ecological assessment:

- Certain/near-Certain: probability estimated at 95% chance or higher.
- Probable: probability estimated above 50% but below 95%.
- Unlikely: probability estimated above 5% but less than 50%.
- Extremely Unlikely: probability estimated at less than 5%

Based on the above and the value of habitats and species a matrix of significance can be used to determine specific impacts. This matrix is shown below in **Table 6.10.**

Table 6.10 Impact Matrix

Impact Significance		Ecological Value				
		Very High	**High**	**Medium**	**Low**	**Negligible**
Magnitude	Very High	Major	Major	Major	Moderate	Minor
	High	Major	Major	Moderate	Minor	Negligible
	Medium	Major	Moderate	Minor	Minor	Negligible
	Low	Moderate	Minor	Minor	Negligible	Negligible
	Negligible	Minor	Negligible	Negligible	Negligible	Negligible

6.5.2 Do nothing scenario

In the absence of the proposed works, it is expected that habitats would remain generally similar with trees becoming more mature over time. Water quality is likely to remain broadly similar in the absence of significant changes in the catchment. However Japanese Knotweed is likely to spread if active control measures are not implemented.

6.6 Predicted Impacts on Terrestrial Habitats

6.6.1 Predicted Impacts on Terrestrial Habitats

Impacts on terrestrial habitats are generally restricted to direct removal of habitats and possible impacts from the spread of invasive species. Levels of dust during construction are predicted to be low and effectively managed by mitigation. The impact on vegetation in adjoining habitats from wind-blown dust is predicted to be negligible. No rare floral species were recorded within the study area. Based on the criteria outlined by the IEEM, as described above, the predicted impacts are detailed in **Table 6.11.**

Table 6.11: Impacts on Terrestrial Habitats

Habitat	Ecological value (NRA guidelines)	Predicted Impact
Treelines WL2	Local importance (Higher value)	Minor to moderate
Hedgerow WL1	Local importance (Low value)	Negligible
Dry meadow and grassy verge GS2	Local importance (Low value)	Negligible
BL1 Stonewalls and other stonework	Local importance (Low value)	Negligible
Wet willow-alder-ash woodland WN6	Local importance (Higher value)	Minor
Mixed Broadleaved woodland WD1	Local importance (Higher value)	Minor to moderate
Amenity grassland GA2	Local importance (Low value)	Negligible
Scattered trees and parkland WD5	Local importance (Low value)	Minor

Habitat	Ecological value (NRA guidelines)	Predicted Impact
Buildings and artificial surfaces BL3	Local importance (Low value)	Negligible
Immature woodland WS2	Local importance (Higher value)	Minor

6.6.2 Predicted Impacts on Aquatic Habitats

With respect to aquatic habitats there a number of potential impacts which can occur during the construction phase and following completion. These are summarised below. Predicted impacts for the different sections of the proposed works are specifically addressed in **Table 6.12.** Potential impacts could arise from loss of habitat due to culverting and in-stream works and from loss of riparian habitat which provides food, cover and shade and helps to stabilise river banks.

Significant impacts on fish populations of Brown Trout and European Eel and on macroinvertebrate populations could occur due to such loss of habitat. No Brook Lamprey were recorded during fish stock surveys, however this species could potentially be present.

Potential impacts associated with construction include the mobilisation of high levels of silt. High silt levels can impact on lamprey and salmonid spawning habitat. Excessive siltation can cause salmonid eggs and fry to be smothered. Spawning salmonids and lamprey are likely to avoid traditional spawning areas due to excessive silt deposits. Adult fish may also be affected by increased silt levels as gills may become damaged by exposure to elevated suspended solids levels. High silt levels may also impact on macroinvertebrate populations and on aquatic flora.

Potential impacts may arise via inadvertent spills of hydrocarbons due to poorly maintained machinery or inadequate storage. Due to the limited size of watercourses within the project area, relatively small volumes of polluting material could have a significant impact.

Potential impacts on otter could occur via the following: increased noise and disturbance, potential impacts on prey availability, potential impacts on resting areas/holts and potential impacts on movement of otter along watercourses.

Notwithstanding that there has already been significant culverting of watercourses, additional culverting may further restrict the movement of fish and may lead to a net loss of habitat. Modifications of the river channel structure may result in the loss of habitat for particular age classes of fish i.e. riffle for juvenile fish or pools for adult fish. Such changes may impact on population dynamics. Impacts on fish populations can reduce prey availability for piscivorous birds such as Heron or macro-invertebrate prey items for Dipper and Grey Wagtail, with knock on effects on breeding success.

It is noted that the replacement of sections of concrete stream bed with natural gravels has the potential to improve habitat quality in certain sections of the works area. It is also noted that flooding in urban areas can introduce deleterious substances into watercourses including hydrocarbons. Prevention of flooding minimises the risk of such occurrences.

Table 6.12: Impacts on aquatic habitats

Aquatic Habitat	Ecological value (NRA guidelines)	Predicted Impact
Tramore River Depositing Lowland River FW1 (Proposed works at Togher)	Local Importance (Higher value)	A number of measures are proposed for the upper reaches of the Tramore River in Togher. The proposed works include the following: • Existing trash screen structure to be removed and replaced with new screen and defence walls. • It is proposed to construct a boundary wall along the open channel on the Lehenaghmore Road over a distance of approximately 30m to the Togher Road roundabout. • New concrete culvert to replace existing culverts at two locations • The existing channel will be widened by 1 metre. A new concrete retaining wall will be provided. Extensive culverting within the upper sections of the Togher River has reduced habitat quality considerably. Electrofishing in proximity to the Lehenaghmore Industrial Estate found that Brown Trout were absent with only a small number of European Eel recorded. In this context, the replacement of existing culverts and a trash screen and the removal of an existing trash screen is not predicted to have any impact on fish movement within this section of the river and will not result in any net loss of aquatic habitat. The long-term impact from these works is predicted to be negligible. The construction of a wall at the section of channel upstream of the Togher Roundabout will result in the loss of riparian vegetation. This section of the Tramore River is completely isolated by upstream and downstream culverts and is heavily shaded. The long-term impact will be negligible. In-stream works associated with widening works have the potential to generate elevated levels of silt. The habitat to be affected is not of high value from an ecological viewpoint as the channel has been highly modified with a concrete riverbed. A natural substrate will be provided which will provide more natural conditions. The impact will be minor in the short term, and negligible in the long term.
Tramore River Tidal River CW2 (Proposed works at St. Patricks Mills, Douglas)	Local Importance (Higher value)	A new flood defence wall will be constructed along the right bank of the Tramore River. Construction of a new parapet wall over the R581 bridge is also proposed. Construction of underground surface water pumping station. The river is tidal at this location. There will be no direct impacts on the river itself and no significant changes in the ecological functioning of the river. No significant impacts on water quality are predicted to occur. The long-term impact is predicted to be negligible.

Aquatic Habitat	**Ecological value (NRA guidelines)**	**Predicted Impact**
Ballybrack Stream Depositing Lowland River FW1	Local Importance (higher value)	A number of measures are proposed for a section of the Ballybrack Stream. The proposed works include the following: • Widening and deepening of the Ballybrack Stream channel in the southern half of the Douglas Community Park and local regrading in the northern half. • Upstream of the community park channel at various locations, widening will be carried out to increase the width of the channel. • New flood defence wall will be constructed at various locations. The total length of river affected will be approximately 200m. • Existing culvert to be replaced at Church Road. • Three small pedestrian/cycle bridges will be removed (ICA Bridge, Church Road cycle track bridge and Ballybrack Woods cycle track bridge) and the Lower Ravensdale Bridge will be replaced with a wider bridge. • A larger trash screen will be installed in Ballybrack Woods. The coarse screen in Ballybrack Woods will consist of galvanised steel posts and will be designed with a bar spacing of 0.3m. During works, there will be mobilisation of silt, which can be limited but not prevented by mitigation, and there will be a net loss of habitat for invertebrates and fish during the in-stream works period. This is considered a moderate, short term impact. Downstream of the works area there is a culvert followed by a tidal section of the Tramore River. The habitats and species found within tidal rivers are adapted to fluctuating silt levels and impacts on such habitats are likely to be minor in the short term. The long-term impact will be negligible. In the longer-term modification of the existing channel, via deepening and widening will affect a mixture of modified and natural river channel which supports macroinvertebrate populations as well as a population of Brown Trout and European Eel. Widening of the channel can potentially result in a shallower river which lacks sufficient depth and holding pools for adult fish and which can heat up excessively during hot weather. The provision of a low flow channel and a natural channel structure will minimise such impacts. The removal of sections of concrete base and replacement with gravel will improve habitat quality for macroinvertebrate populations and fish and thus provides a net beneficial impact. The replacement of a culvert and provision of a bigger trash screen are not predicted to create any new impediments to fish movements. The loss of riparian vegetation and provision of new walls will have a detrimental impact on aquatic ecology. Riparian trees provide shade, insects from trees and leaf litter provides sources of nutrients and undercut roots provide refuges for fish. Overall it is

Aquatic Habitat	Ecological value (NRA guidelines)	Predicted Impact
		predicted that there may be changes in population dynamics and population size of fish populations within the affected areas, but these areas will continue to support fish populations and there will an ecological benefit in terms of more natural substrate in certain areas. The loss of riparian habitat will be a permanent negative impact. It is concluded therefore that the long-term impact will be minor.
Grange Stream Depositing Lowland River FW1	Local Importance (Lower value)	Permanent removal of one trash screen and replacement of a second trash screen is proposed. The existing channel to be regraded to remove sedimentation. Channel banks will be reinforced with rock armour as required. Culverting will be replaced. The loss of riparian vegetation will have a detrimental impact on aquatic ecology. Riparian trees provide shade, insects from trees and leaf litter provides sources of nutrients. In the longer term, modification of the existing channel, via regrading works will affect a mixture of modified and natural river channel which supports macroinvertebrate populations. In-stream works have the potential to generate high levels of silt. Overall the habitat to be affected is not of high value from an ecological viewpoint due to the limited size of the stream. The impact from works is predicted to be minor in the short term and negligible in the long-term.

6.6.3 Predicted impact from invasive species

In the absence of development, the infestation of Japanese Knotweed will continue to spread due to lateral rhizome growth and from dispersal of plant fragments downstream. Works could potentially accelerate that process if fragments of the plant are fragmented and dispersed during site works. This could occur via transport of root fragments outside of the immediate growing area from the movement of vehicles or due to root fragments being dislodged and washed downstream during works.

The preferred treatment method for Japanese Knotweed is to treat an infestation in situ as this minimises the risk of spreading the plant. This process has already commenced with two treatments in 2015 and two treatments planned for 2017. Surveys in 2016 and 2017 indicate that the initial treatments did not kill off this species where it occurs, with some regrowth noted. However, further treatments would be expected to significantly reduce the vigour of this species and may be sufficient to eradicate it from the works area before works commence. However, there remains the potential for this species to spread in the absence of effective mitigation.

6.6.4 Otters

A survey by Dixon.Brosnan in 2016 did not record the presence of otter within a radius of 150m from the works area. Although periodic usage of the works area is likely to occur, it is unlikely that the works areas will provide critical resources for this species during the construction period. During construction works there will be increased noise and activity associated with the site works.

It is noted that otters are largely nocturnal, particularly in areas subject to high levels of disturbance. Otters can habituate to high background levels of noise and disturbance as evidenced by the presence of otters in the centre of Cork City.

As a worst-case scenario, the works could cause some temporary disturbance/displacement of otter from a given section of watercourse. Whilst this could potentially disrupt feeding patterns, given the short-term nature of the disturbance, the often-nocturnal habits of otter and the ability of otter to move away from disturbance the long-term impact on the feeding behaviour of this species is predicted to be negligible.

The use of the walkways and parks by people and dogs along with the lack of cover makes large sections of the works area unsuitable for otter breeding or resting areas and no such areas were detected within the study area. Overall therefore the impact of the proposed route on breeding otters is predicted to be negligible.

With respect to feeding, there may be short-term impacts on water quality which could impact on prey availability. High silt levels could cause temporary changes in otter movement through the catchment. In the short-term the sections of watercourses to be affected will form only part of the territory of otters within the catchment and other feeding resources will be available.

Whilst there will be some changes to channel structure the specified mitigation measures, including the provision of dry water channels and natural substrate, will minimise longer term impacts on fish stocks. Thus there is expected to be a short-term, minor impact on otter feeding within the study area during site works.

With regard to commuting patterns, a 2013 report (Atkins/Cork County Council, 2013) notes that signs of otter were recorded at nine locations along the Ballybrack Stream during a survey by the Irish Wildlife Trust. Using genetic evidence, it was concluded that six otters use the Ballybrack Stream. The report notes that it appears that otters can use the culverted structures through Douglas (north of Church Road) and that Douglas Village does not prevent Otters from the Ballybrack Stream entering the estuary. If otters cannot access the estuary during the works there could be a detrimental impact on otter populations. Therefore, it is important that the site works do not create obstacles to the free movement of otters between the Ballybrack Stream and the estuary.

Based on the above the impact on otter populations is predicted to be minor in the short term and negligible in the long-term.

6.6.5 Bats

Bat surveys did detect usage of the proposed development area by Common Pipistrelle, Soprano Pipistrelle and to a lesser extent by Leisler's Bat. Daubentons Bat have also been recorded within Ballybrack Wood. There will be a net loss of feeding habitat including treelines, grassland and woodland. There is no evidence that the treelines to be affected provide significant connective routes within the landscape and following completion of works the watercourse sections will remain as linear features. Due to the presence of significant culverting along the Tramore River there has already been considerable interruption of this linear feature as a potential commuting route for bats. Recreation of a natural river structure and substrate along the Ballybrack Stream is expected to allow aquatic macroinvertebrate populations, on which bats may feed, to recover to pre-existing levels. No evidence of breeding bats was recorded from trees to be removed by emergence surveys. Overall the impact will be localised and is unlikely to significantly impact on overall bat populations as there will be no loss of critical resources for bats. However, there will be a long-term permanent impact due to the loss of natural habitat which provides feeding areas for bats. Based on the above the short-term and long-term impact on bats is predicted to be minor.

6.6.6 Impacts on birds

The terrestrial bird species recorded during bird surveys are typical inhabitants of the types of habitat noted within the works area and are generally common. There will be a net loss of semi-natural habitats within the proposed development area (woodland, treeline and grassland) and this loss will have a localised impact on nesting and feeding resources for these species. Overall, the loss of habitat for breeding and feeding birds within the development site is considered a permanent minor impact. Some disturbance/displacement of terrestrial birds may occur during construction due to increased noise and disturbance. This is considered a minor, short-term impact.

High turbidity levels during construction or accidental hydrocarbon spills may impact on feeding success for aquatic birds such as Grey Heron, Dipper and Little Egret within and downstream of the works area. However relatively small sections of the overall catchment will be affected and there will be other feeding resources available for these species during the construction period. The impact during construction is therefore predicted to be short-term and minor. In the longer-term changes in the channel structure may lead to changes in population structures for fish and macroinvertebrates and it will take time before stable ecological conditions occur in areas where in-stream works have occurred. Thus there may be medium-term impacts on prey availability for predatory species. However this is unlikely to be of sufficient severity to significantly impact on populations of birds within the overall catchment. The impact is predicted be minor in the short-term (0-2 years) and minor to negligible in the long-term.

6.6.7 Impacts on other fauna

Mammal species which are protected under the Irish Wildlife Act 1976, as amended, such as Pygmy Shrew, Red Squirrel, Hedgehog and Stoat could potentially occur within the proposed works area, although no signs of these species were recorded. No habitats suitable for amphibians or reptiles will be affected by the proposed works. No uncommon invertebrate species are predicted to occur. Aquatic macroinvertebrates will re-colonise areas of stream substrate. Given that small areas of relatively common habitat will be affected, any impact on these species will be short-term and minor to negligible.

6.6.8 Impacts on designated sites

Two pNHAs are hydrologically connected to the works namely Douglas River Estuary (0.5km away) and Dunkettle Shore (4km away). Air emissions will be negligible and no significant impacts on water quality are predicted to occur. In this context and in the context of the robust nature of estuarine habitats and the dilution provided in the estuarine environment, the impacts on these sites is predicted to be minor in the short-term and negligible in the long term.

The Cork Harbour SPA and Great Island Channel SAC are located 0.4km and 6.9km respectively from the proposed works area. Impacts on Natura 2000 sites are specifically addressed in **Appendix 6.5** (Information report provided for AA Screening). The authors of this report have concluded that it is possible to rule out likely significant impacts on all Natura 2000 sites and in addition that the proposed development will not have a significant impact on qualifying interests and conservation objectives for Natura 2000 sites, and that the integrity of these sites will not be adversely affected. No significant direct, indirect or cumulative impacts on Natura 2000 sites have been identified. It is the opinion of the authors of this report that is it is not necessary to undertake any further stage of the Appropriate Assessment process.

6.6.9 Climate change and biodiversity

The EU Commission guidance document on integrating climate change and biodiversity into environmental impact assessment (EU Commission, 2013) aims to improve the way in which climate change and biodiversity are integrated into Environmental Impact Assessment. Key principles specified by the document when considering impacts include the following:

- Consider climate change at the outset
- Analyse the evolving environmental baseline trends
- Take an integrated approach
- Seek to avoid biodiversity and climate change effects from the start
- For biodiversity, EIA should focus on ensuring 'no net-loss'
- Assess alternatives that make a difference in terms of climate change and biodiversity
- Use ecosystem-based approaches and green infrastructure as part of the project design and/or mitigation measures.

- Assess climate change and biodiversity synergies and cumulative effects which can be significant

No significant interactions between the impacts on biodiversity resulting from this development and climate change have been identified.

In relation to biodiversity, it is important to adopt an "ecosystem approach which considers all of the different ecological elements and how they interact with each other. Watercourses are important as linear connective elements within the wider landscape and the works will not significantly impact on this ecological function. Sympathetic landscaping using native species will minimise the loss of trees and terrestrial habitat.

6.6.10 Cumulative impacts

Cumulative impacts on fauna chiefly relate to increased noise and activity levels and the possibility of impacts on water quality. Impacts could also arise in relation to movement of fish through the catchment.

The watercourses are situated within urban/suburban areas and subject to existing pressures. These include water quality issues, barriers to migration and elevated levels of background noise. There are no known substantive developments which are likely to lead to cumulative impacts. If large scale construction projects were proposed they will incorporate appropriate mitigation to minimise cumulative impacts.

Increases in noise/disturbance is likely to be most pronounced during construction. This is a short-term impact which will be localised. The works will take place in the context of suburban areas with relatively high levels of background noise to which fauna to a degree will be habituated. In this context no significant cumulative noise and disturbance impacts are predicted.

A range of mitigation measures will be implemented as standard during construction. There will be temporary impacts on water quality however no long-term impacts related to construction are predicted and no significant cumulative impacts have been identified.

Post construction the works could theoretically impact on fish movement within the catchment particularly as there are large culverts in place. However, no additional barriers to migration are predicted with respect to fish movement. The removal of trash screens in the Grange Stream may have a net beneficial impact. Thus, culverting will not result in significant changes to the existing situation or have a cumulative impact.

6.7 Mitigation Measures

The likely success of the proposed mitigation measures is high, either in their current form or as they will be adapted on-site to achieve the desired result. The mitigation measures have been drawn up in line with current best practice and include an avoidance of sensitive habitats at the design stage. It is clear in what the mitigation measures are designed to achieve in lowering or reducing the risk of impact to acceptable levels. Whilst the proposed methods of mitigation may be amended and supplemented the risk that the mitigation measures will not function effectively in preventing significant ecological impacts is low.

6.7.1 Construction Phase Mitigation Measures

Chapter 4 Construction Activities details the construction methodology for the proposed development and the associated environmental controls to minimise construction impacts. This will be developed further prior to construction into a detailed Construction and Environmental Management Plan (CEMP) by the appointed Contractor.

6.7.1.1 Mitigation – Protection of habitats

To prevent incidental damage by machinery or by the deposition of spoil during the site clearance stage, any trees earmarked for retention will be securely fenced early in the construction phase. A tree survey has been carried out for the site which specifies which trees should be retained where it is feasible to do so (See **Appendix 6.4**). All of the trees which can be retained will be clearly marked with hazard tape and the contractor should be made aware of the necessity of protecting the root structure from machinery damage.

Inadvertent damage to river banks on the margins of the works area or damage to vegetation can destabilise river banks and result in long term erosion and siltation. It is important therefore that the works area is adequately fenced and that works are confined to the works area. Access routes will also be clearly defined.

6.7.1.2 Mitigation - Invasive species

Stands of Japanese Knotweed were located within the proposed works area in proximity to the Ballybrack Stream within and upstream of the Douglas Community Park.

This area was sprayed twice during 2015 as part of a treatment programme. Observations in October 2016 indicate that regrowth has occurred but is less vigorous. The treatment programme will be continued via two treatments in 2017. This will be carried out by a suitably qualified contractor and in line with the provisions of the relevant guidelines.

It is noted that it is not possible to accurately predict the success of the spraying programme in advance. Whilst the spraying programme will result in considerable die off of the plant it may not be entirely eradicated. The root can stay dormant in the soil for long periods and when exposed to light, air and water can start to regrow.

Therefore, the entire works area will be resurveyed immediately prior to the commencement of works. The mitigation measures outlined below can then be incorporated into a specific invasive species management plan based on the most up to date information prior to the commencement of treatment. Further details on the management of non-native invasive species are also provided in **Appendix 4.1** of this EIS.

The management plan will make reference to and use of relevant guidelines including Best Practice Management Guidelines – Invasive Species Ireland

(Maguire et al. 2008), NRA (2010), Best Practice Management Guidelines Japanese knotweed Fallopia japonica (2008) prepared for NIEA and NPWS as part of Invasive Species Ireland. Appropriate methods are also outlined in Irish Water guidelines (Irish Water Report Information and Guidance Document on Japanese Knotweed Asset Strategy and Sustainability).

The management plan will take account of a range of factors including the timeframe in which the work needs to be completed, structural or environmental/ecological features (e.g. watercourses, treelines nesting birds), designated sites, availability of storage areas for contaminated spoil on or off site, access issues and agreement with landowners, seasonal restrictions to work and financial constraints.

To minimise risks in the longer term, a monitoring programme will be put in place for three years following the completion of site works. Where Japanese Knotweed re-emerges within the works area an in-situ herbicide treatment programme will be implemented.

Whilst the exact detail to be provided in the management plan can only be specified following repeat surveys prior to construction, the following information/measures will be provided in the management plan:

- Any areas of Japanese Knotweed identified by the survey prior to construction will be marked to within 7m of each individual stand or plant using hazard tape.
- It is imperative that Japanese Knotweed does not damage flood defences in the future and a root barrier should be put in place for all site works along the Ballybrack Stream.
- A supervising ecologist will be present on site, during any works within 7m of a Japanese Knotweed plant to identify pieces of Japanese Knotweed fragments and to determine the volume of spoil to be removed if this is required.
- Fine nets/silt curtains will be specifically employed downstream of works within areas contaminated with Japanese Knotweed. The purpose of the curtains to catch fragments of Japanese Knotweed dislodged by the site works.

  The supervising ecologist will regularly inspect the nets, remove fragments where possible or determine when the nets should be replaced.
- Methods for treatment of Japanese Knotweed and treatment of contaminated spoil will be specified if required. It is noted that some treatment methods may require an offsite area where Japanese Knotweed can be buried and or bunded. Site selection must take into account environmental/ecological sensitivities and site appropriate mitigation measures will be specified in the management plan. Possible treatment options, if required, include the following:
  - Herbicide treatment;
  - Combined treatment methods;
  - Excavation and Burial;
  - Excavation and Bund Method;
  - Excavation and Root Barrier Cell Method;
  - Removal of contaminated soil to landfill.

- It is noted that if Japanese Knotweed has been treated with a persistent herbicide, the excavated material may to be classified as hazardous waste and may need a Waste Permit if it is removed off site. Furthermore, if Japanese knotweed contaminated material is removed off site it will require a licence from the National Parks and Wildlife Service in advance of any removal, in accordance with the European Communities (Birds and Natural Habitats) Regulations 2011 (SI 477).
- Appropriate site hygiene protocols will be deployed throughout the process. This will include the following:
  - Only vehicles required for the works within the contaminated works area should be brought on site and the number of visits minimised as much as practicable. Vehicle movements within this area should be kept a minimum
  - A specialised wash down area will be created for machinery and footwear. All machinery and equipment (including footwear) should be power washed prior to leaving the contaminated works area within this wash down area They should also be visually checked for clods of soil, bits of vegetation etc. and particular care is required with tracked machinery.
  - This wash down area will be located in close proximity to existing stands and the wash down area will be included in the post-works treatment programme for Japanese Knotweed.
  - Ideally works including site investigation works should be undertaken in dry weather to minimise the potential for dispersal of fragments of invasive species.
  - The areas where contaminated soil is to be stockpiled will be clearly marked out on site. Unauthorised access to these areas will be prevented.
  - Any trucks used to transport contaminated spoil offsite must be sealed so that no fragments of material can escape on route. Vehicles leaving the site will be inspected for any plant material and washed down into a contained wash down area.
- To prevent Japanese Knotweed from outside the site being inadvertently being brought in to the site, the contractor will inspect vehicles before usage on site. Particular attention is required for vehicles with caterpillar tracks. The supplier of fill will be required to provide a guarantee that imported material does not contain Japanese Knotweed. In addition, the fill will be inspected for signs of knotweed, prior to importation to site. The UK Environmental Agency's publication *Managing Japanese knotweed on development sites - The Knotweed Code of Practice* (EA 2013), states that inspection of topsoil brought into the site, should be carried out using the guidance in Appendix I-IV of the code BS 3882:2007 '*The British Standard Specification for topsoil and requirements for use*'. This Standard was replaced subsequently by BS3882:2015 *Specification for Topsoil.* The inspection of fill will be carried out according to this Standard.

6.7.1.3 Protection of water quality

The employment of good construction management practices will minimise the risk of pollution of soil, storm water run-off, seawater or 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).

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.
- Vehicles will not be left unattended during refuelling.
- 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.
- Adequately size spill kits will be provided.
- Collection systems will be used to prevent any contaminated drainage entering surface and groundwater.
- Silt curtains will be installed within the works area during in-stream works. These silt curtains must be effectively installed and must be monitored and maintained during works to ensure they are operating effectively.
- Ensure that all staff are trained and follow vehicle cleaning procedures. Wash down from machinery and in particular concrete trucks must be prevented from entering watercourses. Wash-down should take place well away from the river or in the site compound area provided a sedimentation area is provided.
- Construction works, especially works that involve the pouring of concrete must be conducted under dry conditions.
- Any stripping of areas of topsoil is to be avoided unless absolutely necessary and if unavoidable, the areas concerned are to be kept to a minimum.
- Where temporary stockpiling of topsoil or riverbed material is required, the material should be stockpiled in areas which are not liable to flood and where the risk to water quality is minimised. Geotextile should be used to cover stockpiles to prevent erosion.
- Weather forecasts will be checked daily to allow appropriate measures to be taken to mitigate against any negative impact resulting from heavy rainfall.
- Works will be carried out in line with the specifications of detailed method statements.

- The works will be supervised by a suitably qualified ecologist who will ensure that adequate mitigation is being implemented and who can advise on changes to same where required.

6.7.1.4 Protection of air

Construction activities have the potential to generate dust emissions, which can impact on vegetation. A dust minimisation plan will be prepared and implemented by the building contractor during the construction phase of the project.

6.7.1.5 Waste Management

A construction and demolition waste management plan will be developed and maintained by the main contractor prior to construction works commencing on site. The Plan will meet the requirements of the DoEHLG *Best Practice Guidelines on the Preparation of Waste Management Plans for Construction & Demolition Projects*.

Any hazardous waste will be stored in leak-proof container(s) to prevent contamination.

6.7.1.6 Bird Mitigation Measures

The Wildlife Act 1976, as amended, provides that it is an offence to cut, grub, burn or destroy any vegetation on uncultivated land, or any such growing in any hedge or ditch from the 1st of March to the 31st of August.

Exemptions include the clearance of vegetation in the course of road or other construction works or in the development or preparation of sites on which any building or other structure is intended to be provided. Nonetheless, it is recommended that vegetation be removed outside of the breeding season.

NRA guidelines on the protection of trees and hedges prior to and during construction should be followed (NRA, 2006b).

If works are required within the bird nesting season a survey for nesting birds including dipper, grey wagtail and in particular kingfisher should be carried out. Specific mitigation measures as specified by the supervising ecologist will be implemented where nests are discovered.

An existing dipper box will be removed by the proposed works. A replacement nest box will be provided in the finished development.

6.7.1.7 Otter Mitigation Measures

No otter signs or holts were noted within 150m of the proposed works. However, otters do occur along the watercourses impacted by the works. A detailed pre-construction survey will confirm the absence of otter holts within 150m of the proposed works area.

Any holts found to be present will be subject to monitoring and mitigation as set out in the NRA *Guidelines for the Treatment of Otter prior to the Construction of National Road Schemes (2006b)*. If found to be inactive, exclusion of holts may be carried out during any season. No wheeled or tracked vehicles (of any kind) will be used within 20m of active, but non-breeding, otter holts. Light work, such as digging by hand or scrub clearance will also not take place within 15m of such holts, except under licence. The prohibited working area associated with otter holts will be fenced and appropriate signage erected. Where breeding females and cubs are present no evacuation procedures of any kind will be undertaken until after the otters have left the holt, as determined by a specialist ecologist. Breeding may take place at any season, so activity at a holt must be adjudged on a case by case basis. The exclusion process, if required, involves the installation of one-way gates on the entrances to the holt and a monitoring period of 21 days to ensure the otters have left the holt prior to removal.

As there is evidence that otters move between the Ballybrack Stream and the estuary the works must allow free passage of otters through the works area on the Ballybrack Stream in Douglas. This should be implemented under ecological supervision.

Following completion there must be no impediments to the movement of otters through the affected area on the Ballybrack Stream.

6.7.1.8 Bat Mitigation Measures

Removal of mature trees will be kept to a minimum. Prior to felling mature trees will be checked for bats by the supervising bat expert to ensure impacts on same are minimised.

Trees will be removed where possible during the September/October period. Any ivy covered trees will be left to lie on the ground for 24 hours after cutting to allow any bats to escape.

Excess lighting can impact on bat feeding behaviour. Ideally lights shouldn’t be used from dusk to dawn; if lighting is required it should be kept to the minimum necessary and will focus away from adjoining habitats such as treelines which may be used by feeding bats. Following completion of works any new lighting in proximity to watercourses should be cowled and faced away from the water.

It is noted that any works interfering with bats and especially their roosts, including for instance, the installation of lighting in the vicinity of the latter, may only be carried out under a licence to derogate from Regulation 23 of the Habitats Regulations 1997, (which transposed the EU Habitats Directive into Irish law) issued by NPWS.

There will be replacement planting of trees along sections of the scheme where there is the capacity. Along the Ballybrack Stream, replanting will take place in Douglas Community Park and between the ICA Hall and the Church Road culvert. Replacement planting of trees along will help to maintain thus watercourse as a linear feature which can be used by commuting and feeing bats.

As a mitigation/enhancement measure, four bat boxes will be installed under the guidance of the supervising ecologist.

6.7.1.9 Fish Mitigation Measures

The works will incorporate the relevant elements of the guidelines outlined below:

- Murphy, D. (2004) *Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites*. Eastern Regional Fisheries Board, Dublin.
- IFI (2016) *Guidelines on protection of fisheries during construction Works in and adjacent to waters* (IFI, 2016)
- Inland fisheries Ireland Biosecurity Protocol for Field Survey Work. (2011)

Mitigation will include the following:

- Detailed method statements will be prepared by the contractor in consultation with the supervising ecologist.
- Stone slabs (circa 600mm square x 100mm deep) will be tightly packed to form the base of concrete u-channels in the Ballybrack Stream. This will provide a mixed substrate and will diversify flow patterns in areas where gravel would be scoured out by flood events.
- A low flow channel will be established in the area to be widened and deepened within the Ballybrack Stream. This prevents the river from becoming too shallow during periods of low flow.
- A natural substrate will be provided within any sections of watercourses impacted by in-stream works where it is feasible to do so. Re-use of the original gravels from the affected watercourse, which can be stored for reuse, is preferred. In any event the gravel used should be similar in size and chemical composition. Large rocks will be incorporated into the river bed to create greater heterogeneity within the channel.
- To maintain the gradient and prevent excessive scouring of the river bed the invert of the proposed culvert at Church Road will be buried between 300mm and 500mm in depth. Large rocks will be incorporated into scour protection at the upstream face of the Church Road culvert and concrete u-channels.
- Rock armour will be placed in front of gabions in the lower section of the Douglas Community Park. Varying the line of rock armour will provide staggered deflectors within the channel. Rock armour will also be utilised upstream of the Donnybrook Commercial Centre.
- In-stream works will be carried out in the period from May to September (inclusive). This restriction does not apply to tidal waters on the Tramore River.
- The new trash screen in woodland upstream of Douglas will allow fish movement.
- An electrofishing salvage operation to remove fish from areas affected by direct works will be carried out under section 14 licence as issued by the Department of Communications, Energy and Natural Resources. Fish will be removed to suitable habitat within the same watercourse/catchment. After the

works are complete natural re-colonisation of recreated habitat is predicted to occur.

- In-stream works and fish salvage operation will follow the Inland fisheries Ireland Biosecurity Protocol for Field Survey Work (2011) to ensure no negative impacts are caused to other watercourses.
- Appropriately sized screens will be used where pumps are utilised.

6.7.2 Mitigation - during operation

As detailed in Chapter 7 *Landscape and Visual* a mixture of trees will be used in the final planting scheme. The planting scheme will incorporate a high proportion of native trees. The landscape scheme should replant a similar number of trees with respect to the number of trees removed.

These will be derived from local native-origin stocks where possible. This will ensure that local biodiversity is maintained and enhanced where possible thus minimising impacts on local ecology. In particular trees planted along watercourses provide shade, stabilise riverbanks, provide food for fish and increase their value as commuting routes for bats.

Along river banks where reseeded grassland is required, a species rich grassland mix which incorporates native species of grass and/or wild flowers should be utilised.

6.8 Residual Impacts

There will be removal of an area of habitat including treelines, grassland, woodland and parkland to accommodate the flood scheme works. The impact is considered to be a long term negligible to minor impact. The loss of habitat is predicted to have a long-term minor negative impact on bats. Impacts on other mammal species including otters and birds will be minor negative in the short-term and negligible to minor in the long-term. Impacts on aquatic habitats range from negligible to moderate in the short term depending on location and range from negligible to minor in the long-term. There will be some long-term minor positive ecological impacts on aquatic habitats due to the removal of concrete sections of riverbed and subsequent replacement with a gravel substrate. The impact on designated sites in predicted to be negligible. No significant cumulative impacts have been identified.

6.9 References

Atkins/Cork County Council, 2013. Ballybrack Valley (Mangala), Douglas Ecological Report

Bibby, C.J., Burgess, N.D. and Hill, D.A. (1992). Bird census techniques. BTO

Bibby, C.J., Burgess, N.D., Hill, D.A. & Mustoe, S.H. (2000). *Bird Census Techniques*. Academic Press, London.

CIRIA (2001). Control of water pollution from construction sites. E. Murnane, A. Heap, A. Swain (eds).

Crowe, O. (2005). Ireland’s Wetlands and their Waterbirds: Status and Distribution. BirdWatch Ireland, Newcastle, County Wicklow

EPA (2003) Advice notes on current practice in the preparation of Environmental Impact Statements. Environmental Protection Agency.

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

Fossitt, J. A. (2000) A Guide to Habitats in Ireland .The Heritage Council, Kilkenny

Gilbert, G., Gibbons, D.W. & Evans, J. (1998) *Bird Monitoring Methods - a Manual of Techniques for Key UK Species.* RSPB: Sandy.

Best Practice Guidance for Habitat Survey and Mapping (Heritage Council, 2011)

Kelleher, C. & Marnell, F. (2006) Bat mitigation guidelines for Ireland. Irish Wildlife Manuals No. 25

Lynas, P., Newton, S.F. and Robinson, J.A. (2007). *The status of birds in Ireland: an analysis of conservation concern 2008-2013*. Irish Birds 8:149-166

NRA (2005a). Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes. National Road Authority.

NRA (2005b). Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes. National Road Authority.

NRA (2005c). Guidelines for treatment of bats during construction of National Road Schemes. National Road Authority

NRA (2009). Guidelines for assessment of ecological impacts of National Road Schemes. National Road Authority.

NRA. (2006b). Guidelines for the protection and preservation of trees, hedgerows and scrub prior to, during and post construction of national road schemes. National Roads Authority.

Webb, D.A., Parnell, J. & Doogue, D. (1996) An Irish flora. Seventh edition. Dundalgan Press (W. Tempest), Dundalk.

IEEM (2006) Guidelines for ecological impact assessment in the United Kingdom.

Invasive Species Ireland (2008). Best Practice Management Guidelines Japanese knotweed *Fallopia japonica*.

7 Landscape and Visual

7.1 Introduction

This chapter presents the landscape, townscape and visual impact assessment of the proposed Douglas Flood Relief Scheme, including the Togher Culvert. The scheme comprises sections along the Douglas/Tramore River (including tributaries of Ballybrack Stream, Grange Stream in Donnybrook, and a section of the Tramore River in Togher, County Cork. 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 so as to establish the sensitivity towards and likely landscape and visual impacts arising from the proposed scheme. Potential mitigation measures are also included.

7.2 Assessment Methodology

7.2.1 Introduction

The proposed scheme 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 scheme is localised in nature, yet will likely give rise to a range of 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 included:

- 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 scheme including plans, sections, elevations and photomontages.

7.2.2 Relevant Guidelines and Legislation

The LIVA has had regard to the following legislation, policy and guidance:

Cork County Council, 2014, *Cork County Development Plan 2014*

Cork County Council, 2007, *Cork County Draft Landscape Strategy*

Cork County Council, 2013, *Douglas Land Use and Transportation Study (DLUTS) 2013*

Cork County Council, 2015, *Carrigaline Electoral Local Area Plan 2015*

Cork County Council, 2016, *Draft Ballincollig-Carrigaline Municipal District Local Area Plan 2016.*

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 Statement*

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 Statement*

Government of Ireland, *Planning and Development Acts 2000-2010*

Landscape Institute, and Institute of Environmental Management & Assessment, 2013, *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 the 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.**

Table 7.1 Significance of Effects Terminology from 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).

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.

Impact Level	Definition
Profound	An impact that obliterates sensitive characteristics

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 7.3: Duration of Impacts

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 representative photomontages have been prepared so as to more fully illustrate the physical and visual nature of aspects of the proposed scheme. The photomontages, which are included in **Appendix 7.1**, are from/of the following five locations and have guided the assessment of landscape and visual impacts.

- View 1 – View of open channel of Tramore River at Togher Road
- View 2 – View of open channel of Tramore River at St. Patrick's Mills
- View 3 – View towards Ballybrack Stream within Douglas Community Park
- View 4 – View of Ballybrack Stream from grounds of ICA building
- View 5 – View of Ballybrack Stream within Ravensdale

It will be necessary to remove some trees in each of the proposed works areas. A tree survey has been carried out for the site which specifies which trees should be retained where it is feasible to do so, refer to **Appendix 6.5**. The removal of trees will be kept to a minimum. Every effort will be made to retain these trees where possible. For impact assessment purposes, these trees are assumed to be removed in the EIS.

The necessity for tree removal in Douglas Community Park will be determined during construction. For this view, photomontages will depict both the worst case scenario, i.e. removal of all trees along the stream, as well as a less impacting scenario, i.e. partial removal of trees along the stream.

7.3 Receiving Environment

7.3.1 General Context

Douglas

The Douglas section of the proposed scheme is divided between three sites within the main valley of the Douglas/Tramore River: 1) Tramore River at St Patrick's Mills, 2) Ballybrack Stream (a tributary of the Douglas/Tramore River) running through Ravensdale/Ballybrack Woods, located approximately 380 metres south-east of St. Patrick's Mills, and 3) Grange Stream (a tributary of Ballybrack Stream) within Donnybrook Commercial Centre approximately 500 metres from the Ballybrack Woods section. All of the sites are characterised by a low-lying strong urban form on the river valley floor, with diverse activities and close, built horizons determining limited views out of the sites.

St. Patrick's Mills

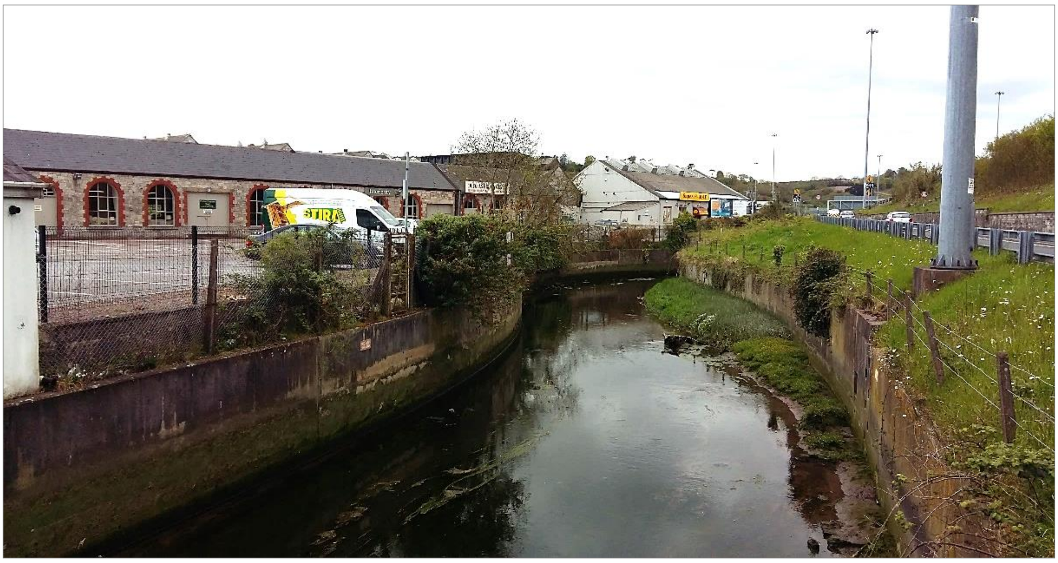

Figure 7.1: View of proposal site from R851, along open culvert on Tramore River, adjacent to St Patrick's Mills on the left and a slip road to the N40 on the right.

The proposed scheme is located along the open channel of the Tramore River in advance of its transition into the Tramore River. Here the channel runs alongside a car park boundary of the former St Patrick's Woollen Mills building (Figure 1). The mills and car park are set within a tight complex of small former light industrial type units (reminiscent of the area's textile industries), with the entrance to the Woollen Mills opposite the Douglas Village Shopping Centre in the centre of Douglas Village.

In addition to the former Woollen Mills stone structure, a large number of smaller modern buildings have developed in a relatively unstructured way. The units are occupied by a wide variety of uses, predominantly mixed retail, service and light industry. The complex is bordered by the N40 to the north-east and the R851 to the west, and lies adjacent to a busy junction between the two roads.

The site lies at the edge of the thriving central commercial business district within Douglas Village; a large and heavily urbanised suburb approximately 3km south of Cork City. The area contains significant and busy road infrastructure, with major junctions and roundabouts dispersed throughout the centre of the village generating much noise pollution. The R851, R609, and R610 intersect the village, while the N40/South Ring Road overpass to the north-west stands as a visually dominating and segregating physical barrier defining the outer boundary of the village centre and separating the village from nearby residential development.

The village is recognisable for its two major shopping complexes, Douglas Court Shopping Centre in the East Village area, and Douglas Village Shopping Centre which spans between the East and West Villages. The commercial/industrial complex of the Woollen Mills also operates a number of successful businesses.

The river does not have a notable influence in visually defining the character of the immediate area, with much of the channel culverted/underground. Nevertheless its presence was key in the development of the area's textile industry in the early 18th century and subsequent urban form. It also marks a continuation of the Douglas River valley and estuary which lie a short distance (less than 600m) north east of this section of the site. Even though the area sits within the wider landscape setting of the open Tramore River valley, this character is eclipsed by the strong urban and suburban fabric.

Instead the main focal point at this location is the protected structure of St. Patrick's Woollen Mills; an important element of the area's architectural and industrial heritage. Views of the structure and complex are quite contained: from the bridge on the R851 looking over the open channel and across to the Woollen Mills and car park (**Figure 7.1**); from the slip road adjoining the N40 (right-hand side, **Figure 7.1**); and from the N40 (off right of **Figure 7.1**, above slip road) where the mills and river can again be temporarily viewed in tandem. Visually, the most sensitive viewing point is within the car park of the industrial heritage complex and the panned sequential viewing of the mills and open channel.

Two Architectural Conservation Areas are designated within the village; the Church Street Conservation Area and the West Douglas Street Conservation Area, the latter forming a substantial part of the Woollen Mills site and outside streetscape, including the terraced buildings directly adjacent to the river. Along with the protected structure of the Woollen Mills, several buildings on the site are listed on the National Inventory for Architectural Heritage.

Ballybrack/Douglas Community Park

Figure 7.2: View of amenity area around Ballybrack Stream at the entrance to Ballybrack woods, with Church Road and Douglas Community Park in the centre background.

The narrow Ballybrack stream flows north into Douglas Village and joins the Tramore River at the closed culvert near the Woollen Mills site, from where **Figure 7.1** was taken. The proposed scheme involves the section of this stream that extends along the western edge of Douglas Community Park, continues under a culvert beneath Church Road before entering Ballybrack Woods and Ravensdale.

Although less than 400 metres from Douglas Village, Ballybrack has a quieter and less densely built-up character, while still maintaining a typical suburban village form. The land use of the area is more residential, with an identifiable main artery along Church Road including a mix of commercial units, schools and clubs, churches and cemeteries, a nursing home, and large areas of open space including Ballybrack Woods and Douglas Community Park, located opposite one another and joined by a designated walkway extending into both spaces.

The tree-lined walkway within the Community Park runs alongside the river, physically separated by a visually permeable wrought-iron fence. There are broken views through the trees of a parallel line of dwellings within a cul de sac named as The Pond Bank and of Coveney's Yard (a small cluster of commercial services). The Community Park lies adjacent to the Church Street Conservation Area to the east, predominately defined by the protected structure and landmark of St Luke's Church and cemetery. The ACA continues as far as Church Road across from the entrance Ballybrack woods.

The entrance to Ballybrack woods includes a small but important river amenity/park (**Figure 7.2**) area in advance of the main Ballybrack Woods walkway. It is accessed from the road by a short metal footbridge over the channel and surrounded by predominantly mixed broadleaf tree lines with some dispersed conifers. Part of the stream (and works area) adjoins the curtilage of the Irish Countrywomen's Association (ICA) hall (also accessed by a similar bridge). The northern river bank at this point is lined with overgrown vegetation and mature trees.

The channel swings around the eastern edge of the curtilage and extends into Ravensdale before continuing into Ballybrack Woods further downstream. Ravensdale is a relatively secluded residential area comprising a small cluster of houses behind the ICA hall. It is accessed by a short local access road off the main Church Road. The area is well screened from the R609 to the immediate east by a line of mature screes, and to the west and south by the trees in and around Ballybrack Woods giving it an enclosed and quiet character. The site extends a short distance (along c.75m of the channel) from Ravensdale and into the open space of the Ballybrack Woods area which comprises a long narrow and enclosed section of land. A public walkway marks the central division between the eastern half covered by woodland and the western half comprising grassland and Ballybrack Stream. Outward and inward views are restricted.

Donnybrook Commercial Centre

Figure 7.3: View north-east through Donnybrook Commercial Centre, with existing open channel (Grange Stream) running down the central car park area of the complex, the mixed use units visible on the left, and the protected red-brick mill structure visible off centre right background.

A small section of the proposed works continues into the Donnybrook Commercial Centre. The site is very contained and largely hidden from view apart from the imposing mill structure that can be seen from the main road. A mix of commercial units are lined together within the complex and along the length of a linear and narrow open channel of the Grange Stream – a tributary of Ballybrack Stream.

While the commercial units are utilitarian, pre-fabricated styled structures, they lie within an older industrial mill complex which includes several buildings listed on the National Inventory of Architectural Heritage (NIAH); the most prominent being the protected structure of the main mill (NIAH Registration No. 20908622).

The site is surrounded by dense clusters of mature deciduous trees, adding to the sense of enclosure and restricted views from within and towards the site. The vegetation along the banks is minimal and limited to grass slopes as the channel dissects the hard surface car park and is detached from the nearby tree clusters.

Togher

Figure 7.4: View of Togher Road, including the key focal point of the Church of the Way of the Cross as an important landmark. The proposed flood defence scheme runs along the western pavement having continued from Brook Avenue.

Togher is a suburb lying on the outskirts of Cork City but within the County boundary. The site extends from the culvert at Lehenaghmore Industrial Estate, beyond the residential area of Brooke Avenue and to the roundabout at Togher Road where a channel section of the Tramore River opens for approximately 50m. The existing culvert (and proposed scheme) then continues north to meet the open channel at Greenwood Estate at the top of Togher Road. The ground level of the site falls to a flat catchment area of the river which lies at the end of a steep incline from the south. The northern end of the site is defined by another open channel running behind the Greenwood Estate.

The land use is mainly a mix of residential and commercial, with the Church of the Way of the Cross forming an important focal point and landmark. The area also includes schools, car parks, a community centre, petrol station and small retail units, while the main thoroughfare of Togher Road runs the length of the study area. The site extends along Togher Road on the side of the church and schools (Figure 7.4), opposite a predominantly residential stretch of buildings on the eastern roadside.

The area has a typical suburban form; open and with low-density settlement patterns. Along with the wide expanse of Togher Road, many open spaces like car parks, green areas and sport pitches give a wide spatial appearance to the townscape, especially on the western side where building footprints are set at clear distances from one another. The area also has several buildings listed on the National Inventory of Architectural Heritage which lie close to the proposal site.

7.3.2 Landscape Character Type and Designations

The *Cork County Draft Landscape Strategy 2007* defines the landscape character for the County and is supported by the *Cork County Development Plan 2014* (CDP), *Carrigaline Electoral Local Area Plan 2015* (CELAP) and the *Draft Ballincollig-Carrigaline Municipal District Local Area Plan 2016*. The Strategy identifies the wider character context of both the Douglas and Togher areas as 'City Harbour and Estuary', and as being of very high value, very high sensitivity (and therefore extra vulnerable to change), and of national importance. It does not provide details specific to the areas in question beyond the following description:

> *"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".*

There are no designated scenic landscapes or routes within the study areas, however the Cork Harbour SPA comprises most of the main intertidal areas of the harbour including the Douglas Estuary close to St Patrick's Mills.

Furthermore the site areas themselves do not possess 'harbour' landscape characteristics and are too far inland/built-up to possess harbour views. The CELAP however identifies how, in relation to the south environs:

> *"the steeply rising slopes on the southern periphery of this settlement add to the visual setting and character of Cork City and therefore should remain relatively free from large scale development."*

South of Douglas, this steep topography rises to agricultural ridgelines incised by extensive riparian wooded river valleys, running in a largely north-south orientation.

The nearest scenic route is identified in the CDP as the S56 east of the airport, approximately 1km from the Togher site and approximately 2km from the Douglas sites. It is considered scenic due to its views towards the city skyline and its northern ridge. Views towards/out of the study areas are limited by intervening topography.

Douglas and Togher possess architectural elements integral to the character of their townscapes. While the visibility of the Woollen Mills is limited to a small amount of brief views, being within quite an enclosed complex, the setting of St. Luke's Church is especially significant, with the church as a main landmark. The ACAs are fundamental in defining the special character of the built environment.

There are no protected structures or ACAs in the Togher study area. Four structures listed on the NIAH are important features contributing to the area's character. The landmark building of the Church of the Way of the Cross lies in the centre of the study area, while closer to the roundabout, three more structures are clustered at small distances from one another, forming a nucleus of heritage structures within an overall contemporary urban form. Of these The Lodge Dental Practice stands as the most prominent and attractive feature of architectural heritage.

7.3.3 Landscape Value and Sensitivity

While the wider landscape character area is identified as of high value and sensitivity, all of the sites fall at the edge of this designation, and do not possess the main harbour/estuarine landscape characteristics that determine this high value and sensitivity. The landscape character of the study areas therefore appears more robust than those closer to the harbour, and of a less significant scale.

It is envisioned in this study that the proposed scheme would nevertheless, without mitigation, result in a significant change to some sections of the study areas in relation to the extent of the removal of trees, and as such altering the character of the river amenity. There is potential to mitigate the impact through criteria for sensitive integration of the proposed scheme into the existing landscape. Overall the landscape has the capacity to absorb the kind of change brought about as a result of the proposed flood scheme, on the condition that the integrity of the river amenity and tree corridors are maintained as much as possible.

The main landscape values of the study areas centre on several characteristics:

- the amenity value of the river and river walkways, associated trees and riparian woodland;
- ecological richness of the riparian habitats; and
- Historical landscape determined by the built heritage of individual protected structures/recorded monuments as well as and industrial townscapes.

A number of key receptors are fundamental in defining these values and every effort should be taken to ensure the protection of their role in contributing to the landscape/townscape character of the study areas:

Douglas

- Landmark/focal point of St Luke's Church;
- Architecturally significant heritage buildings of /around the Woollen Mills;
- Architecturally significant townscape;
- Recorded monuments;
- Open space of Douglas Community Park and playground;
- Ballybrack Woods and amenity area;
- Designated walkway through Douglas Community Park/Ballybrack Woods;
- Tree lines/clusters within Douglas Community Park/Ballybrack Woods;
- Mills at Donnybrook Commercial Estate.

Togher

- Landmark/focal point of the Church of the Way of the Cross;
- Trees, particularly large horse chestnut, around existing open channel adjacent to the roundabout;
- Individual trees throughout site area along western pavement;
- Trees at entrance to Greenwood Estate;
- Trees screening boundary between Lehenaghmore industrial estate and Brookside residential estate;
- Local amenity walkway along open channel above Greenwood Estate;
- Architectural value of recorded monuments cluster near roundabout, especially the visual prominence of The Lodge Dental Practice;

- Open spaces and sports pitches.

7.3.4 Landscape Planning Context

The *Cork County Development Plan 2014, the Carrigaline Electoral Local Area Plan 2015 (2nd Ed), and the Draft Ballincollig-Carrigaline Municipal District Local Area Plan 2016* set out the area's planning context and contain a number of references to the landscape, townscape and amenity of the areas. Douglas and Togher are outlined in the CDP as falling within the 'Cork City South Environs'; the southern suburbs which lie outside the Cork City Area. Douglas Village is zoned as a 'town centre/neighbourhood centre in the CELAP within which a Specific Zoning Objective for St. Patrick's Woollen Mills (TC-01) outlines plans for the redevelopment of the entire site as mixed use.

The Ballybrack site falls outside the Douglas Village zoning and is identified as being within an 'Existing Built-Up Area', with part of the site extending through an open space zoning of Douglas Community Park.

The CDP also refers to the Cork Retail Centres Hierarchy, defined in the Cork Retail Study 2008, which identifies Douglas as one of the 'district centres' in the Cork Suburbs, highlighting its role as an important and established suburb of the city. The study identifies Togher as a 'Neighbourhood Centre'. In relation to development trends in the areas, the CELAP notes the following

> *2.1.8 The southern periphery of the city is located on the southern edge of the River Lee valley partly on low lying gently undulating land and partly on the more steeply rising slopes of the valley side. In the past, it has tended to be a more popular location for development than the more hilly land on which the northern suburbs of the city are largely built.*
>
> *2.1.9. Housing in recent years has been provided in the form of large housing estate developments which, while often suburban in character, have introduced diversity to the housing mix in the town, catering for all age groups and stages in the lifecycle. This enhanced choice in housing is particularly important for the rapidly expanding places such as Douglas and Togher, where the need to maintain mixed communities is an essential element in maturing a neighbourhood and creating a sense of integration between the established and new communities.*

A number of observations and objectives are identified within these plans for their relevance to and implications for the landscape, public realm, and amenity concerns within the wider planning context of the proposed scheme. These are outlined in full in **Appendix 7.2**, with key aspects of relevant objectives summarised below:

- Protect visual/scenic amenities of built and natural environment.
- Discourage proposals necessitating the removal of extensive amounts of trees, hedgerows and historic walls or distinctive boundary treatments.

- Preserve the character of important views and prospects (including views of historical significance, e.g. buildings and townscapes) and views of natural beauty.
- Ensure proposals are of high quality architectural design and appropriate in terms of how they impact on the design and setting of protected structures.
- Conserve and enhance the special character of ACAs including its streetscape, landscape and setting.
- Use of appropriate materials during the course of public infrastructure schemes within ACAs.
- Maintain important features of the landscape which function as ecological corridors and areas of local biodiversity value.
- The redevelopment of St. Patrick's Woollen Mills will include the retention of all buildings of historic and architectural merit and any new build to enhance this precinct shall complement the established building fabric.
- The Douglas Community Park should be at the centre of life in the village and should be an integral part of the population's lifestyle choice.
- Provide a high quality off-road walk and cycleway along the Ballybrack Stream from the Community Park to the Donnybrook Hill area.
- The river, river bank and the park (Douglas) could be more meaningfully structured to give more of an amenity opportunity to the public (DLUTS).

7.4 Characteristics of the Proposed Scheme

As outlined in detail in **Chapter 3 Description of the Proposed Scheme**, the proposed Douglas Flood Relief Scheme (including Togher Culvert) will include the construction of direct and indirect flood defences along the Ballybrack Stream, Grange Stream and Tramore River. The proposed scheme will include flood walls, embankments and conveyance improvements including channel widening, channel deepening and the introduction of or replacement of culverts.

As described previously in **Chapter 1 Introduction**, construction works for the proposed scheme will take place in four separate areas along the Tramore River, Ballybrack Stream and Grange Stream in Douglas and Togher as follows:

Area 1: Ballybrack Stream through Douglas.

Area 2: Tramore River through St Patrick's Mills, Douglas

Area 3: Grange Stream (tributary of Ballybrack Stream) through Donnybrook Commercial Centre

Area 4: Tramore River through Togher

From a landscape and visual perspective, the main characteristics of the development that are of concern are the removal and construction of walls and any removal of trees along the existing wooded river corridors of the main river and its tributaries as a result of the works, especially in areas where they contribute to residential and recreational amenity.

As outlined in **Chapter 3**, many of the linear defences will require the temporary removal of boundary walls and fences as well as tree removal to facilitate the construction access. Boundary walls and fences will be reinstated on completion in agreement with landowners. Landscaping and replanting will also be carried out on completion in agreement with landowners.

Trees in the area were surveyed by an arborist and for potential bat roosts. Trees which are directly within the footprint of the construction works will be removed and are presented in **Appendix 3.2** of this EIS. There are also some trees whose roots may be indirectly impacted due to the presence of adjacent works within the root protection area and which may subsequently require removal depending on the extent of impact. It is noted that every effort will be made to retain these trees where possible. For impact assessment purposes, these trees are assumed to be removed in the EIS.

7.5 Evaluation of Impacts

7.5.1 Construction Impacts

There are a number of specific impacting elements of the proposed scheme in the Douglas and Togher areas that will be bring about certain **temporary** and **localised** changes to the immediate environs during construction:

St. Patrick's Mills

Moderate negative visual impacts during construction of new wall and parapets along open channel.

Slight neutral visual impact from removal of small tree/shrub cluster on channel bank adjoining car park.

Moderate positive visual impact from removal of unkempt/overgrown vegetation along channel.

Moderate negative impacts on immediate amenity of the complex due to general construction works.

Ballybrack/Douglas Community Park

Significant negative impact on the character of the river corridor from the removal of trees and vegetation on and around the Ballybrack Stream banks, especially in Douglas Community Park and the Ballybrack Woods entrance.

Significant negative impact on residential amenity from the removal of trees within Ravensdale.

Moderate negative impact from removal of attractive riverside features (stone steps and walls along channel) at Ballybracks Woods entrance area.

Significant negative visual impact on river character and recreational amenity during the channel deepening and widening, path realignment, and embankment construction in the Douglas Community Park.

Significant negative visual impact on river character and recreational/ residential amenity during the channel widening and deepening, construction of new flood walls and cycletrack/footpath, bridge removal/replacement, ground regrading in and around Ballybrack Woods and Ravensdale.

Donnybrook Commercial Centre

Moderate negative visual impact during culverting of existing channel.

Moderate negative impacts on amenity due to general construction works.

Togher

Moderate negative impact on character of townscape from removal of trees throughout study area (especially large horse chestnut tree near roundabout at Togher Road, trees at entrance to and behind Greenwood Estate.

Significant negative visual impact on townscape and pedestrian accessibility during construction of replacement culverts throughout study area.

Significant negative impact on residential amenity/access during construction of new culvert, footpath and regrading of road on Lehanaghmore Road.

Significant negative impact on residential and public amenity during construction of new channel wall at Greenwood.

7.5.2 Operational Impacts

There are a number of specific impacting elements of the proposed scheme in the Douglas and Togher areas that will have a number of likely operational impacts on the overall landscape character and visual appearance of the study area. These impacts incorporate the effects of the mitigation measures outlined. These measures ensure any significant negative impacts are avoided.

St. Patrick's Mills

Significant positive impact of limestone masonry finish flood defence wall, enhancing the immediate visual environment.

Significant positive impact from the protection of historical townscape and structures from future flooding.

Significant positive impact from removal of existing wire fence and unkempt/overgrown vegetation along channel providing a higher quality public realm.

Ballybrack/Douglas Community Park

Moderate negative impact on the character of the river corridor and public amenity from the removal of trees and vegetation on and around the Ballybrack Stream banks at the Ballybrack Woods entrance area, with this reducing to **slight negative** as new planting matures.

Moderate negative impact on the character of the river corridor, public and residential amenity from the removal of all trees along the banks in Douglas Community Park which is proposed as a worst case scenario and includes appropriate level of replanting. Partial removal of trees (and necessary replanting) will result in a **moderate negative impact** on the character of the river corridor, public and residential amenity.

Moderate negative impact on residential amenity from the removal of trees within Ravensdale.

Moderate neutral/positive impact from the introduction of stone clad wall and bridge parapets (cladding on both dry and wet sides).

Significant positive impact from the protection of ACAs from future flooding.

Significant positive impact through enhancement of public and residential amenity due to flood prevention.

Significant positive impact from enhancement of pubic amenity and recreational aspect of Ballybrack with improved layout, cycle routes and footways.

Moderate positive impact through enhancement of public realm at entrance to Ballybrook Woods and around ICA building with new walkway and walls and reinstated trees.

Donnybrook Commercial Centre

Slight neutral visual impact from new culvert over existing channel.

Togher

Slight negative impact on character of townscape, recreational and residential amenity from removal of trees reducing to **slight neutral/imperceptible** as reinstated planting matures.

Slight neutral to imperceptible visual impact on townscape from new culvert.

Slight neutral to imperceptible visual impact on townscape from in-filling of open channel at entrance to Greenwood.

Slight neutral impact on residential and public amenity from new wall and reinstated planting at Greenwood, reducing to imperceptible as planting matures.

Moderate positive impact on public realm in Togher near roundabout from new pedestrian walkway.

Significant positive impact from the protection of historical structures from future flooding.

7.5.3 Cumulative Impacts

The zoning for the proposed redevelopment of the Woollen Mills Complex together with the proposed flood defence scheme could have moderate negative cumulative impact implications with regard to the detraction from the industrial heritage character of the site if inappropriate and overly contemporary materials are used in both developments. Appropriate materials will reduce this to **slight neutral** cumulative impacts. The combined removal of trees along various sections of the river corridors may have a moderate cumulative negative impact, diminishing the character of the river corridor throughout the Douglas and Togher study area. However this should reduce to **slight negative/neutral** as new and existing planting matures.

7.6 Mitigation Measures

Measures have been considered to avoid, reduce and/or remediate, where possible the likely impacts of the proposed scheme and works.

7.6.1 Construction Mitigation Measures

General

- Where concrete is exposed, careful consideration of the design finish is required to be sympathetic with receiving environment.
- 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.
- Retention of existing trees where possible in the interest of residential amenity, public realm and visual character of the river amenity.
- Remaining trees will be protected and a tree replanting scheme will be devised.
- Where retention of existing trees is not an option, these shall be replaced with new trees as close as possible to the original location in the interest of public realm and visual character of the river amenity.
- 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. Ballybrack stream). 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.

Specific

- Location of the proposed flood walls along the line of an existing wall on river bank at St Patrick's Mills in the interest of minimising intrusion on the existing landscape character.
- Finish of new wall on dry side at St. Patrick's Mills to be sympathetic to historical character of the built fabric.
- Finish of new wall on both sides to be sympathetic to character of river amenity and existing boundaries along Ballybrack Stream.
- Tree removal at entrance area to Ballybrack Woods and within Douglas Community Park to be compensated with newly planted trees along the banks specifically within these areas.

7.6.2 Operational Mitigation Measures

General

- Climbing plants, (*e.g.* Ivy and Honeysuckle) shall be planted along new walls where possible to reduce the visual impact on the character of the river corridor.
- Where trees are removed, new trees of appropriate species (e.g. Alder, Birch) shall be planted in replacement as close as possible to original location (it is noted that replanting potential is restricted at Ravensdale).
- Where shrubs and vegetation are removed, new plants of appropriate species shall be planted in replacement.
- All trees retained in proximity (i.e. within root protection area (RPA) as per BS 5837) shall be subject to a detailed post-construction tree survey carried out by a qualified arborista. Any works recommended shall be undertaken and the survey shall be made available to the Client.

The following planting and species are advised where trees and shrubs are removed in order to avoid any significant negative impacts as a result of their removal:

River edge:

- Alder (Alnus glutinosa), 18-20cm girth, root balled at 4m centres.
- Hawthorn hedge (Crataegus monogyna), 0.9-1.2m high, bare-root, planted at 0.45m centres, double row staggered.

Landscape areas in park/verges:

- Birch (Betula pendula), 18-20cm girth, root balled at 4m centres.
- Maple (Acer platanoides 'Columnare' and Cultivars, 18-20cm girth, root balled at 5m centres.

7.7 Residual Impacts

The landscape, townscape, visual and amenity impacts of the works are generally localised and predominantly in relation to the removal of trees during construction and the aftermath effects of this.

This will have a significant impact on the experience of and visual character of the river amenity and residential amenity during construction, but will be reduced to **moderate/slight negative** over time as new planting matures. The introduction of the stone clad walls and bridge parapets will bring **moderate negative** change to the immediate residential area of Ravensdale, with **moderate negative** change from tree removal due to the restricted scope for new planting. There will be no significant residual impacts, with the development being consistent with existing and emerging trends in the area.

In Togher, residual impacts will generally be **slight neutral** on the character of the townscape, recreational and residential amenity and once new planting establishes.

There are also **moderate to significant positive** residual impacts associated with the enhancement of public and recreational amenity, especially throughout Ballybrack Woods and Douglas Community Park, and on Lehanaghmore Road in Togher, as well as the general benefits to public realm and townscape from flood prevention.

7.8 References

Cork County Council, 2007, Cork County Draft Landscape Strategy

Cork County Council, 2014, Cork County Development Plan 2014

Cork County Council, 2013, Douglas Land Use and Transportation Study (DLUTS) 2013

Cork County Council, 2015, Carrigaline Electoral Local Area Plan 2015

Department of Arts, Heritage and the Gaeltacht. National Inventory of Architectural Heritage

8 Population and Human Health

8.1 Introduction

This chapter addresses impacts of the proposed scheme on population and human beings.

The proposed scheme has the potential to affect the local population 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, topics such as amenities, tourism, population trends, household sizes and employment and economic activity are examined.

The receiving environment and the characteristics of the proposed scheme in terms of construction and operation are described. The potential impacts of the scheme during the construction and operational phases are evaluated, and the mitigation measures for these potential impacts are presented. The chapter concludes with the predicted residual impacts of the proposed scheme.

This chapter refers to the scheme 'works areas' as the areas of Togher and Douglas where flood relief works are proposed. Refer to **Chapter 3 Description of the Proposed Development** and Drawings in **Appendix 3.1** of this EIS.

8.2 Methodology

The current socio-economic status in the areas close to the proposed scheme 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 Quarterly Household Surveys (where available). The data included information on population, number of persons at work and unemployment profile. A site walkover was carried out. Information was also sourced from the following documents/websites.

- Censuses of Ireland 2006, 2011 and 2016
- Central Statistics Office *Quarterly National Household Survey Quarter 4 2016* (www.cso.ie)
- Cork City and County Councils *Cork Area Strategic Plan 2001-2020*
- Cork County Council *Carrigaline Electoral Area Local Area Plan 2015, Second Edition*
- Cork County Council *Ballincollig Carrigaline Municipal District – Draft Municipal District Local Area Plan* (2016)
- Cork County Council, *Cork County Development Plan 2014-2022*
- Fáilte Ireland Annual Report 2015
- Local Electoral Area Boundary Committee, *Committee Report 2013*
- South West Regional Authority *Regional Planning Guidelines 2010-2022*

8.3 Receiving Environment

Douglas and Togher have both frequently been affected by flooding in the past. A summary of the significant past flood events to have affected Douglas and Togher is presented in **Table 8.1**.

Table 8.1: History of Flooding Events in the Douglas and Togher areas

Date of Flood Event	Mechanism	Areas Affected
December 2015	Fluvial	Togher
28 June 2012	Fluvial	Togher, Douglas village
27 November 2002	Fluvial	Togher
21 November 2002	Fluvial	Togher, Douglas village
3 December 2001	Fluvial	Togher
30 November 2000	Fluvial	Togher
5 November 2000	Fluvial	Togher, Douglas
1998	Fluvial	Togher
17 March 1947	Fluvial	Douglas
24 December 1895	Fluvial	Douglas
19 November 1892	Fluvial	Douglas
Historic recurring	Fluvial/Tidal	Tramore River downstream of current Cork landfill site, Douglas

- Area 1 Ballybrack Stream through Douglas (**Figures 3.1** to **3.4**)
- Area 2 Tramore River through St Patrick's Mills, Douglas (**Figures 3.5** to **3.7**)
- Area 3 Grange Stream (tributary of Ballybrack Stream) through Donnybrook Commercial Centre (**Figures 3.8** to **3.10**)
- Area 4 Tramore River through Togher (**Figures 3.11** to **3.13**)

Areas 1 to 4 are described in terms of the topics listed in Section 8.1 (heritage, local amenities, tourism, population, household size and employment and economic activity). Please note that the left and right banks are described as one looks downstream.

8.3.1 Area 1: Ballybrack Stream through Douglas

The most recent significant flood event in Area 1 was in 2012, as recorded by the National Flood Hazard Mapping (OPW). The maximum flood extent for the 2012 flood event is presented in **Figure 8.1**, while a comparison of the maximum flood extent for this flood event with the maximum modelled flood event is presented in **Figure 8.2**.

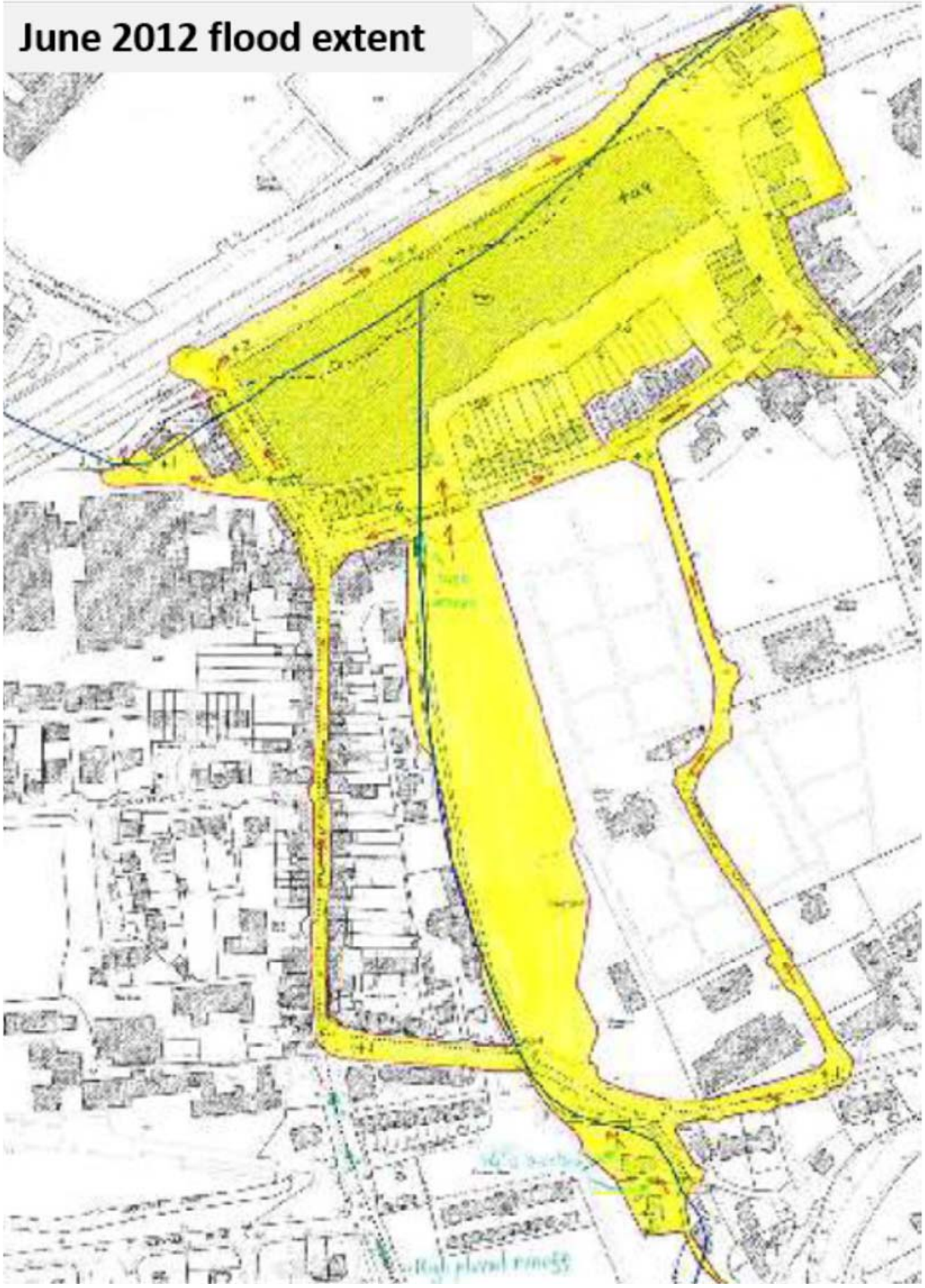

Figure 8.1: Maximum flood extent for the June 2012 flood event. Area 2 (Tramore River through St Patrick's Mills, Douglas) and Area 1 (Ballybrack Stream through Douglas) are located to the north west and the south of this figure, respectively. The N40 (South Ring Road) runs along the northern boundary of the figure. Source: South Western CFRAM consultants.

Figure 8.2: June 2012 flood extent calibration plot (maximum flood extent vs maximum modelled flood event). Area 2 (Tramore River through St Patrick's Mills, Douglas) and Area 1 (Ballybrack Stream through Douglas) are located to the north west and the south of this figure, respectively. The N40 (South Ring Road) runs along the northern boundary of the figure. Source: Cork County Council.

The flooding extended throughout Douglas village. The location of the culvert trash screen at Church Road and photographs of this trash screen under normal conditions prior to the 2012 flood event and following this flood event are presented in **Figures 8.3, 8.4** and **8.5**, respectively. Post flood photographs outside the ICA Hall and at a commercial premises in Douglas East are also presented in **Figures 8.6** and **8.7**. **Figure 8.7** illustrates the high water mark from the 2012 flood event.

The residents of Ravensdale were heavily impacted by the 2012 flood event, with a number of properties in this area severely flooded. **Figure 8.8** presents the likely flood routes of the Ballybrack Stream in the vicinity of Ravensdale during this event.

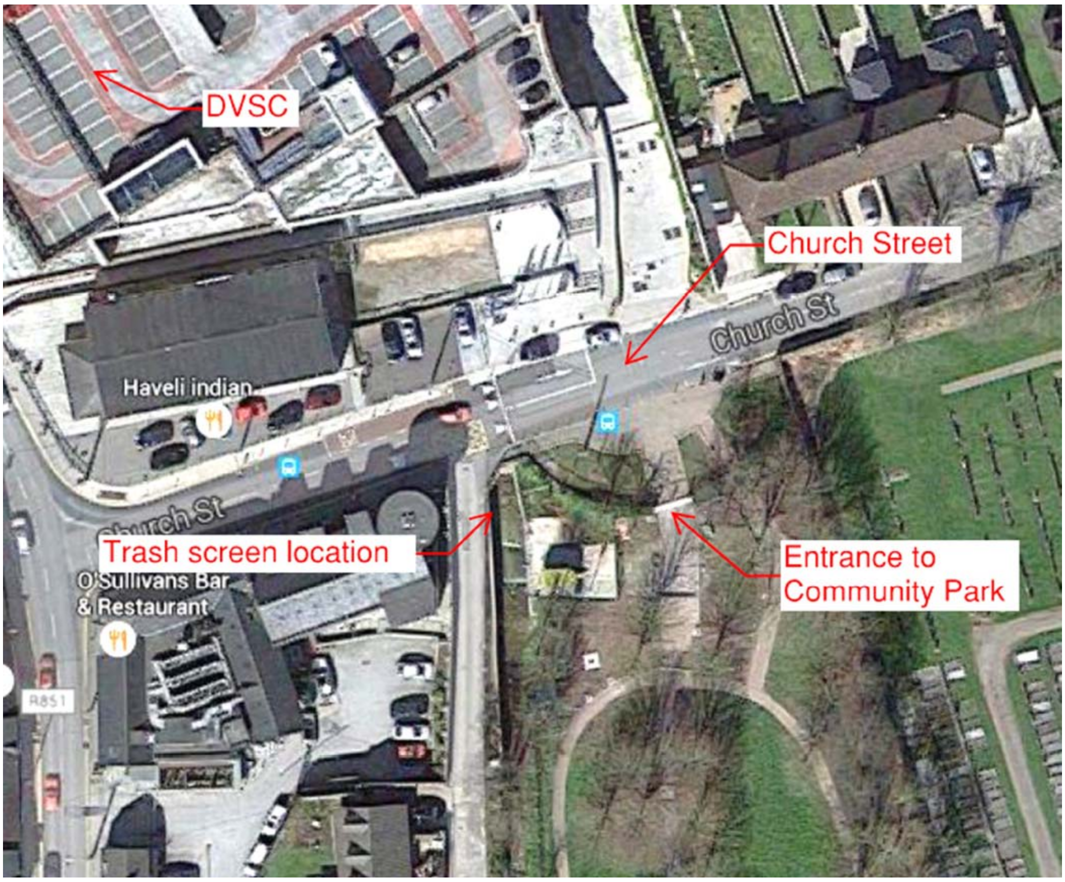

Figure 8.3: Location of culvert trash screen at Church Road

Figure 8.4: Church Road culvert trash screen – normal conditions. Source: OPW

Figure 8.5: Church Road culvert trash screen – post 2012 flood event. Source: OPW

Figure 8.6: Post 2012 flood event – wall knocked down outside ICA Hall

Figure 8.7: Post 2012 flood event high water mark from outside commercial property in Douglas East. Source: OPW

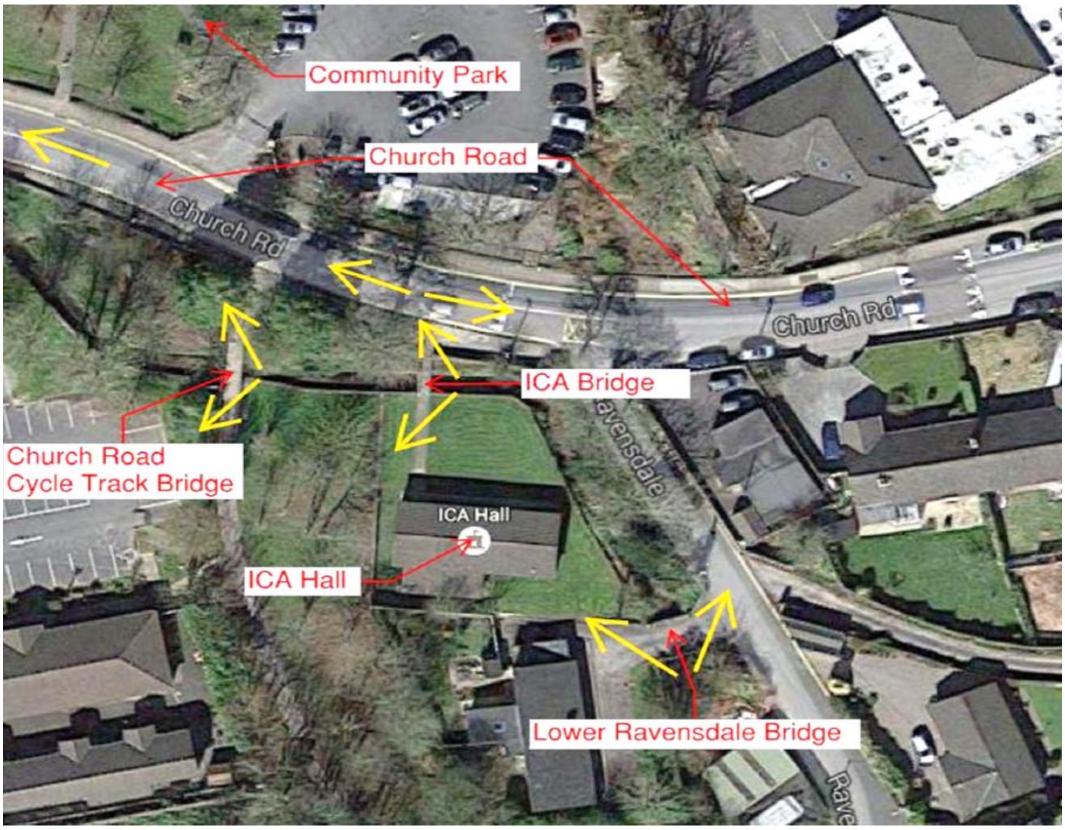

Figure 8.8: 2012 flood event – likely flood routes of the Ballybrack Stream in the vicinity of Ravensdale. The yellow arrows indicate the likely flood routes.

Area 1 is described as the section of Ballybrack stream from Ballybrack Woods, downstream through the residential area of Ravensdale, and northwards as far as the culvert beneath Church Street in Douglas village. Refer to **Figure 3.1**.

Ballybrack woods is a quiet amenity area that can be accessed via a designated cycle track/walkway from Donnybrook Cottages to the south and Church Road to the north. The cycle track/walkway provides a pedestrian and cycle path from Scairt Hill road (opposite Donnybrook Commercial Centre and south of Ballybrack woods) through Ravensdale to Douglas Community Park and Church Street. The cycle track/walkway runs relatively parallel to the stream in certain sections.

From the Ballybrack woods, the Ballybrack stream flows northwards through Ravensdale beneath a number of small bridges (Upper, Middle and Lower Ravensdale bridges (from north to south). The bridges provide access to residences along the left bank of the stream. There is a small cul-de-sac road which runs parallel to the right bank of the stream in Ravensdale and provides access to residential properties in this area. At the junction of this cul-de-sac road and Church Road, there is a Medical Centre provided by the Health Service Executive. There is a joinery business on the right bank of the stream in Ravensdale.

The stream then flows around the Irish Countrywomen's Association (ICA) hall, beneath the hall's access bridge. West of the ICA building is Westbrook Retirement Home. Downstream of the ICA Bridge is the bridge for the cycle track/walkway bridge that links the path to Church Road, refer to **Figure 3.3**.

Saint Luke’s National School is east and adjacent to Douglas Community Park along Church Road. Douglas Community Centre is within the grounds of the park. There is a small car park for those who use the park and community hall. There are also recycling facilities in the corner of the cark park. Also adjacent to the park is Saint Luke’s Church and cemetery which border the length of the eastern boundary of the park. East of the national school is Saint Columba’s Catholic Church and a community hall known as John Slye Scout Hall.

The stream then continues flowing downstream underneath Church Road, through Douglas Community Park to Church Street where it is culverted until it emerges near Saint Patrick’s Mills (also known as Douglas Woollen Mills) (Area 2) and converges with the Tramore River.

The stream passes through the western side of Douglas Community Park between Church Road and Church Street. This is an area of local amenity, which contains a multi-use games area, a set of adult exercise equipment, a Community Centre, recycling facilities, a children’s playground and grassed areas. The designated cycle track/walkway runs parallel to the stream through the Park.

In the Park area, the left bank of the Ballybrack stream is lined with properties, and a local access road (cul de sac), referred to as The Pond Bank. Further west and parallel to the stream is the West Douglas Road (R851) which is also lined with houses. St Luke’s Church and graveyard lie to the east of the Park. An ESB substation of c. $4m^2$ is located to the northern extent of the Park.

While less than 400 metres from Douglas Village, Ballybrack/Ravensdale has a quieter and less densely built-up character, while still having a typical suburban form. The land use of the area is more residential, with an identifiable centre along Church Road including a mix of commercial units, schools, community halls, churches and cemeteries, a nursing home, and large areas of open space including Ballybrack Woods and Douglas Community Park.

8.3.2 Area 2: Tramore River through St Patricks Mills

During the 2012 flood event this general area was severely affected by flooding as well as the village centre and Douglas Village Shopping Centre. Refer to **Figures 8.9**, **8.10** and **8.11**. These areas were not accessible during the height of the flood.

Figure 8.9: Post 2012 flood event outside Douglas Village Shopping Centre. Source: Cork County Council

Figure 8.10: Post 2012 flood event inside Douglas Village Shopping Centre. Source: Cork County Council

Figure 8.11: Post 2012 flood event in Douglas Village Centre. Source: Cork County Council

Area 2 comprises an open channel of the Tramore River running alongside a car park boundary of the former St Patrick's Mills building (also referred to as Douglas Woollen Mills). At this section, the Tramore River has just emerged from a culvert under the N40 South Ring Road and N40 slip road. The mills and car park are set within a tight complex of small former light industrial type units (reminiscent of the area's textile industries), with entrance to St Patrick's Mills on West Douglas Road (R851) opposite the Douglas Village Shopping Centre in the centre of Douglas Village. St Patrick's Terrace is located off the West Douglas Road (R851). The back of St Patricks Terrace adjoins the St Patricks Mills area. St Patrick's Terrace is lined with a number of residential and commercial units, including a dental surgery, solicitor's office, hair and beauty salons, and a fast food restaurant.

In addition to the former St Patrick's Mills stone structure, a large number of smaller modern buildings have developed in a relatively unstructured way. The units are occupied by a wide variety of uses, predominantly mixed retail, service and light industry. The complex is bordered by the N40 to the north-east and the West Douglas Road (R851) to the west, and lies adjacent to a busy junction between the two roads. The site lies at the edge of the thriving central commercial business district within Douglas Village; a large and heavily urbanised suburb approximately 3 km south of Cork City. Refer to **Figures 3.5** to **3.7**.

8.3.3 Area 3: Grange Stream through Donnybrook Commercial Centre

The most recent flood event in the area surrounding the Donnybrook Commercial Centre was in 2012. Constrictions within the Grange Stream culvert in the Commercial Centre and blockages due to debris resulted in the culvert becoming surcharged, causing large volumes of water to discharge through a manhole in the centre.. Photographs of the aftermath of the 2012 flood event in this area are presented in **Figures 8.12**, **8.13** and **8.14.**

Figure 8.12: Post 2012 flood event adjacent to Donnybrook Commercial Centre showing manhole blockages (Source: Donnybrook Commercial Centre)

Figure 8.13: Post 2012 flood event adjacent to Donnybrook Commercial Centre. (Source: Donnybrook Commercial Centre)

Figure 8.14: Post 2012 flood event adjacent to Donnybrook Commercial Centre (Source: Donnybrook Commercial Centre)

The Donnybrook Commercial Centre is located upstream of Areas 1 and 2. It can be accessed from the regional road R851 at Donnybrook Hill.

The Grange Stream (tributary of Ballybrack Stream) runs through the Donnybrook Commercial Centre. This area consists of an open linear channel of the Grange Stream located to the north of units within Donnybrook Commercial Centre. Further downstream, the Grange stream is culverted under hardstanding areas within the Commercial Centre. The site is very contained and largely hidden from view apart from the imposing mill structure that can be seen from the main road. A mix of commercial units, day care centre and religious facilities are located within the complex and along the length of the Grange Stream in this area. Refer to **Figures 3.8** and **3.10**.

A Maxol service station and Breen's Suzuki car dealership are located opposite the Commercial Centre. South and adjacent to the service station is the cycle track/walkway that goes through Ballybrack woods and Ravensdale (Area 1). Further south there are a small number of commercial units and continuing south the road is lined with residential properties on either side. The Donnybrook Cottages housing estate is located to the southeast of the Commercial Centre. Going north towards Ballybrack, there are a number of houses on either side of the R851 and some wooded areas.

8.3.4 Area 4: Tramore River through Togher

The most recent significant flood event in the Togher area was in 2012. A minor flood event occurred in Togher in 2015, but this was not significant. The 2012 flood event corresponded with the 2012 flood events described above for Areas 1, 2 and 3. It occurred following a period of extremely heavy rainfall.

Greenwood Estate was one of the locations in Togher that was worst affected by this event, with significant flooding occurring in this area. Photographs of the aftermath of the 2012 flood event in Area 4 are presented in **Figures 8.15**, **8.16** and **8.17.**

Figure 8.15: Post 2012 flood event in Togher Area. Source: Cork County Council

Figure 8.16: Post 2012 flood event in Togher Area – outside Togher Community Centre. Source: Cork County Council

Figure 8.17: Post 2012 flood event in Togher Area – inside Spar Express shop. Source: Cork County Council

This area comprises the Tramore River between Lehenaghmore Industrial Estate and Greenwood Estate in Togher, refer to **Figure 3.11.** The surrounding area is mixed residential and industrial use. The residential area of Brook Avenue is located adjacent to Lehenaghmore Industrial Estate whilst Greenwood Estate is located off the Togher Road south of the N40 South Link road. There are a number of residential, educational, commercial and religious facilities adjacent to or in the vicinity of the Togher road. The Old Doughcloyne Hotel, the Way of the Cross Church and Togher Girls and Boys National Schools are all located in the vicinity of the proposed scheme works areas. The area has a typical suburban form; open and with low-density settlement patterns.

The majority of the Tramore River is culverted in this area. There are some short open channel sections in between the culverts.

The Lehenaghmore Industrial Estate is located south of Togher Cross, and is accessible from Togher Road. The industrial estate houses the Southern Fruits distribution warehouse and shop, as well as a number of other commercial units. A car park is provided within the complex. The left bank of the river is lined with properties and the rear gardens of Brook Avenue. The southern boundary of the industrial estate is lined with hedges. Opposite the industrial estate entrance there is a temperature controlled storage and logistics facility.

Greenwood Estate is located in the southern area of the proposed scheme. The Tramore River is located to the south of this residential estate. There are also some commercial units located close to the Tramore River.

The Togher Community Park (Greenwood Football Club) playing fields and Togher Sports Pavilion lie to the north of the Greenwood Estate, on the left bank of the river, along which runs a pedestrian walkway.

8.3.5 Heritage

Archaeological, architectural and cultural heritage are discussed in **Chapter 13 Archaeological, Architectural and Cultural Heritage**. Nature conservation areas are discussed **Chapter 6 Biodiversity**. Designated views and prospects, scenic routes and protected views designated in the *Cork County Development Plan 2014-2022* are discussed in **Chapter 7 Landscape and Visual**.

8.3.6 Local Amenity

In Douglas (Areas 1 to 3), there are a number of local amenities that benefit a large cross-section of the community. As previously described, Area 1 has Ballybrack woods and cycle track/walkway, the ICA hall, Douglas Community Park and Centre, recycling facilities, St Luke’s National School, John Slye Scout Hall, and both Saint Luke’s and Saint Columba’s churches near the proposed works areas. At Area 2, St Patrick’s Mills, there are a number of small businesses and a shopping centre that among other units contain a public library and a post office.

In Togher the proposed flood relief scheme works are near to a number of shops and businesses, the Church of the Way of the Cross, a girls and boys national school, Togher Community Services Centre and playing fields.

8.3.7 Tourism

Although Douglas and Togher are not currently popular tourist destinations, the area includes a number of attractions for tourists, including recreation and amenity areas, accommodation, restaurants, public houses and retail outlets. 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.

8.3.8 Population

The smallest geographical units distinguished by the Central Statistics Office (CSO) are Electoral Divisions (ED).

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 Inishkenny, Lehenagh (both Togher area) and Douglas Electoral Divisions within the Ballincollig-Carrigaline Electoral Area. The Ballincollig-Carrigaline Electoral Area is comprised of eight EDs in total. The proposed FRS works cross into both the Inishkenny and Lehenagh ED; the proposed FRS works in Douglas are contained wholly within the Douglas ED.

Table 8.2 outlines the population change between 2006 and 2011 and between 2011 and 2016, as well as the associated population growth rates.

Table 8.2: Population change between 2006 and 2016 and the growth rate of these population figures

District	2006	2011	Change from 2006-2011	2016[1]	Change from 2011-2016[1]
State	4,239,848	4,588,252	+8.2 %	4,757,976	+3.6 %
Cork (County and City)	481,295	519,032	+7.8 %	542,868	+4.5 %
Cork County	361,877	399,802	+10.5 %	417,211	+4.1 %
Cork City	119,418	119,230	-0.2 %	125,657	+5.1 %
Lehenagh (Electoral Division No 18096)	9,534	9,898	+0.04 %	10,267	+3.5 %
Douglas (Electoral Division 18086)	18,182	20,387	+12.13 %	20,913	+2.4 %
Inishkenny (Electoral Division 18092)	5,314	5,522	+0.04 %	5,637	+2.0 %

The trend in population change for the three electoral divisions largely follows the regional and national trend, of slight population increase. Douglas has seen much larger growth in this period than the ED's of Lehenagh and Inishkenny which include Togher.

8.3.9 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 2011 household size in the areas of the proposed flood relief scheme development is still higher than the State and County averages in both 2011 and 2016. The 2016 Census data for the Electoral Divisions listed in **Table 8.3** is currently unavailable.

[1] The 2016 National Census was taken on the 24th April 2016. The relevant 2016 Census data listed above in Table 8.2 for the State, Cork County and Cork City have been officially published, whereas the 2016 Census data for the Electoral Divisions listed are preliminary results only.

Table 8.3: Average household size change between 2006 and 2016

District	2006	2011	2016
State	2.81	2.73	2.70
Cork County	2.88	2.80	2.80
Lehenagh (Electoral Division No 18096)	3.14	2.99	-
Douglas (Electoral Division 18086)	2.94	2.83	-
Inishkenny (Electoral Division 18092)	2.96	2.94	-

8.3.10 Trends in Employment and Economic Activity

The CSO Quarterly National Household Survey, Quarter 4 of 2016 states that 2,048,100 persons were in employment in the State in the fourth quarter of 2016, an annual increase in employment of 65,100 in the year to the fourth quarter of 2016, or 3.3 %. This compares with an annual increase in employment of 2.9% in the previous quarter (Q3) and an increase of 2.3 % in the year to Q4 2015.

The survey states that unemployment decreased by 40,000 (-21.4%) in the year to Q4 2016 bringing the total number of persons unemployed to 147,400. This is the eighteenth quarter in succession where unemployment has declined on an annual basis.

The *Carrigaline Local Area Plan 2011* (LAP) (2nd Ed., 2015) states in Section 2.2.9 that there were 13,234 people employed in the South Environs, more than any other main settlement or urban area in the County. Cork City South Environs is a group of suburbs including Rochestown, Douglas, Grange, Maryborough, Togher and Doughcloyne. The *Draft Ballincollig Carrigaline Municipal District LAP* (2016) notes in Section 3.5.15 that the South Environs employs 12,576. This is a decrease of 758 (5%) people employed in the South Environs since the LAP figures from 2011. However Cork South Environs remains the area with the largest number of people employed in the County (LAP 2016).

The current local area plans for Cork, including Carrigaline LAP, were first adopted in 2011 are due to be replaced by August 2017. The current Carrigaline LAP was revised in 2015 as a second edition. Cork County Council (CCC) has prepared Draft Municipal District Local Area Plans for the next six year LAP cycle (2017-2023). The proposed scheme area is included in the *Draft Ballincollig Carrigaline Municipal District Local Area Plan* (2016). It is available on the CCC website for review (www.corklocalareaplans.com).

The Cork Area Strategic Plan – Strategy for Additional Economic and Population Growth – An Update (Indecon, RPS and Savills HOK July 2008) is a strategy document for the development of the Cork City region up to 2020. The CASP projections show employment for the South Environs in 2020 is 14,734 people in Cork South Environs, an increase of 2,158 or 17.1% on the employment figures from the Draft LAP (2016).

The 2011 CSO census data includes detail of the industries in which people are employed. Looking at this data can provide insight into the economic activity in the three EDs (Inishkenny, Lehenagh and Douglas) in the area of the proposed scheme. The 2016 Census data for the number of people employed by economic sector in these EDs is currently unavailable.

Table 8.4: Persons employed by economic sector (Census 2011)

Industry	Inishkenny	Lehenagh	Douglas
Agriculture, forestry and fishing	34	37	46
Building and construction	107	188	373
Manufacturing industries	349	710	1,596
Commerce and trade	646	1,189	2,817
Transport and communications	173	366	793
Public administration	133	235	487
Professional services	877	1,135	2,364
Other	369	560	1,029
Total	**2,688**	**4,420**	**9,507**

The 2011 Census data indicate that the two largest industries in the area of the proposed scheme are Commerce and trade, and Professional Services. Douglas is an area of significant commercial activity, due to the presence of numerous small businesses, referred to in Section 8.3.7 Tourism.

8.3.10.1 Licensed Industrial Facilities

Large scale industrial and agricultural activities are licensed by the Environmental Protection Agency (EPA) under the Industrial Emissions Directive (2010) and Environmental Agency Act 1992 as amended.

The EPA online mapping indicates that the nearest licensed industrial facility is Brooks Haughton Limited (P0343-01), 820 m northeast of Togher Cross roundabout. The nearest licensed Industrial Emissions facility is Irish Pioneer Works (Fabricators) (P0407-01), approximately 2 km west of the Douglas Church Road culvert.

8.4 Characteristics of the Proposed Scheme

The proposed flood relief scheme will consist of the implementation of flood defences, in various forms, along the Ballybrack Stream and Tramore River in Douglas and in Togher. The proposed 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; installation of trash screens; conveyance improvements (river channel widening and deepening), and localised regrading of ground levels. The proposed scheme is described in detail in **Chapter 3 Description of the Proposed Scheme**. Refer to **Chapter 4 Construction Activities** for details on construction phasing.

The following works are of particular relevance in relation to human beings:

- Construction activity in the vicinity of residential properties,

- Construction activity in the vicinity of commercial, industrial, retail, educational, health and religious properties, sports facilities and community facilities,
- Construction activity in the vicinity of the amenity areas of Ballybrack Woods, Douglas Community Park, the amenity area near the ICA building, cycle track and Togher Community Park,
- Permanent removal of ICA bridge and Church Road cycle track/walkway bridge,
- Replacement of Lower Ravensdale bridge,
- Replacement of Church Road culvert.

8.5 Evaluation of Impacts

Impacts on human beings 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 13 Archaeological, Architectural and Cultural Heritage,

Chapter 14 Roads and Traffic,

Chapter 15 Material Assets,

Chapter 16 Cumulative Impacts.

The impacts of the proposed development on human beings in relation to residential and recreational amenity, economic and employment activity and public health are evaluated in the following sections.

8.5.1 Construction Impacts

8.5.1.1 Area 1: Ballybrack Stream through Douglas

Refer to **Drawings C-000-011, C-000-012** and the cross-sections in **Drawings C-000-015** to **C-000-017** in **Appendix 3.1**. Also refer to **Figures 3.1** to **3.4.**

During the construction phase, potential impacts on local amenities will relate primarily to accessibility and general nuisance (dust, noise etc.) generated by construction activity. Temporary diversions through local amenities and/or temporary alternative access to local amenities may be required to facilitate the construction works. This includes Ballybrack Woods, Douglas Community Park, the cycle track/walkway and the amenity area near the ICA Hall.

There may be a reduction in space availability within the local amenities (e.g. within Douglas Community Park) as the construction works will require some areas to be cordoned off from the general public for construction machinery access and public safety. However, these restrictions will be in place for a short duration only and access will be reinstated upon completion of the works. Within Douglas Community Park, the adult exercise equipment located close to the Ballybrack stream will potentially be unavailable for use during the construction period. The ESB substation that is located to the northern extent of the Douglas Community Park will be also removed and relocated to within 10m of its current position.

It is expected that the small amenity area near the ICA Hall (between the stream and Church Road) will not be available during the construction works for public safety reasons.

Vehicular access via Lower Ravensdale Bridge to the residential properties on the left bank of the Ballybrack stream will not be available for a number of weeks whilst the bridge is being replaced. As there are no feasible temporary diversion routes available, alternative secure parking for cars will be arranged in agreement with the residents affected. It is expected that vehicular access will be restricted for approximately three weeks. This will result in a temporary negative impact on those affected residents. Pedestrian access will be facilitated at all times during the construction phase via a temporary pedestrian bridge or similar. Every effort will be made to carry out the works as quickly as possible in order to minimise impacts on the residents of Ravensdale.

The ICA bridge to Church Road and the Church Road cycle track/walkway bridge will be permanently removed. However, alternative access will be constructed as part of the scheme. Refer to **Drawing C-000-012**. During construction the ICA hall will be accessible via the car park next to the Westbrook Retirement Home. Cyclists and pedestrians can cross the Ballybrack Stream via Church Road culvert. These restrictions will have a negative but temporary impact on users of the area.

The cycle track/walkway, that links Church Road to Ballybrack woods, will be temporarily restricted while the trash screen is being installed at the small bridge in Ballybrack woods.

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 Council and landowners.

Temporary traffic restrictions will be required during the replacement of the Church Road culvert. However, these will be managed via the construction traffic management plan which will be prepared by the Contractor.

It is envisaged that traffic measures such as a stop-go system, temporary one-way traffic systems or similar will be implemented to allow the construction works and utility diversions to be constructed and at the same time to manage traffic. It is not anticipated at this stage that full road closures will be required. However, if they are required, they will be for a very short duration only and will take place at night or other suitable times to minimise the impact on traffic in the area.

It is expected that some trees, shrubs and vegetation will require removal to facilitate the construction works. These areas will be reinstated in general. However, the landscape character of Douglas Park may change due to the works proposed within the park which will necessitate the removal of some trees close to the Ballybrack stream. The path through the park will be realigned. These impacts are dealt with in **Chapter 7 Landscape and Visual**. Construction impacts on air (e.g. dust) and noise are dealt with in the relevant chapters.

8.5.1.2 Area 2: Tramore River through St Patrick's Mills

Refer to **Drawing C-000-010** and the cross-section in **Drawing C-000-015** in **Appendix 3.1**. Also refer to **Figures 3.5** to **3.7.**

The construction works will necessitate temporary restrictions on car parking and access within the Mills in the vicinity of the Tramore River. It is envisaged that one row of car parking spaces (c. 33 spaces) directly next to the river will be removed from public use for the duration of the works, constituting a potential temporary negative impact on the commercial units trading in this area.

8.5.1.3 Area 3: Grange Stream through Donnybrook Commercial Centre

Refer to **Drawings C-000-013, C-000-014** and the cross section in **Drawing C-000-017** in **Appendix 3.1**. Also refer to **Figures 3.8** to **3.10.**

The construction works will necessitate temporary restrictions on car parking and access within the Commercial Centre in the vicinity of the Grange Stream. Access and parking will be restricted during river regrading and culvert replacement in the Commercial centre, constituting a potential temporary negative impact on the commercial units trading in this area.

Where the culvert will be installed by the former mill complex near the entrance to the commercial centre, access and parking to these units will be restricted as the culvert is constructed with a potential temporary negative impact on the commercial units in this part of the commercial centre.

8.5.1.4 Area 4: Tramore River through Togher

Refer to **Drawings C-000-007** to **C-000-009** and the cross sections in **Drawings C-000-015** and **C-000-019** in **Appendix 3.1.** Also refer to **Figures 3.11** to **3.13.**

During the construction phase, potential impacts on residential and other properties will relate primarily to accessibility and general nuisance (dust, noise etc.) generated by construction activity. Accessibility will be maintained for all properties throughout. However, temporary vehicular diversions and temporary alternative access points may be required. Temporary traffic restrictions will be required along Togher Road during the works however these will be managed via the construction traffic management plan which will be prepared by the Contractor.

It is expected that some trees, shrubs and vegetation will require removal to facilitate the construction works. These areas will be reinstated in general.

However, the landscape character of some areas may change due to the permanent removal of some trees. These impacts are dealt with in **Chapter 7 Landscape and Visual**. Construction Impacts on air (e.g. dust) and noise are dealt with in the relevant chapters.

At Lehenaghmore Industrial Estate and Brook Avenue estate vehicular and pedestrian access will be maintained for all properties while the trash screen is being constructed.

At the Togher Community Park (sports ground) north of the Greenwood Estate, there is a pedestrian walkway from the Togher Road, along the left bank of the Tramore River. It is likely that this walkway will be impacted during the construction of the defence wall along the left bank. Any disruption to the access to this amenity walkway will be temporary in nature. It is envisaged that the walkway will remain open throughout.

The car park in the Togher Community Park (sports ground) will be required for use as an access route for construction vehicles. There may be a temporary removal of parking during the construction phase when vehicles need to access the site.

8.5.1.5 Tourism

The proposed development will have limited impact on the tourism activities in Douglas and Togher. Local amenities at the disposal of tourists in the area are predominantly commercial outlets, accommodation, public houses and restaurants. There is potential for localised and temporary disturbance due to the impacts of construction works.

8.5.1.6 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 due to traffic restrictions and general nuisance and accessibility.

There is a potential short term positive economic impact during construction due to the short-term increase in employment. Local businesses may also benefit from an increase in demand for their goods and services due to spending from construction workers in the area.

The proposed scheme will have no impact on licensed industrial facilities during the construction phase.

8.5.1.7 Employment

The proposed scheme has the potential to positively impact on employment in the areas on a short term basis during the construction phase. The duration of the construction phase will be approximately 18 months. Where possible, a local labour force will be employed, and the required materials will be sourced locally.

8.5.2 Operational Impacts

During the operational phase, the impacts on population and human health will be positive. The areas directly affected by the proposed works during the construction phase will also benefit directly from a reduced risk of flooding. Refer to **Drawings C-000-004** to **C-000-006** in **Appendix 3.1** which illustrate the benefitting lands from the proposed scheme.

As discussed previously, there is a history of flooding in the area. Previous flooding events have resulted in considerable damage to residential and commercial properties throughout the area. Such flood events destroy the internal contents of houses including the electrics, plumbing and interiors and may also cause structural damage. Cars and other vehicles often have their engines flooded and are subsequently 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. There may be difficulties in obtaining or retaining house insurance in relation to flood damage.

The provision of the flood relief scheme will minimise the risk of flooding in the Togher and Douglas areas, particularly in the commercial areas where there is employment currently and also in residential areas. The flood relief scheme will allow people to continue to work and live in the area with a much lower flood risk into the future. This will result in a long-term significant positive impact.

There will be a positive impact on health and safety for those living and working in the 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.

The operational phase of the proposed scheme will not 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 therefore have a long-term positive impact on the tourism and local amenities of the area.

The increase in flood protection as a result of this proposed scheme will contribute to securing new and current 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 proposed flood relief scheme will benefit the businesses of Togher and Douglas by rebuilding customer confidence in the area during wet weather.

Wet weather can deter people from shopping in areas with a well-known flooding history due to concerns over personal safety, accessibility, parking and business closure. This is of particular concern to business owners when wet weather coincides with important retail periods such as Christmas.

There will be no significant air or noise emissions from the scheme once it is operational. 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.

In the design of any flood relief scheme, it is important that the flood mitigation measures are considered in the context of a long term strategy which is flexible and adaptive to changes in the climate and its potential impact on flood risk. The proposed scheme has been designed to ensure it is readily adaptable to climate change.

The proposed scheme for Douglas (Areas 1 to 3) is designed to provide protection to properties in the study area from the 1 in 100 year fluvial/1 in 200 year tidal flood events. An allowance for freeboard has also been incorporated into the design. This standard is in line with the OPW's national standard for constructing flood defence schemes in Ireland.

The scheme incorporates the construction of direct defences through Ravensdale and direct defences/channel regrading through the community park for the current scenario. It would be feasible for the heights of the defence walls to be further increased as part of a climate change adaptation strategy in the future without involving a significant impact on environmental and landscape features. This measure would increase the capacity of the channel and allow it convey a greater flow through the reach.

Conveyance improvements could also be implemented as part of the climate change adaptation strategy as the channel could be deepened in the future without involving a significant impact on the environment. The channel could also be widened where space is available to facilitate widening.

The proposed scheme for Togher (Area 4) consists of a replacement culvert which has been designed to meet with OPW Section 50 requirements. It is therefore designed to accommodate the 1 in 100 year fluvial flood plus an allowance for climate change and freeboard.

8.6 Mitigation Measures

8.6.1 Construction Mitigation Measures

8.6.1.1 Local Amenity

Works will be designed to minimise impacts on local amenity during the construction period. 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.

In order to ensure the greatest possible access to the Douglas Community Park during works, the entrances at Church Road and Church Street will remain open. The footprint of the works will be kept to the minimum.

This will minimise impacts on the amenities in the Community Park, ensuring that the cycle track/walkway that runs through the Park, as well as the multi-use games area, Community Centre and playground will remain accessible to the public for the duration of the works. Part of the adult exercise equipment will need to be dismantled during the construction works period. The pedestrian/cyclist routes will be temporarily diverted but access will be maintained at all times.

The duration of works at the Lower Ravensdale Bridge will be limited to a number of weeks to minimise the impact on residents of the area who will have no vehicular access to their properties during the works. Alternative secure parking for cars will be arranged in agreement with the residents affected, while pedestrian access will be maintained throughout the construction period via a temporary pedestrian bridge or similar

The boundary walls/fences, vegetation and trees in the areas of the proposed works (particularly in Area 1 and generally parallel with watercourses) that will be temporarily removed to facilitate construction access will be reinstated on completion of the works in agreement with the Council and landowners. Landscaping and replanting will also be carried out on completion in agreement with the Council and landowners.

A traffic management plan will be implemented to minimise disruptions to traffic. Refer to **Chapter 14 Roads and Traffic** for further details.

Noise disturbance and emissions to air will also 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. A dust minimisation plan will be prepared and implemented by the contractor during construction. Refer to **Chapter 10 Air Quality and Climate** of the EIS for further detail of the mitigation measures to be implemented as part of the dust minimisation plan.

8.6.1.2 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. Dust and noise emissions will be controlled through dust management, and works will not take place outside standard working hours to ensure minimal environmental disturbance. Refer to **Chapter 9 Noise and Vibration**.

8.6.1.3 Population

Noise 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.

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 10 Air Quality and Climate** for details of dust mitigation measures.

8.6.1.4 Economic Activity

The impact on local economic activity can be reduced through ensuring access to local businesses is maintained. A 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 watercourses are not impacting on conveyance or to repair structural elements of the drainage scheme such as flood walls, culverts etc.

Mitigation measures during the operational phase will relate primarily to these maintenance works, and will broadly reflect those employed for the construction phase but on a much smaller scale.

8.7 Residual Impacts

The proposed flood relief 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 proposed scheme will have a long-term positive impact on the local population.

The increased 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 Material Assets,

Chapter 13 Archaeological, Architectural and Cultural Heritage,

Chapter 14 Roads and Traffic,

Chapter 15 Material Assets,

Chapter 16 Cumulative Impacts.

8.8 References

Censuses of Ireland 2006, 2011 and 2016 *(*www.cso.ie)

Central Statistics Office *Quarterly National Household Survey Quarter 4 2016* (www.cso.ie)

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

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

Cork County Council (2016) *Draft Ballincollig Carrigaline Municipal District LAP*

Cork County Council, *Cork County Development Plan 2014*

Fáilte Ireland Annual Report 2015

Indecon, RPOS and Savills HOK (2008) *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*

9 Noise and Vibration

9.1 Introduction

This section assesses the likely noise and vibration impacts arising from the proposed development. During its operational phase, the proposed scheme will have negligible noise or vibration impacts, therefore it is only considered necessary to assess the potential impacts of the construction phase. The section will also identify required or possible mitigation measures.

9.2 Methodology

An assessment was carried out to determine the noise and vibration impacts of the construction phase of the proposed scheme. Due to the nature of the works, significant noise and vibration impacts are not expected during the operational phase. The 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
- 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

9.2.1.1 Construction Phase

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	Category B	Category 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.

As a conservative estimate, Category A noise limits have been selected for day-time, evening time and night time noise limits. These limits are outlined in Table 9.2 and will be applied at the nearest sensitive receptor to each of the construction work areas. Sensitive receptors are defined in BS5228 as any occupied premises outside a site used as a dwelling, place of worship, educational establishment, hospital or similar institution or any other property likely to be adversely affected by an increase in noise level.

Table 9.2: Noise limits to be applied at sensitive receptors.

Assessment Category and Threshold Value Period (L_{Aeq})	Threshold Value (dB)
	Category A [A]
Night-time (23:00 to 07:00hrs)	45
Evenings & Weekends [D]	55
Daytime (07:00 – 19:00hrs) and Saturdays (07:00 – 13:00hrs)	65

The closest sensitive receptors are located c. 10m from the works. Predictions outlined in Section 9.5.1 have been made at this distance in order to estimate noise levels at worst case receptor.

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. There are no expected significant vibration sources associated with the development once the construction phase has been completed.

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 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 ground borne disturbance.

The most significant sources of transient vibration during the construction phase of the development are likely to be from the following activities:

- Excavation;
- Breaking of existing road surfaces and removal of bridges;
- Construction traffic;
- Channel widening and deepening, and.
- Piling foundations and flood defence walls, depending on the methodologies chosen.

Table 9.3 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 9.3: 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, the vibration limits set within Table 9.1 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.

9.2.2.2 Operational Phase

As the proposed scheme contains no operational noise sources and will generate no traffic, no operational traffic assessment has been undertaken.

9.3 Receiving Environment

Construction works for the proposed scheme will take place in four separate areas along the Tramore River and Ballybrack Stream as follows:

Area 1: Ballybrack Stream through Douglas.

Area 2: Tramore River through St Patrick's Mills, Douglas

Area 3: Grange Stream (tributary of Ballybrack Stream) through Donnybrook Commercial Centre

Area 4: Tramore River through Togher

The general study area is shown in **Figure 1.1**. **Figures 1.2a** and **1.2b** show key plans of the proposed flood defence works in Douglas and Togher.

Douglas

As this is a mainly residential and commercial zone, the existing noise environment in this section of the scheme is characterised by traffic noise.

The most southern point of the scheme in Douglas is at the Donnybrook Commercial Centre (Area 3). The centre comprises of both purpose built commercial units and older structures some of which are protected. The purpose built units are in closest proximity to the proposed works. The Grange Stream currently runs through part of this centre before being culverted.

There are a number of buildings to the east of the culvert and included in the commercial centre. Some of these buildings are listed on the National Inventory of Architectural Heritage or as National Monuments. The Jesus Christ Centre Church is located in one of these protected structures to the east of the culverted stream.

There are a number of residential areas surrounding the commercial centre; Grange Park north and behind the commercial units; to the south, Bromley Park and on Donnybrook Hill. The closest residence is approximately 45m north of the Grange Stream culvert and behind the commercial units in Grange Park.

The next section of the proposed flood relief scheme is downstream of the Grange Stream after the convergence of the Grange Stream into the Ballybrack Stream in Ballybrack Woods (Area 1). This area is used for recreation with a combined cycle/walkway through the woods that runs parallel to the Ballybrack Stream. Refer also to Chapters 1 and 3 for further details on the surrounding environment. In Ravensdale, there are a number of one off residential houses adjacent to the stream. Where Church Road crosses over the Ballybrack Stream, the surrounding area is a mix of retail, residential and recreational facilities. The Irish Countrywomen's Association (ICA) Hall is located on the left bank of the stream near Church Road (Refer to Figure 3.1). There is a retirement home and a number of retail units to the west of the ICA Hall. North of Church Road is St Luke's National School and Douglas Community Centre. The Ballybrack Stream flows under Church Road and north through Douglas Community Park towards Douglas village. There are a number of residential houses along the left bank of the stream opposite the Community Park. Many of these houses are c. 10m from the stream. On the right bank of the Ballybrack Stream is Douglas Community Park which runs parallel to the stream. The park contains a playground, large green areas, adult exercise equipment, and a cycle path and footpath that run parallel to the stream connecting Church Road and Church Street. At Church Street the stream is culverted.

Area 2 consists of construction works at Saint Patrick's Mills, north of Church Street and on the right bank of the Tramore River. The N40 national primary road or South Link runs over West Douglas Street and is a significant source of traffic noise in the area. East of Saint Patrick's Mills is the Douglas Village Shopping Centre which attracts significant traffic including cars which park in the multi-level car park.

Togher

As detailed in **Chapter 3**, the existing culvert between Lehenaghmore Industrial Estate and Greenwood Estate will be replaced and extended with a new reinforced concrete culvert. Lehenaghmore Industrial Estate is located at the southern and upstream end of Area 4 (Togher). A small number of commercial properties, as well as the housing estate at Brooke Avenue lie in close proximity to the river bank. The noise environment in this area is characterised by road traffic.

The existing culvert runs partially along the Lehenaghmore Road, through Togher cross and along Togher Road. The culverted section of the Tramore River is beneath the Togher Rd, which is lined with housing estates, the Togher Girls' National School, Togher Boys' National School and the Church of the Way of the Cross. The noise environment in this area is characterised by road traffic, which experiences school- and work-related peaks.

At the northern (downstream) extent of the scheme lies Greenwood Estate, which is a residential estate where numerous residential properties back onto the Tramore River before it is culverted.

A number of commercial properties including Griffin's piano shop are located on the river bank. The noise environment in this area is characterised by road traffic.

9.4 Characteristics of the Proposed Scheme

The proposed scheme consists of a number of construction activities as described in detail in **Chapter 3** of this EIS. The main aspects of the proposed scheme in relation to noise and vibration include the following:

- Construction of new flood defence walls and/or replacement of existing walls with new flood defence walls
- Replacement of and/or extension of existing culverts
- Removal of and/or replacement of bridges
- Removal of existing trash screens and construction of new screens
- Local channel widening, deepening, realignment and regrading
- Construction of new earthen flood defence embankment
- Provision of civil works such as road/footpath regrading at a number of locations;
- Removal of vegetation and trees to facilitate construction works
- Construction of 2 no. underground surface water pumping stations

All construction works are likely to generate noise and vibration to varying degrees, due to the intensity of the works and 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

The TII guidance advises that noise levels associated with construction may be calculated in accordance with the methodology set out in BS 5228: Part 1. This standard sets out sound power levels for plant items normally encountered on construction sites, which in turn enables the prediction of noise levels at selected locations. The TII guidance notes that definitive construction methods and number of plant items are not usually set out at the EIS stage and that the overriding requirement of the contractor will be to construct the scheme to the final design within the constraints of the construction noise limits. These limits are set out in **Table 9.2**.

Table 9.4 to **9.6** presents input data and calculations of indicative noise levels for typical noise sources associated with the construction of the proposed scheme. The numbers in respect of plant presented in the tables below are also indicative.

Noise levels have been predicted using guidance set out in BS 5228: *Code of Practice for Noise and Vibration Control on Construction and Open Sites (Part 1: Noise)* (BSI, 2009+A1:2014).

The assessment has been conducted to be representative of a worst case scenario. The following assumptions have also been made in the preparation of these construction noise prediction calculations:

- Plant items are operating between 25% and 80% of the time;
- All plant items associated with the individual phases are operating simultaneously and at the same distance for any one scenario; and
- The provision of a 2.4m hoarding around the construction works. This has been inputted as a 10dB reduction for each noise source, although a greater level of noise reduction would be expected.

BS 5228: 2009+2014 sets out typical noise levels for items of construction plant. **Table 9.4** sets out assumed plant items during the key phases of construction with the associated source reference from BS 5228.

The first relates to construction of flood defence walls, embankments, culverts and bridges, the second examines noise generated from works to roads.

Table 9.4: Typical construction noise levels from proposed plant (dB $L_{Aeq,1hr}$)

Phase	Typical Plant Item	Sound Power Level (dB $L_{Aeq,1hr}$)[1]	% of time in operation
Construction of flood defence walls, embankments, culverts and bridges	Chainsaw	100	25
	Water pump	90	80
	Mini Tracked Excavator	96	50
	Concrete Pump + Cement Mixer Truck (Discharging)	95	50
	Sheet Steel Piling - Hydraulic Jacking	91	50
Works to roads	Mini Tracked Excavator	96	50
	Mini Planer	96	50
	Asphalt Paver(+Tipper Lorry)	103	50

[1]: BS 5228-1 Code of practice for noise and vibration control on construction and open sites. Noise

It is expected that works in the distinct zones will be confined to very short periods of time, with a predicted maximum of several months. This will minimise the length of time that receptors are exposed to noise and vibration emissions.

9.5.1.1 Construction of flood defence walls, embankments, culverts and bridges

Works proposed: Reinstatement or replacement of existing flood defence wall and construction of new flood defence walls; river bank regrading and embankments; construction or replacement of culverts; trash screen removal/construction, river widening and deepening; replacement of a bridge; bridge removal; tree removal.

Where in-stream works are required as part of construction, this will require over pumping of water or temporary stream diversions, which will produce noise adding to the construction 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.

Ground breaking will be required for accessing and constructing culverts, bridge removal and replacement, and new flood defence walls. Excavators, scrapers, concrete mixers and concrete pumping will be used. In Areas 1, 3 and 4, some trees will be required to be felled and removed from site using chainsaws and elevated work platforms. **Table 9.5** outlines indicative construction noise predictions during this phase at various distances from the construction works.

Table 9.5: Indicative construction noise calculations during construction of flood defence walls, embankments, culverts and bridges

Construction of flood defence walls, embankments, culverts and bridges	Calculated $L_{Aeq, T}$ at distance from works (dB)			
	10m	20m	40m	80m
Chainsaw	61.0	55.0	48.9	42.9
Water pump	51.0	45.0	39.0	33.0
Mini Tracked Excavator	55.0	49.0	42.9	36.9
Concrete Pump + Cement Mixer Truck (Discharging)	54.0	48.0	41.9	35.9
Sheet Steel Piling - Hydraulic Jacking	50.0	44.0	37.9	31.9
Combined L_{Aeq} from all plant	*63*	*57*	*51*	*45*

The results of the assessment in **Table 9.5** indicate that for the construction of flood defence walls, embankments, culverts and bridges, the construction daytime noise limit of 65dB LAeq can typically be complied with for the scenario assessed. The nearest sensitive receptor is located c. 10m from these works.

9.5.1.2 Works to Roads

Works proposed: Provision of and re-grading of road/footpaths; replacement of culverts below roadways

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. Road construction activities, including excavation, will also generate noise.

Replacing existing culverts below the Togher Road and Church Road will require ground breaking excavation, pumping and regrading works. The impact is likely to be moderate temporary but not significant as existing noise levels in these areas are already dominated by traffic noise.

Table 9.6 outlines indicative construction noise predictions during this phase at various distances from the construction works.

Table 9.6: Indicative construction noise calculations during works to roads

Works to Roads	Calculated $L_{Aeq, T}$ at distance from works (dB)			
	10m	20m	40m	80m
Mini Tracked Excavator	55.0	49.0	42.9	36.9
Mini Planer	55.0	49.0	42.9	36.9
Asphalt Paver (and Tipper Lorry)	62.0	56.0	49.9	43.9
Combined L_{Aeq} from all plant	63	57	51	45

The results of the assessment in **Table 9.6** indicate that for the construction of works in roads, the construction daytime noise limit of 65dB LAeq can typically be complied with for the scenario assessed. The nearest sensitive receptor is located c. 10m from these works.

9.5.2 Operational Impacts

Once the works are complete it is not envisaged that there will be any operational impacts. Channel maintenance works may be necessary during operation such as trash screen clearing but it is not envisioned that these works will have a significant impact on noise and vibration in the area.

The two surface water pumping stations proposed (located adjacent to Church Road and in St Patricks Mills) as part of the scheme have the potential to generate noise when operational. However, the surface water stations will be installed underground so it is not envisaged that they will have a significant impact. The pumps will also be in operation during flood events only.

9.6 Mitigation Measures

9.6.1 Construction Mitigation Measures

The construction contractor will be required to manage noise and vibration aspects of the project in accordance with BS 5228 Part 1 (2009) and the European Communities (Noise Emission by Equipment for Use Outdoors) Regulations, 2001 *Code of Practice for Noise and Vibration Control on Construction and Open Sites*. This document provides for practical measures that limit the hours in which noisy activities are permitted, provision of acoustic screening for noisy activities, use of silencers on equipment, siting of noisy mobile equipment away from sensitive receptors, and the provision of relevant training with respect to minimising noise disturbance. It is recommended that the contractor liaises with residents of nearby dwellings in advance of works to assist in managing expectations with regard to length and duration of works, to minimise upset and aggravation.

It is expected that works in the distinct zones will be confined to very short periods of time, with a predicted maximum of several months. This will minimise the length of time that receptors are exposed to noise and vibration emissions. Noise emissions will comply with daytime noise limits (65dB $L_{Aeq\ 1h}$).

The following measures will also be employed by the Main Contractor(s):

- 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
- A site representative shall be appointed to be responsible for matters relating to noise and vibration.
- Unnecessary revving of engines shall be avoided and equipment shall be switched off when not required;
- Internal haul routes shall be well maintained and shall avoid steep gradients;
- Rubber linings shall be used in chutes and dumpers etc. to reduce noise impact;
- Drop heights of materials shall be minimised;
- Plant and vehicles shall be started sequentially rather than all together.
- Construction plant and activities to be employed on site shall be reviewed to ensure that they are the quietest available for the required purpose;
- Where required, improved sound reduction methods, e.g. enclosures shall be used;
- Site equipment shall be located away from noise sensitive areas, as much as is feasible;
- Regular and effective maintenance by trained personnel shall be carried out to reduce noise and/or vibration from plant and machinery;
- 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.
- A 2.4m hoarding will be provided around the construction works area where possible. However if this is not suitable for the construction of embankments, the use of pressed-in sheet piling where possible will avoid vibration nuisance. Screens will be positioned as close as possible to either the source or the receptor. The screen will ensure that there is no direct line of sight between the source and the receptor. The site layout will be considered as this can also contribute to noise screening - the position of storage, offices, or other elements of the construction compound can also provide a degree of noise screening if placed between source and receptor;
- Site activities shall be limited to 8am - 7pm, Monday to Friday; and 9am - 4pm, Saturday (It may be necessary in exceptional circumstances to undertake certain types of activities outside of normal construction core working hours. Any such working hours outside the normal construction core working hours will be agreed with Cork County Council. The planning of such works will have regard to nearby sensitive receptors;

- The Main Contractor(s) shall be required to carry out continuous noise and vibration monitoring in areas where residential properties are directly adjacent to the works. These levels will be compared to the limit values outlined in **Table 9.2** and **Table 9.3**. If exceedances are recorded, alternative construction methodologies will be proposed to ensure limits are complied with.

9.6.2 Operational Mitigation Measures

In operation, the scheme will not generate significant noise or vibration impacts and therefore mitigation is not required for this phase. Channel maintenance activities may be required where necessary during operation but these activities are not envisaged to have any impacts on noise and vibration.

9.7 Residual Impacts

9.7.1 Construction Phase

A preliminary noise assessment of the construction phase impacts has shown that compliance with limit values can be achieved. Noise and vibration monitoring will be undertaken in areas where residential properties are directly adjacent to the works, as outlined in Section 9.6.1. No significant residual impacts are predicted.

9.7.2 Operational Phase

No residual impacts on noise and vibration are predicted during the operational phase.

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*, NRA, 2004.

TII (formerly the NRA) (2014) *Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes*. NRA, Dublin, Ireland.

UK Highways Agency, 2011. Design Manual for Roads and Bridges (DMRB) Volume III, Section 3, Part 7 Noise and Vibration.

10 Air Quality and Climate

10.1 Introduction

This chapter describes and assesses the potential impacts of the proposed Douglas Flood Relief Scheme (including Togher culvert), on air quality and climate. The receiving environment and the characteristics of the proposed scheme for construction and operation are described. The potential impacts of the scheme during the construction and operational phases are evaluated, and the mitigation measures for these potential impacts are presented. The chapter concludes with the predicted residual impacts of the proposed scheme.

10.2 Methodology

This chapter has been prepared sourcing the most relevant and recent air quality data for the proposed scheme works area. The following sources were used to source local air quality information:

- 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.
- 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.
- Met Éireann (www.met.ie) The Irish Meteorological Service Online
- The Environmental Protection Agency – EPA Map Viewer Envision (www.gis.epa.ie/Envision)

This chapter also has regard to the requirements of the Transport Infrastructure Ireland (TII), formerly the National Roads Authority (NRA) document '*Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes*' (TII, 2011). These guidelines provide an assessment methodology for construction sites which can be adapted for all construction works depending on the nature of the works. As the proposed scheme is a linear development, these guidelines are deemed appropriate for this assessment.

10.2.1 Ambient Air Quality Standards

In order to reduce the risk of poor air quality, National and European statutory bodies have set limit values for 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 (µg/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

There are no national or EU limits for dust deposition. However, the TA Luft *Technical Instructions on Air Quality* (TA Luft, 2002) provide a guideline for the rate of dust deposition of 350 mg/m^2/day averaged over one year. The Environmental Protection Agency (EPA) concurs that this guideline may be applied, although applied as a 30-day average, in its document *Environmental Management in the Extractive Industry (Non-Scheduled Minerals)* (EPA, 2006).

10.2.2 Climate

The Climate Action and Low Carbon Development Act 2015 is Ireland’s first dedicated climate change law. The Act makes provision for requiring the Minister, as specified in the Act, to submit a National Mitigation Plan and a National Adaptation Framework to the Government for approval. At the time of issuing this document the Department of Communications, Climate Action and Environment is the responsible Minister. These documents and framework are:

“[f]or *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 draft National Mitigation Plan was published in December 2016 for public consultation. The first National Mitigation Plan is due to be published in June 2017.

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 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; and
- the possible extinction of vulnerable species.

In the design of any flood relief scheme, it is important that the flood mitigation measures are considered in the context of a long term strategy which is flexible and adaptive to changes in the climate and its potential impact on flood risk. The proposed scheme has been designed to ensure it is readily adaptable to climate change.

The proposed scheme for Douglas (Areas 1 to 3) is designed to provide protection to properties in the study area from the 1 in 100 year fluvial/1 in 200 year tidal flood events. An allowance for freeboard has also been incorporated into the design. This standard is in line with the OPW's national standard for constructing flood defence schemes in Ireland.

The scheme incorporates the construction of direct defences through Ravensdale and direct defences/channel regrading through the community park for the current scenario. It would be feasible for the heights of the defence walls to be further increased as part of a climate change adaptation strategy in the future without involving a significant impact on environmental and landscape features. This measure would increase the capacity of the channel and allow it convey a greater flow through the reach.

Conveyance improvements could also be implemented as part of the climate change adaptation strategy as the channel could be deepened in the future without involving a significant impact on the environment. The channel could also be widened where space is available to facilitate widening.

The proposed scheme for Togher (Area 4) consists of a replacement culvert which has been designed to meet with OPW Section 50 requirements. It is therefore designed to accommodate the 1 in 100 year fluvial flood plus an allowance for climate change and freeboard.

10.2.3 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_{10} [a]	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 PM_{10} Limit Values specified in SI No. 180 of 2011, which allows 35 daily exceedances/year of 50 $\mu g/m^3$

The impact of dust emissions during the construction phase is assessed by considering the proximity of sensitive receptors to the works. TII guidance defines sensitive receptors as residential housing, schools, hospitals, places of worship, sports centres and shopping areas. The impact of construction dust on sensitive habitats is also considered, and additional mitigation measures proposed, as required.

10.3 Receiving Environment

10.3.1 Air Quality Zones

The EPA categorises Ireland into Air Quality Zones as is 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 Scheme is included in Zone B (Cork). **Table 10.3** outlines the monitoring data provided by the EPA for Zone B (Cork) for pollutants relevant to this Study Area. Where no data is available for Zone B, Zone C or Zone D data is used. Air quality monitoring took place adjacent to the South Link Road at the Cork City Council Civic Amenity Centre and approximately 2km west of Douglas village.

Table 10.3: Baseline Monitoring Data for Zone B for 2014

Pollutant	Annual mean 2014 Zone B	Air Quality Directive Limit Values
NO_2	22 μg/m^3	40 μg/m^3/year
NO_x	49 μg/m^3	30 μg/m^3/year (critical level or target value)
SO_2	4 μg/m^3	125 μg/m^3/day
CO	300 μg/m^3	10,000 μg/m^3 as 8 hour mean
PM_{10}	15 μg/m^3 [1]	40 μg/m^3/year
$PM_{2.5}$	7 μg/m^3	25 μg/m^3/year

Note 1: Zone C data applied (Zone B monitoring data incomplete).

10.3.2 Study Area

Construction works for the proposed scheme will take place in four separate areas along the Tramore River and Ballybrack Stream as follows:

Area 1: Ballybrack Stream through Douglas.

Area 2: Tramore River through St Patrick's Mills, Douglas

Area 3: Grange Stream (tributary of Ballybrack Stream) through Donnybrook Commercial Centre

Area 4: Tramore River through Togher

The general study area is shown in **Figure 1.1**. **Figures 1.2a** and **1.2b** in **Chapter 1** provide key plans of the proposed flood defence works in Douglas and Togher.

Area 1: Ballybrack Stream through Douglas

The Ballybrack Woods area is used for recreation with a combined cycle and footpath through the woods that runs parallel to the Ballybrack Stream. Refer also to Chapters 1 and 3 for further details on the surrounding environment. In Ravensdale, there are a number of one off residential houses adjacent to the stream.

Where Church Road crosses over the Ballybrack Stream, the surrounding area is mix of retail, residential and recreational facilities. The Irish Countrywomen's Association (ICA) Hall is located on the left bank of the stream near Church Road (Refer to **Figure 3.1** in **Chapter 3**). There is a retirement home and a number of retail units to the west of the ICA Hall. North of Church Road is St Luke's National School and Douglas Community Centre. The Ballybrack Stream flows under Church Road and north through Douglas Community Park towards Douglas village. There are a number of residential houses along the left bank of the stream opposite the Community Park. Many of these houses are approximately 10m from the stream. On the right bank of the Ballybrack Stream is Douglas Community Park that runs parallel to the stream. The park contains a playground, large green areas, adult exercise equipment, as well as a cyclepath and footpath that run parallel to the stream connecting Church Road and Church Street. At Church Street the stream is culverted.

Area 2: St Patricks Mills

Area 2 consists of construction works at St Patrick's Mills, north of Church Street and on the right bank of the Tramore River. The N40 national primary road or South Link runs over West Douglas Street and is a significant source of traffic noise in the area. East of Saint Patrick's Mills is the Douglas Village Shopping Centre which attracts significant traffic including cars which park in the multi-level car park.

Area 3: Donnybrook Commercial Centre

The centre comprises of both purpose built commercial units and older structures some of which are protected. The purpose built units are in closest proximity to the proposed works. The Grange Stream currently runs through part of this centre before being culverted. There are a number of buildings to the east of the culvert and included in the commercial centre. Some of these buildings are listed on the National Inventory of Architectural Heritage or as National Monuments. The Jesus Christ Centre Church is located in one of these protected structures to the east of the culverted stream. There are a number of residential areas surrounding the commercial centre; Grange Park north and behind the commercial units; to the south, Bromley Park and on Donnybrook Hill. The closest residence is approximately 45m north of the Grange Stream culvert and behind the commercial units in Grange Park.

Area 4: Togher

As detailed in Chapter 3, the existing culvert between Lehenaghmore Industrial Estate and Greenwood Estate will be replaced and extended with a new reinforced concrete culvert. Lehenaghmore Industrial Estate is located at the southern and upstream end of Area 4 (Togher). A small number of commercial properties, as well as the housing estate at Brooke Avenue lie in close proximity to the river bank.

The existing culvert runs partially along the Lehenaghmore Road, through Togher cross and along Togher Road. The culverted section of the Tramore River is beneath the Togher Rd, which is lined with housing estates, the Togher Girls' National School, Togher Boys' National School and the Church of the Way of the Cross. The noise environment in this area is characterised by road traffic, which experiences school- and work-related peaks.

At the northern (downstream) extent of the scheme lies Greenwood Estate, which is a residential estate where numerous residential properties back onto the Tramore River before it is culverted. A number of commercial properties including Griffin's piano shop are located on the river bank. The noise environment in this area is characterised by road traffic.

10.4 Characteristics of the Proposed Scheme

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 additional traffic. A detailed description of the proposed works to be constructed for the proposed scheme is presented in **Chapter 4 Construction Activities**. Refer to section 10.5 below for details on potential impacts.

The proposed scheme consists of a number of construction activities as described in detail in Chapter 3 of this EIS. The main aspects of the proposed scheme in relation to noise and vibration include the following:

- Construction of new flood defence walls and/or replacement of existing walls with new flood defence walls
- Replacement of and/or extension of existing culverts
- Removal of and/or replacement of bridges
- Removal of existing trash screens and construction of new coarse screens
- Local channel widening, deepening, realignment and regrading
- Construction of new earthen flood defence embankment
- Provision of civil works such as road/footpath regrading at a number of locations;
- Removal of vegetation and trees to facilitate construction works

10.4.2 Operational Phase

Chapter 3 Description of the Scheme details the flood defence infrastructure that will be in operation once the scheme is complete. There are no activities which are of relevance for air quality during the operational phase of the scheme.

10.5 Evaluation of Impacts

10.5.1 Construction Impacts on Air Quality

10.5.1.1 Dust Generation

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. This activities include:

- Excavations,
- embankment works,
- general construction activities and,
- vehicle movements on-site during construction.

Dust emissions can lead to elevated PM_{10} and $PM_{2.5}$ concentrations. The potential for dust emissions will only arise during site clearance and excavation in dry weather, and during such activities the levels of dust are likely to be small. Dust may be raised by wind from dry surfaces and stockpiles.

When rainfall has occurred, dust emissions are significantly reduced due to the cohesion created between dust particles and water, removing the suspended dust particles from the air. Rainfall data collected from Cork Airport Meteorological Station (1962-2014) showed that the average year has 210 wet days (rainfall greater than 0.2mm) Therefore, just over 57% of time, no significant dust generation will be likely due to average meteorological conditions.

Table 10.2 from the TII guidelines provides a semi-quantitative approach to determining the likelihood of a significant impact from dust in combination with the proposed mitigation measures. During the construction phase of the works, the scale of works sites will typically be '*Minor*', described as '*minor construction sites, with limited use of haul routes*' (see **Table 10.2**) (TII, 2011). 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 PM_{10}.

Area 1: Ballybrack Stream through Douglas

In Area 1 there are approximately 20 sensitive receptors within 25m of the proposed scheme that may be subject to soiling effects. There are approximately 15 sensitive receptors within 10m of the proposed scheme that may be subject to PM_{10} effects.

At locations where in-stream works will be required the excavated riverbank and stream material will have a higher moisture content due to the proximity to the stream. This will reduce the potential for soiling and significant effects by PM_{10} particles. It will be a particular priority to keep the duration of these works to a minimum in this part of the scheme as restrictions on vehicular access will be required for some properties.

The works along the stream in Douglas Community Park will be on the right bank only. In-stream works will also be required at this location. The construction machinery, associated movements and compound will be on the right bank. While the construction site will be cordoned off from the public, members of the public utilising Douglas Community Park will be in proximity to the works.

Area 2: St Patrick's Mills

In Area 2 there are approximately 10 sensitive receptors within 25m of the proposed scheme that may be subject to soiling effects. There are 5 sensitive receptors within 10m of the proposed scheme that may be subject to PM_{10} effects.

No excavation activities will be necessary in Area 2. The proposed flood defence wall will be built upon the existing wall. The proposed 1.2m high bridge parapet, adjacent to West Douglas Road over the culvert, will be built after the removal of the current metal railing.

Area 3: Donnybrook Industrial Estate

There are no sensitive receptors located within 25 m of the proposed scheme in this area.

Area 4: Togher Culvert

In Area 4 there are approximately 30 sensitive receptors within 25m of the proposed scheme that may be subject to soiling effects. There are approximately 10 sensitive receptors within 10m of the proposed scheme that may be subject to PM_{10} effects.

Excavation works will be required for the channel realignment, trash screen installation and culvert construction. However, in-stream works will be required here where a new culvert is being installed. The excavated riverbank and stream material will have a higher moisture content due to the proximity to the stream. This will reduce potential for soiling and effects by PM_{10} particles.

The duration of works in this part of the scheme will be particularly prioritised as there will have to be traffic restrictions on this road. This should limit the construction period to a minimum.

10.5.1.2 Construction Traffic

During construction there is also the potential for impacts on air quality from exhaust emissions generated by construction machinery on site and the transport of materials. Construction machinery movement generates exhaust fumes that can potentially increase the concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ (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 an imperceptible impact on the transport infrastructure in the area with mitigation measures implemented.

10.5.2 Construction Impacts on Climate

Impacts on climate during the construction phase include the generation of greenhouse gas emissions from the transport of materials to and from site and vehicle movement on site. Traffic movements on-site will be limited and at low speeds as set out in the Construction Management Plan. These emissions will be short-term and will not likely to be significant.

10.5.3 Operational Impacts

There are no impacts on air emissions or climate envisioned once all the scheme works are complete and operational. Channel maintenance may be necessary in the future along the works areas.

The heights of the defence walls may also be further increased and conveyance improvements may be implemented as part of a climate change adaption strategy in the future. However, it is not envisaged that these activities will impact on air quality or climate.

10.6 Mitigation Measures

10.6.1 Construction Mitigation Measures

The construction mitigation measures are described in **Chapter 4 Construction Activities**. These measures include mitigation measures specifically to mitigate the impact of dust during construction. A traffic management plan will be put in place to mitigate any temporary traffic disruptions during construction.

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.
- Control of vehicle speeds and speed restrictions; and
- Sweeping of hard surface roads.

In addition, the following measures will be implemented for the proposed scheme:

- A 2.4m hoarding will be provided around the site works to minimise the dispersion of dust from the working areas;
- Generators will be located away from sensitive receptors.
- Stockpiles will be located as far as possible from sensitive receptors and covered and/or dampened during dry weather.
- Employee awareness is also a most important way that dust may be controlled on any site. Staff training and the management of operations will ensure that all dust suppression methods are implemented and continuously inspected.

Dust monitoring will be undertaken at the site boundary throughout the construction phase. The TA Luft dust deposition limit values of 350 mg/m^2/day (averaged over one year) will be applied as a 30-day average.

10.6.2 Operational Mitigation Measures

As there will be no emissions generated during the operational phase, no mitigation measures for air quality or climate are proposed.

10.7 Residual Impacts

No significant residual impacts are predicted on air quality during the construction or operational phase of the proposed scheme having regard to the effectiveness of the mitigation measures proposed above.

Dust deposition monitoring will be carried out to ensure the effectiveness of mitigation measures during the construction phase. The provision of a hoarding around the construction works areas will reduce the dust impact on the sensitive receptors listed in Section 10.5.1.1

10.8 References

Department of the Environment, Community and Local Government (2012) *Building Resilience to Climate Change*

Environmental Protection Agency (2002) Guidelines on the information to be contained in EIS

Environmental Protection Agency (2003) Advice Notes on Current Practice in the Preparation of EIS

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 (2016). Air Quality in Ireland 2015 – Key Indicators of Ambient Air Quality. EPA, Wexford, Ireland.

TA Luft, 2002. Technical Instructions on Air Quality.

Transport Infrastructure Ireland (TII), (formerly the National Roads Authority (NRA)) (2011). Guidelines for the Treatment of Air Quality during the Planning and Construction of National Roads Schemes. TII, Dublin, Ireland.

11 Soils, Geology and Hydrogeology

11.1 Introduction

This chapter describes and assesses the potential impacts of the proposed Douglas Flood Relief Scheme (including Togher culvert), hereto referred to as the proposed scheme, on soils, geology and hydrogeology. The receiving environment and the characteristics of the proposed scheme during construction and operation are described. The potential impacts of the proposed scheme during the construction and operation phases are evaluated, and mitigation measures described. The chapter concludes with the predicted residual impacts of the proposed scheme.

11.2 Methodology

This chapter has been compiled on the basis of a desktop assessment and site investigation (SI). The desktop assessment consisted of information on bedrock geology, soils, landslide risk, economic geology, geological heritage and local potential for contamination sourced from national databases. The SI was designed by the project team and carried out by an appointed SI contractor. A summary of the findings of that SI in relation to the soils, geology and hydrogeology of the proposed scheme works area is also included.

This section of the EIS was prepared in accordance with the following guidance documents:

- Geological in Environmental Impact Statements – A Guide (Geological Survey of Ireland, 2002)
- 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:

- Transport Infrastructure Ireland (formerly 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);
- Cork County Development Plan 2014-2022 (Cork County Council, 2014)

The following sources were consulted in compiling this section of the EIS:

- Geological Survey of Ireland (www.gsi.ie)
- Aerial photography (Google Earth)
- Envision, EPA online mapping (www.gis.envision.ie)
- Catchments, EPA online database (www.catchments.ie)

This chapter refers to the proposed scheme ‘works areas’ as the areas of Togher and Douglas where flood relief works are proposed and includes the construction footprint of these works. In general, a construction zone of 10m around the proposed flood relief works may be required to facilitate the construction however this area may be reduced in restricted areas. Refer to **Chapter 3 Description of the Proposed Development** for details of the proposed development.

11.3 Receiving Environment

11.3.11 Soils and Geology

11.3.11.1 Bedrock Geology

The bedrock geology of South Cork is dominated by Old Red Sandstone rocks laid down during the late Devonian and Carboniferous Periods. For the purposes of mapping and description, related beds of rock are commonly grouped into formations which can be further sub-divided into members. Geological members can represent distinctive features or local variations.

The bedrock geology underlying the proposed scheme works includes the following and is shown on **Figure 11.1**.:

- Ballytrasna Formation (BS) – purple mudstones and sandstones
- Gyleen Formation (GY) – sandstones with mudstones and siltstones
- Old Head Sandstone Formation (OH) – flaser-bedded sandstone and minor mudstone
- Cuskinny Member (KNcu) - flasser-bedded sandstone and mudstone

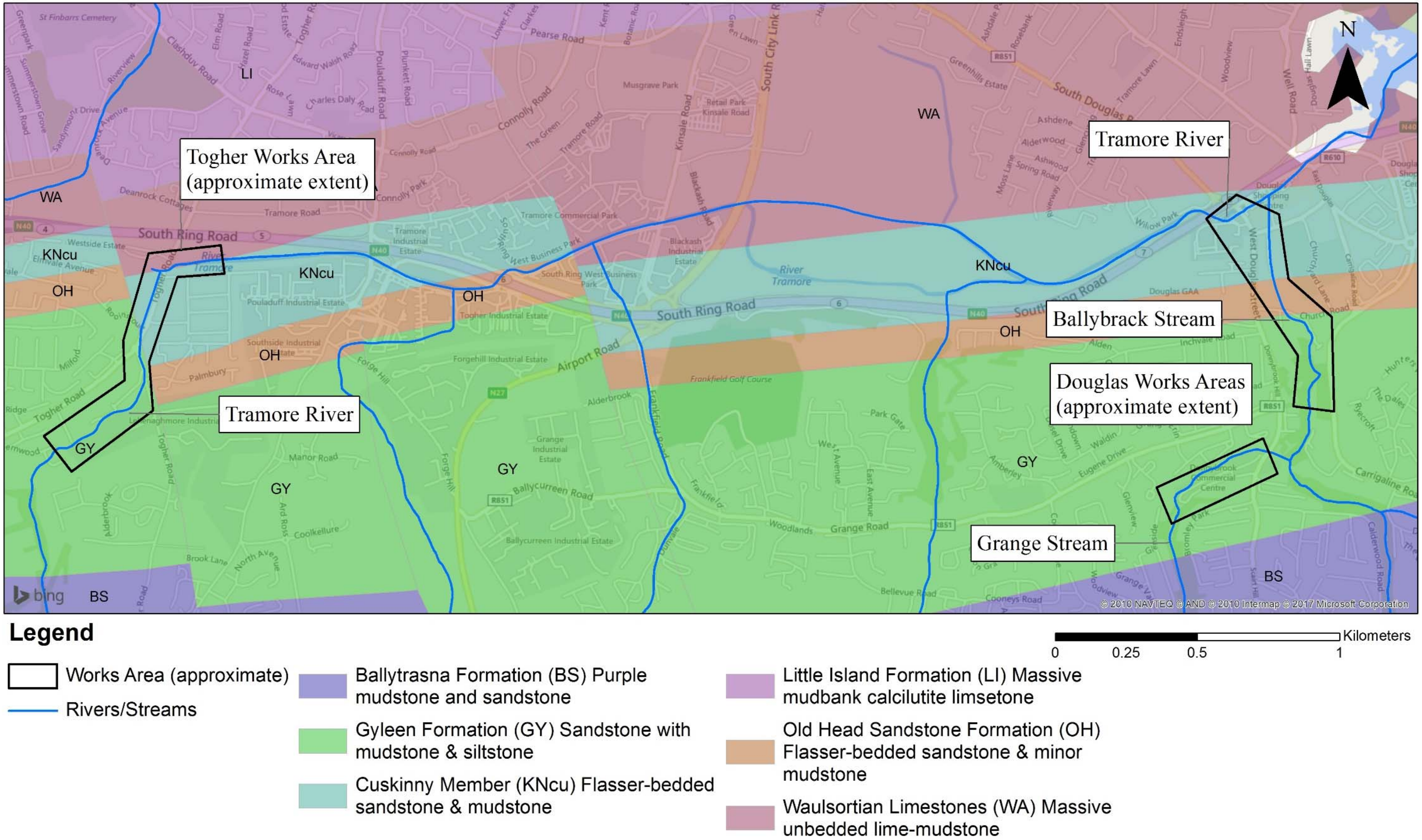

Figure 11.1: Bedrock geology of the proposed scheme works areas (Geological Survey of Ireland).

11.3.11.2 Site Investigation

Two site investigations to inform the detailed design of the proposed scheme have been carried out. A total of 13 no. slit trenches, 4 no. in Douglas and 9 no. in Togher, were excavated in May 2015 to identify existing utility locations in the vicinity of the proposed flood defence works. A detailed site investigation was completed in June 2016, consisting of the following elements:

- 3 No. Rotary Boreholes
- 16 No. Trial Pits
- 16 No. Inspection Pits to 1.2m below ground level
- 1 No. Slit Trench
- 1 No. Groundwater Monitoring Installation
- 2 No. Wall Cores
- 1 No. Reinforcement Scanning
- In-situ testing including variable head permeability and SPT testing
- Environmental testing
- Soil and rock geotechnical laboratory testing

A topographical survey, including utility identification was undertaken in August 2016.

The trial pits were excavated to depths of between 1.9m below ground level (bgl) and 4.2m bgl by PGL (in 2016). Slit trenches (2 No.) were excavated to depths of between 1.4m and 2.4m bgl. The 3 No. rotary boreholes were drilled to depths of 10.0m bgl and 10.2m bgl.

The site investigations largely reflect the desktop bedrock geology from the GSI database. The rotary cores showed sandstone bedrock at two sites in Douglas at depths 3.5m bgl and 8.5m bgl respectively.

11.3.11.3 Soils

During the last Ice Age of the Quaternary Period much of the surface deposits of Ireland were deposited. Rocks picked up by flowing ice were abraded and concurrently grounded by the underlying rock. Rocks deposited directly from the base or margins of the glacier ice were deposited as till. Rocks partly ground down and deposited by glacier melt water were sorted and deposited as gravel, sand, silt or clay.

In south Cork, the Quaternary deposits (subsoils) are dominated by glacial tills derived from sandstones of the Devonian period. Areas where the topsoil is present generally have acid brown earth soils (Teagasc Soil Database, GSI).

Most of the subsoils and topsoils around Cork city and suburbs have been removed or disturbed for development, these areas are dominated by made ground.

The site investigations largely reflect the desktop subsoil information from the GSI database. The typical stratigraphic profile for the sites in Douglas were brown gravelly silt TOPSOIL or made ground over sandy gravelly SILT or silty sandy GRAVEL. The SI at Togher showed some sandy gravelly CLAY at some locations at depths of 1.5- 2.5m bgl beneath sandy gravelly SILT.

Table 11.1 Summary of overburden from the site investigation in Douglas.

Stratum	Depth to top of stratum (m)	Thickness of Stratum (m)
Brown gravelly silt TOPSOIL	Ground level	0.2 – 0.7
MADE GROUND	Ground level	0.7 – 0.96
Brown sandy/gravelly SILT	Ground level – 0.4	0.2 – 2.0
Silty sandy GRAVEL	0.2 – 1.2	0.7 – 2.8
Silty gravelly SAND	2.5	1.0

Table 11.2 Summary of overburden from the site investigation in Togher.

Stratum	Depth to top of stratum (m)	Thickness of Stratum (m)
Brown gravelly silt TOPSOIL	Ground level	0.2 – 1.1
MADE GROUND	Ground level	0.45 – 1.5
Sandy gravelly SILT	1.1 – 1.8	0.7 – 1.0
Silty sandy GRAVEL	0.2 – 1.2	0.4 – 2.6
Sandy gravelly CLAY	1.5 – 2.1	0.7 – 1.8

11.3.11.4 Landslide Risk

The GSI online National Landslide Database for Ireland indicates that there are no recorded landslides in the area.

11.3.11.5 Economic Geology

The term ‘economic geology’ refers to the commercial use of soils and bedrock. The principal commercial activities include extractive processes, such as sand/gravel pits, and mining. The GSI maintains a Directory of Active Quarries and Pits in Ireland. The Directory indicates that there are no active quarries or pits within 2km of the areas designated under the proposed scheme. The nearest active quarry is Ballygarvan Sandstone Quarry, approximately 5km south of Douglas Community Park (GSI, 2014).

GSI also has a database of historical pits and quarries nationally that dates back to sites recorded on six-inch mapping, 1833-1946. There are no recorded historical pits or quarries within the proposed scheme works area. The nearest historical pit or quarry to Togher is a former quarry in Deanrock Avenue, Togher (OSI/GSI Six-inch mapping, 1833-1946: Quarries).

It is approximately 480m north of the Lehenaghmore Industrial Estate in Togher (OSI/GSI Six-inch mapping, 1833-1946: Quarries).

In Douglas, the nearest historical pit or quarry is a small pit recorded in Park Hill, south of the Skehard Road (R582) in Ballinlough. The former pit is approximately 1.5km north east of Douglas Community Park.

The GSI database has a list of active quarries around the country in 2014. There are two crushed rock quarries in Ballygarvan for sandstone/shale and limestone respectively, approximately 5.5km south of Douglas village. Both quarries are operated by Roadstone Ltd.

11.3.11.6 Geological Heritage

Areas of Geological Interest in Cork County are listed in Chapter 3 (Section 3.9) of the *Cork County Development Plan 2014-2021*. The GSI online Spatial Resource was also reviewed. Blackrock diamond quarry is listed as a County Geological Site in both resources. It is located approximately 2km north of Douglas village in Blackrock.

11.3.11.7 Local Potential for Contaminated Land

The EPA and National Waste Collection Permit Office (NWCPO) databases were searched for potentially contaminating industrial and waste facilities respectively within 2km of the proposed Scheme works areas.

Industrial Emissions (IE) and Integrated Pollution Prevention Control (IPPC) Licence

The EPA website was checked for both existing and historically licensed industrial sites which may hold an Industrial Emissions Licence (IE) or an Integrated Pollution Prevention Control (IPPC) within 2km of the proposed Scheme works area, refer to **Table 11.1**.

There are four EPA licensed industrial facilities within 2 km of the proposed works in Togher and Douglas. None of these facilities are located within the proposed works areas. The facilities are listed below in **Table 11.1** and shown in **Figure 11.2**.

Table 11.2 Industrial facilities which hold an EPA Industrial Emissions or Integrated Pollution Control licence within 2km of the proposed Scheme.

Industrial Facility Name	Licence Registration No.	Licence Type	Licence Status
Brooks Haughton Limited	P0343-01	IPPC	Licensed
Galco (Cork) Limited	P0391-01	IE	Licensed
Irish Pioneer Works (Fabricators) Limited	P0407-01	IE	Licensed
Fronville Limited	P0059-02	IPPC	Licensed

Waste Licensing

Facilities in Ireland carrying out waste disposal and/or recovery activities are required to obtain authorisation in accordance with the Waste Management Act 1996, as amended. Depending on the type of waste activities carried out at the facility may:

- Be exempt with no authorisation required,
- Require a Waste licence (under Part V of the Waste Management Act 1996, as amended);
- Require a Waste Facility Permit (under Waste Management (Facility Permit and Registration) Regulations, SI 821 of 2007, as amended); or
- Require a Certificate of Registration (under Waste Management (Facility Permit and Registration) Regulations SI 821 of 2007, as amended).

The EPA are the competent authority for issuing and enforcing all waste activities listed in the Third and Fourth Schedule to the Waste Management Act 1996, as amended. The EPA issue Certificates of Registration (COR) to local authorities for waste activities listed in the Third Schedule Part II of the Waste Management (Facility Permit and Registration) Regulations, SI 821 of 2007, as amended).

Local authorities are the competent authorities to grant and enforce Waste Facility Permits (WFP) and CORs to private operators for those activities listed in the Third Schedule to the Waste Management (Facility Permit and Registration) Regulations SI 821 of 2007, as amended).

The EPA website was checked for sites holding an EPA Waste Licence within 2km of the proposed scheme works. The National Waste Collection Permit Office (NWCPO) website is a database for all WFPs and CORs within 2km of the proposed scheme works. Refer to **Table 11.2**.

Table 11.3: Facilities that hold a Waste Licence, Waste Facility Permit or Certificate of Registration within 2km of the proposed scheme works area (Source: EPA and NWCPO, 2016).

Waste facility name and address	Registration No.	Status
Starrus Eco Holdings Limited (Kinsale Road)	W0173-01	Surrendered
Cork University Hospital	W0038-01	Surrendered
Kinsale Road Landfill	W0012-03	Licensed
David O'Leary, Unit 16, Togher Industrial Estate , Ballycurreen, Co Cork	WFP-CK-13-0134-01	Granted
CND Recycling Ltd., South Ring West Business Park, Tramore Road	WFP-CC-08/2015	Granted
Cork Hygiene Ltd., Sarsfield Road	WFP-CK-09-0015-02	Granted
Instant Waste Disposal Ltd., Ballinvuskig, Grange, Douglas	WFP-CK-11-0095-01	Granted
Ocon Chemicals Limited, Unit 5, South Cork Industrial Estate, Vicars Road, Cork City.	WFP-CC-02/2016	Granted
Emerald Waste Company Ltd., Centra, Kinsale Road	COR-CC-04/2013	Granted
Cork Recycling Company, Lehenaghmore, Togher	WFP-CK-14-0141-01	Granted
Pouladuff Dismantlers Cork Ltd., Airport Road	WFP-CK-10-0070-03	Granted

There are no licensed landfills operating within the scheme. The closest landfill site to the Study Area is at Bottlehill, approximately 20km north of Douglas however activities at the site have not commenced according to the Plan (2015).

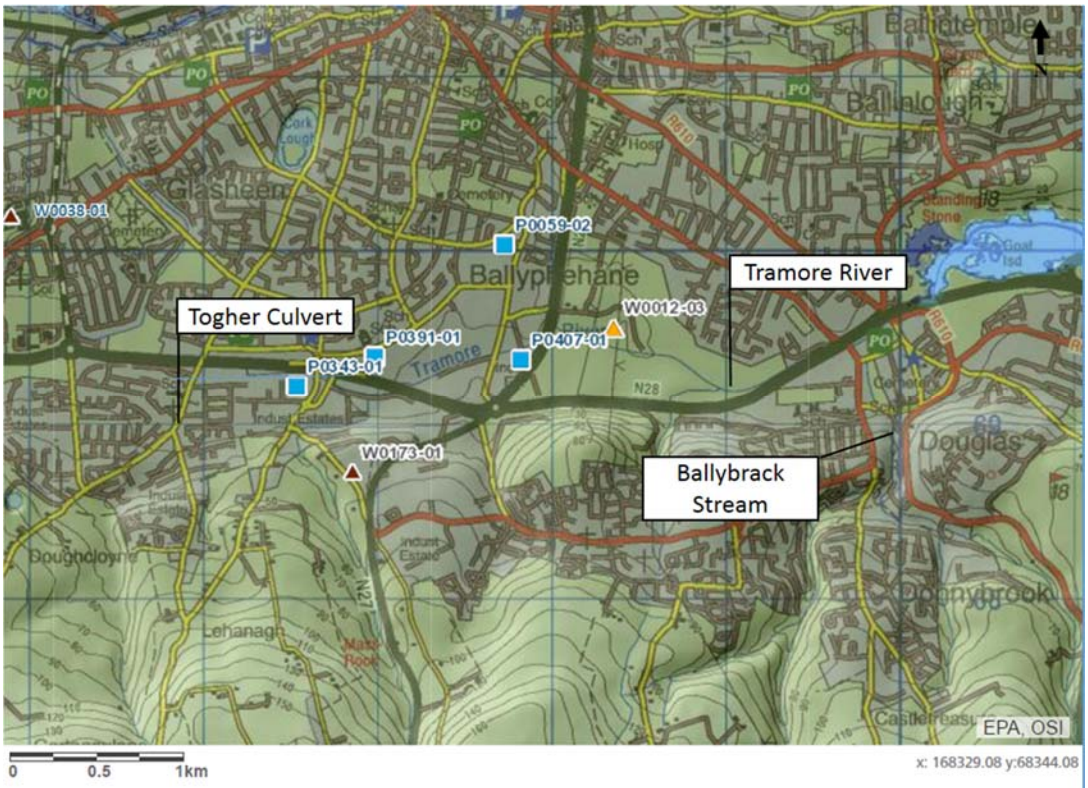

Figure 11.2: Location of industrial sites currently and formerly licensed by the EPA (Source EPA).

Figure 11.2 shows the location of facilities holding an EPA IE licence (denoted P0XX-XX) and facilities that currently or have previously have held a EPA Waste Licence (denoted W0XX-XX) in relation to the location of the proposed works.

11.3.11.8 Invasive Species

It has been documented that the invasive plant species, Japanese knotweed is present at a number of locations in Togher and Douglas including within the proposed works areas. This species has an extensive root system that can be up to 3m below the surface and may extend up to 7m laterally from the main plant stem. As a result, root material of this plant is likely to be present within the soils. A survey will be required to be carried out prior to any works taking place. An *Outline Japanese Knotweed Management Strategy* is included in **Appendix 4.1** which outlines the management approach that will be taken to constructing phase of the flood scheme in order to prevent the spread of the plant.

11.3.12 Hydrogeology

The proposed works areas in Togher and Douglas are within the Ballinhassig East groundwater body (Code IE_SW_G_004), described as having poorly productive bedrock. Under the WFD, the EPA is required to monitor and assign a groundwater body status, with Ballinhassig East groundwater body being rated as ‘good’ for the period from 2010 to 2015.

11.3.12.1 Aquifer Classification

The European Water Framework Directive (WFD) (2000/60/EC) describes a body of groundwater as a '*distinctive volume of water within an aquifer or aquifers*'.

The term 'aquifer' refers to a '*subsurface layer or layers of rock or other geological strata of sufficient porosity and permeability to allow either a significant flow of groundwater or abstraction of significant quantities of groundwater'*.

In order to develop aquifer classification in Ireland, the GSI developed a system of generalising bedrock formations and members into 27 rock unit groups (RUG) based on similar properties and age. This facilitated in part the development of basic aquifer boundaries and compartments. Togher and Douglas are within the RUG referred to as Devonian Old Red Sandstones (DORS).

The Geological Survey of Ireland (GSI) system for classifying the aquifers in Ireland is based on the hydrogeological characteristics, size and productivity of the groundwater resource. The three main classifications are:

Regionally Important Aquifers (R);

- Karstified bedrock (Rk)[1],
- Fissured bedrock (Rf),
- Extensive sand & gravel (Rg),

Locally Important (L) Aquifers;

- Bedrock which is Generally Moderately Productive (Lm),
- Bedrock which is Moderately Productive only in Local Zones (Ll),
- Locally important karstified bedrock (Lk),
- Sand & gravel (Lg),

Poor (P) Aquifers;

- Bedrock which is Generally Unproductive except for Local Zones (Pl),
- Bedrock which is Generally Unproductive (Pu).

The GSI aquifer classification classifies the aquifer underlying the proposed works areas (both Togher and Douglas) and surrounds as a "*Locally Important Aquifer (LI) – bedrock which is Moderately Productive in Local Zones*".

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[1] Note that, depending on the degree and nature of the karstification, regionally important karstified bedrock aquifers (Rk) may be further characterised as either Rkc – dominated by conduit flow or Rkd – dominated by diffuse flow.

11.3.12.2 Aquifer Properties

According to the GSI document, *Irish Aquifer Properties – A Reference Manual and Guide* (2015), locally important (Ll) (and poor) aquifers, with the exception of sands and gravels are:

- dominated by impure limestones, shales and sandstones, granites and other rock types;
- dominated by poor yielding boreholes (less than 40 m^3) with fewer and fewer productive boreholes (which tend to be unsustainable over long pumping periods/dry weather spells);
- a high drainage density with low base flow; and
- often many small springs and seepages present, that dry out in long periods.

In the case of the aquifer beneath Togher and Douglas the bedrock geology is in agreement with the rock type (sandstone) that was logged in the site investigation as well as shown in the GSI database.

Groundwater Flow

Permeability describes the ability of fluids to flow through an aquifer. Permeability increases with increasing porosity. For example sand and gravel aquifers have typically greater permeability than those composed of clayey material, refer to **Table 11.4**. Aquifers with greater permeability may be more vulnerable to contamination.

Permeability is quantified as transmissivity (T) [m^2/day], the rate by which water can pass through the full aquifer thickness. Kelly et al. (2015) on behalf of GSI and the EPA, created a summary transmissivity table for RUGs and corresponding aquifer classification.

The (‘best’ estimate) transmissivity rate for DORS is 5m^2/day for a Ll aquifer, which underlies Togher and Douglas. In comparison, the ‘best’ estimate for the general flow type Sand and Gravel Aquifers (Rg and Lg categories) have a greater transmissivity of approximately 350m^2/day (Kelly et al. 2015) due to much greater aquifer permeability.

Aquifer Recharge Rates

The GSI groundwater database provides information on the recharge rates of groundwater bodies around Ireland. The main hydrogeological controls on groundwater recharge include subsoil permeability, subsoil thickness, saturated soils and the ability of the underlying aquifer to accept percolating waters (Hunter Williams et al. 2011). The GSI groundwater database shows the groundwater for the proposed works areas at Togher and Douglas have an average groundwater recharge rate of 200mm per year.

Water Table Level

The site investigation encountered groundwater in Douglas at depths of 1.4mbgl to 2.5mbgl during rotary coring and at depths of 1.4mbgl to 2.2mbgl for trial pits dug within the proposed works area. In Togher, groundwater was encountered at 2.1mbgl to 2.2mbgl in trial pits dug within the proposed works area.

11.3.12.3 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 GSI, is shown in **Table 11.4** below.

The Extreme vulnerability class is further sub-divided into '*Extreme (E) – rock near Surface or Karst'* and '*Extreme (E) - subsoils <3m thick*'.

Table 11.4: 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 GSI groundwater vulnerability maps show that the vulnerability rating varies across the proposed works areas. Refer to **Figure 11.3**.

In Togher the groundwater vulnerability rating ranges from 'Moderate' to 'Extreme'. The groundwater vulnerability in Douglas ranges from 'Moderate' to 'Extreme' including 'Rock at or near the surface or Karst'. The GSI bedrock maps do not indicate karst (e.g. limestone) in the proposed works area in Douglas nor did the site investigation report any karst geology. It is known from site visits that there are bedrock outcrops in the Ballybrack Woods, south of Ravensdale in Douglas.

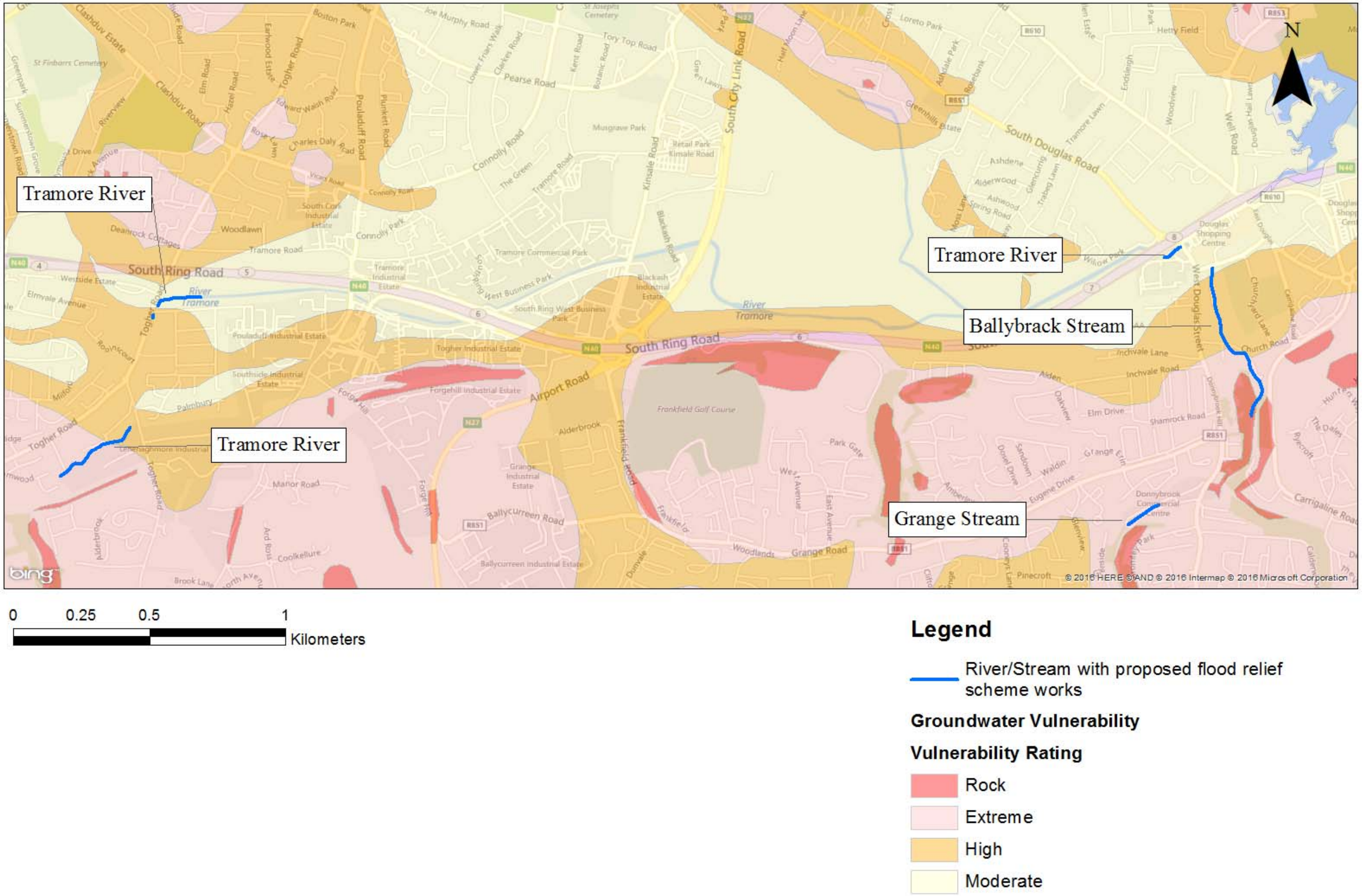

Figure 11.3: Aquifer vulnerability for Togher (west) and Douglas (east) works areas. Source GSI.

11.3.12.4 Wells and Springs

The GSI database shows that there is a potential for a number of groundwater wells to be within the proposed scheme works area. These wells are listed below for both Togher and Douglas. These locations are recorded as being accurate to within 1km or 2km. Refer to **Tables 11.4** and **11.5**.

In Douglas, one of the three wells potentially located within the study area are reported as poor yielding, refer to **Table 11.5**. A review of wells and springs located within the study area in Togher shows that the wells and boreholes are poor yielding, refer to **Table 11.6**.

Table 11.5: Groundwater wells and springs potentially within the proposed Scheme works area in Douglas (GSI).

GSI Code	Well Type	Well Use	Location Accuracy (km)	Yield Class	Yield (m^3/day)	Well depth (m)
1405NWW003	Borehole	Unknown	1.0	Good	140.0	47.9
1705NWW001	Borehole	Unknown	1.0	Good	130.9	45.7
1705NWW002	Borehole	Unknown	1.0	Poor	9.8	117.3

Table 11.6: Groundwater wells and springs potentially within the proposed Scheme works area in Togher (GSI).

GSI Code	Well Type	Well Use	Location Accuracy (km)	Yield Class	Yield (m^3/day)	Well depth (m)
1405NEW066	Borehole	Unknown	2.0	Poor	21.8	24.4
1405NEW060	Borehole	Unknown	2.0	Poor	28.0	25.0
1405NEW053	Borehole	Unknown	2.0	Poor	27.3	30.5

11.3.12.5 Groundwater Source Protection Areas

The GSI has identified certain areas nationwide as groundwater Source Protection Areas in order to provide protection for groundwater resources, particularly group water schemes and public water schemes. A groundwater Source Protection Area is delineated according to the hydrogeological characteristics of the aquifer, the pumping rate, and the recharge in the area. Activities that may impact on groundwater are tightly controlled within the Source Protection Area. The closest Source Protection Area is located approximately 12 km south of the proposed works areas in Minane Bridge.

11.3.12.6 Groundwater Dependent Terrestrial Ecosystems

The National Parks and Wildlife Service (NPWS) online database was consulted to establish whether any groundwater dependent terrestrial ecosystems are located within the vicinity of the scheme. No groundwater dependent terrestrial ecosystems in the vicinity of the scheme were identified from the database. Refer to ***Chapter 6 Biodiversity*** for the description of the impact of the proposed scheme on biodiversity and ecology.

11.4 Characteristics of the Proposed Scheme

11.4.11 General

The proposed scheme comprises of a combination of direct defences and conveyance improvements. Construction works which are of relevance for soils, geology and hydrogeology include the excavations required for flood defence walls and embankments, river channel deepening and widening and culvert construction.

A detailed description of the works and the locations are presented in **Chapter 3 Description of the Proposed Development**. A summary of the works in terms of the soils, geology and hydrogeology where relevant is described below in **Table 11.6**.

Table 11.7: Summary of the proposed flood relief scheme works in relation to soils, geology and hydrogeology.

Area	Location	Proposed Works
1	Ballybrack Stream through Douglas	New flood defence walls and/or replacement of existing walls with new flood defence walls; new alternative access bridge for the ICA hall; removal of Church Road cycle track bridge and construction of new combined cycle/pedestrian track in this area; replacement of Lower Ravensdale vehicular bridge and new access road to residences on western bank; local channel widening and channel realignment of Ballybrack stream in Ravensdale; replacement of Church Road culvert; channel widening of Ballybrack Stream in Douglas Community Park; right bank in community park to be raised (small embankment); realignment of existing footpath in community park; installation of non-return valves on drainage outlets along the line of the flood defence works.
2	Tramore River through St Patrick's Mills	New flood defence wall on right bank of the Tramore River.
3	Grange Stream at Donnybrook Commercial Centre	Regrading the existing channel upstream of the existing trash screen; removal of the existing trash screen; new coarse screen to replace the existing; reinforcement of channel banks with reinforced rock armour/gabions; replacement of existing culvert with new 2.4m wide by 1.8m high reinforced concrete culvert.
4	Tramore River in Togher	Replacement and extension of existing culvert with new culvert between Lehenaghmore Industrial Estate and downstream of Greenwood Estate; replacement of existing trash screen with new trash screen at Lehenaghmore Industrial Estate; realignment of a section of river channel immediately upstream of the proposed new trash screen to facilitate tie-in with new culvert.

11.4.12 Site Investigation

Refer to Section 11.3.11.2.

11.4.13 Site Preparation

Site preparation will include the removal of existing structures such as existing river bank walls, culverts, bridges, vegetation removal and road surface removal. Excavation of soil and river bank material will be required for foundations, regrading, river widening and deepening, and trash screen construction.

11.4.14 Channel Realignment

Channel realignment will require excavation and regrading of the existing channel. Excavated material will be reused on-site or in the wider flood relief works areas where possible, for example, in embankments. Where material must be disposed off-site it will be sent to a suitable facility depending on prior soil characterisation.

11.4.15 Excavation

It is envisaged that excavation works for flood defence walls and culverts will be required between 1.5m to 2.5m below ground level depending on local site conditions. Local dewatering may be required during the excavations.

Construction works in the vicinity of Japanese knotweed will require the implementation of an Invasive Species Management Plan in order to control the spread of Invasive Species during construction. Material containing Japanese knotweed will require a licence from the NPWS if it is to be transported off-site. Further details are provided in **Chapter 4 Construction Activities**. **Appendix 4.1** presents the outline management strategy that will be taken to manage invasive plant species during the construction and operation of the proposed scheme.

11.4.16 Construction Environmental Management Plan

As part of standard good construction practice a construction environmental management plan (CEMP) will be implemented during the construction phase of the proposed scheme by the contractor.

The CEMP 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. Refer to **Chapter 4 Construction Activities** for a detailed description the proposed construction of the scheme.

The construction compounds will be used to store all construction related materials including any chemical, fuel or oil stores. The construction compounds will also have contractor facilities including toilets. Wheel wash areas will also be present where vehicles enter and depart the construction site.

The management of all potential polluting materials on site will be managed in accordance with the construction environmental management plan (CEMP), as discussed in **Chapter 4 Construction Activities**.

11.5 Evaluation of Impacts

11.5.11 Construction Impacts

11.5.11.1 Soils and Geology

During construction there will be significant 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 re-grading of footpaths as described in **Section 11.4**. The residual material will need to be removed off-site to a suitable facility. **Table 11.8** presents the estimated volumes of material that will need to be excavated and imported from/to each works Area respectively.

Table 11.8: Estimate volumes of material excavated and imported.

Works Areas	**Estimate volume of excavated material**	**Estimated volume of imported material**
Area 1: Douglas Community Park	2,050m^3	800m^3
Area 1: Ravensdale	5,100m^3	3,225m^3
Area 2: St Patrick's Mills	60m^3	75m^3
Area 3: Donnybrook Commercial Centre	2,250m^3	65m^3
Area 4: Togher	9,000m^3	65m^3
Total excavated volumes:	18,460m^3	4,230m^3

During excavation there is also the potential for silt or mud to enter the river channel.

There is potential for soil contamination due to the potential spread of Japanese Knotweed during construction works.

11.5.11.2 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. However the risks will be significantly reduced by the implementation of the CEMP. Further details are provided in **Chapter 4 Construction Activities**.

It is not envisaged that local water supplies will be impacted due to the construction works as the area is generally served by a local authority water supply rather than directly from groundwater wells.

Due to the shallow nature of the excavations, it is not envisaged that there will be significant impacts on groundwater flow pathways and indeed groundwater vulnerability in the area. Most of the proposed flood walls and culverts that could potentially impact groundwater flow, are replacing such existing structures. Therefore the construction of additional structures will be neither be significant nor extensive.

Any impact on groundwater levels due to the construction of the scheme will be limited to the possible dewatering of excavations.

There are no groundwater dependent terrestrial ecosystems in the vicinity of the works.

With the implementation of standard good construction practices (including the CEMP), it is envisaged there will be no significant impact on the local hydrogeology during the construction of the proposed scheme.

11.5.12 Operational Impacts

11.5.12.1 Soils and Geology

Routine maintenance of the scheme area will be carried out as required and will typically include works such as clearing blockages and debris, clearing trash screens or treating invasive species. It is not envisaged that these works will significantly impact the soils, geology or hydrogeology in the vicinity of the proposed scheme.

11.5.12.2 Hydrogeology

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. It is not envisaged that these flood event changes will significantly impact the local hydrogeology.

11.6 Mitigation Measures

11.6.11 Construction Mitigation Measures

As discussed in **Section 11.4.15**, standard good construction management practices will be employed as part of the construction phase of this scheme which include the implementation of a CEMP which will serve to minimise the risk of pollution of soils (and groundwater) during construction. These will be implemented by the contractor. These measures have been described in detail in **Section 4.6.2** in **Chapter 4 Construction Activities** and specific measures are outlined below:

- Designated fuel storage facilities, 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 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;
- 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.
- 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.

11.6.12 Operational Mitigation Measures

No mitigation measures will be required for soils, geology or hydrogeology during operation of the proposed Scheme.

11.7 Residual Impacts

A wide range of construction management measures have been specified for the construction and operational phase of the project. These measures seek to ensure that construction and operational discharges are controlled to prevent potential pollution impacts to all soils, subsurface material and groundwater bodies.

No negative residual impacts to the subsurface (soils and geology) or groundwater are anticipated with the implementation of the construction and operational measures described above and in **Chapter 4 Construction Activities**.

11.8 References

Construction Industry Research and Information Association (CIRIA) (2001) Good practice guidelines on the control of water pollution from construction sites

Cork County Council (2014) Cork County Development Plan 2014-2022

Environmental Protection Agency (2002) Guidelines on the information to be contained in EIS

Environmental Protection Agency (2003) Advice Notes on Current Practice in the Preparation of EIS

Environmental Protection Agency (2015) Advice Notes for Preparing Environmental Impact Statements Draft September 2015

Environmental Protection Agency (2015) Revised Guidelines on the Information to be contained in Environmental Impact Statements Draft September 2015

Geological Survey of Ireland (2015) Irish Aquifer Properties – A Reference Manual and Guide

Hunter Williams, N., Misstear, B., Daly, D., Johnston, P., Lee, M., Cooney, P., Hickey, C. (2011) A National groundwater recharge map for Ireland. National Hydrology Conference 2011

Kelly, C., Hunter Williams, T., Misstear, B.M., Motherway, K. (2015) Irish Aquifer Properties – A reference manual and guide. Prepared on behalf of the Geological Survey of Ireland and the Environmental Protection Agency.

Transport Infrastructure Ireland (formerly NRA) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes

12 Hydrology

12.1 Introduction

This chapter describes and assesses the potential impacts of the proposed Douglas Flood Relief Scheme (including Togher culvert), on hydrology. The receiving environment and the characteristics of the proposed scheme for construction and operation are described. The potential impacts of the scheme during the construction and operation phases are evaluated, and the mitigation measures for these potential impacts are presented. The chapter concludes with the predicted residual impacts of the proposed scheme.

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); and
- 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); and
- 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);
- Maltby Land Services Ltd. Topographical Survey of the Tramore River, Ballybrack Stream and Moneygurney Stream (2007);
- Murphy Surveys Ltd. Topographical Survey of the Tramore River, Ballybrack Stream and Moneygurney Stream (2014);
- Cork County Council Topographical Survey of the Study Area (2015);
- Amelio Utilities Topographical Survey of the Study Area (2016);
- Douglas Flood Relief Scheme (Including Togher Culvert) Hydrology Report (Arup, 2016);
- Douglas Flood Relief Scheme (Including Togher Culvert) Hydraulics Report (Arup, 2016);
- Douglas Flood Relief Scheme (Including Togher Culvert) Togher Hydraulics Report (Arup, 2016);
- Douglas Flood Relief Scheme (Including Togher Culvert) Douglas Options Report (Arup, 2016);
- Douglas Flood Relief Scheme (Including Togher Culvert) Togher Options 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 (GSI) Online Mapping;

12.2.2 Site Visits

Site visits were conducted as part of the impact assessment process to ascertain specific areas which may be at risk of being impacted by the proposed works.

12.2.3 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.

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)

<table>
<tr><th colspan="2">Q Value[Note1]</th><th>WFD Status</th><th>Pollution Status</th><th>Condition[Note 2]</th></tr>
<tr><td colspan="2">Q5, Q4-5</td><td>High</td><td>Unpolluted</td><td>Satisfactory</td></tr>
<tr><td colspan="2">Q4</td><td>Good</td><td>Unpolluted</td><td>Satisfactory</td></tr>
<tr><td colspan="2">Q3-4</td><td>Moderate</td><td>Slightly polluted</td><td>Unsatisfactory</td></tr>
<tr><td colspan="2">Q3, Q2-3</td><td>Poor</td><td>Moderately polluted</td><td>Unsatisfactory</td></tr>
<tr><td colspan="2">Q2, Q1-2, Q1</td><td>Bad</td><td>Seriously polluted</td><td>Unsatisfactory</td></tr>
<tr><td>where:</td><td colspan="4">Biotic indices or Quality (Q) value indicates specified groups of macro-invertebrates sensitivity to pollution, with:</td></tr>
<tr><td></td><td>Q5 =</td><td colspan="3">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.</td></tr>
<tr><td></td><td>Q4 =</td><td colspan="3">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.</td></tr>
<tr><td></td><td>Q3 =</td><td colspan="3">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.</td></tr>
<tr><td></td><td>Q2 =</td><td colspan="3">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.</td></tr>
<tr><td></td><td>Q1 =</td><td colspan="3">No pollution sensitive, less sensitive, and pollution tolerant, a few to no very pollution tolerant, and dominant in most pollution tolerant macro-invertebrate species.</td></tr>
</table>

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

12.2.4 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.

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. Refer to Section 12.3.1 for the hydrology of the existing environment.

Table 12.3: Hydrological Baseline Categorisation

	Functional Value
• 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
• 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
• 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
• 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
• Surface Watercourses that have been culverted. • Surface Water Features solely used for visual amenity.	Very Low

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.

12.2.4.1 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.

12.2.4.2 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.

12.2.4.3 Significance Criteria / Impact Assessment

The source and type of all potential impacts is described in Section 12.4 and Section 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
• 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
• 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
• 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
• Short-term contamination of local surface water. • Short term potential changes in local drainage patterns.	Slight
• 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

12.2.5 Flood Risk Information Collation

A detailed assessment of the fluvial and tidal flood risk, from the Tramore River and Ballybrack Stream 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 not assessed in the Hydrology and Hydraulic assessment of the scheme. To determine the flood risk from these sources, a comprehensive desk-top study examining the available sources of information was undertaken.

12.3 Receiving Environment

12.3.1 Hydrology and Water Quality

The study area is located with Hydrometric Area 19 which is the EPA classification for the catchments flowing into the River Lee, Cork Harbour and Youghal Bay. Togher and Douglas are included in this hydrometric area. This Hydrometric Area falls within the South Western River Basin District which also included Togher and Douglas. Refer to **Figure 12.1**. Hydrometric Area 19 is 1,732km^2 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, Blarney, Midleton and Macroom.

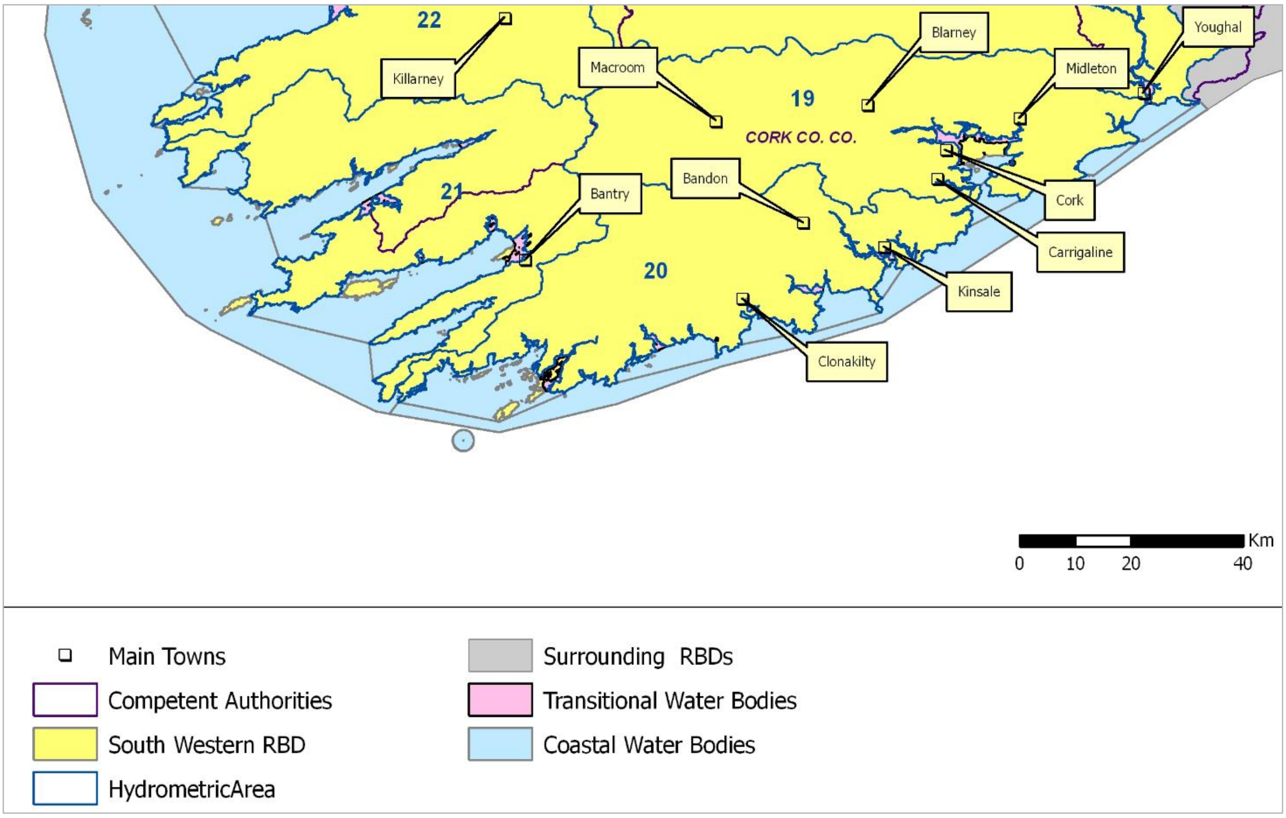

Figure 12.1 Hydrometric Area 19 as part of the South Western River Basin including Togher and Douglas (Water Framework Directive Ireland, 2005).

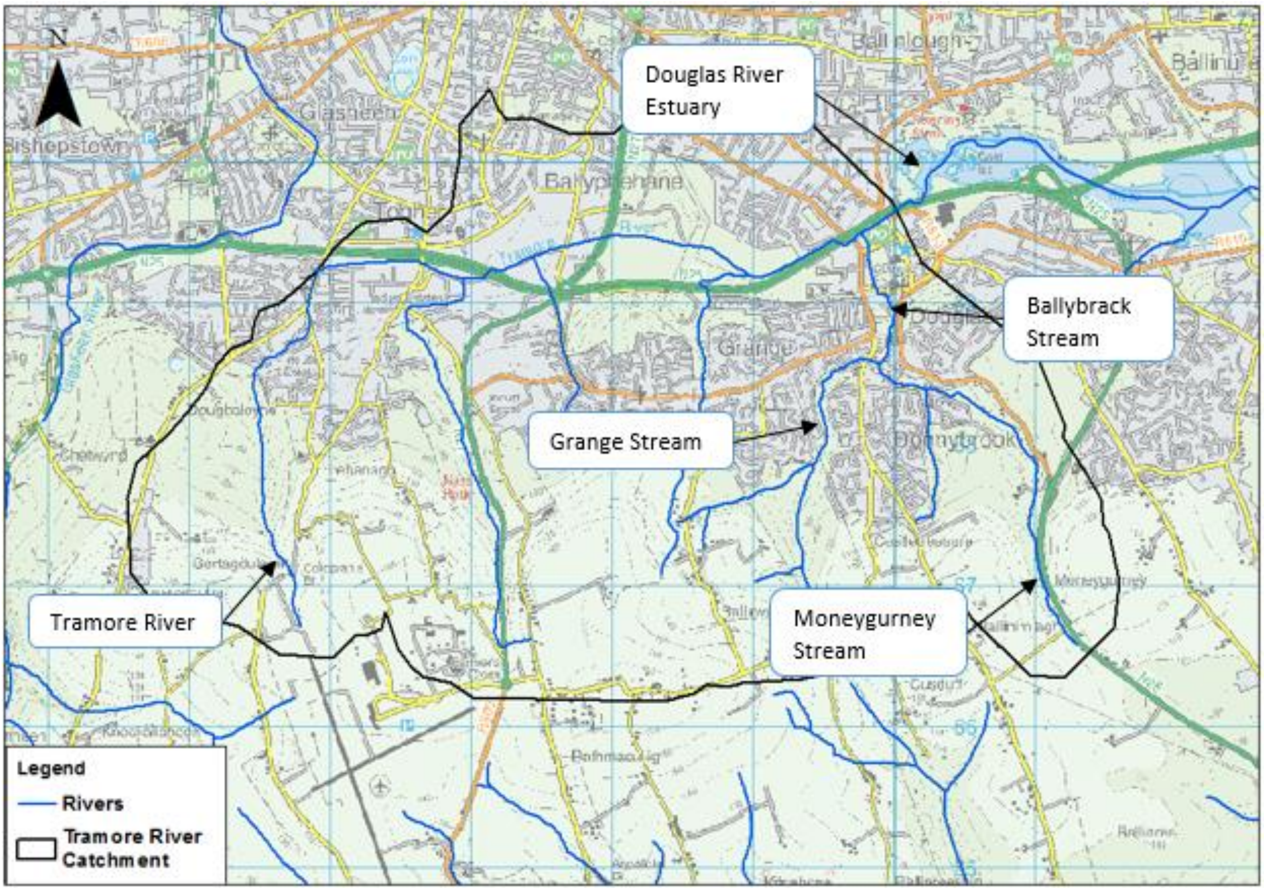

Figure 12.2: Hydrological Features

The following sub-sections outline the existing hydrological environment in the vicinity of the proposed scheme which includes the catchments of the Tramore River, Ballybrack Stream and their tributaries. Both of these river systems are discussed in the following sections and all hydrological features relevant to the project are indicated in **Figure 12.2**.

The South Western River Basin District (SWRBD) 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 un-sewered 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 SWRBD 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 scheme is located within the Lower Lee/Owenboy WMU. The key measures to be implemented in the Lower Lee/Owenboy 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."*

12.3.1.1 Tramore River

The Tramore River rises in the southwest of the study area and flows eastwards for approximately 7.5km before entering the Douglas River Estuary and subsequently Lough Mahon, approximately 200m east of Douglas. The catchment area of the Tramore River covers an area of 21km^2 with 41% of the catchment consisting of discontinuous urban fabric. The urban areas are concentrated in the north of the catchment with agricultural land making up the remainder of the land use.

The Tramore River (Coastal) (IE_SW_19_1717*) Water Matters Report*, available at www.wfdireland.ie, covers the catchment of the Tramore River upstream of its confluence with the Ballybrack Stream at Douglas Village. The report states that the watercourse is not heavily modified, however, the Tramore River is culverted over the majority of its length through Togher. The overall ecological status of the watercourse is classified as '*moderate*' with the watercourse classified as "*at risk of not achieving good status*" in accordance with the WFD. Refer to **Figure 12.3**. The watercourse is identified as being at risk from diffuse sources in the EPA diffuse model and point sources in the form of combined sewer overflows (CSOs).

The functional value of the Tramore River in Togher is considered '*very low*' as the watercourse is culverted for the majority of its length in this area. Refer to **Table 12.3**.

The WFD ecological status of Lough Mahon, the water body to which the Tramore 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.

Tramore River Surface Water Quality

There are no EPA water quality monitoring stations located on the Tramore River, therefore, biological quality ratings (Q-values) are not available for the watercourse.

There is surface water quality information available for the Tramore River as reported in the Annual Environmental Report (AER) (2015) for the Kinsale Road Landfill which operates under an EPA waste licence (licence registration No. W0012-03). The site is a former landfill site operated by Cork City Council and no longer accepts waste. The Kinsale Road Landfill is located at the Tramore Valley Park, off the Kinsale Road and the Tramore River flows around the southern section of the site before flowing through Douglas. Refer to **Figure 12.4**. The site monitors the water quality of the Tramore River as part of the EPA licence conditions. This report is available online on the EPA website.

Biological oxygen demand (BOD) is one of the physico-chemical parameters used to assess water quality of rivers, refer to **Table 12.5**. **Table 12.2** summarises surface water quality results for three locations (labelled EM2, EM10 and EM11 in **Figure 12.2**) on the Tramore River as reported in the Kinsale Road Landfill AER (2015). All the reported BOD measurements are less than 3mg/l for all but one (EM11, **Table 12.4**). A BOD measurement less than 3mg/l would suggest a Q4/Q5 water quality rating according to the quality classes listed in **Table 12.5**.

Table 12.6: Surface water quality results (summarised) for sampling location EM 2, EM10 and EM11 as reported in the Kinsale Road Landfill AER (2015) under the EPA waste licence No. W0012-03.

Sampling Point	Sampling Date	pH	BOD (mg/l)
EM2	11/03/2015	7.67	1
	08/09/2015	8.06	1.7
	01/12/2015	7.71	1.2
EM10	11/03/2015	7.71	2.5
	08/09/2015	8.33	2.9
	01/12/2015	7.53	1.6
EM11	11/03/2015	7.22	4.3
	08/09/2015	8.41	1.1
	01/12/2015	8.11	1.2

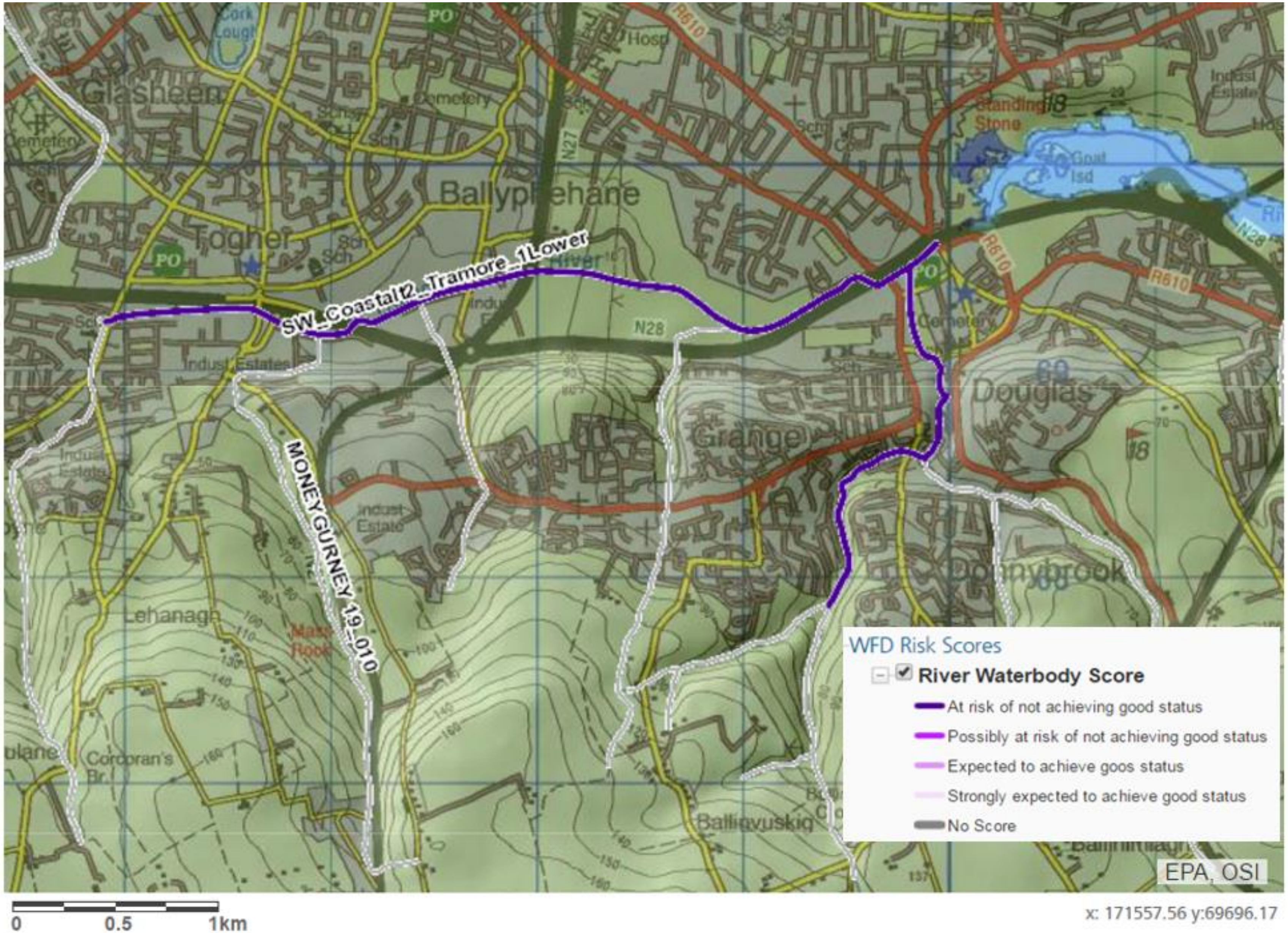

Figure 12.3: Water Framework Directive Risk Scores for the Tramore River Source: EPA Envision Mapping, 2016)

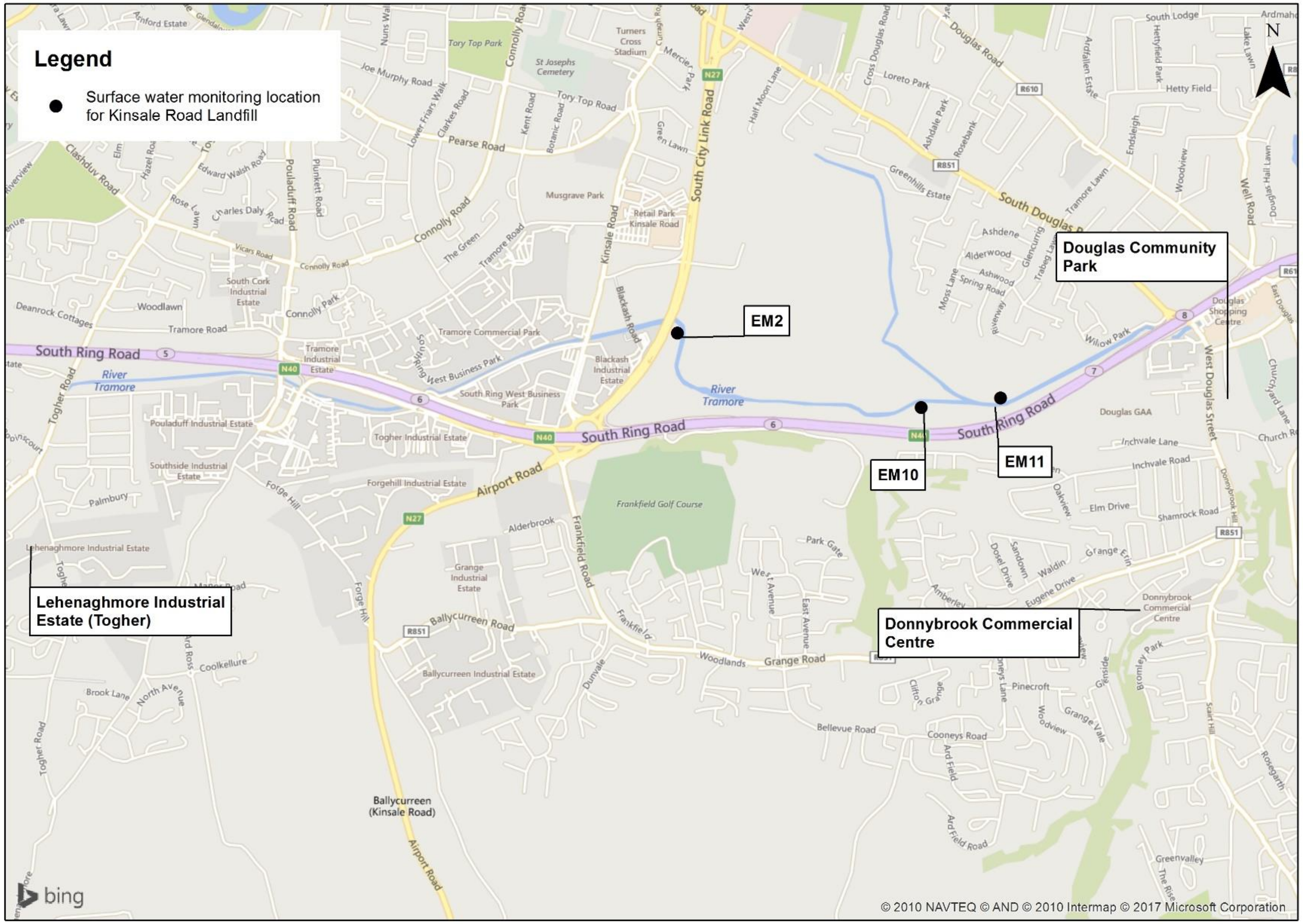

Figure 12.4: Surface water monitoring locations for Kinsale Road Landfill (EPA Licence Reg. No. W0012-03) Source: Kinsale Road Landfill Annual Environmental Report 2015, accessed from www.epa.ie.

12.3.1.2 Ballybrack Stream

The Ballybrack Stream is formed by the confluence of the Grange and Moneygurney Streams. The Grange Stream rises in Ballinvuskig approximately 2.5km south of the confluence with the Moneygurney Stream. The catchment area of the Grange Stream primarily consists of arable land in the south while the north of the catchment is urbanised.

The Moneygurney Stream rises in Moneygurney approximately 2km south of its confluence with the Grange Stream. Similar to the Grange Stream, the catchment of the Moneygurney Stream watercourse is primarily arable land in the south and urbanisation in the north. An unnamed watercourse joins the Moneygurney Stream approximately 420m upstream of its confluence with the Grange Stream.

The Ballybrack Stream catchment is primarily arable land in the south and is urbanised in the north. The Ballybrack Stream generally flows in a northerly direction through Ballybrack Woods, Ravensdale and Douglas Community Park. The stream is culverted under Douglas Village Shopping Centre before joining the Tramore River adjacent to the South Ring Road.

The Tramore River (Coastal) (IE_SW_19_1964) *Water Matters Report*, available at www.wfdireland.ie, covers the catchment of the Ballybrack Stream. Similar to the Tramore River upstream of Douglas Village, the overall ecological status of the Ballybrack Stream is classified as '*moderate*' with the watercourse classified as "*at risk of not achieving good status*". The watercourse is identified as being at risk of diffuse (EPA diffuse model, 2008) and point (CSOs) sources of pollution.

There are no EPA water quality monitoring stations located on the Ballybrack Stream, therefore, no biological quality ratings (Q-values) are available for the watercourse.

The functional value of the Ballybrack Stream and Grange Stream has been determined based on the available flood plain storage in accordance with **Table 12.3** as no Q values for the streams are available. Therefore, both watercourses in the area of the proposed works are considered to have low functional values as the floodplains have no storage capacity for potential floodwaters due to the urbanisation of the area.

12.3.2 Flood Risk

12.3.2.1 Fluvial Flood Risk

Togher

A detailed assessment of the fluvial flood risk in Togher was undertaken as part of the Lee CFRAM Study. The Tramore River is not tidally influenced in Togher. An extract from the flood mapping produced as part of this study is included in **Figure 12.5**.

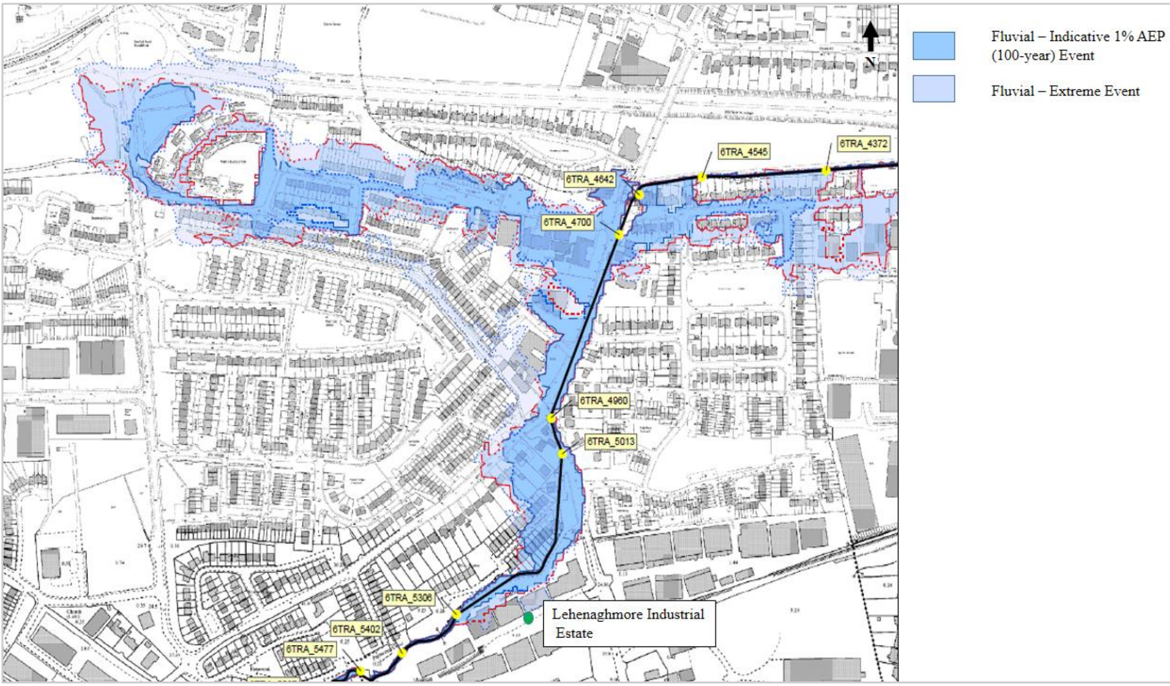

Figure 12.5: Extract from the Lee CFRAM Study Fluvial Flood Map for Togher

Figure 12.5 indicates that a number of residential and commercial properties in Togher are 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). Lehenaghmore Road and Togher Road also lie within Flood Zone A.

Douglas

To determine the extent of flood defences required in Douglas, detailed modelling the Ballybrack Stream and Tramore River in Douglas was undertaken as part of the Douglas Flood Relief Scheme (including Togher Culvert). The fluvial flood map for Douglas produced from the modelling is included in **Figure 12.6**. The flood extents shown on the map correspond to Flood Zone A (the 1 in 100 year fluvial flood extent). The fluvial flood map for Donnybrook Commercial Centre is included in **Figure 12.7**

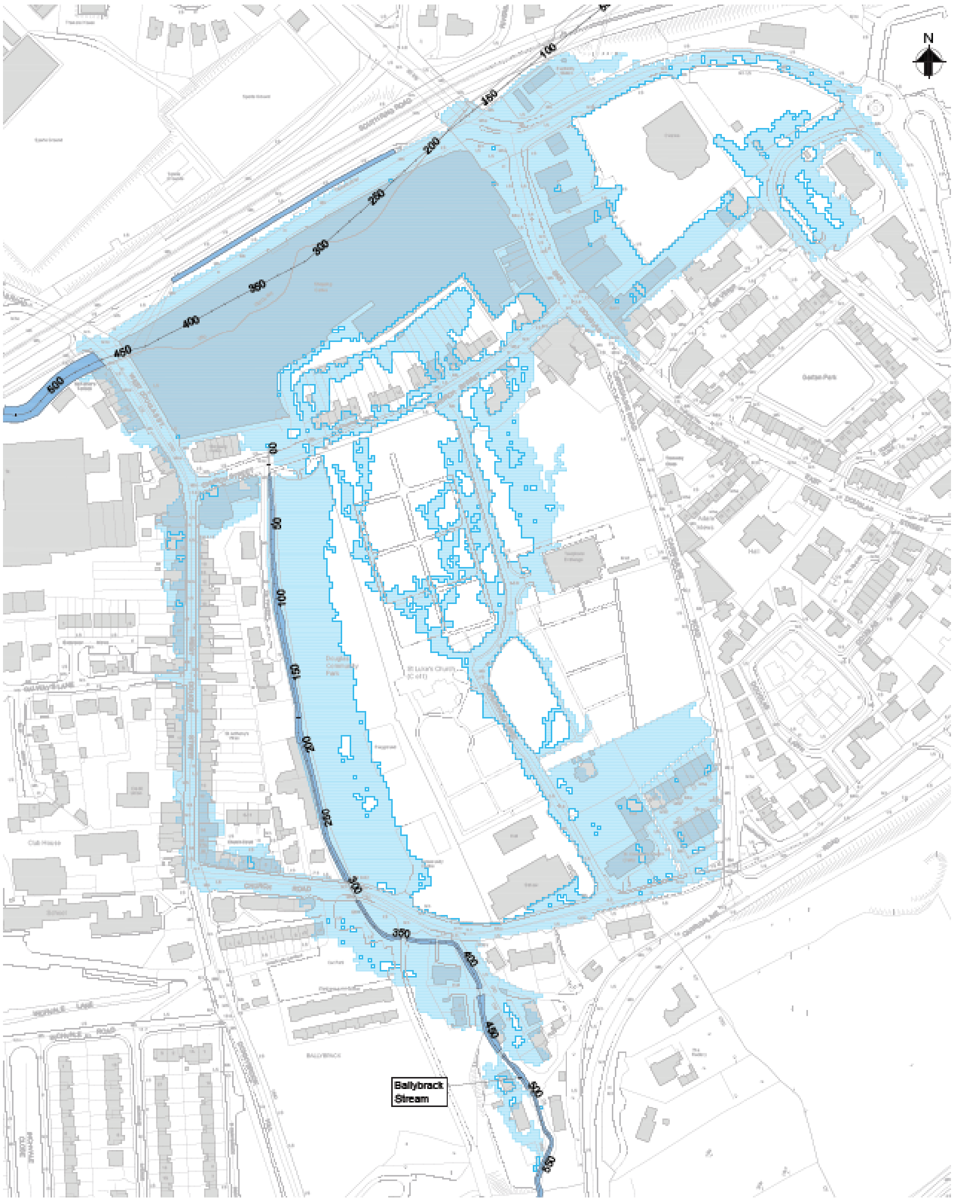

Figure 12.6: Extract from the Douglas FRS Flood Map showing the 1 in 100 year fluvial flood extent.

Figure 12.7: Extract from the Douglas FRS Flood Map showing the 1 in 100 year fluvial flood extent in Donnybrook Commercial Centre.

Figure 12.6 indicates that a number of residential and commercial properties are located within Flood Zone A. Douglas Community Park, Church Road and Church Street are also located within Flood Zone A as a result of fluvial flooding.

Figure 12.7 indicates that a number of commercial properties within Donnybrook Commercial centre are also located within Flood Zone A.

12.3.2.2 Tidal Flood Risk

Togher

There is no tidal flood risk in Togher.

Douglas

The risk of tidal flooding was considered as part of the Douglas Flood Relief Scheme (including Togher Culvert). The results of the hydraulic modelling indicated that the 0.5% AEP tidal flood event does not get out of bank in Douglas. Although the 0.5% AEP tidal flood event does not overtop the river bank in St Patrick's Mills, a flood defence wall is proposed in this area to provide freeboard.

12.3.2.3 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 Togher and Douglas, the OPW Preliminary Flood Risk Assessment (PFRA) mapping has been reviewed. An extract from the PFRA pluvial flood map for Togher is included in **Figure 12.8**.

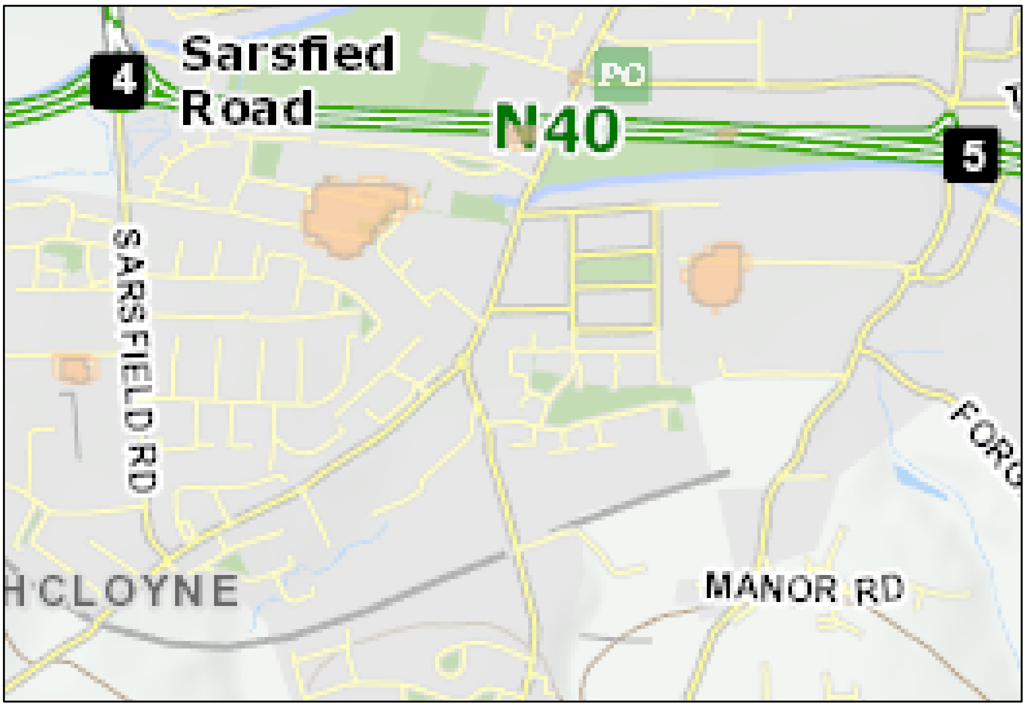

Figure 12.8: Extract from the OPW PFRA pluvial flood Map at Togher (highlighted in orange) | Source: www.myplan.ie

The pluvial flood map for Togher indicates that the two areas of Togher are at risk of pluvial flooding – within Elmvale Avenue and on Pouladuff Road. Anecdotal evidence from Cork County Council and residents in the area however suggests that significant overland flow occurs along Lehenaghmore Road and subsequently Togher Road during extreme rainfall events.

A 2D “direct rainfall” hydraulic model of the catchment was developed to identify the potential issues which lead to the observed flow on Lehenaghmore Road and estimate the peak flow and volume that might be expected to flow down the road during the 1 in 100 year rainfall event.

The pluvial flood map for Douglas indicates that the area is generally at low risk of pluvial flooding with the exception of Donnybrook Commercial Centre which is shown to lie within the indicative 1% AEP (100 year event) pluvial flood extent. An extract from the PFRA pluvial flood map for Douglas is included in **Figure 12.9** below.

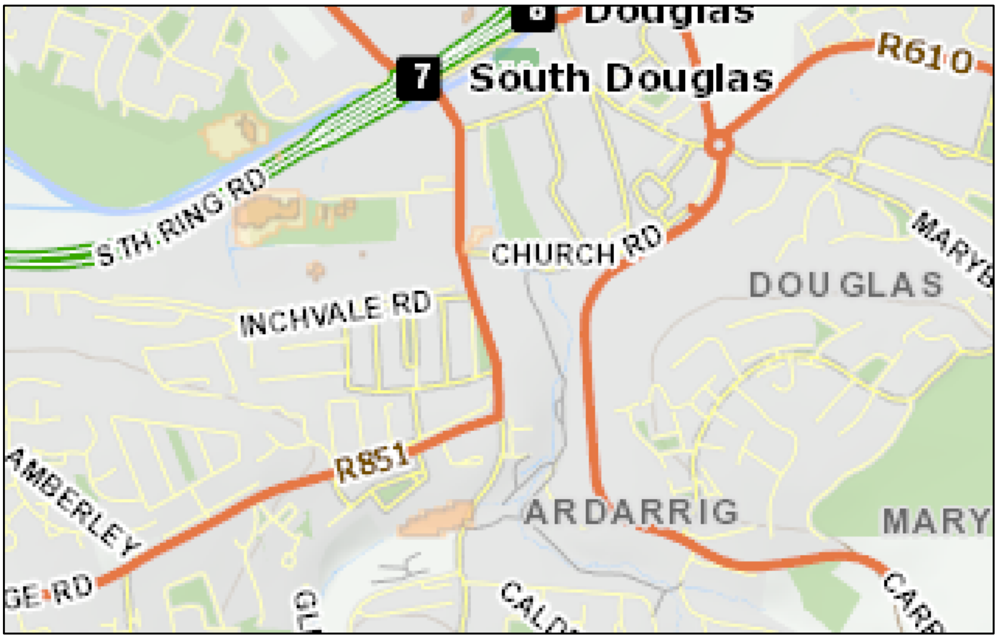

Figure 12.9 Extract from the OPW PFRA pluvial flood map at Douglas (highlighted in orange) | Source: www.myplan.ie

12.3.2.4 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. This does not indicate any areas in the vicinity of the works as being at risk of groundwater flooding.

12.3.2.5 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 both Togher and Douglas Village, primarily related to the 2012, 2009 and 2002 events.

Copies of summary reports for flooding events at Togher and Douglas by the OPW can be found on the National Flood Hazard Mapping website (www.floodmaps.ie). An extract from the reports is included in **Figure 12.10**.

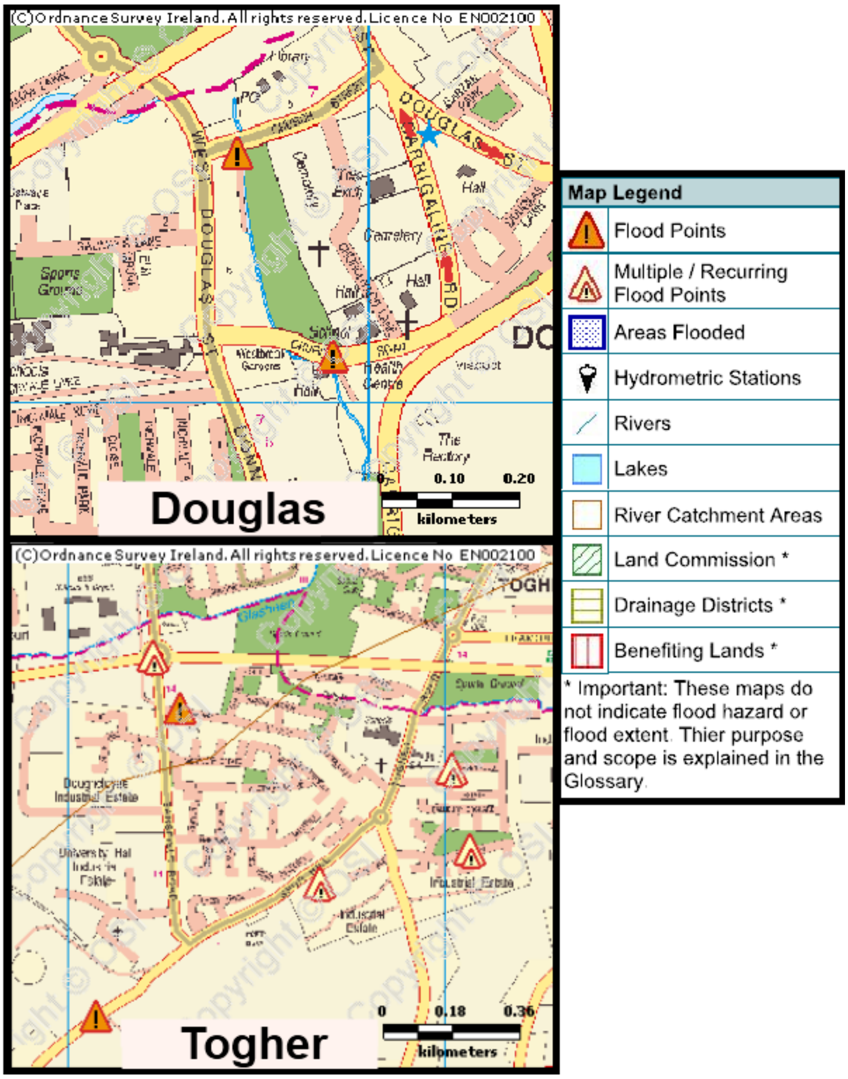

Figure 12.10 Extract from the National Flood Hazard Mapping reports.

Historic mapping was examined and found to contain evidence of historical flooding in the study areas. The Ordnance Survey 6” map contains a reasonably detailed “extent of inundation” line along the Tramore River as far as the former Kinsale Road Landfill. The line indicates a wide floodplain upstream, which narrowed through Douglas before widening again as the Tramore River entered the Douglas River estuary.

The Ordnance Survey 25” map shows an area of marshy ground along the left bank of the Ballybrack Stream that was once a pond which fed a mill at the corner of Church Street and West Douglas Street. Extracts from the historic maps showing the above features are included in **Figure 12.11**.

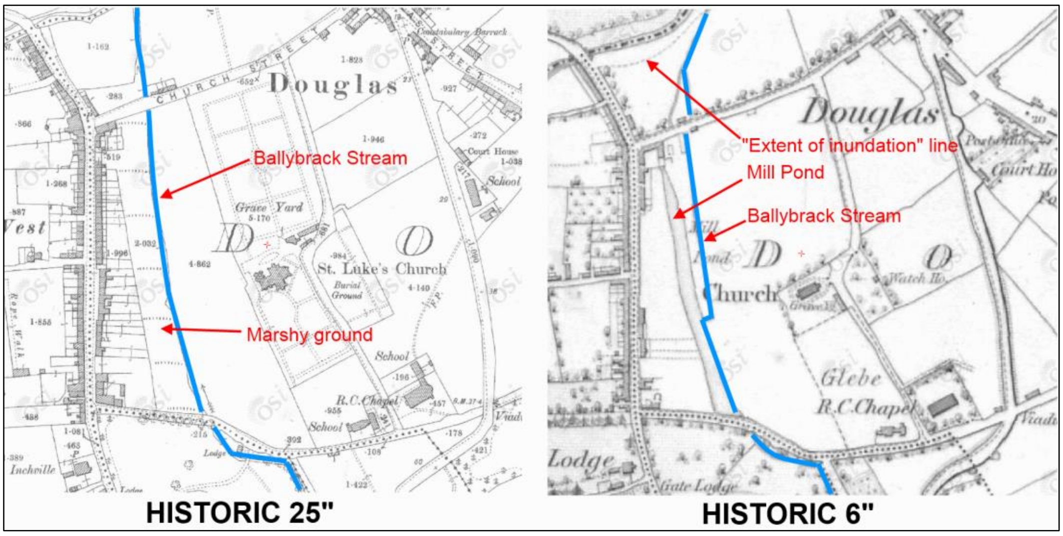

Figure 12.11: Extract from Historic 25" (1888-1913) and 6" (1837-1842) maps for Douglas. Source Ordnance Survey Ireland (2006) via www.geohive.ie

Reports and other information on past flooding in the study areas were supplied by Cork County Council (CCC) and the Office of Public Works (OPW). Anecdotal evidence from CCC staff suggests that Douglas experienced infrequent minor flooding in the past from backing-up/blockage at the entrance to the old Ballybrack culvert at Church Street.

Based on the above review, a timeline of flood events in Togher and Douglas has been created and summarised in **Table 12.7**.

Table 12.7: Timeline of major fluvial and tidal flood events in Togher and Douglas

Date of Flood Event	Mechanism	Areas Affected
December 2015	Fluvial	Douglas village
28 June 2012	Fluvial	Togher, Douglas village
December 2009	Fluvial	Tramore River (Kinsale Road roundabout area only)
27 November 2002	Fluvial	Togher
21 November 2002	Fluvial	Togher, Douglas village
3 December 2001	Fluvial	Togher
30 November 2000	Fluvial	Togher
5 November 2000	Fluvial	Togher, Douglas
1998	Fluvial	Togher
27 November 1953 (Date unconfirmed)	Fluvial	Douglas
17 March 1947	Fluvial	Togher, Douglas
24 December 1895	Fluvial	Douglas
19 November 1892	Fluvial	Douglas
Historic recurring	Fluvial / Tidal	Tramore River downstream of the former Kinsale Road Landfill, Douglas

12.4 Characteristics of the Proposed Scheme

As discussed in **Chapter 2 Need for the Proposed Scheme and Alternatives Considered**, due to past flooding events in Togher and Douglas the need to increase flood defences has been identified in these areas. A summary of the flooding history in Togher and Douglas is presented in this chapter in **Section 12.3.2.5**.

A detailed description of the proposed scheme is included in **Chapter 3 Description of the Proposed Scheme** of this EIS. In summary, the scheme will consist of the construction of flood defences along the Tramore River, Ballybrack Stream and Grange Stream. The works to be carried out on site are summarised below:

- Construction of new flood defence walls and/or replacement of existing walls with new flood defence walls
- Replacement of and/or extension of existing culverts
- Removal of and/or replacement of bridges
- New underground surface water pumping stations
- Removal of existing trash screens and construction of new coarse screens
- Local channel widening, deepening, realignment and re-grading of river channel
- Construction of new earthen flood defence embankments
- Provision of civil works such as road/footpath re-grading at a number of locations;
- Removal of vegetation and trees to facilitate construction works
- Protecting drainage outlets along the line of flood defence works
- Once construction is completed, ongoing maintenance of the river channel, trash screens etc.

12.4.1 Hydrology and Water Quality

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 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.

12.5 Evaluation of Impacts

The impacts of the Scheme are evaluated for both the construction and operation phases of the scheme. Refer to **Table 12.4** and **12.5** for the description of impacts magnitude given in the following sections.

12.5.1 Construction Impacts

12.5.1.1 Hydrology and Water Quality

Construction activities pose a potentially significant temporary risk to all watercourses as these sites will be exposed to rainfall which has the potential to produce run-off during the construction phase. Surface water run-off from 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, 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 pH 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 increase to the risk of fluvial from the Tramore River, Ballybrack Stream and Grange Stream. During the construction phase, it will be necessary to temporarily divert the existing watercourses to facilitate the construction of replacement culverts. There is a risk that flooding could be exacerbated if the temporary diversions do not have sufficient conveyance capacity or if adequate overflow arrangements are not put in place. Over pumping of the watercourses, if used, may also increase the risk of flooding.

The construction of the scheme will require in channel works in a number of areas. These include:

- Togher;
- Donnybrook Commercial Centre;
- Ravensdale; and
- Douglas Community Park.

The construction phase also poses a temporary increase to the risk of pluvial flooding in Togher and Douglas. 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 Hydrology and Water Quality

The impacts on hydrology as a result of maintenance of the proposed flood defence works 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 considerably reduce the fluvial and tidal flood risk in Togher and Douglas by providing a flood defence standard equal to the 1 in 100 year fluvial flood level plus the 1 in 200 year tidal flood level including freeboard. Therefore the risk of fluvial and tidal flooding in the areas to be protected by the scheme will be greatly 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.

The operational phase of the scheme poses a permanent and slight risk of pluvial flooding in the vicinity of the flood defences. The construction of the flood defences will result in increased water levels in the watercourse channel during flood events which could result in surcharging of surface water drainage outfalls. As a result, water may back up through the surface water drainage network and cause flooding behind the flood defences. Surcharging of the surface water outfalls could also prevent surface water runoff from entering the watercourse which will result in flooding behind the defences.

The flood defences may also block existing overland flow routes, where surface water run-off flows overland into the watercourses. This could result in an increased risk of pluvial flooding if adequate surface water drainage networks are not constructed to collect these flows.

12.5.2.3 Geomorphology

A baseline geomorphological survey was carried out as part of the design process. The information gathered has been used to assess the impact of the proposed scheme on the geomorphological processes within the catchment. The key aspects considered in the assessment are the likely impact of the scheme on the erosion and deposition of sediment in the catchment and how the functioning of the scheme may be adversely impacted by it. It is noted that as the works are being constructed in urban areas, it is considered that the impact of the scheme on the overall catchment geomorphology, or any high-quality physical river habitat, will likely be limited.

The key considerations of the scheme are:

- The scheme should not alter the morphological typology (i.e. the ‘type of river morphology’) of the various watercourses in the catchment and should improve the hydromorphological conditions in general. This statement is made in the context of the scheme increasing channel capacity in general, which will help partially restore / improve natural processes in comparison to the existing more confined state;

Togher

The primary flood relief option for Togher involves the removal of the existing multiple undersized culverts/drainage pipes that convey the Tramore flow from upstream of Lehenaghmore Industrial Estate to downstream of Greenwood Estate, and replacing it with a single larger culvert with increased capacity. The two existing open channel sections along the existing route are to be included as part of the proposed single culvert. As these two sections are relatively short (circa 45m and 15m) the reduction in open channel river habitat will be very minor.

This is unlikely to have any significant negative impact on the geomorphological conditions within the wider catchment as the proposed upgraded culvert will not influence sediment delivery processes from the upper catchment.

However, there is potential for localised sediment accumulation within the culvert during low flow conditions due to the upgraded culvert being wider than the existing culvert, leading to a reduction in velocities. This is unlikely to compromise the functioning of the culvert as a flood relief measure in Togher as 'morphologically-effective' flows should still move sediments through the culvert during high flow events. However, it is recommended that this localised change to sediment transport conditions be monitored by inspecting the culvert at least once a year and/or after every significant flood event as part of the scheme's maintenance regime.

Donnybrook Commercial Centre

The proposed design for Donnybrook Commercial Centre involves the upgrade of the lower section of the existing 190m long culvert that runs underneath the centre and the re-grading of certain sections of the reach. Additionally, this design involves the removal of two screens that currently trap sediment and artificially raise bed levels in the channel immediately upstream as a result.

Removing both coarse screens will benefit the geomorphological systems as it will facilitate more natural sediment storage and transport locally, and provide more favourable fish passage conditions through the reach.

Removal of the screens is unlikely to increase the overall sediment delivery into long culvert than runs underneath the centre when compared to the existing situation (i.e. when the screens are storing a maximum amount of sediment upstream, coarse sediment is delivered over the top of the screens). The volumes of stored sediments will be removed as part of the local screen removal works and be taken from the site.

As with the culvert in Togher, there is potential for localised sediment accumulation within the culvert during low flow conditions. A benched low flow channel will however be incorporated into the culvert which will mitigate the risk of sedimentation. Again, it may be the case that local higher magnitude and longer duration morphologically-effective flows have the effect of flushing sediments through the culvert if and when sediment transport exceeds supply from upstream.

It is recommended however that this localised change to sediment transport conditions be monitored at Donnybrook by inspecting the culvert at least once a year and/or after every significant flood event as part of the scheme's maintenance regime.

Douglas – Ballybrack stream

The flood relief option for Douglas along the Ballybrack stream are direct flood alleviation structures combined with channel conveyance improvement works.

The proposed works will have a minimal impact on the sediment delivery to the watercourse as the proposed direct defences only cover a relatively short reach of the channel (circa 240m).

The proposed works have the potential to mobilise a greater amount of sediment during high flow events as all the flow will be kept in channel, as opposed to spilling over a wider floodplain as it does in the existing scenario. There is therefore the potential for an increase in sedimentation downstream of the works in areas of reduced velocities. This however is not likely to have an adverse impact on conveyance through the reach as these events are infrequent and will be mitigated by the flows in normal conditions.

The proposed works are unlikely to have an adverse impact at low flows as the existing channel width will be maintained for low flows through the reach.

St Patricks Mills

The proposed design at St Patricks Mills are direct defences along the right bank of the Tramore River within St Patricks Mills. These flood alleviation structures are not likely to have any adverse impact on the geomorphology of the Tramore river due to their localised nature and size in comparison to the wider channel.

12.6 Mitigation Measures

12.6.1 Construction Mitigation Measures

12.6.1.1 Hydrology

The following precautionary measures will be implemented as part of the project design.

Prior to construction, the Contractor will be required to develop a Construction Environmental Management Plan (CEMP) which will incorporate the precautionary measures detailed below. These precautionary measures apply for the prevention of pollution to all waters during construction. These measures are implemented as standard for construction projects of this type. No impediments to the effective implementation of these measures have been identified. **Chapter 4 Construction Activities** outlines the recommended Construction Industry Research and Information Association (CIRIA) guidance in relation to minimising the risk of spills and contamination of surface waters.

The following construction precautionary measures will be utilised to minimise the risk of surface water 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 precautionary 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;
- Washout from mixing plant or concrete trucks 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; and
- 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.

Process water used during construction will be disposed of appropriately.

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.

12.6.2.2 Flood Risk

The proposed scheme will reduce the risk of fluvial and tidal flooding by providing a standard of protection equal to the 1 in 100 year fluvial flood level and 1 in 200 year tidal level including freeboard. Therefore no mitigation measures are required in relation to fluvial and tidal flood risk.

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 due to the risk of surcharge during the 1 in 100 year fluvial flood including freeboard.

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.

12.6.2.3 Geomorphology

It is recommended that the localised change to sediment transport conditions be monitored at Togher and Donnybrook by inspecting the culvert at least once a year and/or after every significant flood event as part of the scheme's maintenance regime.

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 flood risk are anticipated with the implementation of the construction and operational mitigation measures described above. The risk of flooding will be considerably reduced due to the proposed flood relief scheme.

12.8 References

Arup, Douglas Flood Relief Scheme (Including Togher Culvert) Douglas Options Report (2016)

Arup, Douglas Flood Relief Scheme (Including Togher Culvert) Hydrology Report (2016)

Arup, Douglas Flood Relief Scheme (Including Togher Culvert) Hydraulics Report (2016)

Arup, Douglas Flood Relief Scheme (Including Togher Culvert) Togher Hydraulics Report (2016)

Arup, Douglas Flood Relief Scheme (Including Togher Culvert) Togher Options 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, Architectural and Cultural Heritage

13.1 Introduction

This report comprises an appraisal of the potential impact of Douglas Flood Relief Scheme in Douglas and Togher, Co Cork. The scheme will impact the Tramore River in Togher and at Douglas Mills/ St Patrick's Mills in Douglas; the Ballybrack Stream in Douglas and the Grange Stream in Donnybrook Commercial Centre in Douglas. 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 appraisal was carried out by Lane Purcell Archaeology.

There are a total of 34 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 2km radius of the flood relief scheme areas. Two of these sites are within proposed works areas for the flood relief scheme, both are milling complexes in Grange in Douglas (CO074-095 and CO086-100). The 34 archaeological sites provide evidence for human settlement and activity in the area dating back to the Bronze Age. There are 21 structures listed in the Record of Protected Structures (RPS) of the Cork County Development Plan (CDP) (2014) within a 2km radius of the flood relief scheme. There are 68 buildings included in the National Inventory of Architectural Heritage (NIAH) within 1km radius of the flood relief 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.

Study Area

In order to obtain a comprehensive assessment of the Cultural Heritage Environment, a study area within a circa 2km radius of the proposed scheme was examined. The study area was reduced to 1km in relation to buildings listed in the NIAH.

13.2 Methodology

The methodology used to complete this section of the EIS comprised the following:

- A review of the relevant Legislation and Guidelines
- A desktop appraisal of the proposed development site and Study Area
- A survey or inspection of the proposed development site.
- A wading and metal detector survey of the areas of works proposed for the scheme
- 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.
- Proposed mitigation measures to be undertaken to prevent or reduce any potential impacts on the archaeological, architectural and cultural heritage.

13.2.1 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 Local Government (Planning and Development) Act 2000. 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).

13.2.2 Desktop Study

The desktop study provided a cultural heritage overview of the proposed flood relief scheme area and study area using the following sources.

13.2.2.1 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 County. 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. CO086-013 refers to circle 13 on OS sheet 86 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.

13.2.2.2 Sites and Monuments Database of the Archaeological Survey of Ireland at the NMS

The purpose of the Archaeological Survey of Ireland (ASI) is to compile a base-line 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

13.2.2.3 Archaeological Inventory

The inventories for each county are follow-ons by 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.

13.2.2.4 Consultations

During the compilation of the EIS the following were consulted;

- Ms Mary Sleeman, County Archaeologist for Co Cork
- Ms Connie Kelleher, Underwater Archaeology Unit, National Monuments Service
- Ms Mairead Weaver Planning Office for Co Cork with the National Monuments Service

13.2.2.5 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
- Monuments listed in the Register of Historic Monuments – None in the Study Area.

13.2.2.6 Underwater Archaeology Unit, DAHG

The Underwater Archaeology Unit maintains files on the Ports, Piers and Harbours of Ireland. There are no references in the files to the watercourses or settlements in the study area.

13.2.2.7 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 within these files.

However, the British Museum holds an Early Bronze Age gold disc which was recovered from Castletreasure in the mid-19th century (Cahill 2006). A roman coin minted during the reign of Philip the Arab who was the Roman Emperor from AD 244 – 249 was found at Cork Airport in the townland of Lehenagh More. It is uncertain whether this coin is genuine or possibly a Victorian fake and it is not possible to determine when the coin arrived in Ireland (McNamee no date).

13.2.2.8 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 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 practises are promoted.
- Ensuring high quality architectural design of new development relating to or impacting on structures and their settings included in the RPS.

Works will be undertaken in the vicinity of St Patrick's Woollen Mills which is included twice in the RPS, listed as St Patrick's Woollen Mills (RPS 01243) and Douglas Woollen Mills (RPS 00482). No works will be undertaken to the range of buildings which comprise the milling complex but works will be undertaken within their curtilage. Works will be undertaken in the milling complex known as Donnybrook Commercial Centre. Millhouses at the eastern end of the complex are included in the RPS (00566). No works will be undertaken to the millhouses which is approximately 100m to the east of the proposed works area. The proposed works will, however, be within the attendant grounds of the millhouses. There are 19 other protected structures within the proposed development site within the 2km study area (**Table 13.1**).

Table 13.1: Architectural features included in the County Development Plan Record of Protected Structures within the study area.

RPS No.	Location	Name
01243	Douglas	St Patrick's Woollen Mills (Industrial Estate)
00482	Douglas	Douglas Woollen Mills
00481	Douglas	St Luke's Church of Ireland Church
00684	Douglas	Former Garda Station
00752	Maryborough Hill	Maryborough Lodge
00479	Maryborough Hill	Maryborough House Hotel
00566	Grange	Millhouses
01231	Grange	No. 11 Grange Terrace
01232	Grange	No. 10 Grange Terrace
01233	Grange	No. 9 Grange Terrace
01234	Grange	No. 8 Grange Terrace
01235	Grange	No. 7 Grange Terrace
01236	Grange	No. 6 Grange Terrace
01237	Grange	No. 5 Grange Terrace
01238	Grange	No. 4 Grange Terrace
01239	Grange	No. 2 Grange Terrace
01240	Grange	No. 3 Grange Terrace
01241	Grange	No. 1 Grange Terrace
00480	Curraghconway	Vernon Mount
00564	Curraghconway	Frankfield Church of Ireland church
00565	Curraghconway	Mount Conway

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. Any "place, area, group of structures or townscape that is of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest or contributes to the appreciation of protected structures" is an Architectural Conservation Area (ACA). ACAs will be conserved and their special character enhanced, including their "traditional building stock and material finishes, spaces, streetscape, shop fronts, landscape and setting". This will be achieved by:

- Protecting from demolition and non-sympathetic alterations all buildings, structures, etc., and all features considered to be intrinsic elements to the special character of the ACA.
- Promoting sensitive re-use and rehabilitation of buildings and sites in the ACA.
- Ensuring new development, within or nearby, respects the established character of the area and is of high quality architectural design.
- Encouraging repair and re-use of traditional shop fronts and high quality architectural design.
- Ensuring that new signage etc. is appropriate.
- Ensuring that open spaces are protected.
- Ensuring that appropriate materials are used during public infrastructure projects.

The County Development Plan includes two ACA's which are within the study area, these are Church Street Conservation Area and West Douglas Street Conservation Area both in Douglas (**Table 13.2**).

Table 13.2: Architectural Conservation Areas included in the County Development Plan within the study area

Townland	Name
Douglas	Church St Conservation Area
Douglas	West Douglas Street Conservation Area

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.

NIAH Architectural 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 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 and the Gaeltacht. 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.

No gardens included in the Inventory are within the proposed development site. A number of gardens included in the Inventory lie within the 2km study area, these include: Ballinlough House in Ballinlough; Ballincurrig House in Ballincurrig; Ballincurrig Villa in Ballincurrig; Ballybrack in Ballybrack; Castle Treasure in Castletreasure; Donnybrook in Castletreasure; Douglas House in Douglas; Doughcloyne in Doughcloyne; Doughcloyne House in Doughcloyne; Endsleigh in Ballincurrig; Frankfield in Curraghconway; Mount Conway in Curraghconway; Maryborough in Douglas; and Vernon Mount in Curraghconway.

Table 13.3: Architectural features listed in the NIAH within 1km of the proposed works

NIAH No	Name	Location
20871030	St Patricks Woollen Mills/ Douglas Commercial Estate (engine house)	Grange
20871031	St Patricks Woollen Mills/ Douglas Commercial Estate (engine house)	Grange
20871032	St Patricks Woollen Mills/ Douglas Commercial Estate (water mill)	Grange
20871033	1-7 St Patricks Terrace	Grange
20871034	St Columba's Boys National School	Grange
20871035	Ballybrack House – gates/railings/walls	Ballybrack
20871036	Ballybrack House	Ballybrack

NIAH No	Name	Location
20871037	Douglas Hall	Ballincurrig
20871038	River View B&B	Douglas St
20871040	Schoolhouse Studio	Carrigaline Rd
20871042	St Lukes C of I Church and environs	Church yard Lane
20871043	Sextons House, St Lukes Church	Church yard Lane
20871045	John Slye Scout Hall	Church yard Lane
20871046	St Columba’s Roman Catholic Church	Church yard Lane
20871050	Single arch road bridge	Church Road/ Carrigaline Rd
20871047	House	Church Rd
20871048	Pair of semi-detached houses	Church Rd
20871049	The Rectory	Carrigaline Rd
20872002	Douglas House,	Douglas
20872001	Windyridge	Douglas
20872003	Rochestown Park Hotel	Monfieldstown
20908622	Douglas Woollen Mills	Grange
20908623	Terrace of 5 houses	Grange
20908624	Pair of 2-storey houses	Grange
20908625	Terrace of 6 houses	Grange
20908626	Former Gate Lodge	Grange
20908627	Post box	Grange
20908628	Store/warehouse	Grange
20908629	Office	Grange
20908630	Christy Floor Coverings	Castletreasure
20908631	Terrace of 5 Houses	Castletreasure
20908632	Donnybrook House	Castletreasure
20872004	Maryborough House Hotel	Maryborough
20908619	Stonehouse (school)	Curraghconway
20908618	Post box	Curraghconway
20908620	Holy Trinity Church of Ireland Church	Curraghconway
20871037	Douglas Hall	Ballincurrig
20871027	Glaneskin Gate Lodge	Ballincurrig
20871028	Glanskin	Ballincurrig
20871026	Ellerslie	Ballincurrig
20871025	Palmeira	Ballincurrig
20871024	Hetty Field	Brownstown
20871020	5-6 Wood View	Ballincurrig
20871021	3-4 Wood View	Ballincurrig
20871022	1-2 Wood View	Ballincurrig
20868038	Ravenscourt	Ballinlough
20870008	The Lodge Dental Practice	Lehenaghmore
20870009	House (Spur Hill)	Lehenaghmore
20871010	Entrance gates to Lehenaghmore House	Lehenaghmore
20870007	Church of the Way of the Cross	Lehenaghmore
20908608	Bridge	Doughcloyne
20908604	Bridge	Chetwynd
20908609	Bridge	Lehenaghmore
20908610	Bridge	Ballycurreen
20870006	Mortuary	Farrandahadore Beg
20870004	Church	Farrandahadore Beg
20870005	Church	Farrandahadore Beg
20870003	Mausoleum	Farrandahadore Beg
20870002	Sexton’s House	Farrandahadore Beg
20870001	Gates, railings, walls	Farrandahadore Beg
20869006	Wilton Villas	Farrandahadore More
20869005	Milestone/Milepost	Ballinaspig Beg

NIAH No	Name	Location
20869004	Church	Farrandahadore More
20869003	St Joseph's College	Farrandahadore More
20869002	St Joseph's College outbuilding	Farrandahadore More
20869001	Wilton Park House	Ballinaspig More
20865061	Mount Philomena House	Ballinaspig More
20866215	Peterborough House	Huggarts-Land

13.2.2.9 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 the watercourses affected by the proposed works (**Appendix 13.1**). These and other investigations undertaken are discussed below.

13.2.2.10 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.

13.2.2.11 Cartographic Sources

The following maps were consulted:

- Ordnance Survey 6-inch maps: the three editions of the 6-inch to one mile scale maps were consulted, the first edition published in 1841-1842, the second edition published in 1902, and the third edition published in 1933 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.

13.2.2.12 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). 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.

13.2.3 Site Inspection

The primary purpose of a site inspection is to assess the physical environment in which the proposed development scheme will take place and identify any possible features of archaeological, architectural or 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 flood relief scheme areas were visited on a number of occasions, most recently on the 17th May 2016. The two proposed construction compounds were visited on the 16th and 17th June 2016.

13.3 Receiving Environment

13.3.1 Cultural Heritage and the Existing Environment

13.3.1.1 Douglas

Douglas village is located approximately 3km south of Cork City and has in the last decades become one of the city's largest suburbs. The Douglas River, after which the village is named, flows south through the village, joining the Tramore River, before discharging into the Douglas Estuary in the inner reaches of Cork Harbour. The name Douglas or *Dúglas* means darkish stream (logainm.ie). The village, which developed here in the early 18th century, grew up around the establishing textile industries. The power, which was harnessed from the rivers, along with the harbour-front location initially attracted these industries to Douglas. By the mid-19th century the village had a post office, court house and police barracks and continued to grow through the 20th century. Lewis described the settlement in favourable terms in 1837 noting the numerous country houses in the area (Cadogan 1998, 221-2).

The catchment area of the Douglas River extends beyond the low lying area of Douglas village itself (in the townlands of Douglas and Grange), to the higher ground to the south into the townlands of Ardarrig, Ballybrack and Castletreasure where a number of tributaries rise. Works are also proposed on a number of these tributaries. They include the Grange Stream which flows through Donnybrook Commercial Centre in Grange to the southwest of Douglas village.

The stream flows into the Ballybrack Stream at Donnybrook Hill a short distance northeast of the commercial park and runs broadly along the townland boundary of Ballybrack and Ardarrig continuing south through the Ravensdale area and Douglas Community Park. The stream runs through a culvert under Church Street and Douglas Village Shopping Centre and enters the Douglas River which flows into Cork Harbour a short distance to the east.

13.3.1.2 Togher

Togher is a suburb to Cork city lying approximately 5km to the southwest of the city centre and has in the last decades grown to become one of the city's many large suburbs. The name Togher comes from the Irish word *Tóchar* meaning causeway.

The suburb is cut by the N40 South Ring Road which runs generally along the line of the Cork and Macroom Direct Railway line. The centre of the village of Togher extends north along the Togher Road from the bottom of Spur Hill. Its southern extent is more difficult to define, extending possibly as far as Vicars Road, where it has become largely residential. In the mid-19th century Togher was a small settlement comprising a crossroads with a school house and a small cluster of houses. The entrance and lodge to Doughcloyne House (situated to the west) remains at this junction. The village changed little from that time until the second half of the century when it grew as a suburb to the city.

The Tramore River rises in high ground to the south of Togher between the townlands of Gortagoulane and Lehanagh More and flows north forming the townland boundary between the two and then between Doughcloyne and Lehanagh More before turning east (where it is named the Douglas River) towards the Douglas estuary. Much of the river is culverted in the suburban area of Togher with only small portions of the channel open.

The flood relief scheme area extends over the townlands of Douglas, Grange, Ballybrack, Ardarrig and Castletreasure in the parish of Carrigaline and barony of Cork and Lehenagh More, Doughcloyne and Deanrock in the parish of St Finbars and barony of Cork.

There are 34 no. recorded archaeological sites listed in the RMP and SMR database for the 2km study area, one of which is a redundant record (CO086-008) (**Fig 13.1 and 13.2, Table 13.4**). There are 21 no. protected structures listed in the RPS of the Cork County Development Plan (2014) within the study area (**Table 13.1**). There are 68 structures included in the NIAH within 1km of the flood relief proposed works areas (**Table 13.3**).

Table 13.4: Archaeological sites included on the RMP and SMR database within the constraints study area (see Figures 13.1 and 13.2)

RMP	Townland	Site Type
CO086-010	Ballinvuskig	Possible Church
CO086-106	Curraghconway	Fulacht Fiadh
CO086-059001-	Curraghconway	Graveyard
CO086-059002-	Curraghconway	Church
CO074-060	Curraghconway	Country house
CO086-060	Castletreasure	Country House
CO086-012001	Castletreasure	Possible Ringfort
CO086-012002	Castletreasure	Possible Souterrain
CO086-013	Castletreasure	Castle (site of)
CO086-014	Douglas	Ringfort
CO086-100	Grange	Flax Mill
CO086-102	Castletreasure	Country House
CO074-095	Grange	Woollen Mill
CO074-097	Douglas	Graveyard
CO074-098	Douglas	Graveyard
CO074-066	Ballinlough	Standing stone
CO074-089	Maryborough	Country House
CO074-063	Ballinlough	Midden

RMP	Townland	Site Type
CO074-076	Huggarts-Land	Country House
CO074-048	Huggarts-Land	Souterrain
CO074-129	Ballinaspig More	Fulacht fia
CO086-006	Doughcloyne	Holy well
CO086-007	Doughcloyne	Fulacht fia
CO086-132	Gortagoulane	Fulacht fia
CO086-008	Gortagoulane	Redundant record
CO086-058	Chetwynd	Country House
CO086-009	Lehenaghmore	Enclosure
CO086-099	Lehenaghmore	Country House
CO086-127	Lehenaghbeg	Enclosure
CO086-069	Ballycurreen	Mass-rock
CO086-107	Curraghconway	Fulacht fia
CO074-075	Cork City	Burial Ground
CO074-102	Spittal-Lands	Graveyard
CO074-094	Skahabeg North	Workhouse

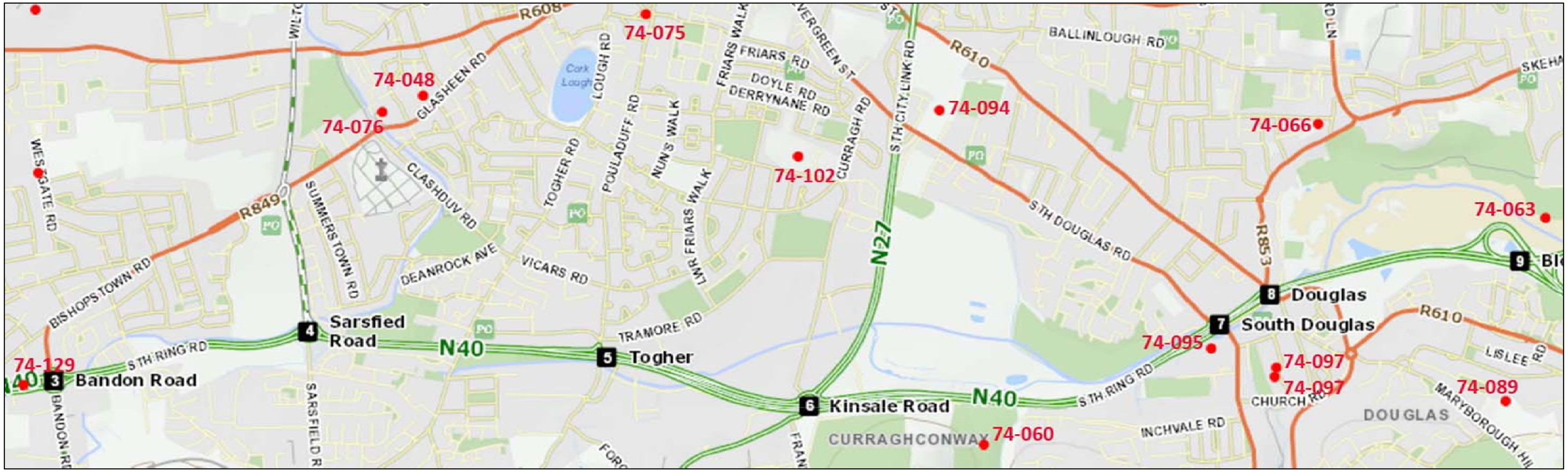

Figure 13.1: Archaeological sites included in the RMP and SMR database within the northern end of the study area (from www.archaeology.ie)

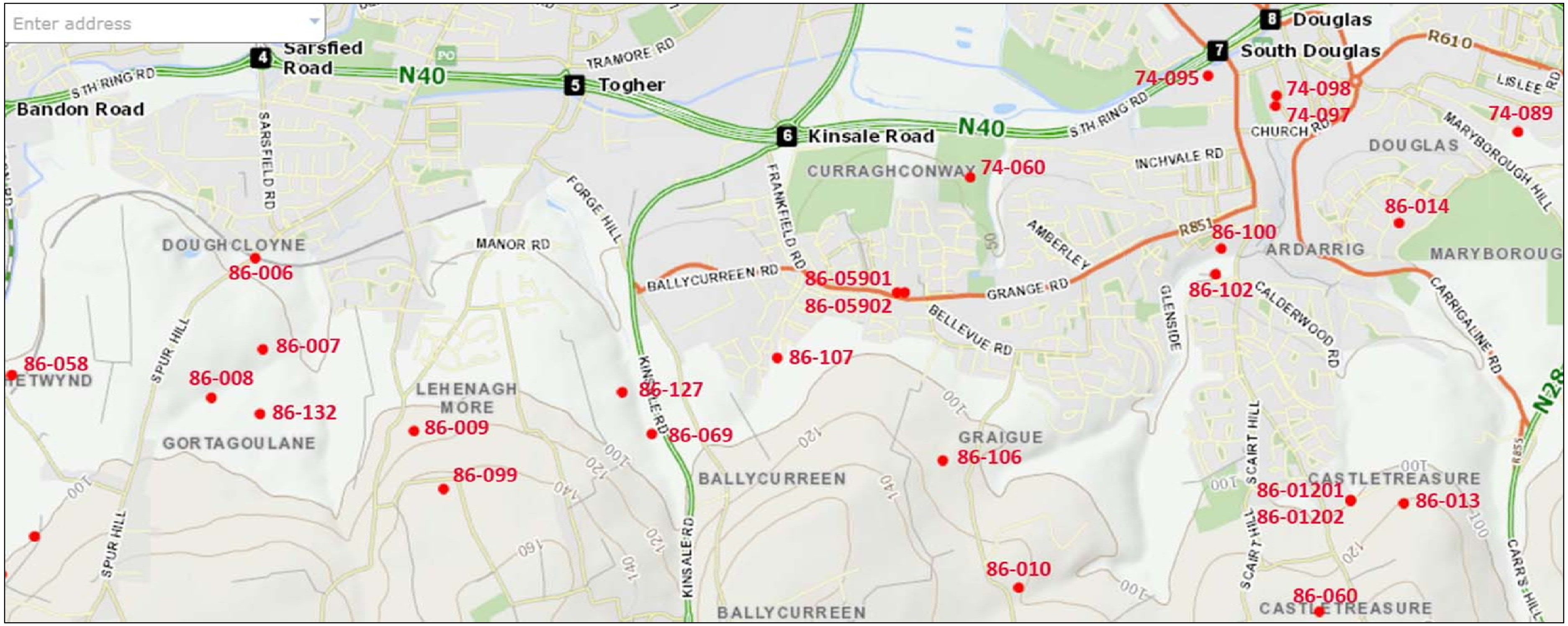

Figure 13.2: Archaeological sites included in the RMP and SMR database within the southern end of the study area (from www.archaeology.ie)

13.3.1.3 Historical Overview

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. 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 circa1400 – 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.

The earliest evidence for human colonisation and settlement in Ireland can be dated to 7000 BC, the Mesolithic Period. The people of this era were hunter-gatherers, entirely dependent on what food could be obtained through hunting and gathering. They used flint and other hard stone to manufacture their tools, and their presence can often be identified by scatters of these discarded stone tools in ploughed fields. The transition of these early settlers from hunting and gathering to farming in the Neolithic Period was revolutionary. It led to more permanent settlements and substantial houses, the construction of monumental megalithic structures for the dead, and a more complex and structured social hierarchy.

There are no known archaeological sites dating to the Mesolithic or Neolithic periods within the Study Area. The general lack of sites does not, however, mean that such early settlement and occupation were unknown to the region. Within the broader landscape of Cork harbour, there are a number of Neolithic sites, the closest of which is a settlement site in Ballinure on the Mahon peninsula (CO074-130), discovered during development works approximately 3km to the northeast (Purcell 2005).

There are six known archaeological sites which date to the Bronze Age in the study area, a standing stone in Ballinlough (CO074-066) and five fulachta fia, two in Curraghconway (CO086-106 and CO86-107) and one each in Ballinaspig More (CO074-129), Doughcloyne (CO086-007) and Gortagoulane (CO086-132). Fulachta fiadh are ancient cooking sites also known as burnt mounds which present as low crescent shaped mounds usually in poorly drained ground.

Many have been levelled and are visible as a spread of heat shattered stones and blackened soil in ploughed fields. Standing stones had a number of possible functions in the landscape from prehistoric burial markers to boundary markers along ancient routeways. In more recent times they were sometimes erected as scratching posts for cattle and these can be difficult to distinguish from ancient examples. Ancient standing stones are generally thought to be of Bronze Age date, but may also be later extending into the Iron Age or historical period. The precise date of these monuments can usually only be determined by excavation. The Ballinlough standing stone lies within the front garden wall of a modern dwelling house at Ardmahon Estate.

There are a number of sites within the study area which date to the Early Christian or Early Medieval Period (c. 500 to 1100 AD). The early medieval period in Ireland is characterised by the introduction of Christianity to the island from the late 4th century onwards becoming widely established during the second half of the sixth century. One of the most characteristic monuments of this period was the ringfort, occupied by the elite and their families of the time. Ringforts are defended farmsteads generally circular or oval in plan defined by an earthen bank with an external ditch or fosse. On more elaborate sites additional banks and ditches can be present (bi-vallate and tri-vallate) but the large majority of ringforts are uni-vallate. The main phase of construction and occupation of these sites dates from the beginning of the 7th century AD to the end of the 9th century. There is a ringfort in Douglas (CO086-014) and a possible ringfort in Castletreasure (CO086-012001). Some ringforts have associated souterrains, or man-made underground tunnels leading to a chamber or series of chambers. A possible souterrain (CO086-012002) is associated with the ringfort in Castletreasure and there is also a souterrain in Huggarts-Land (CO074-048) in a suburban garden. Two enclosures in Lehenaghmore (CO086-127) and Lehenaghbeg (CO086-127) may be levelled ringforts which no longer survive above ground.

The site of Castletreasure Castle (CO086-013) is at the southeast of the study area. No visible trace of the castle survives but its location was marked on all editions of the OS 6 inch maps and some structural remains were depicted on the 1842 OS map. Lewis, in 1837 (Cadogan 1998, 222) notes ‘some slight remains of Treasure castle’.

There are four graveyards, a burial ground, a church and a possible church in the study area. Two of the graveyards are adjacent to each other in Douglas (CO074-097 and CO074-098). Another is in Curraghconway (CO086-059001) adjacent to the Holy Trinity church in Frankfield (CO086-059002) (built in 1838 and probably designed by the Pain brothers) and the fourth is St Joseph’s Cemetery in Spittal-Lands (CO074-102) which is still in use. The burial ground is in Cork city (CO074-075) and was a mass grave of disarticulate remains discovered in Greenmount in 1990. There is a possible church in Ballinvuskig (CO086-010) in a field named Church Field on the 1841 OS 6-inch map and according to local information, there was a church and burial ground at this location. Although churches and graveyards can date to a multitude of periods, all of these sites appear to be post medieval in date. Douglas itself was part of Carrigaline Parish during the medieval period, but appears to have become a parish, probably in 1752, when a church was built near Grange Cross. No visible remains of this church now survive (Foley 1991, 39-40).

There is a record that the Augustinians held property including a mill in west Douglas at the beginning of the Reformation (ibid. 166). The mill was apparently built by the O'Dalys in Ballybrack (ibid.).

There is also a tradition of a Mass Rock in a wooded area in Donnybrook in a small structure known as the 'Shelly House'. Foley (ibid. 41), however, notes this is an unlikely location for a Mass Rock as it is in proximity to a number of country houses. There is a mass rock in Ballycurreen (CO086-069) where a metal cross pinned to a rock face marks the location. There was a holy well in Doughcloyne (CO086-006) which was disturbed and buried when the Cork Bandon Railway line was built but was walled and covered with an arch of stone.

In the post medieval period when the walls of Cork city were removed and the suburbs expanded many of its wealthier citizens choose to move beyond the city's medieval core. In the 18th century Douglas was one of the favoured areas, where the city's merchant princes chose to locate their new more spacious homes mixing them with the existing country houses and estates of the wealthy farming community. There are seven country houses within the study area included in the SMR database. Two are in Castletreasure (CO086-060 and CO086-102) and one each in Maryborough (CO074-089), Curraghconway (CO074-060), Huggarts-Land (CO074-076), Chetwynd (CO086-058) and Lehenaghmore (CO086-099). Maryborough House in Maryborough (CO074-089) is an early 18th century house which is now a hotel. Archaeological investigations undertaken in the grounds of the house in 2014 revealed a dump of slate which probably related to removal of weather slating from the original house (Quinn 2014). The house in Huggarts-Land (CO074-076) is an 18th century gable ended house. Vernon Mount in Curraghconway (CO074-060) and one of the Castletreasure houses (CO086-102) are also 18th century in date while Cruiskeen Lodge in Lehenaghmore (CO086-099) is late 18th /early 19th century in date. In contrast to the affluent country houses of the upper classes there is a mid-19th century workhouse (CO074-094) now within the St Finbarr's Hospital complex which was built by the Poor Law Commissioners in Skahabeg North within Cork city.

There is a midden in Ballinlough (CO074-063) on the northern side of the Douglas River estuary which comprised a layer of shell, bones and modern pottery and glass which probably dates to the 18th or 19th century.

Douglas was a thriving milling village from the 18th to the 20th century. There are two mills included in the RMP within the study area; St Patrick's Woollen Mills (Douglas Mills) Grange (CO074-095) and Douglas Woollen Mills (now Donnybrook Commercial Centre) (CO086-100) also in Grange. Douglas Woollen mills in Donnybrook are in the vicinity of an earlier sailcloth mill dating to the early 18th century (Foley 1991, 15) which was founded by the Besnard family. By the middle of the 19th century the firm was taken over by Wallis and Pollock and in 1869 Pollock extended the mills at Donnybrook. In 1890 the mill was taken over by Morroghs and finally closed in 1971 (ibid. 31). St Patrick's Woollen Mills was founded in 1882 by the O'Brien family (ibid.) and is located at the western side of the village of Douglas.

There were a number of smaller mills in the village including one at Ravensdale, known as “the scutching mill” (ibid. 26). Another mill was located between Church Street, Church Road, West Douglas Street and St Lukes Cemetery. The mill pond associated with this mill is shown and named on the 1842 OS 6-inch map with a mill race shown on its eastern side (**Fig. 13.3**). The area is now known as The Pond Bank. The associated buildings are not named but may include a U-shaped building on the southeastern corner of Church Street and West Douglas Street.

A Flour Mill is named and depicted on the 1842 OS 6-inch map at the eastern edge of Ballybrack townland. The flour mill is shown on the map as a large irregular L-shaped building with what appears to be a mill race running directly west of the Ballybrack Stream. Several smaller buildings are shown nearby which may also be associated with the flour mill. It is not shown or named on any of the later OS map editions and no above ground remains of it now survive. The scutching mill discussed by Foley (1991, 26) is also in this area and it is possible the building may have accommodated both industries at different times.

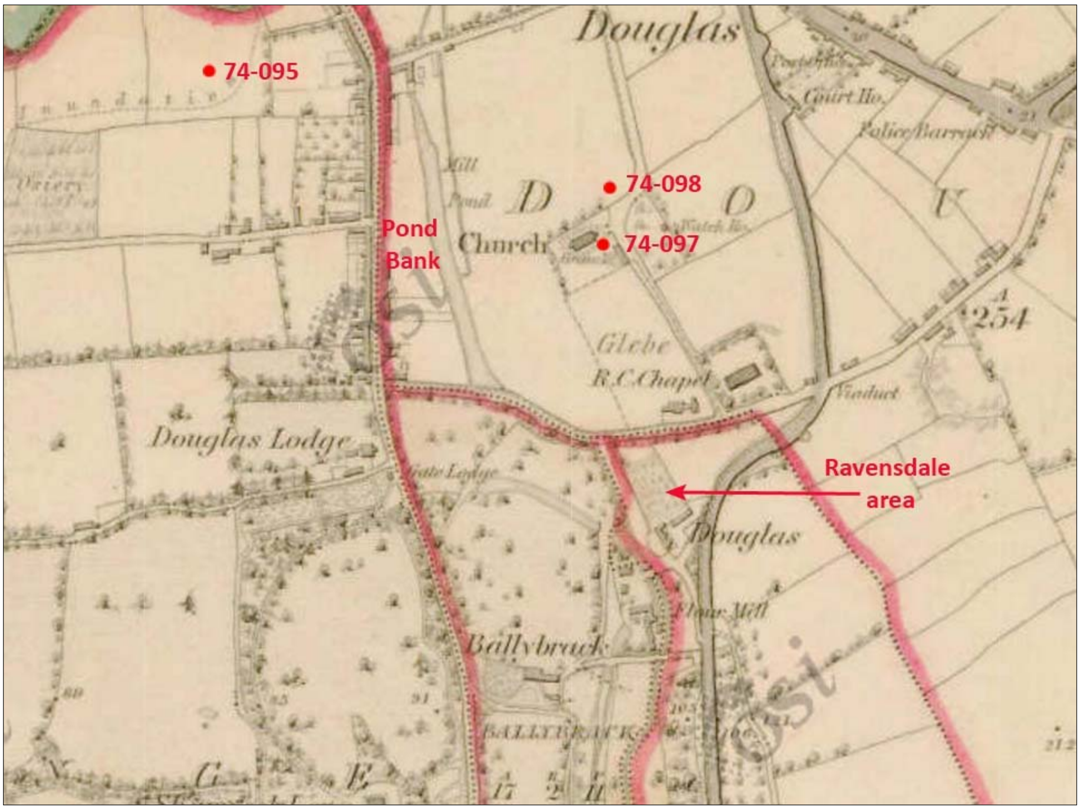

Figure. 13.3: Extract from OS 6-inch map (1842) showing Douglas area

13.3.1.4 Cartographic Information

The Douglas area is depicted on the 1842 OS map as mainly rural with the village of Douglas on its northern edge, centred at the confluence of the Douglas River and the Tramore River. The Besnards sailcloth factory is shown in Donnybrook (**Fig. 13.4**) and the mill at Ravensdale is also depicted and named Flour Mill.

A mill pond is marked to the south of the Ravensdale mill and another is shown and named to the west of St Luke's Church and graveyard and east of West Douglas Street, it is thought that this served a mill in the area of Douglas West and Church St. The land to the south of Ravensdale is occupied by estate houses and gardens and there are a number of houses also in the vicinity of Besnards sailcloth factory in Donnybrook.

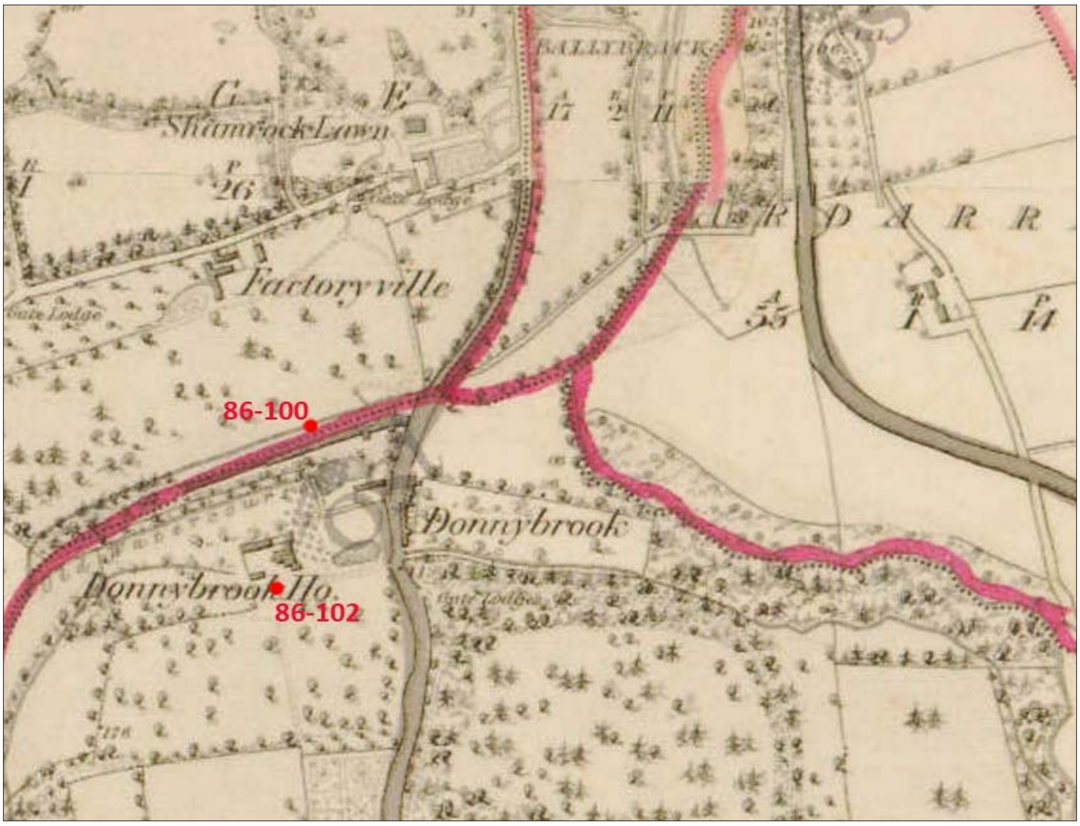

Figure. 13.4: Extract from OS 6-inch map (1842) showing Donnybrook area

By the turn of the 20th century, when the 25-inch OS map was compiled, settlement in the village of Douglas has become denser (Fig. 13.5). St Patrick's Woollen Mills, and to the south Douglas Woollen Mills, (largely on the site of Besnards sailcloth factory) appear as prominent features (Fig. 13.6). The Ravensdale mill is no longer shown and the mill pond to the west of St Luke's Church and graveyard and east of West Douglas Street is no longer shown.

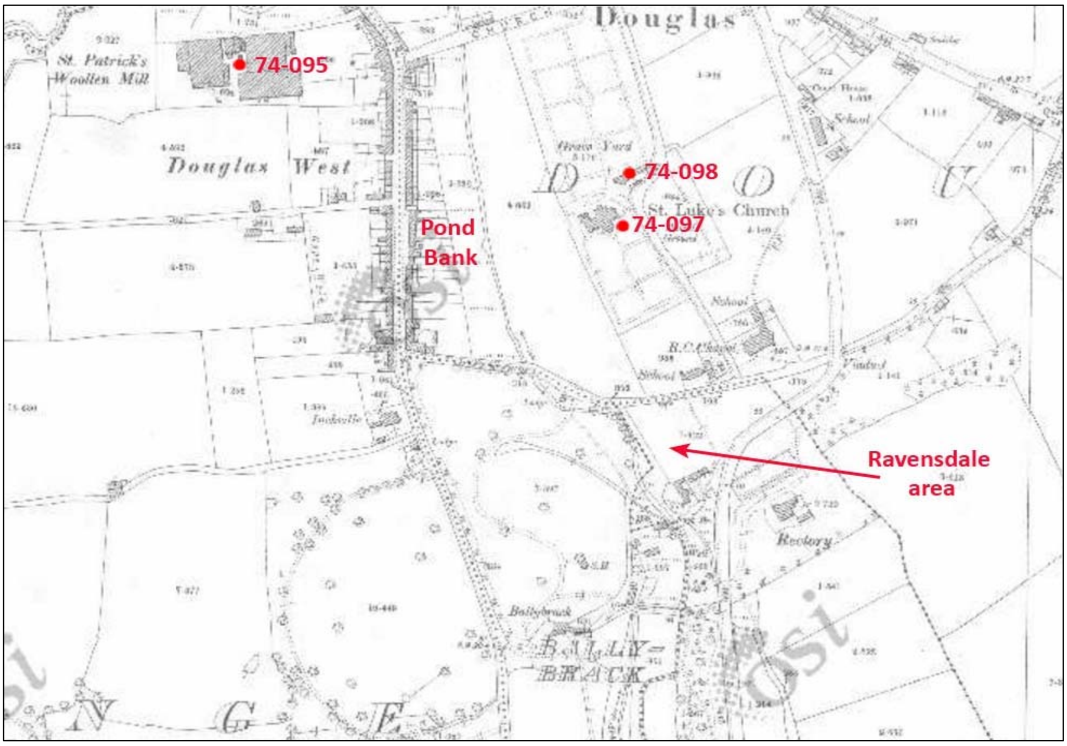

Figure. 13.5: Extract from OS 25-inch map (1902) showing Douglas area.

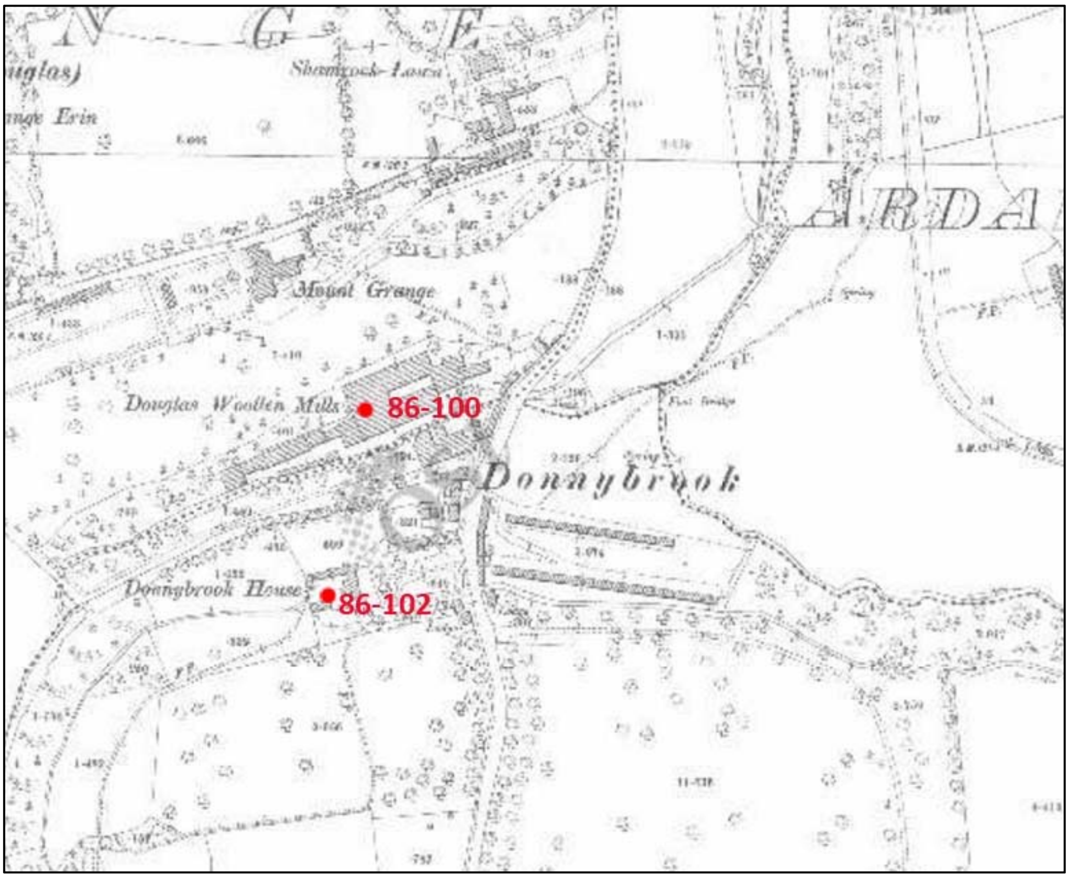

Figure. 13.6: Extract from OS 25-inch map (1902) showing Donnybrook area

In the following century the nature and scale of the settlement both within Douglas and the surrounding area changes completely from rural to suburban. Numerous residential housing estates have created a large suburb of Cork city and the centre of Doulas is a thriving hub of commercial activity. The rural village and surrounding landscape of country house estates has been completely replaced.

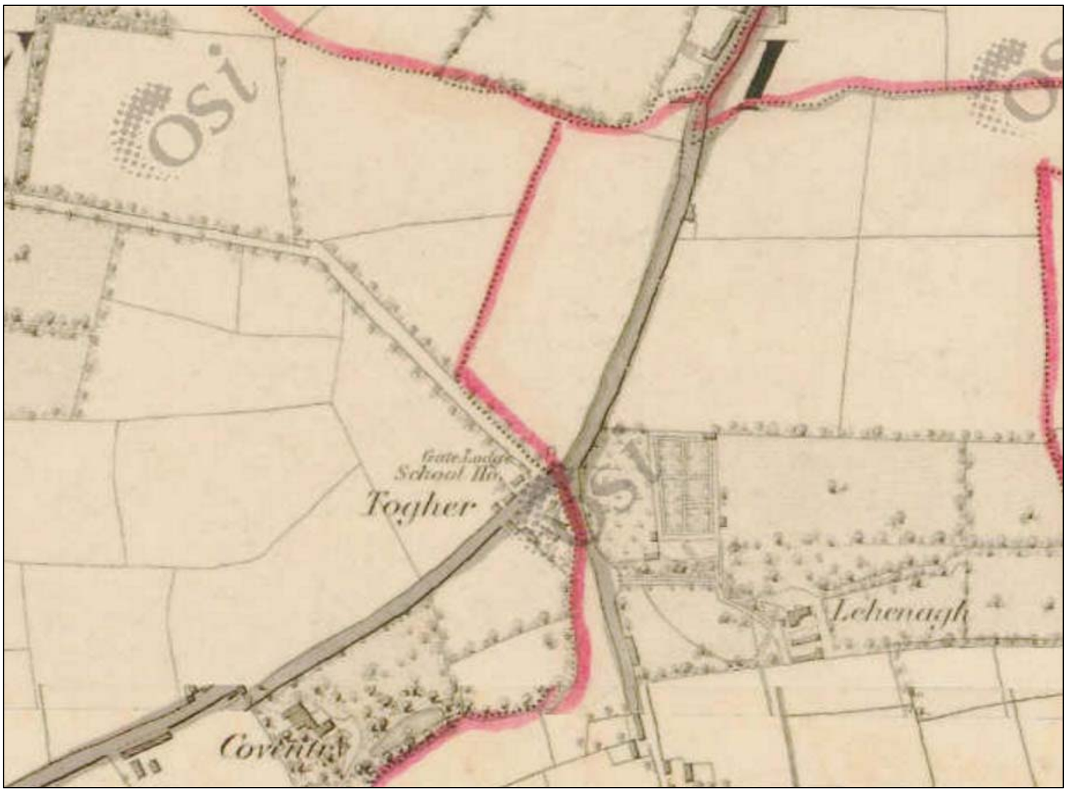

Figure. 13.7: Extract from OS 6-inch map (1842) showing Togher area

In the mid-19th century Togher is depicted and named on the 1842 OS map as a crossroads with a school, a smithy and a small cluster of houses (Fig. 13.7). The entrance and lodge to Doughcloyne House (situated to the west) is at this junction. The surrounding land is largely agricultural dotted with country houses and associated gardens. By the turn of the 20th century the cluster of houses, the lodge and the smithy remain on the 25 inch OS map (Fig. 13.8). The school, however, is now further to the north (along the Togher Road), houses are depicted along the road to the north of the school and the name Togher is now attached to a set of houses further north. The Cork & Macroom Direct Railway line runs east-west between the houses. The rural setting of the village still prevails as it did in the mid-19th century. It remained thus until the second half of the century when it grew as a suburb to the city. In more recent times the railway fell into disuse and became the route for the N25 motorway.

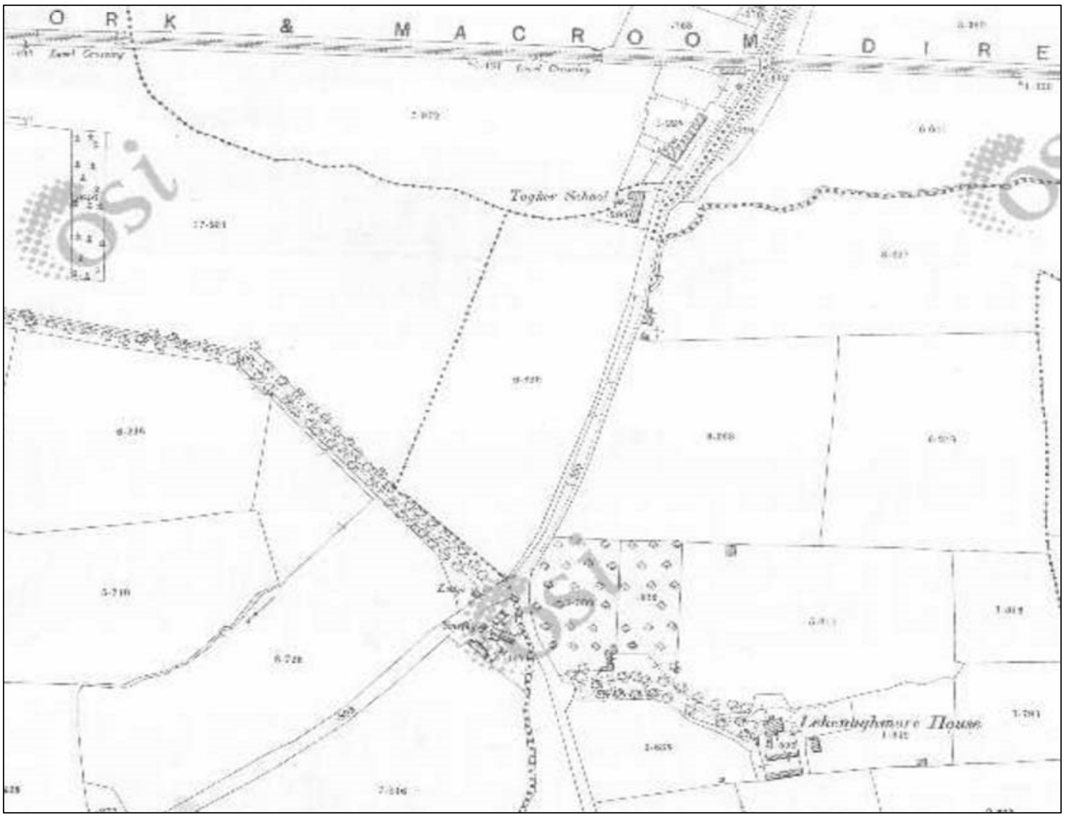

Figure. 13.8: Extract from OS 25-inch map (1902) showing Togher area.

13.3.1.5 Townland Boundaries and Names

Douglas comes from Dúglas meaning darkish stream. Grange comes from An Ghráinseach meaning grange or monastic farm. Ballybrack comes from An Baile Breac meaning the speckled townland or homestead. Ardarrig comes from Ard Dearg meaning red high or height. Doughcloyne comes from Dúchluain or Dúbh chluain meaning black lawn or bog meadow. Lehenagh More comes from Leithenach Mór meaning half or side and Mór meaning big.

13.3.2 Archaeological Investigations

A number of archaeological investigations have been undertaken in the study area, some of which have been discussed above. Archaeological testing was undertaken in Lehenagh More close to Cork Airport in 2004. No feature or finds of archaeological significance were revealed (Purcell 2004). Archaeological testing was carried out in Doughcloyne and a number of other townlands in advance of the upgrading of the N25 South Ring Road. No features of archaeological significance were revealed during the testing (Conran 2010).

As part of this project, a wading and metal detector survey of the watercourses to be impacted was undertaken under licence number 16D48 and 16R65. The watercourses were waded and the stream 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 were followed as well as the existing channels. No feature of archaeological or cultural heritage significance was noted. The full survey is included in **Appendix 13.1**.

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, most recently on the 17th May 2016 in dry, generally sunny weather conditions. The two proposed construction compounds were visited on the 16th and 17th of June 2016.

Each area of impact was inspected and is described below. All plates (photographs) may be viewed in **Appendix 13.2** of this EIS.

Grange Stream in Donnybrook Commercial Park, Douglas. Grange and Castletreasure townlands (Plates 13.1 – 13.3)

The stream at this location now runs in a modified channel comprising an open channel at the western end and a culvert at the eastern end. The larger western section comprises a sloping earth cut channel with large boulders along both banks and smaller stones along the stream bed. Above the banks the sides of the channel are sloping and grass covered. Another small section of open channel lies to the east of this, separated from it by a small culvert, and comprises a stepped concrete channel with railings above. The remainder of the stream is within a culvert extending through the eastern section of the commercial park to Donnybrook Hill at the east. A road and car park flank both sides of the open sections of the stream with a modern range of commercial buildings to the north. The culverted section is covered by an internal road which is adjoined by hard standing areas used for car parking and as yards. The road and car park will provide the proposed access route to the works area.

Ballybrack Stream in Douglas Community Park. Douglas townland (Plates 13.4 – 13.7)

The stream runs in an earth-cut channel along the western side of the Community Park. The stream bed is stoney and stones are visible protruding along parts of the bank. The bank and the bed are heavily eroded in places with a narrow, deeper channel cut along parts of the bed. The stream is quite fast flowing. At the southern end of the park the stream channel is lined in concrete before entering a concrete culvert running under Church Street. Stone gabions extend southwards along the western bank for a short distance from the concrete channel. A small number of pipes cross the stream and there are three outfall pipes discharging into it. Towards the southern end of the park a warehouse lies along the western bank of the stream and a concrete wall forms the western bank here. Elsewhere the bank is generally covered in low vegetation with some mature trees and tree stumps. At the southern end of the park the stream is again concrete-lined before entering a concrete culvert which carries it under Church Road.

The stream is separated from the park by steel fencing. The park itself is largely laid out in grass cut by a number of pathways with sports and playground facilities provided. A number of individual properties lie on the eastern bank of the stream and there is no visual trace of the mill pond shown on the 1842 OS map in the area of these properties. The access routes to the proposed works area are currently laid out in grass and concrete both within the park and outside the park to the south of Church Road.

Ballybrack Stream in Ravensdale, Douglas. Douglas townland (Plates 13.8 – 13.15)

The stream runs along the southern side of Church Road for some distance within a concrete stone lined channel. Two modern bridges cross the stream, both opening from Church Road; the western one forms part of a recreational track south to Ballybrack Woods and the eastern one provides access to the ICA Hall.

The stream turns south through Ravensdale where it appears to be largely within its original channel. The bed is stoney with some silty patches and the banks are generally earth-cut with some sections of wall and gabions along the western bank. At the southern end of Ravensdale the eastern bank is also concrete-lined. The stream runs mainly along property boundaries with a public road along the eastern side, although at one point a warehouse/workshop lies along its eastern bank. The eastern bank is generally covered in low vegetation with some semi-mature trees where the concrete walls have not been constructed. The stream is crossed by three modern bridges (Lower, Middle and Upper Ravensdale Bridges) which provide access to the dwelling houses on the western bank and a large pipe crosses the stream bed between the middle and upper bridges. The southern end of this section of stream is an earth cut channel in Ballybrack Woods crossed by a modern bridge with a trash screen below. Proposed access routes to the works areas are along existing roads within Ravensdale, two grass covered areas along both sides of Church Road, the northern one of which is within the community park and along the existing path to Ballybrack Woods.

Tramore River at Douglas Mills/St Patricks Mills. Grange townland (Plates 13.16 – 13.18)

The river runs in a concrete channel which extends east from a concrete culvert under the N40 South Ring Road. The river is open within the concrete channel for a short distance before entering another culvert to the east running under West Douglas Street and Douglas Village Shopping Centre. The river channel appears to have been moved south of its original course to accommodate the N40. A road and car park lie to the south of the channel and these combined with Douglas Road West will provide the access routes to the proposed works area.

Tramore River at Lehenaghmore Industrial Estate. Doughcloyne and Lehenagh More townlands (Plates 13.19 – 13.20)

The river runs in an earth-cut channel with a stoney bed. The banks are overgrown with low vegetation and with some mature trees. To the northeast the river runs into a concrete culvert closed by a large trash screen.

The culvert runs through the area of Brooke Avenue and emerges to the north of Brook Avenue on the western side of Lehenaghmore Road. The road to the industrial estate lies to the south and east of the stream and will provide the access route to the proposed works area.

Tramore River adjacent to the Lehenaghmore Road, upstream of Togher Road Roundabout. Togher, Doughcloyne and Lehenagh More townlands (Plates 13.21 – 13.23)

The river emerges from a culvert and flows in a relatively narrow channel west of Lehenaghmore Road. A random rubble wall along the eastern bank of the river separates it from the road. The western bank is heavily overgrown with some occasional patches of random rubble wall visible behind the undergrowth. Some erosion of the western bank is also apparent. The river bed is generally stoney with some silt. At the northern end of this stretch the river runs into a culvert under the Togher Roundabout which is closed with a large trash screen. The culvert runs along the western side of Togher Road.

Tramore River at Deanrock and Lehenagh More, Togher Road and north of Greenwood Estate, Togher (Plates 13.24 – 13.25)

The river emerges from a culvert under the Togher Road and runs in a concrete channel to the north (rear) of the houses in Greenwood Estate. A hard surfaced area to the north of the channel will provide the access route to the proposed works area.

Construction Compound (Plate 13.26)

The proposed construction compound will be in an existing compound area on the northern side of Togher Industrial Estate. The area is surfaced and there is a standing building at the western end.

13.4 Characteristics of the Proposed Scheme

A detailed description of the proposed scheme is included in **Chapter 3 Description of the Proposed Scheme** of this EIS. Refer also to **Chapter 4 Construction Activities** for details on construction phasing.

In summary, the scheme will consist of the construction of flood defences along the Tramore River, Ballybrack Stream and Grange Stream. The works to be carried out on site are summarised below:

- Construction of new flood defence walls and/or replacement of existing walls with new flood defence walls
- Replacement of and/or extension of existing culverts
- Removal of and/or replacement of bridges
- New underground surface water pumping stations
- Removal of existing trash screens and construction of new coarse screens
- Local channel widening, deepening, realignment and regrading of river channel
- Construction of new earthen flood defence embankment

- Provision of civil works such as road/footpath re-grading at a number of locations;
- Removal of vegetation and trees to facilitate construction works
- Protecting drainage outlets along the line of flood defence works with non-return flap valves;
- Once construction is completed, ongoing maintenance of the river channel, trash screens etc.

13.4.1 Construction Impacts

As the proposed flood relief scheme will extend over a number of different locations each is evaluated below.

Grange Stream in Donnybrook Commercial Park, Douglas Grange and Castletreasure townlands

Works will comprise regrading of the existing channel to remove sedimentation and the reinforcement of the channel banks with rock armour or gabions as required. Two existing coarse screens are to be removed along the channel and services diverted. Further to the east where the stream is already culverted a proposed 2.4m wide by 1.8m high new culvert will be constructed extending to the road at Donnybrook Hill. Within the commercial park the stream runs within a modified channel; a culvert at the eastern end and two open sections at the center and western end. The western open section is earth-cut with both banks defined by large boulders. The smaller central section is a stepped concrete channel. The western section was waded and metal detected and no archaeological features or finds were noted. The remainder of the stream running through the eastern section of the park is culverted below an existing road and hard standing area. The stream is part of the mill race to a flax mill (CO086-100) which stands immediately to the north of the culverted section.

Associated millhouses at the eastern end of the commercial park are listed in the RPS of Cork County Development Plan (2014) (RPS 00566). The NIAH also includes a number of buildings within the milling complex, including the former water mill (20908622), associated store or warehouse (20908628) and office (20908629).

A range of modern buildings and a road and car park surround the open sections of the stream suggesting significant amounts of ground disturbance has occurred in the recent past. The culverted section was constructed probably during the second half of the 20th century (it is shown as an open channel in 1933) and its construction is likely to have caused significant disturbance to surrounding areas. The proposed regrading and reinforcement works on the open channel will involve further ground disturbance. It is unlikely that *in situ* archaeological deposits survive in the area, however, any such deposits will be negatively impacted by the works. The works within the sections of open channel will have a negligible impact on the mill houses, flax mill and other associated buildings which are located at the eastern end of the park with limited visibility over the open channel.

The setting of the features may be negatively impacted by the works on a temporary basis, however this will be confined to the construction process.

The proposed culvert at the eastern end of the commercial park will be located to the south of the millhouses listed in the RPS (RPS 00566). The culvert will be within the setting of the millhouses and overlooked by them from the north. The visual amenity of the millhouses will be negatively impacted during the construction of the culvert, this will, however, be a temporary impact confined to the duration of construction. The setting of the buildings included in the NIAH will also be negatively impacted by the construction of the culvert. This impact will be temporary extending only through the construction process. The construction of the culvert will involve extensive ground disturbance within an area which has been previously disturbed. It is unlikely that *in situ* archaeological deposits survive in the area, however, any such deposits will be negatively impacted by the works.

The elimination of future flooding events from impacting the buildings will have a significant positive impact on them.

Ballybrack Stream in Douglas Community Park. Douglas townland

Works will include local regrading along the right (east) bank of the stream in the northern half of the park. In the southern half of the park works will comprise the widening and deepening of the stream channel.

The entire length of the stream within the park was waded and metal detected and no archaeological features or finds were noted. The stream is largely along the line of the 19th century mill race and at the southern end the eastern edge of the associated mill pond.

The construction works for the regrading, flood defence wall and channel widening and deepening will involve extensive ground disturbance. Such works may have a significant negative impact on sub-surface archaeological remains including elements of the mill infrastructure if they survive.

Church Road Culvert

The existing culvert will be replaced by a new, larger culvert. The construction works for the larger culvert will involve ground disturbance to previously disturbed ground. The proposed works are likely to have a negligible impact on cultural heritage remains.

Ballybrack Stream in, Ravensdale, Douglas. Ardarrig and Ballybrack townlands

Works will comprise channel widening and construction of new stone-clad flood defence walls along one or both banks, replacement of three modern bridges one of which will have a larger trash screen installed. The flood defence walls on both banks will extend and will tie into higher ground as necessary. The flood defence wall on the west bank of the stream will also tie into higher ground as necessary. The existing ICA Bridge will be removed and replaced. The existing Ravensdale Lower Bridge is to be replaced with a wider bridge. The cycle track bridge will be replaced and a larger trash screen will be installed.

The stream was waded and metal detected along its entire length and no archaeological features or finds were noted. The construction works for the flood defence walls, channel widening and bridge replacements will involve extensive ground disturbance. Such works may have a significant negative impact on sub-surface archaeological remains, if they survive. A pair of semi-detached two storey houses (20871048) and a detached two storey house (20871047) are listed in the NIAH on Church Road. They lie 20m and 10m (respectively) east of the channel where channel widening and a flood defence wall will be constructed. The proposed works may temporarily negatively impact the setting of the houses and the flood defence wall may permanently have a negative impact on the visual amenity of the houses. The elimination of future flooding events from impacting the houses will have a significant positive impact on them.

Tramore River at Douglas Mills/St Patrick’s Woollen Mills in Grange townland

Works will comprise the construction of a new 1.2m high flood defence wall along the south bank of the Tramore River and the construction of new reinforced concrete bridge parapets 1.2m high.

The river, at this location, runs within a modified concrete channel. The construction works for the flood defence wall and parapet walls will involve ground disturbance.

The woollen mill (CO074-095) is located less than 20m to the south. A road and car park lie between the mill and the river channel. The construction of these combined with the modifications to the river channel suggest significant amounts of ground disturbance have been undertaken in the recent past. The construction works for the flood defence wall will involve further ground disturbance. It is unlikely that in situ archaeological deposits survive in the area, however, any such deposits will be impacted by the works. The proposed works are likely to have a minor impact on subsurface archaeological remains. Douglas Woollen Mills is included in the RPS of Cork County Development Plan (2014) (RPS 00482) and also included as St Patrick’s Woollen Mills (Industrial Estate) (RPS 01243). The river is approximately 20m north of the building and lies within the curtilage of the mill. It is also listed in the NIAH as a former water mill (20871032) and two engine houses (20871030 and 20871031) in Douglas Commercial Estate. A terrace of eight houses (20871033) immediately south of the river is also listed in the NIAH. The proposed works may temporarily negatively impact the setting of the buildings and the flood defence wall and parapets may permanently have a negative impact on their visual amenity. The elimination of future flooding events from impacting the buildings will have a significant positive impact on them.

Tramore River at Lehenaghmore Industrial Estate. Doughcloyne and Lehenagh More townlands.

Works will comprise the construction of a new trash screen, a slight realignment of the channel and defence walls.

The stream was waded and metal detected along its length and no archaeological features or finds were noted.

The construction works for the flood defence walls and trash screen will involve extensive ground disturbance. Such works may have a significant negative impact on sub-surface archaeological remains, if they survive.

Tramore River at Lehenaghmore Industrial Estate Culvert. Doughcloyne and Lehenagh More townlands.

Works will involve removal of the existing culvert network and replacement with a single 3m wide and 1.4m high concrete culvert. The construction works for the larger culvert will involve ground disturbance to previously disturbed ground. The proposed works are likely to have a negligible impact.

Tramore River upstream of Togher Road Roundabout, Togher. Doughcloyne and Lehenagh More townlands.

Works will comprise the construction of a new 3m wide by 1.4m high concrete culvert to replace the existing 2.5m wide by 0.9m high open channel.

The stream was waded and metal detected along its length and no archaeological features or finds were noted. The construction works for the culvert will involve extensive ground disturbance. Such works may have a significant negative impact on sub-surface archaeological remains, if they survive. A single-storey house listed in the NIAH (20870009) is located immediately west of the channel and its grounds define the western bank of the river.

The proposed works will impact the grounds of the house and will negatively impact its setting. The elimination of future flooding events from impacting the house will have a significant positive impact on the house.

Tramore River at Togher Roundabout and Togher Road, Doughcloyne and Lehenagh More.

Works will comprise the removal of the existing culverts and their replacement with new concrete culverts. The construction works for the larger culvert will involve ground disturbance to previously disturbed ground. The proposed works are likely to have a negligible impact. The gate lodge to Doughcloyne House listed in the NIAH (20870008) is located on the western side of Togher Roundabout. The proposed works to the road may temporarily negatively impact the setting of the building. The Church of the Way of the Cross listed in the NIAH (20870007) is located on the western side of Togher Road. The proposed works to the road may temporarily negatively impact the setting of the church.

Tramore River at, Togher Road, Togher. Deanrock and Lehenagh More.

Works will involve widening the existing channel by 1m over this stretch and the construction of a new concrete retaining wall with a 1.2m high railing on the south bank.

The river at this location is within a modified concrete channel. The construction works for the retaining wall will involve ground disturbance, however, as this channel has already been modified it is unlikely that *in situ* archaeological deposits will be impacted. The proposed works are likely to have a negligible impact.

13.4.2 Operational Impact

The operation of the flood relief scheme will have a positive impact on buildings and recorded monuments listed in the RPS of the Cork County Development Plan (2014), NIAH and RMP where the risk of flooding will be significantly reduced. 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 relief 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 urban environment.

13.5 Mitigation Measures

13.5.1 Construction Mitigation Measures

Construction work on the proposed development site will require extensive ground disturbance in a number of locations. Some of these areas have been previously disturbed. However, *in situ* localised sub-surface deposits may survive in places. Archaeological monitoring of ground works will be carried out at a number of locations including:

- Ballybrack Stream, Douglas townland, in Douglas Community Park
- Ballybrack Stream in Ardarrig and Ballybrack townlands, Ravensdale, Douglas
- Tramore River at Doughcloyne and Lehenagh More townlands, Leheneghmore Industrial Estate
- Tramore River at Doughcloyne and Lehenagh More townlands upstream of Togher Road Roundabout, Togher

Intermittent archaeological monitoring/inspections of subsurface disturbance will be carried out in the following areas:

- Grange Stream in Grange and Castletreasure townlands in Donnybrook Commercial Park, Douglas
- Tramore River at St Patrick's Woollen Mills/ Douglas Mills in Grange townland

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.

Two structures included in the RPS in Cork County Development Plan (2014) are in proximity to the proposed works; St Patrick's Woollen Mills which is included twice in the RPS, listed as St Patrick's Woollen Mills (RPS 01243) and Douglas Woollen Mills (RPS 00482) and millhouses associated with the milling complex at Donnybrook Commercial Park (RPS 00566).

All construction works will be securely fenced off and separated by a buffer zone from the Protected Structures. Intermittent archaeological monitoring and inspection of the buildings will be undertaken.

A number of buildings included in the NIAH are in proximity to the proposed works. In Douglas a number of these are adjacent to the works areas; a terrace of eight houses (NIAH 20871033) near Tramore River at Douglas Mills/St Patrick's Woollen Mills and the former water mill (20908622), associated store or warehouse (20908628) and office (20908629) associated with the milling complex at Donnybrook Commercial Park.

In Togher one of these is adjacent to the works areas; a single-storey house (NIAH 20870009) near Tramore River upstream of Togher Road Roundabout, Togher. Archaeological monitoring and inspection of the buildings will be undertaken.

13.5.2 Operational Mitigation Measures

No operational mitigation measures are required.

13.6 Residual Impacts

The risk of flooding of a number of structures and buildings included in the RPS of the CDP (2014), the NIAH and the RMP for Co Cork will be significantly reduced. No other 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.

Bennet, I. (1997-2010). *Excavations Bulletin. Summary accounts of archaeological excavations in Ireland*. Wordwell Limited.

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.

Cahill, M. (2006) *John Windele's golden legacy – prehistoric and later gold ornaments from Co Cork and Co Waterford*. Proceedings of the Royal Irish Academy Vol. 106C

Conran, S (2010) *Doughcloyne/Garrendarragh/ Ardarostig, Cork* www.excavations.ie 2010:127

Department of Arts, Heritage, Gaeltacht & the Islands (1999). *Framework & Principles for the Protection of the Archaeological Heritage.* Dublin: The Stationery Office

Department of Arts, Heritage, Gaeltacht & the Islands (1999). *Policy & Guidelines on Archaeological Excavation.* Dublin: The Stationery Office

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.*

Donnelly, W. (1861) *General Alphabetical Index to The Townlands and Town, Parishes and Baronies of Ireland.* Reprinted (2000) Genealogical Publishing Co. Inc.

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*. Ireland: Walsh Printers.

Flanagan, D and L (1994) *Irish Place Names.* Bantry, County Cork.

Foley, C (1991) *A History of Douglas* second edition

J. F. L (1912). *Notes and Queries. Journal of the Cork Historical and Archaeological Society*. Vol. XVIII. Cork.

McNamee, L (no date) *Roman Coin of Philip the Arab*. National Museum of Ireland Collections and Research Section.

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'Flanagan, P. And Buttimer, C.G. (editors) *Cork History and Society*. Geography Publications

Power, D., Byrne, E., Egan, U., Lane, S. and Sleeman, M. (1994). *Archaeological Inventory of County Cork Volume 2: East and South Cork*. Dublin.

Pochin Mould, D. D. C (1991). *Discovering Cork*. Kerry: Brandon Books.

Power, P. (1923). *Placenames and Antiquities*. Proceedings of the Royal Irish Academy Vol. 34C.

Purcell, A. (2004) *Lehenagh More, Kinsale Road, Cork*. www.excavations.ie 2004:0239

Purcell, A. (2005). *Archaeological Excavation at Ballinure, Mahon Peninsula, Cork*. Unpublished report

Quinn, A. (2014) *Maryborough House, Douglas, Cork* www.excavations.ie 2014:093

Reeves-Smith, T. (1997) *The Natural History of Demesnes in Foster, W. eds. Nature in Ireland, A Scientific and Cultural History*. Dublin: Lilliput Press.

Ronan, S., Egan, U., Byrne, E., et al. (2009). *Archaeological Inventory of County Cork, Volume 5*. Dublin: The Stationery Office.

Rynne, C. (1993). *The Archaeology of Cork City and Harbour from the Earliest Times to Industrialisation*. Cork: 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 An Archaeology* Cork: Collins Press.

Stout, M. (1997). *The Irish Ringfort*. Dublin: Four Courts Press.

Sweetman, D. (2000). The Man-Made Heritage: The Legislative and Institutional Framework in Buttimer, N., Rynne, and Guerin, H. (editors) *The Heritage of Ireland*. Cork: Collins Press.

Taylor, G. and Skinner, A. (1778). *Taylor and Skinner's Maps of the Roads of Ireland*. Surveyed 1777. London.

14 Roads and Traffic

14.1 Introduction

This chapter of the EIS consists of an appraisal of the proposed Douglas Flood Relief Scheme (including Togher culvert) 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 flood 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 flood 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

14.3.1.1 Douglas

The road network within the Douglas study area comprises the national road N40, the regional roads R851 and R609/R610 as well as numerous local and access roads.

The N40 South Ring Road (SRR) is a strategic national traffic route which routes broadly on an east-west axis to the north of Douglas Village, effectively dividing the built-up area to the north (mostly residential areas) from Douglas, Rochestown, Maryborough Woods, etc. to the south. The route acts as a barrier to movement in a north-south direction between Douglas and Cork City, which is facilitated via a number of routes which pass beneath the N40, including the R851 South Douglas Road and the R610 Douglas Road. There are two eastbound exits from the N40 SRR to Douglas and one westbound access to the N40 from Douglas.

The R851 links Douglas village to Cork city centre to the north via the South Douglas Road, and links Douglas village westward to the N27 Kinsale road and Cork Airport via Frankfield. The R851 is a key regional route, which also links parts of Douglas village both north and south of the N40 South Ring Road, and also crosses the Tramore River. In the Douglas area, the R851 goes through predominantly residential areas and housing estates, and the route also facilitates access to a number of amenity facilities and some commercial developments.

The R851 is a standard two-lane single carriageway road for the majority of the route with the provision of a bus-only lane in a single direction (eastbound). The bus lane is present along sections of Grange Terrace and Donnybrook Hill where the road width is approximately 9 metres in comparison to Douglas Road where the road width is approximately 6 metres. Footpaths are present on both sides along the R851. The route has direct access to a number of residential properties and has no hard shoulder.

As the R851 approaches Douglas from the west, the route is typically a two-lane carriageway, with localised widening in places to accommodate turning lanes. Further east between Frankfield and Douglas, the route widens to accommodate an eastbound bus lane, which routes from Grange Wood Court along Grange Terrace and on to the Douglas Road, before terminating at the junction with Inchvale Road. The route reverts to two-way single carriageway (with some localised widening at junctions) thereafter.

The R609 Carrigaline Road in Douglas village links to the R610 Douglas Road and the N28 south of Douglas (at the Fingerpost Roundabout). The R610 routes beneath the N40 SRR and continues east and south to the Fingerpost Roundabout, continuing east to Rochestown. The R609 commences at the Fingerpost Roundabout and routes southwards to Carrigaline, connecting to the N28 at Carr’s Hill.

The R609 routes through predominantly residential areas with numerous housing estates either side of the road towards the north. Further south from Douglas village, the southern sections of the R609 are adjacent to agricultural land to the west and amenity areas (Douglas Golf Club) northeast of the road.

The R609 is a three-lane carriageway to the north with two lanes in each direction and the third lane providing right and left turning movements into residential developments. The route reverts to a standard two-lane single carriageway road to the south. The R609 ranges from approximately 10 metres wide to the north to approximately 6 metres along the southern section of road. Footpaths are provided along one side of the road. The route has direct access to a number of residential properties and has no hard shoulder.

Both routes have numerous junctions with other local and regional routes. Refer to **Figure 14.1**.

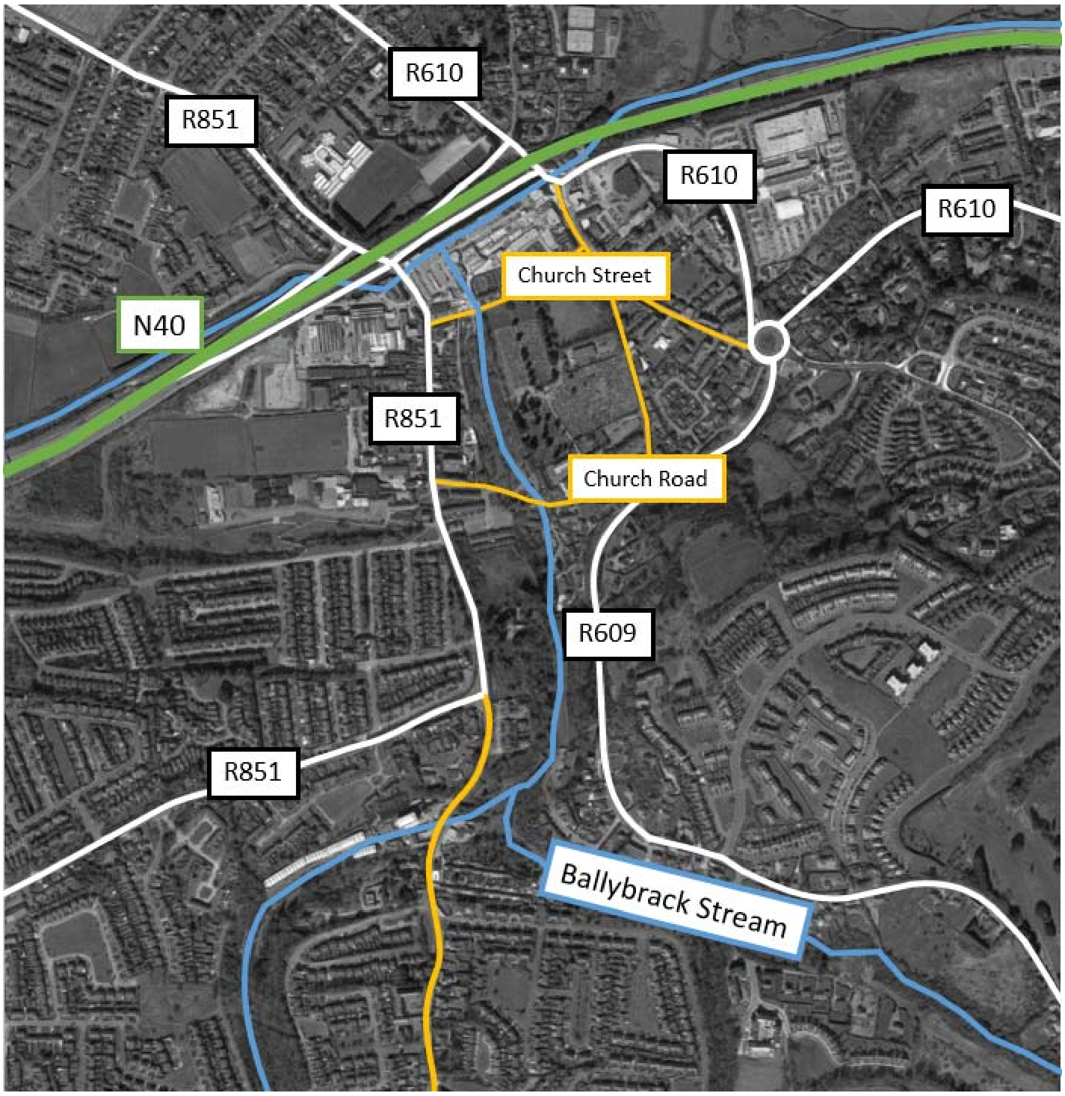

Figure 14.1: Existing Local Road Network (shown with access to/from N40 Cork SRR and the Ballybrack Stream Route for context)

14.3.1.2 Togher

The existing road network within the Togher study area comprises the N40 South Link Road and a number of regional and access roads, namely Togher Road and Sarsfield Road.

Togher Road links northwards to Cork city, and to the south with Fivemilebridge (via the R613) and the N71 (via Spur Hill). It is a standard two-lane single carriageway road with footpaths on either side of the road. The road is approximately 9 metres in width along its length.

The R849 Sarsfield Road links Togher Road to the Sarsfield Interchange at Junction 4 of the N40 SRR. It is a standard two-lane single carriageway road with footpaths on either side of the road with a grass verge dividing the carriageway and the footpath. The road is approximately 7.5 metres in width along its length. Refer to **Figure 14.2** below.

Figure 14.2: Existing Road Network and Tramore River Route

In the vicinity of the works, both routes are in predominantly urbanised areas, with numerous residential, industrial and commercial areas in the environs (in particular along the R849 Sarsfield Road), as well as a number of schools. Outside of the Togher area, Togher Road quickly transitions from a built-up environment to a largely undeveloped, greenfield environment.

14.4 Characteristics of the Proposed Scheme

As described previously in **Chapter 1 Introduction**, construction works for the proposed scheme will take place in four separate areas along the Tramore River and Ballybrack Stream in Douglas and Togher as follows:

Area 1: Ballybrack Stream through Douglas;

Area 2: Tramore River through St Patrick's Mills, Douglas;

Area 3: Grange Stream (tributary of Ballybrack Stream) through Donnybrook Commercial Centre; and

Area 4: Tramore River through Togher.

The majority of the proposed works under the Douglas Flood Relief Scheme (FRS) (including the Togher Culvert) consist of a number of measures which are summarised below:

- Construction of new flood defence walls and/or replacement of existing walls with new flood defence walls;
- Replacement of and/or extension of existing culverts;
- Removal of and/or replacement of bridges;
- Removal of existing trash screens and construction of new coarse screens;
- Local channel widening, deepening, realignment and regrading of river channel
- Construction of new earthen flood defence embankment;
- Provision of civil works such as road/footpath re-grading at a number of locations;
- Removal of vegetation and trees to facilitate construction works
- Protecting drainage outlets along the line of flood defence works with non-return flap valves;
- Once construction is completed, ongoing maintenance of the river channel, trash screens etc.

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**.

14.5 Evaluation of Impacts

The 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 Ballybrack Stream and Tramore River, 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;
- Temporary impact during construction due to the works elements that are on or adjacent to the existing road network, including culverts, bridges, and flood defence walls, etc., which may require full or partial road closures; and
- Residual impacts due to the removal of certain components of the existing transport infrastructure (and replacement with similar infrastructure).

14.5.1 Construction Impacts

14.5.1.1 Potential Impacts of Construction Related Traffic

Subject to statutory consent, construction of the proposed scheme will commence mid-2018. A construction duration of approximately 18 months is envisaged with an estimated completion date of late 2019/early 2020. It is envisaged that all the works will be constructed under one contract and the works will be constructed in Douglas and Togher simultaneously. Specific activities (such as Lower Ravensdale Bridge and Church Road Bridge replacement) will be completed over a much shorter duration.

Construction of the proposed works in Douglas are estimated to take approximately 9-12 months overall, while proposed works in Togher are estimated to take approximately 12-15 months overall. Specific allowances may be made for interruptions to construction work (for example during specific moratoria at Christmas periods, seasonally-constrained works, etc., which would increase the working times to the maximum estimates). However, the shorter construction timeline estimates (9 months for Douglas and 12 months for Togher) have been used in this Chapter for assessment purposes, as these represent a worst-case scenario in terms of quantifying peak daily construction traffic movements. Refer to Table 4.1 of Chapter 4 for further details.

It is estimated that both works elements will be undertaken within the overall 18-month construction duration, with certain works elements ongoing simultaneously, resulting in an overlap between both work streams during construction, although the sites are not proximate. The overall works duration is expected to be a total of 18 months.

The construction phase of the proposed scheme will have a temporary impact on traffic volumes in the Douglas and Togher 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. Excavation and backfilling works will comprise the more trip-intensive portions of the schemes, while construction works themselves will be minor in comparison. For both schemes, excavation works will be undertaken initially, and excavation works will comprise the most intensive portion of the overall works.

Furthermore, works in Douglas have been sub-divided into a number of distinct areas (see **Section 14.4** above and **Figure 1.2a and Table 4.1** of **Chapter 4**). Works will not be occurring at all sub-areas in Douglas simultaneously; however for the purpose of this assessment it has been assumed that a number of works areas in Douglas are in operation at the same time.

The removal and delivery of material will typically be operated during standard working hours as set out in **Chapter 3**, which would generally be from 08:00-19:00 (Mon-Fri) and 09:00-16:00 (Saturday). However, this will be subject to approval and agreement with Cork County Council and An Garda Síochána.

Douglas

14.5.1.2 Excavation works

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 estimated to be a total of 2,250 two-way trips (i.e. 1,125 vehicles) over the anticipated construction period of approximately 9 months, or an average of 10 two-way trips per day. During the most intensive excavation period, it is estimated that this will increase to a maximum of 96 two-way trips (or 48 vehicles) per day. During the peak hour, this will equate to a maximum of 18 two-way trips (or 9 vehicles).

14.5.1.3 Delivery of materials

Imported material for backfilling/reinstatement purposes and construction materials including concrete, etc. will comprise approximately 1,318 two-way trips (i.e. 659 vehicles) over the 9-month program, an average of 6 two-way trips per day.

During intensive works periods, it is anticipated that delivery of materials will total 46 two-way trips (i.e. 23 vehicles) per day. During the peak hour, this will equate to a maximum of 24 two-way trips (i.e. 12 vehicles).

Delivery of concrete for construction purposes will comprise an average of 18 two-way trips per day (i.e. 9 vehicles), and during the peak hour it is estimated that 12 of these two-way trips (i.e. 6 vehicles) will deliver to the works sites.

14.5.1.4 Construction workforce

Construction staff numbers at Douglas are estimated at an average daily number of 14 personnel. However, at peak periods, this will increase to a maximum of 24 personnel. As outlined in **Chapter 3**, 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 14 construction personnel arrive before 08:00, all 14 depart after 19:00, and 7 personnel leave and return during lunch. Therefore, the estimated number of two-way trips for construction personnel employed on site is approximately 42 per day over the construction period. During peak periods, this will increase to 72 two-way trips per day.

14.5.1.5 Total Excavation/Delivery trips

For the purpose of this assessment, the total trips per day for excavation, delivery of materials and for construction workforce movements have been combined. As set out above, excavation works will occur in Douglas prior to backfilling and construction works.

A contingency factor of 20% has been applied to the excavation and backfilling/delivery figures presented above to account for any additional or unforeseen trips that may occur periodically.

It is also noted that works in Douglas will be sub-divided into a number of smaller localised works areas, and works will not be undertaken at all of these sites simultaneously. However, the worst-case scenario assumed as part of this assessment is that a number of works areas in Douglas are ongoing simultaneously.

Table 14.1 gives a breakdown of the estimated construction workforce traffic.

Table 14.1: Average Construction Traffic Daily Breakdown

Description of trip	Total round trips (two-way) (for entire duration of works)	Average round trips per day* (two-way)	Maximum round trips per day (two-way)	Maximum round trips in peak hour (two-way)
Removal of Excavated Material	2,250	10	96	18
Delivery of Materials	1,318	6	64	36
Construction Workforce	8,190	42	72	24
Total (excluding 20% contingency)	11,758	58	232	78
Total	**12,472**	**62**	**264**	**89**

*Trips per Day calculated based on total works programme of 195 working days for works in Douglas)

*20% contingency applied to excavation/delivery figures only

Taking into account the large numbers of existing vehicles using the road network in and in the vicinity of the Douglas area, it is unlikely that traffic generated during the construction phase will have a significant impact on traffic flow locally.

It has been assumed that the N40 SRR east and west, the Rochestown Road and the South Douglas Road will be the main approach routes for traffic to and from the works sites in Douglas, whilst Grange Road and Carrigaline Road will also carry a minor amount of traffic to and from the works sites.

Traffic Surveys undertaken in Douglas as part of the development of the Douglas Land-Use Transportation Strategy (Douglas LUTS) in April 2012 identified AM and PM peak hour two-way flows on certain sections of the road network, as shown in **Table 14.2**:

Table 14.2: Two-way traffic flows on road network (AM & PM Peaks)

Route	Two-way traffic flow (AM Peak)	Two-way traffic flow (PM Peak)	Percentage of Scheme Traffic added	Scheme Traffic added	Total Traffic (AM Peak)	Total Traffic (PM Peak)
South Douglas Road (includes N40 approach from West)	1,171	878	30%	27	1,198 (+2.3%)	905 (+3.1%)
Douglas Road (includes N40 approach from West)	1,730	1,669	20%	18	1,748 (+1%)	1,687 (+1.1%)
Rochestown Road (N40 approach from East)	1,205	1,485	35%	31	1,236 (+2.6%)	1,516 (+2.1%)
Grange Road	730	1,361	10%	9	739 (+1.2%)	1,370 (+0.7%)
Carrigaline Road	692	372	5%	4	696 (+0.6%)	376 (+1.1%)

Conclusion: Temporary Minor Impact

As can be seen in **Table 14.2** above, the construction-related traffic associated with the works in Douglas will impact on the local road networks to a minor extent. As outlined above, the average daily traffic associated with construction works is approximately 62 (two-way trips), increasing to a maximum of 264 daily two-way trips during the intensive work periods, which corresponds to a maximum peak hour estimate of 89 two-way trips (i.e. approximately 45 vehicles). These 89 trips have been applied to the local road network as per **Table 14.2** above, which shows that the impact on the local road network will be minimal.

As outlined above, it has been assumed that excavation and delivery works are ongoing simultaneously in Douglas; however in reality it is likely that excavation works will for the most part commence separately to backfilling works. Furthermore, construction personnel will arrive prior to 08:00 (commencement of the working day), and therefore will arrive outside of the typical morning peak period, and depart after 19:00, outside of the typical evening peak period. However, these traffic flows have also cumulatively been included on the local road network in the peak periods above in **Table 14.2**, for robustness.

It is not therefore anticipated that the construction traffic will significantly affect the flow of traffic through the Douglas area. The impact of construction traffic will therefore be minimal, will be short-term and there will be no residual impact beyond the construction stage.

Togher

14.5.1.6 Excavation works

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 estimated to be a total of 2,148 two-way trips (i.e. 1,074 vehicles) over the anticipated construction period of approximately 12 months, or an average of 8 two-way trips per day. During the most intensive excavation period, it is estimated that this will increase to a maximum of 76 two-way trips (or 38 vehicles) per day. During the peak hour, this will equate to a maximum of 10 two-way trips (or 5 vehicles).

14.5.1.7 Delivery of materials

Imported material for backfilling/reinstatement purposes and construction materials including concrete, etc. will comprise approximately 1,720 two-way trips (i.e. 860 vehicles) over the 12-month program, an average of 6 two-way trips per day (i.e. 3 vehicles).

During intensive works periods, it is anticipated that delivery of materials (including culvert units, pavement reinstatement materials, etc.) will total 46 two-way trips (i.e. 23 vehicles) per day. During the peak hour, this will equate to a maximum of 20 two-way trips (i.e. 10 vehicles).

14.5.1.8 Construction workforce

Construction staff numbers at Togher are estimated at an average daily number of 12 personnel. However, at peak periods, this will increase to a maximum of 16. As outlined in **Chapter 3**, 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 12 construction personnel arrive before 08:00, all 12 depart after 19:00, and that 6 leave and return during lunch. Therefore, the estimated number of round trips for construction personnel employed on site is approximately 36 round trips per day over the construction period during the most intensive period of works (during peak periods this will increase to a maximum value of 48).

14.5.1.9 Total Excavation/Delivery trips

For the purpose of this assessment, the total trips per day for excavation and for construction workforce movements have been combined. As with Douglas, excavation works will occur in Togher prior to backfilling and construction works. A contingency factor of 20% has been applied to the excavation and backfilling/delivery figures presented above to account for any additional or unforeseen trips that may occur periodically.

Table 14.3 gives a breakdown of the estimated construction workforce traffic.

Table 14.3: Average Construction Traffic Daily Breakdown

Description of trip	Total round trips (two-way) (for entire duration of works)	Average round trips per day* (two-way)	Maximum round trips per day (two-way)	Maximum round trips in peak hour (two-way)
Removal of Excavated Material	2,148	8	76	10
Delivery of Materials	1,720	6	46	20
Construction Workforce	9,360	36	48	16
Total (excluding 20% contingency)	13,228	50	170	46
Total	**14,001**	**53**	**194**	**52**

*Trips per Day calculated based on total works programme of 260 working days for works in Togher)

*20% contingency applied to excavation/delivery figures only

Taking into account the large numbers of existing vehicles using the road network in and in the vicinity of the Togher area, it is unlikely that traffic generated during the construction phase will have a significant impact on traffic flow locally.

Traffic surveys for the road network in Togher in the vicinity of the works areas were not available for the purpose of this assessment; however the two-way traffic flows for the peak hour from **Table 14.3** above have been assumed to arrive and depart the Togher area from the local road network as follows:

Table 14.4: Estimated additional two-way traffic flows on road network (AM & PM Peaks)

Route	Percentage of Scheme Traffic added	Scheme Traffic added (two-way)
N40 (from East, via Sarsfield Interchange)	40%	21
N40 (from West, via Sarsfield Interchange)	40%	21
Wilton Road (from North)	10%	5
Togher Road (from North)	5%	3
Togher Road (from South)	5%	2

Conclusion: Temporary Minor Impact

It is not anticipated that the construction traffic will significantly affect the flow of traffic through the Togher area. Nevertheless, as with the proposed works at Douglas 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 53 (two-way trips), increasing to a maximum of 194 daily two-way trips during the intensive work periods, which corresponds to a maximum peak hour estimate of 52 two-way trips (i.e. 26 vehicles).

As with Douglas, it has been assumed (as a worst-case scenario) that excavation and backfilling works will occur simultaneously, whereas these works are likely to occur independently of each other. Furthermore, as with the proposed works in Douglas, construction personnel will arrive and depart the works areas outside of the morning and evening peak periods (but have been included above for robustness). The impact of construction traffic will therefore be minimal, will be short-term and there will be no residual impact beyond the construction stage.

14.5.2 Sourcing of Materials and Transportation

As set out in **Chapter 4 Construction Activities,** 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.

14.5.3 Potential Impacts on Traffic and Transport Infrastructure

The proposed schemes have the potential to impact on the transport infrastructure in the area, most significantly during the construction phase. This impact is likely to occur as a result of the following works;

- Removal and Replacement of Lower Ravensdale Bridge;
- Togher Road – reinstatement of the culvert along Togher Road;
- Church Road – replacement of the culvert and extension of the existing tabletop ramp; and
- Removal of ICA pedestrian bridge and Church Road cycle track bridge.

In all of the above instances, the transport network elements removed are to be replaced at the same locations, or replaced at an adjacent, similar location. For example, Lower Ravensdale Bridge is to be replaced with a new bridge at the same location, whereas the ICA pedestrian bridge and Church Road cycle track bridge are to be relocated slightly further west, adjacent to the proposed flood defence wall. The proposed new bridge to replace Lower Ravensdale Bridge will be in place prior to removal of the existing bridge, thereby ensuring that access is retained to local properties.

Conclusion: No significant residual impact

14.5.4 Potential Impacts due to Construction Requirement Works (e.g. Road Closures)

It is likely that traffic management measures will be required during the construction phase of the works at the following locations:

- Lehenaghmore Industrial Estate;
- Lehenaghmore Road;
- Togher Road;
- West Douglas Street;
- Church Road;
- Lower Ravensdale;
- Donnybrook Hill; and
- Donnybrook Industrial Estate;

Typically, it is envisaged that traffic measures such as a stop-go system, temporary one-way traffic systems or similar will be considered for implementation to allow the trenches for the culverts and utility diversions to be constructed and at the same time to manage traffic.

It is envisaged that where possible, traffic flows will be restricted via lane closures only, so as to maintain access on specific routes. Where full closures are required, it is envisaged that these will be short-term in duration, and alternative access routes will be provided. In specific areas, such as Donnybrook Industrial Estate, alternative temporary accesses are to be provided for the works duration, following which full access will be restored.

Where full road closures are required, the works will be programmed so as to minimise the duration of closure, and alternative traffic routes will be clearly signed to drivers. For example, temporary closures on Togher Road to accommodate the culvert crossing the main road will require traffic to divert via Pouladuff Road (from the south) or via Tramore Road (from the north), etc. All road closures will be subject to agreement of traffic management and diversion routes, etc. with Cork County Council, Cork City Council and An Garda Síochána.

It is expected that the majority of the intensive works on the public road will be programmed to be carried out in the summer months to avoid school traffic, etc. such as outside the primary school on the Togher Road. In Ravensdale it is likely that access will be restricted to a number of residential properties while the Lower Ravensdale Bridge is demolished. Vehicular access will be restricted for the duration of the works while pedestrian access will be maintained via alternative routes. Alternative provisions will be made to accommodate displaced residential parking demands for the duration of the works.

In other specific locations, such as Lehenaghmore Industrial Estate, it is envisaged that there will be some temporary reduction in available parking space to accommodate the proposed works areas; however as with the other elements, these will be reinstated upon completion.

Conclusion: Temporary Significant Impacts

14.5.5 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.

14.5.6 Potential Cumulative Impacts

Subject to statutory consent, construction of the proposed scheme will commence mid-2018. A construction duration of approximately 18 months is envisaged with an estimated completion date of late 2019/early 2020. There are a number of local minor schemes proposed in the vicinity of the works areas, and a number of major infrastructure schemes planned in the wider Cork county region.

Locally, there are improvement works proposed for Lehenaghmore Road, and on Matthew Hill. The Matthew Hill pedestrian enhancement scheme involves a program of works along Matthew Hill, and localised works at a number of specific locations. The majority of the works involve carriageway improvements to provide wider pedestrian footpaths, additional public transport infrastructure including bus stops and shelters, and traffic calming works. The scheme has been sub-divided into a number of works packages, and has received Part VIII planning permission. Subject to funding, sub-elements will be tendered out for construction in 2017 and 2018. The majority of the works are envisaged to be implemented without any significant road closures, although temporary lane restrictions and associated traffic management will be provided where necessary.

Major infrastructure proposals in the wider county area include the Dunkettle Interchange Upgrade scheme and the N28 upgrade scheme. The Dunkettle Interchange upgrade 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-to-late 2018, although there is no current confirmed works start date.

The N28 upgrade scheme involves the improvement of the N28 Cork-Ringaskiddy Route from the Bloomfield Interchange along the N40 Cork South Ring Road network, through to Ringaskiddy. The N28 will be upgraded to motorway standard as a result. The scheme will facilitate access to the Port of Cork terminal in Ringaskiddy and will remove strategic traffic flow from the existing N28 and the urban settlements currently served by the N28 route. The scheme is part of the current Capital Investment Program and is currently progressing through the detailed design process, ahead of a submission for planning permission in late 2017 – the scheme therefore does not have planning approval.

It is not therefore envisaged that the Dunkettle Interchange Upgrade or the N28 Upgrade schemes will impact upon the Douglas FRS works, as the N28 construction timeline is not expected to be coincidental with the Douglas FRS works, and the Dunkettle Interchange is not sufficiently close to the Douglas and Togher works sites for there to be a significant interaction between both. Furthermore, it is expected that traffic flows at the Dunkettle Interchange will be required to be maintained as part of the construction contract associated with the scheme.

14.6 Mitigation Measures

14.6.1 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 local access bridge at Ravensdale 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. The length of the bridge replacement works will also be kept to a minimum to ensure disruption to residents will be minimised.

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.

14.6.2 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.

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 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.

14.6.3 Mitigation Measures during Operation

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

14.8 References

Cork County Council (2012) Douglas Land-Use and Transportation Strategy – Baseline Transport Report, Section 6 – Existing Traffic Flows and Traffic Survey Results (MVA Consultancy).

Department of Transport, Tourism and Sport (2010) Guidance for the Control and Management of Traffic at Roadworks – Second Edition.

Department of Transport, Tourism and Sport (2015) Guidelines for Managing Openings in Public Roads.

15 Material Assets

15.1 Introduction

This chapter describes and assesses the potential impacts of the proposed Douglas Flood Relief Scheme (FRS) (including Togher culvert) 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, a flood relief scheme, will consist of a series of measures and structures designed to reinforce the river banks, to mitigate flooding risk in the Cork City south environs, principally in the areas of Douglas, Donnybrook and Togher, along the Tramore River, Grange Stream and Ballybrack Stream.

Material assets are defined in the EPA Advice notes on current practice in the preparation of EIS (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*'.

This chapter addresses the following aspects:

- Local Settlement,
- Commercial and Industrial Development
- Services,
- Natural Resources,
- Waste Management.

15.2 Methodology

This chapter has been prepared having regard to the following guidelines:

- 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;
- 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 FRS refers to the areas in which works are proposed. These are in the vicinity of the Tramore River, Grange Stream and Ballybrack Stream in Togher, Donnybrook and Douglas respectively, in Cork City and County. The main settlements within the area are Togher and Douglas. However, the location for the scheme is a predominantly urban and built-up zone, mostly residential, community and commercial developments, with a number of small industrial estates. For the purposes of this EIS, the population study area will comprise the District Electoral Divisions (DEDs) within which the FRS study area is located. These include Lehenagh, Douglas, and Innishkenny. Refer to **Chapter 3 Description of the Proposed Development** of this EIS for further detail of the locations of the scheme.

15.3.2 Commercial and Industrial Development

The works will take place in close proximity to a number of commercial and industrial developments including the multi-unit developments at Lehenaghmore Industrial Estate, Donnybrook Commercial Centre, St Patricks Mills and the development along the left bank of the Ballybrack Stream opposite Douglas Community Park and Timber Joinery Workshop in Ravendsale. In Togher there is a commercial premises located in close proximity to the proposed works including convenience supermarket and dental practice located along Togher road and commercial premises at the northern junction of Greenwood Estate with Togher Road.

15.3.3 Services

This section reviews the services within the study area, assesses the potential impact on each service and describes the mitigation measures to be implemented to minimise any impacts.

Utility data for the study area has been collated from the following sources:

- Utility records received from the various providers including Cork County Council, Irish Water, ESB, Gas Networks Ireland, Virgin Media, Eir, E-NET and British Telecom (BT).
- Site visits.
- Survey information including topographic and utility surveys.
- Site investigation data including slit trenches and ground penetrating radar.

15.3.3.1 Wastewater

This section reviews the existing wastewater infrastructure, including pipe networks, pumping stations and treatment plants within the study area. The following is a brief description of the wastewater infrastructure in the study area:

- A 450mm diameter sewer crosses the Grange Stream in Donnybrook Commercial Centre
- 600mm and 1500mm diameter sewers cross the Ballybrack Stream to the south of Church Road
- A 450mm diameter sewer crosses the Ballybrack Stream in Douglas Community Park
- A 225/300mm diameter sewer is laid parallel to the Tramore River along Lehenaghmore Road and Togher Road. There are a number of connections to this sewer from the adjoining roads and buildings

15.3.3.2 Water Supply

This section reviews the existing water supply infrastructure, including pipe networks, pumping stations and treatment plants, within the study area. The following is a brief description of the water supply infrastructure in the study area:

- A 150mm diameter pipe crosses and is laid parallel to the proposed works in Donnybrook Commercial Centre
- A 100mm diameter pipe is laid parallel to the Ballybrack Stream through Ravensdale
- A 1200mm diameter pipe crosses the Ballybrack Stream at the ICA Hall
- A 150mm diameter pipe crosses the Ballybrack Stream at Church Road

- A 76mm diameter pipe is laid parallel to the Ballybrack Stream along the Pond Bank
- A 100mm diameter pipe crosses the Tramore River at Brooke Avenue
- A 150/100mm diameter pipe is laid parallel to the Tramore River along Lehenaghmore Road and Togher Road. There are a number of pipes of varying diameter, from Spur Hill, Robinscourt, Elmvale Close and Greenwood Estate, connected to this watermain
- A 600mm diameter pipe is laid parallel to the Tramore River along Togher Road

15.3.3.3 ESB

This section reviews the existing ESB infrastructure, including underground and overhead infrastructure, within the study area. The following is a brief description of the ESB infrastructure in the study area:

- 10kV/20kV underground power lines in Donnybrook Commercial Centre
- 230V/400V overhead power lines adjacent to and crossing the Ballybrack Stream in Ravensdale
- 230V/400V underground power lines cross the Ballybrack Stream at Church Road
- 230V/400V underground power line is laid parallel to the right bank of the Ballybrack Stream in Douglas Community Park
- 10kV/20kV underground power line is laid adjacent to the Tramore River in St Patricks Mills
- 230V/400V overhead power lines are located along Lehenaghmore Road and Togher Road
- 230V/400V underground power lines are located at various locations along Togher Road
- A substation is located adjacent to the Ballybrack Stream in Douglas Community Park
- A substation is located adjacent to the Ballybrack Stream to the south of Church Road

15.3.3.4 Gas Networks Ireland

This section reviews the existing Gas Networks Ireland infrastructure, including distribution and transmission infrastructure, within the study area. The following is a brief description of the Gas Networks Ireland infrastructure in the study area:

- A 125mm (4 bar) gas main is located within Donnybrook Commercial Centre
- A 180mm (4 bar) and 125mm (75 mbar) gas mains cross the Ballybrack Stream at Church Road

- A 63 mm (4 bar) and 125mm (75 mbar) gas mains are located within the footpath of the Tramore River Bridge on West Douglas Road
- A 315mm (4 bar) gas main is laid along Lehenaghmore Road
- A 180mm (75 mbar) gas main is laid along Togher Road
- Numerous 75 mbar connections, of varying pipe size, to the 180mm gas main are located on Togher Road
- A 150mm (4 bar) gas main is laid parallel to the Tramore River at Togher Road and the sports ground to the north of the Greenwood Estate

15.3.3.5 Telecommunications

This section review the existing telecommunications infrastructure, including Eir, British Telecom, Virgin Media and E-Net infrastructure, within the study area. The following is a brief description of the telecommunications infrastructure in the study area:

- BT and Eir ducting in Donnybrook Commercial Centre
- Virgin Media, BT and Eir ducting in Ravensdale and crossing the Ballybrack Stream at Church Road
- Virgin Media, E-Net and Eir ducting in Lehenaghmore Road and Togher Road. There are numerous ducts crossing the existing Tramore River culvert along Lehenaghmore and Togher Road.

15.3.4 Waste Management

A desktop study has been undertaken as part of this EIS to review the licensed waste facilities in proximity of the proposed scheme.

As discussed in detail in **Chapter 11 Soils, Geology and Hydrogeology**, facilities In Ireland carrying out waste activities are required to obtain authorisation in accordance with the Waste Management Act 1996, as amended. Depending on the type of waste activities carried out at the facility may be exempt or require either a waste licence, waste facility permit (WFP) or a certificate of registration (COR).

The EPA database and the National Waste Collection Permit Office (NWCPO) were reviewed for licensed waste facilities in proximity to the proposed works. **Table 15.1** presents the licensed waste facilities in proximity to the scheme and the type of waste they accept.

There are no licensed landfills operating within the scheme. The closest landfill site to the Study Area is at Bottlehill, approximately 20km north of Douglas however activities at the site have not commenced according to the Plan (2015). The Kinsale Road Landfill is approximately 1.5km northeast of Douglas Community Park and is a former landfill. The site is now closed and is currently a civic amenity site for domestic use only and operated under an EPA Waste Licence (Registration No. W0012-03).

Table 15.1: Cork County Council permitted Waste Facilities - Certificates of Registration, in the Study Area

Facility Name	Permit No.	Location	Waste accepted
Instant Waste Disposal Ltd.	WFP-CK-11-0095-01	Grange, Douglas	Wood, paper, cardboard, mixed construction and demolition waste, plastics, metals, mixed municipal waste.
David O'Leary	WFP-CK-13-0134-01	Unit 16 Togher Industrial Estate, Togher	End of life vehicles.
Pouladuff Dismantlers Cork Ltd.,	WFP-CK-10-0070-03	Airport Road, Cork	Waste metals, end-of-life vehicles and associated parts, batteries, glass, plastic, waste alumina.
Cork Hygiene Ltd.	WFP-CK-09-0015-02	Sarsfield Road	Wastes whose collection and disposal is not subject to special requirements in order to prevent infection (for example dressings, plaster casts, linen, disposable clothing, and diapers).
Ocon Chemicals Limited	WFP-CC-02/2016	Unit 5, South Cork Industrial Estate, Vicars Road, Cork City.	Sharps, medicines, discarded electrical and electronic equipment.
Emerald Waste Company Ltd.	COR-CC-04/2013	Kinsale Road	Biodegradable kitchen and canteen waste, mixed municipal waste.
Cork Recycling Company Ltd.	WFP-CK-14-0141-01	Lehenaghmore, Togher	Waste from wood not otherwise described (timber block rejects); Packaging; Concrete bricks, tiles and ceramics; Wood; Bituminous mixtures; Soil and Stone; C&D; Garden & Park; Other municipal wastes; Paper & Cardboard; WEEE.
CND Recycling Ltd.	WFP-CC-08/2015	South Ring West Business Park, Tramore Road	Plant tissue waste, sawdust, shavings, plastic packaging, plastic, bricks, concrete, mixed metals, minerals, rubber, glass, textiles, WEEE, mixed municipal waste, bulky waste, wood, soil and stones.

15.4 Characteristics of the Proposed Scheme

The proposed development will consist of the implementation of flood defences, in various forms, along the Ballybrack Stream and Tramore River. The entire Douglas FRS (including Togher culvert) consists of a number of measures which are summarised below and described in detail in **Chapter 4 Construction Activities**.

- Construction of new flood defence walls and/or replacement of existing walls with new flood defence walls;
- Replacement of and/or extension of existing culverts;
- Removal of and/or replacement of bridges;

- Removal of existing trash screens and construction of new screens;
- Local channel widening, deepening, realignment and regrading of river channel;
- Construction of new earthen flood defence embankment;
- Provision of civil works such as road/footpath re-grading at a number of locations;
- Removal of vegetation and trees to facilitate construction works;
- Protecting drainage outlets along the line of flood defence works;

Once construction is completed, ongoing maintenance of the river channel, trash screens etc. will be carried out.

15.5 Evaluation of Impacts

15.5.1 Construction Impacts

15.5.1.1 Local Settlement

The construction phase of the proposed scheme will be 18 months in total, however, localised works 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.

In total, the scheme will impact on the curtilage of 9 no. residential properties, 8 in Douglas and 1 in Togher, and 7 no. social / community developments including the Church of the Way of the Cross, Togher Primary School, Togher Music School and Togher Community Association along Togher Road, Douglas Community Park and the HSE building and ICA Hall in Ravensdale.

In Togher, there will be disruption to residential property to the west of the existing section of open channel at Lehenaghmore Road during construction. The works in this area will consist of the construction of a new culvert in place of the open channel, a new footpath to connect the existing footpath on the western side of Lehenaghmore Road to the footpath on Spur Hill and a new boundary wall at the edge of the path. A number of trees will be removed to facilitate the construction of the scheme in this area.

At Togher Road, there will be disruption to the eastern boundary of the church, primary school and music school to facilitate the construction the works. No permanent works are proposed in these areas but they form part of the proposed works area to provide adequate room for the works to be constructed while maintaining traffic flow on Togher Road.

In Douglas Community Park, the area of the park to the west of the footpath / cycle track running through the park will be closed during construction, including the walkway nearest the stream and the outdoor exercise equipment.

The construction works in this area will consist of the widening of the existing channel in the southern part of the park and the construction of a low flood defence embankment in the northern half of the park. Stabilisation works to both banks are also required. The construction of the scheme will also require a number of trees within the park to be removed.

In Ravensdale, there will be disruption to all residential properties located along the stream bank. The gardens of the properties adjacent to the Ballybrack Stream will be inaccessible while the defences in that location are constructed. Once construction is complete, the gardens will be fully reinstated. The works proposed in Ravensdale consist of the construction of new reinforced concrete flood defence walls, widening and realignment of the Ballybrack Stream downstream of Middle Ravensdale Bridge and the replacement and relocation of Lower Ravensdale Bridge. The proposed walls will be stone clad in this area. To construct the works in this area, existing trees and vegetation along the stream bank will be removed.

There will also be disruption to the grounds of the ICA Hall between the building and the Ballybrack Stream. It is proposed to widen the channel by 2m in this area and construct new reinforced concrete flood defence walls along both banks. The walls will be stone clad on both sides in this area. The existing access bridge to the ICA Hall will be removed as part of the works and a new pedestrian access provided. The disruption to the HSE building will involve the temporary loss of use of the area in the vicinity of the existing western boundary wall. This wall may need to be strengthened to facilitate the regrading of the access road to the properties in Ravensdale.

The above impacts will be temporary during the construction phase of the scheme and generally consist of lands adjacent to the watercourse being inaccessible for short durations while each section of the scheme is constructed. It is considered that the works will have a slightly negative impact on these properties during the construction phase.

15.5.1.2 Road and Transport Network

The proposed FRS works will require traffic diversions during the construction phase to facilitate construction works. In Togher, the Togher Road will need traffic management for proposed works on the culvert. In Douglas, West Douglas Street, Church Road and Ravensdale will likely experience traffic disruptions during construction. Construction impacts on the roads and transportation network are detailed in **Chapter 14 Roads and Traffic**.

15.5.1.3 Commercial and Industrial Development

The proposed FRS works will take place in proximity to a number of commercial and industrial developments. In total, the scheme will impact on the curtilage of 5 commercial/industrial developments, including the multi-unit developments at Lehenaghmore Industrial Estate, Donnybrook Commercial Centre, St Patricks Mills, the development along the left bank of the Ballybrack Stream opposite Douglas Community Park and Timber Joinery Workshop in Ravensdale.

In Lehenaghmore Industrial Estate, there will be disruption to the existing parking area and circulatory road at the northern boundary of the site. The works in this area will comprise the construction of a new culvert along the northern boundary of the parking area / circulatory road and the construction of a new trash screen upstream of the existing screen. The construction of the trash screen will require the removal of any trees in the vicinity, however, the hedgerow between the industrial estate and Brooke Avenue will be maintained.

At St Patricks Mills, there is no direct impact to the existing commercial developments, however, the majority of the existing car park adjacent to the Tramore River will be closed during the construction phase.

The impact to the commercial development along the western bank of the Ballybrack Stream at Douglas Community Park will be temporary to construct the proposed bank stabilisation works. Any stabilisation works required to the existing concrete walls which form part of this development will be undertaken from the channel.

In Ravensdale there will be temporary impact due to the disruption caused by the construction works.

In Donnybrook Commercial Centre, there will be a temporary impact on the businesses due to the construction of the proposed culvert. The existing access route to the eastern part of the centre to be closed during construction.

The above impacts will be temporary during the construction phase of the scheme and generally consist of lands adjacent to the works being inaccessible for short durations while each section of the scheme is constructed. It is considered that the works will have a slightly negative impact on these properties during the construction phase.

15.5.1.4 Services

During the construction of the scheme in Douglas and Togher there will be a number of conflicts with existing utilities. These impacts may require the relaying and/or realignment of the utilities local to the proposed works. Relaying the utilities is anticipated to be required where the existing utilities are located immediately adjacent to the proposed defences.

In Donnybrook Community Centre, it is envisaged that any services clashing with the proposed culvert upgrade will be diverted locally to facilitate the construction of the scheme.

In Douglas, it is envisaged that a number of permanent local diversions will be required to provide adequate space for the construction of the flood defence walls. Temporary diversions will also be required to facilitate the construction of the proposed culvert at Church Road. In Douglas Community Park, it is anticipated that the existing services laid parallel and in close proximity to the Ballybrack Stream will be permanently diverted. This includes the ESB substation in the park. The ESB substation located to the south of Church Road will also be relocated.

There are a number of large diameter wastewater sewers and water supply pipes crossing the Ballybrack Stream in the vicinity of Church Road. It is envisaged that these pipes, including the 1500mm and 600mm diameter foul sewers and the 1200mm diameter watermain, will be protected in place and the proposed flood defence walls designed to span over the utilities.

At St Patricks Mills it is envisaged that any services clashing with the proposed flood defence wall will be diverted locally.

In Togher, it is envisaged that there will be a significant number of permanent local diversions required to construct the proposed culvert. Temporary diversions will also be required to facilitate the construction of the culvert in Lehenaghmore Road and Togher Road.

Some minor and temporary disruption to the existing services which are to be diverted will occur during the construction of the scheme. This disruption is expected to be over a short duration and therefore no significant impacts on the operation of these services in Douglas and Togher is anticipated.

15.5.1.5 Natural Resources

The construction of proposed FRS will require natural resources in the form of engineering fill, water, electricity and fuel for construction vehicles and plant machinery.

15.5.1.6 Waste Management

The proposed scheme will not impact on waste management operations in the area. However, construction works associated with the proposed scheme are likely to generate construction waste from excavation works and general construction activities.

Excavated material will be generated from ground preparation for foundations flood defence walls, embankments, regarding and channel widening and deepening works. Where possible excavated material will be re-used on site. Where material must be removed from site it will be classified 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.

15.5.2 Operational Impacts

15.5.2.1 Local Settlement

Generally the operational impact of the scheme will be positive due to the standard of protection to be provided against flooding.

There will be no operational impacts on the properties in Togher, however, there will be an impact in Douglas Community Park and Ravendale.

In Douglas Community Park, there will be a loss in the recreational area of the park due to the widening and stabilisation works proposed along the right bank of the Ballybrack Stream. The residential property on the left bank of the Ballybrack Stream, immediately north of Church Road, will be impacted due to the reconstruction of the existing embankment. This impact will be limited to the garden adjacent to the stream. These impacts are considered to be minor as the loss of land in the park is small in the overall context of the park and the new embankment along the left bank will generally be constructed on the footprint of the existing embankment.

In Ravensdale, there will be a permanent loss of land at the ICA Hall and the three properties along the left bank of the stream to the south of the ICA Hall due to the widening and realignment of the Ballybrack Stream. The impact on the ICA Hall and the property located at Middle Ravensdale Bridge will be minor with the impact due to the channel realignment to the two properties accessed from Lower Ravensdale Bridge considered moderate due to the close proximity of the flood defence walls and loss of land.

Once operational the FRS will require maintenance activities. These activities will include clearing of the trash screens to prevent blockages, inspection of the defences, repair works and invasive plant species (Japanese knotweed) treatment. Refer to **Appendix 4.1** for details on the treatment strategy for the scheme in relation to managing the Japanese knotweed.

15.5.2.2 Road and Transport Network

Operational impacts on the roads and transportation network are detailed in **Chapter 14 Roads and Traffic**.

15.5.2.3 Commercial and Industrial Development

There will be no significant operational impacts on the commercial and industrial developments in Togher, St Patrick’s Mill, Douglas or Donnybrook Commercial Centre.

Once operational, the FRS will require maintenance activities. These activities will include clearing of the trash screens to prevent blockages, inspection of the defences, repair works, removal of trees and vegetation and invasive plant species (Japanese knotweed) treatment. Refer to **Appendix 4.1** for details on the treatment strategy for the scheme in relation to managing the Japanese knotweed.

15.5.2.4 Services

There will be no operational impacts on services due to the scheme.

15.5.2.5 Natural Resources

There will be no operational impacts on natural resources due to the scheme.

15.5.2.6 Waste Management

There will be no operational impacts on waste management due to the scheme.

15.6 Mitigation Measures

15.6.1 Construction Mitigation Measures

15.6.1.1 Local Settlement

The impact of the scheme during the construction stage has been carefully considered in the design of the defences. Vehicular and pedestrian access to all properties will be maintained throughout the construction of the scheme.

In Douglas Community Park, the proposed works are limited to the area in the vicinity of the Ballybrack Stream. This will require the closure of the walkway closes to the stream but the existing footpath / cycle track running through the centre of the park will be open throughout the construction period. The outdoor exercise equipment impacted by the scheme will be reinstated / relocated on completion of the works.

In Ravensdale, it is proposed to use precast concrete U channels in areas where space is restricted. This will minimise the land required in the gardens of the existing properties to construct the works.

15.6.1.2 Road and Transport Networks

Mitigation measures for impacts on roads and transport networks are discussed in **Chapter 14 Roads and Traffic**.

15.6.1.3 Commercial and Industrial Development

In Lehenaghmore Industrial Estate, the horizontal and vertical alignment of the culvert has been designed to minimise the construction impacts. Also, it is proposed to construct the new trash screen adjacent to the existing river channel to minimise the impact on the river itself and the industrial estate circulatory road.

At St Patricks Mills the construction methodology chosen for the flood defence wall will minimise the time taken to complete the works and therefore, minimise the impact on the car park adjacent to the Tramore River.

In Donnybrook Commercial Centre, a temporary access to Donnybrook Hill will be constructed to maintain access to the properties in the eastern part of the development during the construction of the new culvert.

15.6.1.4 Services

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 detailed design of the scheme to avoid any clashes where possible. All diversions will be designed and constructed in accordance with the requirements and under the supervision of the relevant utility provider. Businesses and residents will be notified in advance of any disruptions. Contractors will be provided with all the locations of any services.

15.6.1.5 Natural Resources

No mitigation measures will be required during the construction of the scheme.

15.6.1.6 Waste Management

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**.

15.6.2 Operational Mitigation Measures

15.6.2.1 Local Settlement

To mitigate the impact on the existing walkway in the park due to the widening of the channel and construction of the flood defence embankment, the walkway will be realigned adjacent to the top of the proposed bank adjacent to the channel widening. At the location of the embankment, the walkway will be constructed on top of the embankment.

To mitigate the impact on the parking / turning area at the properties accessed by Lower Ravensdale Bridge, a new car parking area will be provided to the south of the property.

15.6.2.2 Road and Transport Networks

No mitigation measures will be required during operation of the scheme.

15.6.2.3 Commercial and Industrial Development

No mitigation measures will be required during operation of the scheme.

15.6.2.4 Services

No mitigation measures will be required during operation of the scheme.

15.6.2.5 Natural Resources

No mitigation measures will be required during operation of the scheme.

15.6.2.6 Waste Management

No mitigation measures will be required during operation of the scheme.

15.7 Residual Impacts

The residual impact of the scheme on each aspect viz; Local Settlement, Commercial and Industrial Development, Services, Natural Resources and Waste Management will be minimised through mitigation, but is expected to be slight.

15.8 References

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 Douglas Flood Relief Scheme (FRS) (including Togher Culvert). 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 Hydro-geology	Roads and Traffic
Noise and Vibration		-	-	-	-	C	C	-	C	-	-
Air Quality	-		-	-	-	-	C	-	C	-	-
Hydrology	-	-		-	-	-	O	O	C	-	-
Landscape and Visual	-	-	-	-		C	CO	-	-	-	-
Archaeological Architectural & Cultural Heritage	-	-	-	-			-	-	-	-	-
Population and Human Health	-	-	-	-	-	-		-	-	-	-
Material Assets	-	-	-	-	-	-	CO		-	-	-
Biodiversity	-	-	-	-	-	-	-	-		-	-
Soil, Geology and Hydrogeology	-	-	C	-	CO	-	C	-	C		C
Traffic	C	C	-	C	-	-	C	-	C	-	

16.4 Potential Interactions and Cumulative Impacts

During construction noise and vibration impacts may have a cumulative impact on population and biodiversity, as discussed in **Chapter 8 Population and Human Health** and **Chapter 6 Biodiversity** 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 impacts from dust and emissions generated during the construction phase on air quality may interact with population and human health (see **Chapter 8**) and biodiversity (see **Chapter 6**). Mitigation measures will be implemented to ensure there will be no significant impacts.

The proposed flood relief works for Douglas and the Togher culvert are designed to alleviate flooding in the area which will by their nature change the local hydrology during a flood event (see **Chapter 12**). These hydrological impacts have the potential to interact with the population (**Chapter 8**) by reducing the flooding risk and material assets (see **Chapter 15**) through the greater flood protection for roads, services and properties during operation of the scheme.

The construction activities will generate visual impacts (**Chapter 7**) and these impacts will interact with human beings (see **Chapters 8**) both during construction and operation once the scheme is built. Mitigation measures will be implemented to ensure there will be no significant impacts.

The proposed flood relief scheme will include works close to or adjacent to some protected structures (such as St Patrick's Mills, mill at Donnybrook) which may potentially result in cumulative visual impacts on the archaeological, architectural and cultural heritage (see **Chapters 7** and **13** respectively). Mitigation measures will be implemented to ensure there will be no significant impacts.

Construction works that require works to the soils and geology may potentially impact the biodiversity (**Chapter 6**), landscape (**Chapter 7**) from the construction flood relief wall and embankments (**Chapter 14**) and people (**Chapter 8**) through the transport of material on and off site. The movement of soil and other material due to the construction works may also have a cumulative impact on the roads and traffic (**Chapter 14**). Mitigation measures will be implemented to ensure there will be no significant impacts.

The construction phase of the drainage scheme will 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**.

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 intend to ensure that any potential adverse effects of the proposed scheme 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 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

<table>
<tr><th>Source / Scale of Effect</th><th>Control and Mitigation</th><th>Residual Impacts, Significance Level, Environmental Consequence</th></tr>
<tr><td colspan="3">CONSTRUCTION PHASE</td></tr>
<tr><td colspan="3">General</td></tr>
<tr><td></td><td>Every effort will be made to ensure that any significant environmental effects will be avoided, prevented or reduced during the construction phase of this scheme.
A construction environmental management plan (CEMP) will be prepared by the Contractor 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 conditions attached to the statutory consent issued by An Bord Pleanála. The main aspects of the CEMP are outlined below. Implementation of the CEMP will ensure disruption and nuisance are kept to a minimum.
The CEMP 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 CEMP will be developed in accordance with industry best practice and will be effective for the duration of the construction works.
Cork County Council 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 works are carried out in accordance with industry best practice 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.</td><td>Slight to moderate short-term residual effect</td></tr>
<tr><td colspan="3">Generation of Waste</td></tr>
</table>

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
• Construction waste • Excavated material	• 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. • A construction and demolition waste management plan will be developed and maintained by the main contractor prior to construction works commencing on site. The Plan will meet the requirements of the DoEHLG Best Practice Guidelines on the Preparation of Waste Management Plans for Construction & Demolition Projects. • Hazardous waste generation will be minimised, and such waste will be recovered where feasible, and only disposed of if recovery is not feasible. • The management of hazardous waste will be in line with the National Hazardous Waste Management Plan (2014-2020) and managed in accordance the Waste Management Act 1996 as amended and other relevant legislation.	**Not significant**
Site Tidiness		
• Untidy site	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.	**Imperceptible residual effect** No significant residual impact predicted.

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• 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		
• Construction establishment will require temporary fencing, signage, temporary site entrances • Erection of signage • Temporary office and welfare facilities • Cranes or other tall site machinery on-site • Removal of trees and vegetation and the construction of new flood defence walls • Visual impacts on the historical character of the built environment and immediate settings of protected structures • Visual impact from construction of new embankments • Impact on public realm and residential amenity from the localised noise, dust, vibration, access restrictions and visual disturbance associated with the construction works	**General:** • Where concrete is exposed, careful consideration of the design finish will be ensured so as to be sympathetic with the receiving environment. • 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. • Retention of existing trees where possible in the interest of residential amenity, public realm and visual character of the river amenity. Remaining trees will be protected and a tree replanting scheme will be devised. Where retention of existing trees is not an option, these shall be replaced with new trees as close as possible to the original location in the interest of public realm and visual character of the river amenity. • 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. Ballybrack stream). 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. **Specific:** • Location of the proposed flood walls along the line of an existing wall on river bank at St Patrick's Mills in the interest of minimising intrusion on the existing landscape character. • Finish of new wall on dry side at St. Patrick's Mills to be sympathetic to historical character of the built fabric.	**Slight to moderate residual effects** Significant short-term visual effects during the construction phase but these will be reduced to slight to moderate residual effects over time following the implementation of control and mitigation measures.

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• Finish of new wall on both sides to be sympathetic to character of river amenity and existing boundaries along Ballybrack Stream. • Tree removal at entrance area to Ballybrack Woods and within Douglas Community Park to be compensated with newly planted trees along the banks specifically within these areas.	
Traffic		
• Increase in traffic due to construction activities in the form of HGVs, and workforce and general site traffic • Temporary traffic restrictions	**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. • 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 local access bridge at Ravensdale 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. The length of the bridge replacement works will also be kept to a minimum to ensure disruption to residents will be minimised. • 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.	**Slight residual effect** Temporary and short term impact on local traffic volumes. Temporary and short term impact on local traffic movement.

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• 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. **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. • 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 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.	
Noise and Vibration		

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
Principal sources of noise: • Earthworks plant and equipment • Construction plant and equipment • Construction traffic	• The construction contractor will be required to manage noise and vibration aspects of the project in accordance with BS 5228 Part 1 (2009) and the European Communities (Noise Emission by Equipment for Use Outdoors) Regulations, 2001 Code of Practice for Noise and Vibration Control on Construction and Open Sites. This document provides for practical measures that limit the hours in which noisy activities are permitted, provision of acoustic screening for noisy activities, use of silencers on equipment, siting of noisy mobile equipment away from sensitive receptors, and the provision of relevant training with respect to minimising noise disturbance. It is recommended that the contractor liaises with residents of nearby dwellings in advance of works to assist in managing expectations with regard to length and duration of works, to minimise upset and aggravation. • It is expected that works in the distinct zones will be confined to very short periods of time, with a predicted maximum of several months. This will minimise the length of time that receptors are exposed to noise and vibration emissions. Noise emissions will comply with daytime noise limits (65dB LAeq 1h). The following measures will also be employed by the Main Contractor(s): • 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 • A site representative shall be appointed to be responsible for matters relating to noise and vibration. • Unnecessary revving of engines shall be avoided and equipment shall be switched off when not required; • Internal haul routes shall be well maintained and shall avoid steep gradients; • Rubber linings shall be used in chutes and dumpers etc. to reduce noise impact; • Drop heights of materials shall be minimised; • Plant and vehicles shall be started sequentially rather than all together. • Construction plant and activities to be employed on site shall be reviewed to ensure that they are the quietest available for the required purpose; • Where required, improved sound reduction methods, e.g. enclosures shall be used; • Site equipment shall be located away from noise sensitive areas, as much as is feasible;	**Slight residual effect** A preliminary noise assessment of the construction phase impacts has shown that compliance with limit values can be achieved. No significant residual impacts are predicted.

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• Regular and effective maintenance by trained personnel shall be carried out to reduce noise and/or vibration from plant and machinery; • 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. • A 2.4m hoarding will be provided around the construction works area where possible. However if this is not suitable for the construction of embankments, the use of pressed-in sheet piling where possible will avoid vibration nuisance. Screens will be positioned as close as possible to either the source or the receptor. The screen will ensure that there is no direct line of sight between the source and the receptor. The site layout will be considered as this can also contribute to noise screening - the position of storage, offices, or other elements of the construction compound can also provide a degree of noise screening if placed between source and receptor; • Site activities shall be limited to 8am - 7pm, Monday to Friday; and 9am - 4pm, Saturday (It may be necessary in exceptional circumstances to undertake certain types of activities outside of normal construction core working hours. Any such working hours outside the normal construction core working hours will be agreed with Cork County Council. The planning of such works will have regard to nearby sensitive receptors; • The Main Contractor(s) shall be required to carry out continuous noise and vibration monitoring in areas where residential properties are directly adjacent to the works. These levels will be compared to the limit values outlined in Table 9.2 and Table 9.3 in Chapter 9 of the EIS. If exceedances are recorded, alternative construction methodologies will be proposed to ensure limits are complied with.	
Air Emissions		

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
• Dust from excavation and site clearance activities • Emissions from exhausts of construction plant and vehicles • Dust from movements on site in dry windy weather • Dust from dry surfaces and stockpiles	A Dust Minimisation Plan will be formulated for the construction phase of the project. The focus of the control procedures will be to reduce the generation of airborne material. 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. • Control of vehicle speeds and speed restrictions; and • Sweeping of hard surface roads. In addition, the following measures will be implemented for the proposed scheme: • A 2.4m hoarding will be provided around the site works to minimise the dispersion of dust from the working areas; • Generators will be located away from sensitive receptors. • Stockpiles will be located as far as possible from sensitive receptors and covered and/or dampened during dry weather. • Employee awareness is also a most important way that dust may be controlled on any site. Staff training and the management of operations will ensure that all dust suppression methods are implemented and continuously inspected. • Dust monitoring will be undertaken at the site boundary throughout the construction phase. The TA Luft dust deposition limit values of 350 mg/m2/day (averaged over one year) will be applied as a 30-day average.	**Slight residual effect** No significant residual impact predicted.
Climate		

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
• Construction vehicles, generators etc., may give rise to CO_2 and NO_x emissions	• There will be minor emissions to the atmosphere during the construction phase. No mitigation measures required.	**Imperceptible effect** No significant impact on climate predicted.
Soils, Geology and Hydrogeology		
• Potential impact on soil and groundwater from leaks or spills from fuel, etc. • Excavation of soil for flood defence structures (wall foundations, embankments, culverts, etc.) • Soil containing Japanese knotweed will be disturbed	As discussed in Section 11.4.15 of the EIS, standard good construction management practices will be employed as part of the construction phase of this scheme which include the implementation of a CEMP which will serve to minimise the risk of pollution of soils (and groundwater) during construction. These will be implemented by the contractor. These measures have been described in detail in Section 4.6.2 in Chapter 4 Construction Activities and specific measures are outlined below: • Designated fuel storage facilities, 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 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;	**Not significant** No significant residual impact predicted.

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• 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. • 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.	
Hydrology		
• Potential impact on surface water during heavy precipitation from stormwater runoff which could contain silt, or oils from plant and vehicles • Potential temporary impact on the risk of fluvial flooding from the Tramore River, Ballybrack Stream and Grange Stream and pluvial flooding in Douglas and Togher	The employment of good construction management practices will minimise the risk of pollution of soil, storm water run-off, seawater or 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). 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. • Vehicles will not be left unattended during refuelling.	**Negligible** No significant residual impact predicted.

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• 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. • Adequately size spill kits will be provided. • Collection systems will be used to prevent any contaminated drainage entering surface and groundwater. • Silt curtains will be installed within the works area during in-stream works. These silt curtains must be effectively installed and must be monitored and maintained during works to ensure they are operating effectively. • Ensure that all staff are trained and follow vehicle cleaning procedures. Wash down from machinery and in particular concrete trucks must be prevented from entering watercourses. Wash-down should take place well away from the river or in the site compound area provided a sedimentation area is provided. • Construction works, especially works that involve the pouring of concrete must be conducted under dry conditions. • Any stripping of areas of topsoil is to be avoided unless absolutely necessary and if unavoidable, the areas concerned are to be kept to a minimum. • Where temporary stockpiling of topsoil or riverbed material is required, the material should be stockpiled in areas which are not liable to flood and where the risk to water quality is minimised. Geotextile should be used to cover stockpiles to prevent erosion. • Weather forecasts will be checked daily to allow appropriate measures to be taken to mitigate against any negative impact resulting from heavy rainfall. • Works will be carried out in line with the specifications of detailed method statements. • The works will be supervised by a suitably qualified ecologist who will ensure that adequate mitigation is being implemented and who can advise on changes to same where required.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• 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 precautionary 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 trucks 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. • Biodegradable oils and fuels will be used where possible. • 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 CEMP. • Drip trays will be placed underneath any standing machinery to prevent pollution by oil/fuel leaks. Where it is necessary to refuel machinery on site this will be done in a carefully managed manner at a minimum distance of 25m away from watercourses.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• 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 CEMP. • Emergency spill kits will be available on site and staff will be trained in their use. • 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. • Process water used during construction will be disposed of appropriately • 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.	
Biodiversity		
• Temporary physical damage to habitats within the construction footprint or access routes • Changes in the hydrological regime • Changes in water quality and pollution • Disturbances to sensitive species such as birds, otters and bats • Disturbance to fisheries	**Habitats and Flora** • To prevent incidental damage by machinery or by the deposition of spoil during the site clearance stage, any trees earmarked for retention will be securely fenced early in the construction phase. A tree survey has been carried out for the site which specifies which trees should be retained where it is feasible to do so (See Appendix 6.4). All of the trees which can be retained will be clearly marked with hazard tape and the contractor should be made aware of the necessity of protecting the root structure from machinery damage. • Inadvertent damage to river banks on the margins of the works area or damage to vegetation can destabilise river banks and result in long term erosion and siltation. It is important therefore that the works area is adequately fenced and that works are confined to the works area. Access routes will also be clearly defined.	**Not significant** No significant residual impact predicted.

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
• Invasive plant species in works areas • Channel maintenance activities	**Invasive Plant Species (Japanese Knotweed)** • Where feasible, works will be avoided in areas infested with Japanese knotweed. • The treatment programme will be continued via two treatments in 2017. This will be carried out by a suitably qualified contractor and in line with the provisions of the relevant guidelines. • It is noted that it is not possible to accurately predict the success of the spraying programme in advance. Whilst the spraying programme will result in considerable die off of the plant it may not be entirely eradicated. The root can stay dormant in the soil for long periods and when exposed to light, air and water can start to regrow. Therefore, the entire works area will be resurveyed immediately prior to the commencement of works. The mitigation measures outlined below can then be incorporated into a specific invasive species management plan based on the most up to date information prior to the commencement of treatment. Further details on the management of non-native invasive species are also provided in **Appendix 4.1** of this EIS. • The management plan will make reference to and use of relevant guidelines including Best Practice Management Guidelines - Invasive Species Ireland (Maguire et al. 2008), NRA (2010), Best Practice Management Guidelines Japanese knotweed Fallopia japonica (2008) prepared for NIEA and NPWS as part of Invasive Species Ireland. Appropriate methods are also outlined in Irish Water guidelines (Irish Water Report Information and Guidance Document on Japanese Knotweed Asset Strategy and Sustainability). The management plan will take account of a range of factors including the timeframe in which the work needs to be completed, structural or environmental/ecological features (e.g. watercourses, treelines nesting birds), designated sites, availability of storage areas for contaminated spoil on or off site, access issues and agreement with landowners, seasonal restrictions to work and financial constraints. • To minimise risks in the longer term, a monitoring programme will be put in place for three years following the completion of site works. Where Japanese Knotweed re-emerges within the works area an in-situ herbicide treatment programme will be implemented. Whilst the exact detail to be provided in the management plan can only be specified following repeat surveys prior to construction, the following information/measures will be provided in the management plan: • Any areas of Japanese Knotweed identified by the survey prior to construction will be marked to within 7m of each individual stand or plant using hazard tape. It is imperative that Japanese Knotweed does not damage	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	flood defences in the future and a root barrier should be put in place for all site works along the Ballybrack Stream. • A supervising ecologist will be present on site, during any works within 7m of a Japanese Knotweed plant to identify pieces of Japanese Knotweed fragments and to determine the volume of spoil to be removed if this is required. Fine nets/silt curtains will be specifically employed downstream of works within areas contaminated with Japanese Knotweed. The purpose of the curtains to catch fragments of Japanese Knotweed dislodged by the site works. The supervising ecologist will regularly inspect the nets, remove fragments where possible or determine when the nets should be replaced. • Methods for treatment of Japanese Knotweed and treatment of contaminated spoil will be specified if required. It is noted that some treatment methods may require an offsite area where Japanese Knotweed can be buried and or bunded. Site selection must take into account environmental/ecological sensitivities and site appropriate mitigation measures will be specified in the management plan. Possible treatment options, if required, include the following: Herbicide treatment; Combined treatment methods; Excavation and Burial; Excavation and Bund Method; Excavation and Root Barrier Cell Method; Removal of contaminated soil to landfill. • It is noted that if Japanese Knotweed has been treated with a persistent herbicide, the excavated material may to be classified as hazardous waste and may need a Waste Permit if it is removed off site. Furthermore, if Japanese knotweed contaminated material is removed off site it will require a licence from the National Parks and Wildlife Service in advance of any removal, in accordance with the European Communities (Birds and Natural Habitats) Regulations 2011 (SI 477). Appropriate site hygiene protocols will be deployed throughout the process. This will include the following: • Only vehicles required for the works within the contaminated works area should be brought on site and the number of visits minimised as much as practicable. Vehicle movements within this area should be kept a minimum • A specialised wash down area will be created for machinery and footwear. All machinery and equipment (including footwear) should be power washed prior to leaving the contaminated works area within this wash down area They should also be visually checked for clods of soil, bits of vegetation etc. and particular care is required with tracked machinery. This wash down area will be located in close proximity to existing stands and the wash down area will be included in the post-works treatment programme for Japanese Knotweed.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	Ideally works including site investigation works should be undertaken in dry weather to minimise the potential for dispersal of fragments of invasive species. • The areas where contaminated soil is to be stockpiled will be clearly marked out on site. Unauthorised access to these areas will be prevented. Any trucks used to transport contaminated spoil offsite must be sealed so that no fragments of material can escape on route. Vehicles leaving the site will be inspected for any plant material and washed down into a contained wash down area. • To prevent Japanese Knotweed from outside the site being inadvertently being brought in to the site, the contractor will inspect vehicles before usage on site. Particular attention is required for vehicles with caterpillar tracks. The supplier of fill will be required to provide a guarantee that imported material does not contain Japanese Knotweed. In addition, the fill will be inspected for signs of knotweed, prior to importation to site. The UK Environmental Agency's publication Managing Japanese knotweed on development sites - The Knotweed Code of Practice (EA 2013), states that inspection of topsoil brought into the site, should be carried out using the guidance in Appendix I-IV of the code BS 3882:2007 'The British Standard Specification for topsoil and requirements for use'. This Standard was replaced subsequently by BS3882:2015 Specification for Topsoil. The inspection of fill will be carried out according to this Standard **Birds** • Vegetation will be removed outside of the breeding season, when possible. NRA guidelines on the protection of trees and hedges prior to and during construction will be followed. • If works are required within the bird nesting season a survey for nesting birds including dipper, grey wagtail and in particular kingfisher will be carried out. Specific mitigation measures as specified by the supervising ecologist will be implemented where nests are discovered. • An existing dipper box will be removed by the proposed works. A replacement next box will be provided in the finished development. **Otter**	

Source / Scale of Effect	**Control and Mitigation**	**Residual Impacts, Significance Level, Environmental Consequence**
	• No otter signs or holts were noted within 150m of the proposed works. However, otters do occur along the watercourses impacted by the works. A detailed pre-construction survey will confirm the absence of otter holts within 150m of the proposed works area. • Any holts found to be present will be subject to monitoring and mitigation as set out in the NRA *Guidelines for the Treatment of Otter prior to the Construction of National Road Schemes (2006b).* If found to be inactive, exclusion of holts may be carried out during any season. No wheeled or tracked vehicles (of any kind) will be used within 20m of active, but non-breeding, otter holts. Light work, such as digging by hand or scrub clearance will also not take place within 15m of such holts, except under licence. The prohibited working area associated with otter holts will be fenced and appropriate signage erected. Where breeding females and cubs are present no evacuation procedures of any kind will be undertaken until after the otters have left the holt, as determined by a specialist ecologist. Breeding may take place at any season, so activity at a holt must be adjudged on a case by case basis. The exclusion process, if required, involves the installation of one-way gates on the entrances to the holt and a monitoring period of 21 days to ensure the otters have left the holt prior to removal. • As there is evidence that otters move between the Ballybrack Stream and the estuary the works must allow free passage of otters through the works area on the Ballybrack Stream in Douglas. This should be implemented under ecological supervision. • Following completion there must be no impediments to the movement of otters through the affected area on the Ballybrack Stream. **Bats** • Removal of mature trees will be kept to a minimum. Prior to felling mature trees will be checked for bats by the supervising bat expert to ensure impacts on same are minimised. • Trees will be removed where possible during the September/October period. Any ivy covered trees will be left to lie on the ground for 24 hours after cutting to allow any bats to escape. • Excess lighting can impact on bat feeding behaviour. Ideally lights shouldn't be used from dusk to dawn; if lighting is required it should be kept to the minimum necessary and will focus away from adjoining habitats such as treelines which may be used by feeding bats. Following completion of works any new lighting in proximity to watercourses should be cowled and faced away from the water.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• It is noted that any works interfering with bats and especially their roosts, including for instance, the installation of lighting in the vicinity of the latter, may only be carried out under a licence to derogate from Regulation 23 of the Habitats Regulations 1997, (which transposed the EU Habitats Directive into Irish law) issued by NPWS. • There will be replacement planting of trees along sections of the scheme where there is the capacity. Along the Ballybrack Stream, replanting will take place in Douglas Community Park and between the ICA Hall and the Church Road culvert. Replacement planting of trees along will help to maintain thus watercourse as a linear feature which can be used by commuting and feeing bats. • As a mitigation/enhancement measure, four bat boxes will be installed under the guidance of the supervising ecologist. **Fish** The works will incorporate the relevant elements of the guidelines outlined below: • Murphy, D. (2004) *Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites. Eastern Regional Fisheries Board, Dublin.* • IFI (2016) *Guidelines on protection of fisheries during construction Works in and adjacent to waters (IFI, 2016)* • Inland fisheries Ireland Biosecurity Protocol for Field Survey Work. (2011) Mitigation will include the following: • Detailed method statements will be prepared by the contractor in consultation with the supervising ecologist. • Stone slabs (circa 600mm square x 100mm deep) will be tightly packed to form the base of concrete u-channels in the Ballybrack Stream. This will provide a mixed substrate and will diversify flow patterns in areas where gravel would be scoured out by flood events. • A low flow channel will be established in the area to be widened and deepened within the Ballybrack Stream. This prevents the river from becoming too shallow during periods of low flow.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• A natural substrate will be provided within any sections of watercourses impacted by in-stream works where it is feasible to do so. Re-use of the original gravels from the affected watercourse, which can be stored for reuse, is preferred. In any event the gravel used should be similar in size and chemical composition. Large rocks will be incorporated into the river bed to create greater heterogeneity within the channel. • To maintain the gradient and prevent excessive scouring of the river bed the invert of the proposed culvert at Church Road will be buried between 300mm and 500mm in depth. Large rocks will be incorporated into scour protection at the upstream face of the Church Road culvert and concrete u-channels. • Rock armour will be placed in front of gabions in the lower section of the Douglas Community Park. Varying the line of rock armour will provide staggered deflectors within the channel. Rock armour will also be utilised upstream of the Donnybrook Commercial Centre. • In-stream works will be carried out in the period from May to September (inclusive). This restriction does not apply to tidal waters on the Tramore River. • The new trash screen in woodland upstream of Douglas will allow fish movement. • An electrofishing salvage operation to remove fish from areas affected by direct works will be carried out under section 14 licence as issued by the Department of Communications, Energy and Natural Resources. Fish will be removed to suitable habitat within the same watercourse/catchment. After the works are complete natural re-colonisation of recreated habitat is predicted to occur. • In-stream works and fish salvage operation will follow the Inland fisheries Ireland Biosecurity Protocol for Field Survey Work (2011) to ensure no negative impacts are caused to other watercourses. • Appropriately sized screens will be used where pumps are utilised.	
Archaeological Architectural and Cultural Heritage		
• Ground disturbance at numerous locations	Construction work on the proposed development site will require extensive ground disturbance in a number of locations. Some of these areas have been previously disturbed. However, in situ localised sub-surface deposits may survive in places. Archaeological monitoring of ground works will be carried out at a number of locations including:	**Imperceptible effect** No significant impact on features predicted.

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
• Potential disturbance to potentially surviving subsurface archaeological deposits • Removal of features of cultural significance	• Ballybrack Stream, Douglas townland, in Douglas Community Park • Ballybrack Stream in Ardarrig and Ballybrack townlands, Ravensdale, Douglas • Tramore River at Doughcloyne and Lehenagh More townlands, Leheneghmore Industrial Estate • Tramore River at Doughcloyne and Lehenagh More townlands upstream of Togher Road Roundabout, Togher Intermittent archaeological monitoring/inspections of subsurface disturbance will be carried out in the following areas: • Grange Stream in Grange and Castletreasure townlands in Donnybrook Commercial Park, Douglas • Tramore River at St Patrick's Woollen Mills/ Douglas Mills in Grange townland • 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. • Two structures included in the RPS in Cork County Development Plan (2014) are in proximity to the proposed works; St Patrick's Woollen Mills which is included twice in the RPS, listed as St Patrick's Woollen Mills (RPS 01243) and Douglas Woollen Mills (RPS 00482) and millhouses associated with the milling complex at Donnybrook Commercial Park (RPS 00566). • All construction works will be securely fenced off and separated by a buffer zone from the Protected Structures. Intermittent archaeological monitoring and inspection of the buildings will be undertaken. • A number of buildings included in the NIAH are in proximity to the proposed works. In Douglas a number of these are adjacent to the works areas; a terrace of eight houses (NIAH 20871033) near Tramore River at Douglas Mills/St Patrick's Woollen Mills and the former water mill (20908622), associated store or warehouse (20908628) and office (20908629) associated with the milling complex at Donnybrook Commercial Park. • In Togher one of these is adjacent to the works areas; a single-storey house (NIAH 20870009) near Tramore River upstream of Togher Road Roundabout, Togher. Archaeological monitoring and inspection of the buildings will be undertaken.	

<table>
<tr><th>Source / Scale of Effect</th><th>Control and Mitigation</th><th>Residual Impacts, Significance Level, Environmental Consequence</th></tr>
<tr><td colspan="3">Population and Human Beings</td></tr>
<tr><td>• Traffic disturbances
• Nosie and vibration effects
• Dust generation
• Visual impacts
• Potential loss of cultural heritage
• Temporary amenity loss</td><td>• See Roads and Traffic
• See Nosie and Vibration
• See Air Emissions
• See Visual Impact
• See Archaeological, Architectural and Cultural Heritage
• Works will be designed to minimise impacts on local amenity during the construction period. 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.
• In order to ensure the greatest possible access to the Douglas Community Park during works, the entrances at Church Road and Church Street will remain open. The footprint of the works will be kept to the minimum.
• This will minimise impacts on the amenities in the Community Park, ensuring that the cycle track/walkway that runs through the Park, as well as the multi-use games area, Community Centre and playground will remain accessible to the public for the duration of the works. Part of the adult exercise equipment will need to be dismantled during the construction works period. The pedestrian/cyclist routes will be temporarily diverted but access will be maintained at all times.
• The duration of works at the Lower Ravensdale Bridge will be limited to a number of weeks to minimise the impact on residents of the area who will have no vehicular access to their properties during the works. Alternative secure parking for cars will be arranged in agreement with the residents affected, while pedestrian access will be maintained throughout the construction period via a temporary pedestrian bridge or similar
• The boundary walls/fences, vegetation and trees in the areas of the proposed works (particularly in Area 1 and generally parallel with watercourses) that will be temporarily removed to facilitate construction access will be reinstated on completion of the works in agreement with the Council and landowners. Landscaping and replanting will also be carried out on completion in agreement with the Council and landowners.</td><td>Imperceptible effect

No significant negative residual impact predicted.</td></tr>
</table>

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• A traffic management plan will be implemented to minimise disruptions to traffic. Refer to Chapter 14 Roads and Traffic for further details. 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. • Access to tourist amenities such as shops, restaurants and public houses will be maintained throughout the construction stage to ensure minimal impact on tourism. • Noise disturbance and emissions to air will also 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. A dust minimisation plan will be prepared and implemented by the contractor during construction. Refer to Chapter 10 Air Quality and Climate of the EIS for further detail of the mitigation measures to be implemented as part of the dust minimisation plan. • With regard to liaison, the Main Contractor will be required to prepare a Community Liaison Plan, which will include details of how the local community, road users and affected residents will be notified in advance of the scheduling of major works, any temporary traffic diversions and the progress of the construction works.	
Material Assets		
• Impacts on local settlement, road and transport networks, commercial and industrial development. • Construction phase will require potable water, power, fuel and materials such as steel and concrete	• The impact of the scheme during the construction stage has been carefully considered in the design of the defences. Vehicular and pedestrian access to all properties will be maintained throughout the construction of the scheme. • In Douglas Community Park, the proposed works are limited to the area in the vicinity of the Ballybrack Stream. This will require the closure of the walkway closes to the stream but the existing footpath / cycle track running through the centre of the park will be open throughout the construction period. The outdoor exercise equipment impacted by the scheme will be reinstated / relocated on completion of the works. • In Ravensdale, it is proposed to use precast concrete U channels in areas where space is restricted. This will minimise the land required in the gardens of the existing properties to construct the works. • Refer to Traffic section for details on mitigation measures for traffic.	**Not significant and short-term impact**

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• In Lehenaghmore Industrial Estate, the horizontal and vertical alignment of the culvert has been designed to minimise the construction impacts. Also, it is proposed to construct the new trash screen adjacent to the existing river channel to minimise the impact on the river itself and the industrial estate circulatory road. • At St Patricks Mills the construction methodology chosen for the flood defence wall will minimise the time taken to complete the works and therefore, minimise the impact on the car park adjacent to the Tramore River. • In Donnybrook Commercial Centre, a temporary access to Donnybrook Hill will be constructed to maintain access to the properties in the eastern part of the development during the construction of the new culvert. • 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 detailed design of the scheme to avoid any clashes where possible. All diversions will be designed and constructed in accordance with the requirements and under the supervision of the relevant utility provider. Businesses and residents will be notified in advance of any disruptions. Contractors will be provided with all the locations of any services. • Standard mitigation measures for dealing with waste arising will be employed, including the implementation of a CEMP	
OPERATIONAL PHASE		
Visual Impact		
• Visual impact • Impact on landscape character of the local area	• Climbing plants, (e.g. Ivy and Honeysuckle) shall be planted along new walls where possible to reduce the visual impact on the character of the river corridor. • Where trees are removed, new trees of appropriate species (e.g. Alder, Birch) shall be planted in replacement as close as possible to original location (it is noted that replanting potential is restricted at Ravensdale). Where shrubs and vegetation are removed, new plants of appropriate species shall be planted in replacement.	**Slight to moderate negative residual effects** Following the implementation of mitigation measures, impacts on the overall landscape character and visual appearance of the study area will be reduced to slight to moderate negative for the most part,

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• All trees retained in proximity (i.e. within root protection area (RPA) as per BS 5837) shall be subject to a detailed post-construction tree survey carried out by a qualified arborista. Any works recommended shall be undertaken and the survey shall be made available to the Client. • The following planting and species are advised where trees and shrubs are removed in order to avoid any significant negative impacts as a result of their removal: River edge: • Alder (Alnus glutinosa), 18-20cm girth, root balled at 4m centres. • Hawthorn hedge (Crataegus monogyna), 0.9-1.2m high, bare-root, planted at 0.45m centres, double row staggered. Landscape areas in park/verges: • Birch (Betula pendula), 18-20cm girth, root balled at 4m centres. • Maple (Acer platanoides 'Columnare' and Cultivars, 18-20cm girth, root balled at 5m centres.	particularly as existing and new planting matures. **Moderate to Significant positive effects** Moderate to Significant positive impacts will also arise due to the enhancement of the visual environment and public realm, the enhancement of public and residential amenity, the enhancement of recreational aspects and the protection of historical townscapes and structures from flooding.
Traffic		
• Potential impact during channel maintenance works	• No mitigation measures are deemed necessary as channel maintenance will be an infrequent maintenance item, and will comprise negligible traffic flows.	**Not significant**
Noise and Vibration, Air Emissions, Climate, Soils, Geology, Surface Water and Groundwater		
	• No mitigation measures are deemed necessary.	**Not significant**
Archaeological, Architectural and Cultural Heritage		

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• No mitigation measures are deemed necessary.	**Not significant and temporary** Positive impact on archaeological, architectural and cultural heritage features due to the significantly reduced risk of flooding impacting these features.
Population and Human Beings and Material Assets		
• Improved resilience of the local area to flood events	• Maintenance works may be undertaken at various intervals post-construction in order to ensure that blockages (e.g. fallen trees) within the watercourses are not impacting on conveyance or to repair structural elements of the drainage scheme such as flood walls, culverts etc. • Mitigation measures during the operational phase will relate primarily to the proposed maintenance works, and will broadly reflect those employed for the construction phase but on a much smaller scale.	**Positive effect** Positive residual impact due to lower risk of flooding to residential, commercial properties, amenities etc.