OPW
The Office of Public Works
Oifig na nOibreacha Poiblí

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MORRISON'S ISLAND PUBLIC REALM AND FLOOD DEFENCE PROJECT

ENVIRONMENTAL REPORT

FEB 2018

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1 INTRODUCTION

1.1 INTRODUCTION

This Environmental Report (ER) has been prepared by Ryan Hanley in association with McCarthy Keville O'Sullivan Ltd. on behalf of Cork City Council.

Cork City Council (CCC) propose to construct a public realm improvement scheme with integrated flood defence measures along Morrison's Island, Cork City.

As the project will incorporate flood defence works, the project will be jointly-funded by the Office of Public Works (OPW), as the lead agency for flood risk management in Ireland.

Ryan Hanley in association with McCarthy Keville O'Sullivan Ltd. were appointed as Planning and Environmental Consultants on this project and commissioned to prepare an ER.

This ER is a written statement of the potential environmental effects and impacts which may arise from the proposed flood alleviation works, cumulatively and in-combination with other plans and projects. Where effects are identified which are unacceptable, these can then be avoided or reduced. Brief Description of the Proposed Development

The design of the proposed Morrison's Island Public Realm and Flood Defence Project incorporating integrated flood defences has evolved over time, with the flood defence element of the project having been put through an initial screening process of a range of potential engineering measures typically considered for flood alleviation schemes, the development of potential options and finally the development of an emerging preferred works design. The proposed design measures carry out public realm improvements while also alleviating flooding in the area. This ER takes account of these design works in full as part of its impact assessment.

The scheme proposes to enhance the public realm along Fr. Mathew Quay and Morrison's Quay, creating a more pedestrian friendly space, and incorporating open plaza spaces at Parnell Plaza and Trinity Bridge, as well as incorporating flood defence works. The proposed work involves raising the existing ground levels and providing an effective continuous flood defence along the left (north) bank of the South Channel of the River Lee at Morrison's Island. The required flood defence levels have been established as an output of the Lower Lee Flood Relief Scheme (which has built on the Lee Catchment Flood Risk Assessment and Management Study (CFRAMS)). The defence level corresponds to the modelled 1:200-year combined event (tidal region), and 1:100-year flow (fluvial zone) taking account of climate change modelling and freeboard.

The key features for the proposed Morrison's Island scheme will broadly comprise the following:

- Targeted detailed site investigations
- Flood defence works
- Alteration of the area layout for traffic and pedestrians
- Landscaping works
- Regrading works
- Drainage works, including the construction of pumping stations
- Diversion of services and utilities

The description of the scheme is provided in more detail in Section 3.1 of this ER. A description of the study area for this proposed development is given in Section 2.1 of this ER.

Initially, the flood defence element of the Morrison's Island Public Realm and Flood Defence Project formed part of the greater Lower Lee Flood Relief Scheme. A constraints study was carried out as part of this larger project. The Study Area at this constraints study stage was described as 'the channel, floodplain and immediate surrounding areas of the River Lee from the Inniscarra Dam extending along the main channel of the river'. The Morrison's Island Public Realm and Flood Defence Project was pursued as a separate project to the wider Lower Lee Flood Relief Scheme. The Study Area for the proposed Morrison's Island Public Realm and Flood Defence Project includes the river bank along Father Mathew Quay and Morrison's Quay and surrounding areas. This area is shown on Figure 1.1. As the scheme design progressed based on feedback from the constraints study and other relevant assessments, the Study Area was refined to a more specific area, within which impacts may arise. The Study Area for each aspect of the receiving environment is defined in each section of the ER in order to clarify the extent of the area assessed for impacts relating to the proposed works.

Where the 'site' is referred to in this ER, this means location of the proposed development, primarily along Father Mathew Quay, Morrison's Quay and Union Quay in Cork City centre. The proposed works will be mostly restricted to existing road corridor and pedestrian areas and as the construction schedule is planned to be split over 3 phases, the active construction area will generally be only in a smaller area at any one time.

The proposed development has been carefully considered, avoiding unnecessary disturbance and making use of the existing public road corridor. The construction method and mitigation measures have been designed to ensure that the potential for significant environmental impacts has been either reduced to a low risk or eliminated. Need for the Proposed Development

The public realm improvement works are required to improve the visual and recreational amenity of the area around Father Mathew Quay and Morrison's Quay, and to allow the area be developed as a desirable area of Cork City. In addition, flood alleviation works are required to provide an improved standard of protection to residents and businesses in the Morrison's Island area of Cork City against flooding. This will also reduce the financial pressure and stresses that flood risk places on individuals and companies. The Morrison's Island flood defences are an essential part of the overall flood relief scheme for the Lower Lee, and will provide flood protection to approximately 2,100 properties.

1.2 FORMAT OF ENVIRONMENTAL REPORT AND METHODOLOGY

While this report is not an Environmental Impact Assessment Report (EIAR) it follows generally the format and for clarity and consistency uses the impacts and effects terminology of an EIAR and as set out in the 'Guidelines on the Information to be contained in Environmental Impact Assessment Reports – Draft August 2017 '(EPA 2017).

Section 2 of this Report sets out the background to the proposed project, including the relevant planning policy and site design process. Section 3 provides a description of the characteristics of the project, including the construction and operational phases.

Potential impacts to the environment resulting from the proposed project alone and in combination with other plans and projects are examined under the following topics in Sections 4 to 13:

- Human Beings, Population and Human Health
- Flora and Fauna
- Land, Soils and Geology in the Existing Environment
- Water - Hydrology and Hydrogeology

- Air and Climate, Noise & Vibration
- Landscape and Visual Assessment
- Material Assets (including traffic)
- Cultural Heritage (including Archaeology)

Assessment of potential impacts are achieved by reference to the existing environment, the characteristics of the proposed development together with the magnitude, duration, consequences and significance of the development.

These terms are used in order to describe impacts in terms of magnitude, duration, consequences and significance. Where potential impacts are envisaged, remedial and/or mitigation measures that are practical and reasonable are recommended. Where there is a requirement for environmental monitoring during the construction and/or operational phases, such requirements are described together with the proposed methods for carrying out such monitoring.

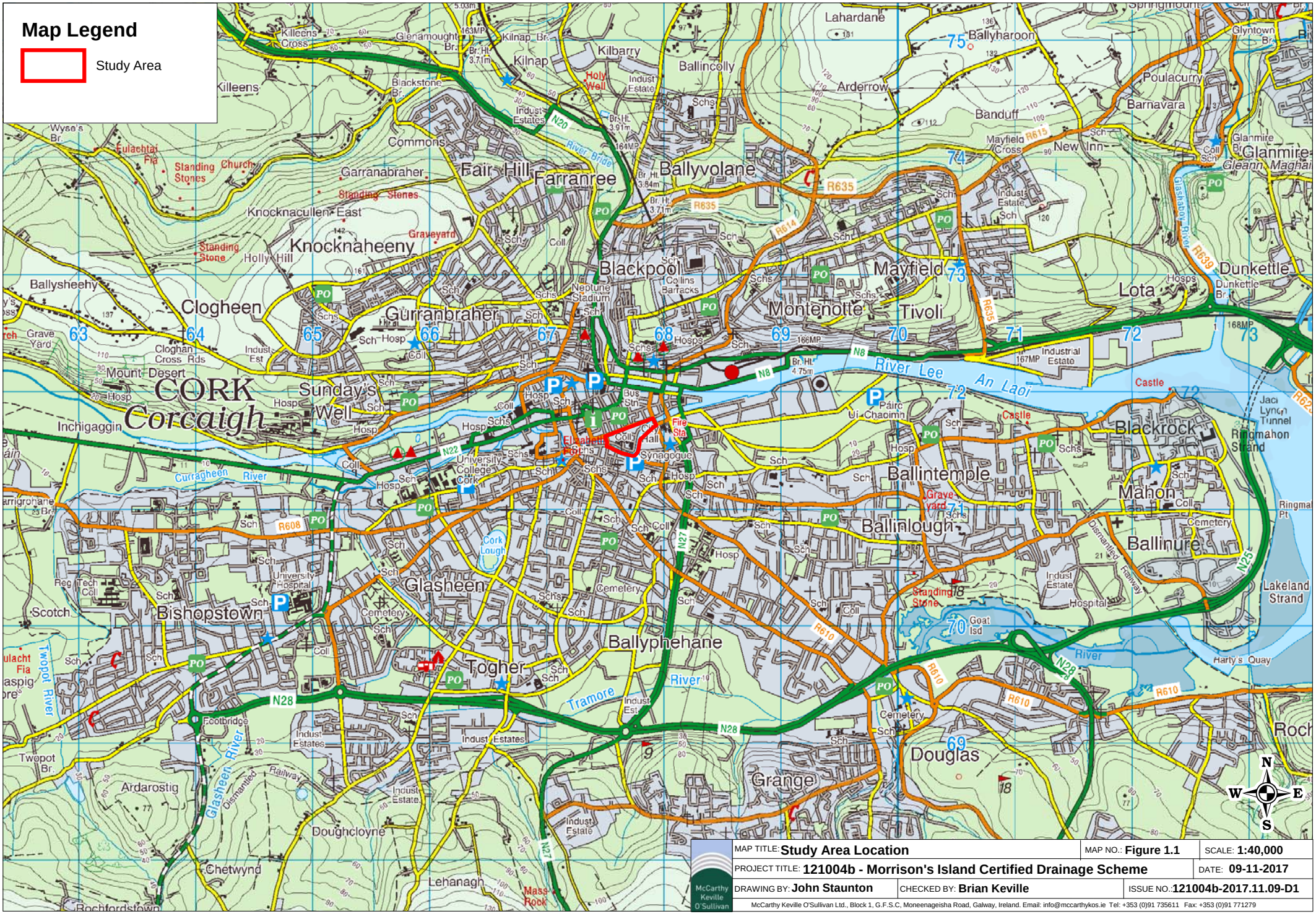
1.3 PURPOSE AND SCOPE OF THE ER

The purpose of this ER is to document the current state of the environment in the vicinity of the proposed development site in an effort to quantify the possible effects, if any, of the proposed development on the environment. The assessment process that led to the compilation of this document served to highlight any areas where mitigation measures may be necessary in order to protect the surrounding environment from any negative impacts of the proposed development.

The objective of this process is to facilitate the most efficient and positive design of the proposed scheme in order to enable the scheme to be incorporated into the receiving environment insofar as possible and to plan for the identified effects so that measures are in place to ensure that any adverse impacts are avoided, reduced or remedied as appropriate.

1.4 PREPARATION

Ryan Hanley Consulting Engineers in association with McCarthy Keville O'Sullivan Ltd. (MKO) have had responsibility for the preparation and compilation of this Environmental Report (ER). Input was also required from ARUP Consulting Engineers, The Paul Hogarth Company, Alastair Coey Architects, Damian Brosnan Acoustics, JBA Consulting, John Cronin and Associates, and Proviz. No difficulties, such as technical deficiencies, lack of information or knowledge, were encountered in compiling any specific information contained in the ER.



MAP TITLE: **Study Area Location**		MAP NO.: **Figure 1.1**	SCALE: **1:40,000**
PROJECT TITLE: **121004b - Morrison's Island Certified Drainage Scheme**			DATE: **09-11-2017**
DRAWING BY: **John Staunton**	CHECKED BY: **Brian Keville**	ISSUE NO.: **121004b-2017.11.09-D1**	

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2 BACKGROUND TO THE PROPOSED DEVELOPMENT

2.1 SITE OF THE PROPOSED DEVELOPMENT

2.1.1 Site Location

The site of the proposed works is located completely within the environs of Cork City. Site location maps are presented in Figures 1.1 and 2.1. Figure 2.2 shows an aerial view of the proposed development site. Where the 'site' is referred to in this Environmental Report (ER), this refers to the Study Area for the assessments undertaken in order to prepare the ER. For the purposes of providing background information on the project in this section, the 'study area' relates to the wider area around the Father Mathew's Quay and Morrison's Quay riverbanks. The study area varies for each of the disciplines (Sections) within this ER in order to allow for correct assessments, and is defined at the beginning of each Section as required.

The population density is generally high within the study area due to the location within Cork City. The Grid Reference co-ordinates for the approximate centre of the catchment study area are E167,700 N71,600. The land within the Study Area is relatively flat, with a slight slope towards the river. The Lower Lee has a relatively flat gradient within the Cork City area, where the proposed works will take place.

2.1.2 Site Access

The proposed development site is accessed via several routes along the length of the works. Various local roads provide most of the direct site access, while the N27 national road runs near the eastern side of the site and the N22 national road runs near the northern side of the site. In addition, the R848 regional road runs along the eastern side of the study area, while the R610 regional road runs along the southern side of the study area, on the south bank of the river. The wider area and Cork City are served by the M8 motorway, and the N8, N40, N22, N71, N20 and N28 national roads.

2.1.3 Physical Characteristics of Site and Surrounding Lands

The proposed works area is along Morrison's Quay and Fr Matthew Quay on the northern bank of the south channel of the River Lee, as well as Union Quay, on the southern bank of the south channel, in the centre of Cork City. This area is located within the Landscape Character Area: City, Harbour and Estuary (LCA No. 19), as set out in the Draft Landscape Strategy for County Cork. The City, Harbour and Estuary LCA forms part of the general Landscape Type: City, Harbour and Estuary (Type 1). The City, Harbour and Estuary Landscape Type extends east and southeast from Cork City and in the areas surrounding Cork Harbour.

Current land-use in the area surrounding the proposed works comprises mainly residential, educational and commercial development and public car parking spaces (currently 148 No. spaces on Fr. Mathew Quay and Morrison's Quay). Continuous urban fabric occurs throughout the area.

2.2 NEED FOR THE PROPOSED DEVELOPMENT

The public realm improvement works are required to improve the visual and recreational amenity of the area around Father Mathew Quay and Morrison's Quay, and to allow the area be developed as a desirable area of Cork City. There has been an extensive history of flooding in Cork City in recorded history, with several major flood events occurring in recent years. Flooding at Morrison's Island is primarily due to high tide water levels.

The risk of tidal flooding may increase with time. The most important future change, which has the potential to affect the risk of tidal flooding is climate change, resulting in higher rainfall and rising sea levels, which would have negative consequences on flooding in the Morrison's Island area.

The proposed integrated flood defence works will reduce the financial pressure and stresses that flood risk places on individuals and companies. The Morrison's Island flood defences are an essential part of the overall flood relief scheme for the Lower Lee, and will provide flood protection to approximately 2,100 properties.

2.3 STRATEGIC PLANNING AND DEVELOPMENT CONTEXT

2.3.1 National Level

National Flood Policy

The Office of Public Works has the main responsibility for devising and implementing measures to deal with flooding. This responsibility is assigned by Government Decision S 28507 of 7 March 1995. In addition, the Arterial Drainage (Amendment) Act, 1995 enables the OPW to undertake local flood relief work schemes.

The National Flood Policy that was adopted by Government in 2004 identified OPW as the lead agency in coordinating the management of flood risk in the State. The Policy introduced a shift away from solely structural to non-structural measures to protect against flooding. The report prepared by the Flood Management Review Group decided that future Flood Management policy in Ireland would be:

> *"to minimise the national level of exposure to flood damages through the identification and management of existing, and particularly potential future, flood risks in an integrated, proactive and river basin based manner".*

It encompasses a series of measures regarding sustainable flood prevention, protection and mitigation. An implementation plan of work programmes and associated resources that would be required to put the new policy into effect was developed by OPW.

In November 2007 the EU Floods Directive (Directive on the Assessment and Management of Flood Risks - 2007/60/EC) came into effect. The existing national Flood Policy described above is in line with the Directive.

2.3.2 Regional Level

Regional Planning Guidelines for the South West 2010 – 2022

The Regional Planning Guidelines (RPGs) for the South West Region 2010 – 2022 provide a framework for long-term strategic development in the South West Region, which comprises the administrative areas of Cork County Council, Cork City Council and Kerry County Council. The RPGs aim to ensure the successful implementation of the National Spatial Strategy at regional, county and local level. A key aspect of the RPGs is to maintain a balance between protecting and enhancing the environment and sustainable economic development of the South West Region. Flood protection is identified in Chapter 1 of the guidelines as a priority for the 2010 to 2022 period. Flood Risk Management is highlighted as an important issue for the region.

Cork City Development Plan 2015 - 2021

The Cork County Development Plan 2015 - 2021 sets out the overall strategy for the proper planning and sustainable development of the administrative area of Cork City Council. It recognises that rivers within the city are an important asset to the city with many functions including provision of habitats, public amenity, drainage and flood water storage. One of the strategic goals identified in the plan is to "*Tackle climate change through reducing*

energy usage, reducing emissions, adapt to climate change and mitigate against flood risk". Open spaces within the city are noted as playing a large role in flood risk management. Chapter 12 of the Plan deals with the issues of Environmental Infrastructure and Management and also contains a subsection on Flood Risk Management. One of the key needs in terms of surface water drainage identified in the plan is the construction of a major flood relief scheme on the Lower Lee. It is noted that the responsibility for these schemes rests with the Office of Public Works (OPW). The specific Objectives of the Cork City Council Planning Authority with regards to flooding include:

12.1 (i) Restrict landuse or require appropriate design as necessary to reduce risk of hazard, including those arising from flooding and controlled substances in industrial processes

12.13. Cork City Council shall have regard to the recommendations of the Draft Lee Catchment Flood Risk Assessment and Management Plan and shall incorporate the updated hydraulic modelling, mapping data and recommendations of South West CFRMP / Lee CRFMP (River Catchment Framework Management Plan) and the Lower Lee Flood Relief Scheme as each plan progresses.

12.14. Cork City Council will implement The Planning System and Flood Risk Management: Guidelines for Planning Authorities, 2009 in the preparation of land-use plans and determining planning applications.

12.15. To restrict development in identified flood risk areas, in particular, floodplains, except where the applicant satisfies the Justification Test as outlined in The Planning System and Flood Risk Management: Guidelines for Planning Authorities 2009.

12.16. To protect, enhance and manage the City's floodplains, wetlands and coastal habitat areas that are subject to flooding as vital 'green infrastructure' which provides space for storage and conveyance of floodwater, enabling flood risk to be more effectively managed and reduce the need to provide flood defence infrastructures.

12.17. All significant developments impacting on flood risk areas will be required to provide a Flood Impact Assessment to accompany the planning application to identify potential loss of floodplain storage and proposals for the storage or attenuation (e.g. SUDS) of run-off discharges (including foul drains) to ensure development does not increase the flood risk in the relevant catchment.

The Father Mathew Quay and Morrison's Quay areas are within an area mapped as a city-centre commercial core area in the Cork City Development Plan 2015-2021 land-use map. A strategic pedestrian link runs along the entire length of the quay in this area, highlighting the importance of the area for foot traffic. This compounds the current poor state of the public realm facilities in the area. The proposed improvement in the facilities in the Father Mathew Quay and Morrison's Quay areas will offer a much-improved experience for users of those areas. The specific Objectives of the Cork City Council Planning Authority with regards to waterfront amenity areas include:

13.14. To create Waterfront Amenity Areas to provide accessible public space along the river for pedestrians and cyclists. There is a general presumption against development encroaching within 10 metres of the existing quayside apart from:

- Small-scale development within the space, which relates to the use of the river or quayside space and can ensure an adequate amenity space to facilitate passive recreation, walking and cycling; or
- In confined sites provision of a reduced setback supplemented by a boardwalk may be an acceptable alternative.

13.15 Priority Public Realm Improvement Projects: (c) Waterfront amenity route on Northside of South Channel.

2.4 SCHEME DESIGN PROCESS

The design process comprised a number of steps involving co-ordination of project architectural, engineering and environmental teams. For the public realm improvements, the project design process involved a collaborative effort between several bodies including the project engineers, landscape architects, Cork City Council and the OPW, so that the proposed design could improve the experience of all users of the Morrison's Island area.

As part of the design process for the flood relief works which are incorporated into the proposed development, a number of steps were completed at the outset of the wider Lower Lee (Cork City) Drainage Scheme (which included the Morrison's Island Study Area) to identify the key environmental issues, and allow a better project design. These steps included a constraints study, hydrology study and hydrological modelling, preliminary site investigation, flood risk assessments, completion of an options report and selection of the preferred option, appropriate assessment screening, cost benefit analysis, and environmental assessment. Many of these documents are available to access online at http://www.lowerleefrs.ie.

2.5 CONSIDERATION OF ALTERNATIVES

2.5.1 Options Report

This section of the ER contains a description of the alternatives that were considered for the proposed works, in terms of flood alleviation works design and location of the works.

The consideration of alternatives is an effective means of avoiding environmental impacts. It is important to acknowledge however the existence of difficulties and limitations when considering alternatives. These include hierarchy, non-environmental factors and site-specific issues, as described below.

A copy of the Flood Risk Management Options Report is available to download on www.lowerleefrs.ie. There follows a summary of the information regarding alternatives considered as part of the options assessment.

The possible flood risk management (FRM) methods were initially screened to identify those that would be applicable and viable considering the risks to society, the environment, cultural heritage and the economy and the objectives of the flood risk management plan for the project. The potentially viable options were developed so that they could be evaluated in more detail. This involved hydraulic modelling of options where flood levels and extents had to be considered. The options were assessed against the flood risk management objectives with the use of local weightings. The preferred option was then identified following discussion with the OPW and steering group. The Morrison's Island flood Alleviation works will provide greater protection against high frequency tidal events and will raise the threshold of tidal flooding for South Mall, Oliver Plunkett Street etc., from circa 1 in 2 years to 1 in 10 years. This will increase to 1 in 200 years upon completion of the wider Lower Lee (Cork City) Drainage Scheme.

2.5.2 Public Consultation

As a result of the public consultation process for the Lower Lee (Cork City) Drainage Scheme, there were a number of submissions made suggesting alternative flood defence measures. These included:

- Alternative upstream storage options
- Natural flood management measures
- Dam operation improvement

- Storage downstream of dams
- Flood Forecasting Systems
- Early Flood Warning System
- River diversions
- Dredging the river
- Flood resilience measures
- Tidal barrier

Details about the above submissions, and the detailed responses to each are given in the Exhibition Report, which is available on www.lowerleefrs.ie.

2.5.3 Possible Flood Risk Management Methods

The possible flood risk management methods which could be utilised in a flood relief scheme include:

a) Do Nothing (i.e., implement no new flood risk management measures)

b) Do Minimum (i.e. implement some small additional minimal measures to reduce the flood risk in specific problem areas without introducing a comprehensive strategy)

c) Non-Structural Measures (e.g. planning control, land use management, modified dam operation, flood forecasting and early warning system, etc.)

d) Structural Measures (e.g. washland creation, direct defences, channel modification, flow regulation, bridge/weir modification, upstream storage,pumping, tidal barrage, etc.)

The criteria used for the screening of the various options included:

- Applicability to Area
- Social
- Environmental
- Cultural
- Economic

2.6 LOWER LEE (CORK CITY) FLOOD RELIEF SCHEME CONSULTATION

The proposed Morrison's Island works are located within the study area of the wider Lower Lee (Cork City) Flood Relief Scheme. Consultation in relation to the wider scheme which incorporated the Morrison's Island area has been completed on a number of occasions at various stages in the design process. These have included broad general consultation at the Constraints Study stage and an associated Public Information Event and Questionnaire. A scoping exercise was carried out at the Constraints Study stage, where numerous local and national bodies, groups and representatives were sent scoping letters in July 2013.

2.6.1 First Public Information Day

The first public information day was initiated with a presentation to the Members of the OPW, Cork City Council and Cork County Council on the 17th of July 2013. This event was carried out to include the larger Lower Lee (Cork City) Flood Relief Scheme, which included the Morrison's Island Flood Alleviation Works. The purpose of this was to present the Study Area to the elected members, prior to the Public Information Event, and to outline the process involved in the preparation for the Morrison's Island Flood Alleviation Works.

The presentation was held in Cork City Hall, between 3.00pm and 9.00pm. Members of staff from the Office of Public Works, Cork County Council, Cork City Council, Environmental Team (Ryan Hanley and McCarthy Keville O'Sullivan) and Design Team (Arup Consulting Engineers and JBA Consulting) were available to answer questions from the members of the Council.

Advertising of the Public Consultation Event was undertaken by the Environmental Team, in the local press in the week preceding the event. This included an advert in the local publications; Cork Independent, The Corkman, The Carrigdhoun, The Cork News and The Southern Star, in addition to adverts in two national daily newspapers; The Examiner and The Evening Echo. In addition, notices were placed on the local radio in the week and weekend preceding the event. The event was also well publicised locally through distribution information on local websites and through text alerts.

Overall feedback from members of the public was that they were happy to have been involved in the Public Consultation; they felt like their views were being heard, but wanted to see action arise out of the information as soon as possible.

2.6.2 Second Public Information Day

The second Public Information Day for the Lower Lee (Cork City) Flood Relief Scheme, which includes the Morrison's Island Flood Alleviation Works, was held in Cork City Hall foyer in Bandon on Tuesday 29 July 2014. The purpose of this second Public Information Day was to provide information to the local community on the emerging preferred flood relief scheme which comprises a combination of dredging and defences.

The event was opened to the public from 3pm to 9pm. A total of 181 attendees signed the attendance book at the event in Cork City Hall. In advance of this event, a briefing was held for the City and County Councillors on Monday 28th July 2014 at 3.30pm.

At the Public Information Day on the 29th, information was displayed and available describing the process to date, the various options assessed, a preliminary impact assessment, summaries of surveys undertaken and drawings showing the emerging preferred flood relief scheme.

The majority of people that attended the Public Information Day reacted positively to the proposals presented on the day and felt that the proposals are appropriate for the area.

2.6.3 Public Exhibition and Open Days

The statutory public exhibition for the Lower Lee (Cork City) Drainage Scheme (Flood Relief Scheme) was held between 12 December 2016 and 20 January 2017. A series of schedules, drawings and plans were displayed at the following venues for the statutory public exhibition, which was extended from the normal four week duration to account for the Christmas holiday period:

- The Foyer, City Hall, Anglesea Street, Cork
- The Foyer, County Hall, Carrigrohane Road, Cork
- Public Library, Ballincollig, Co Cork

- Central Library, Grand Parade, Cork

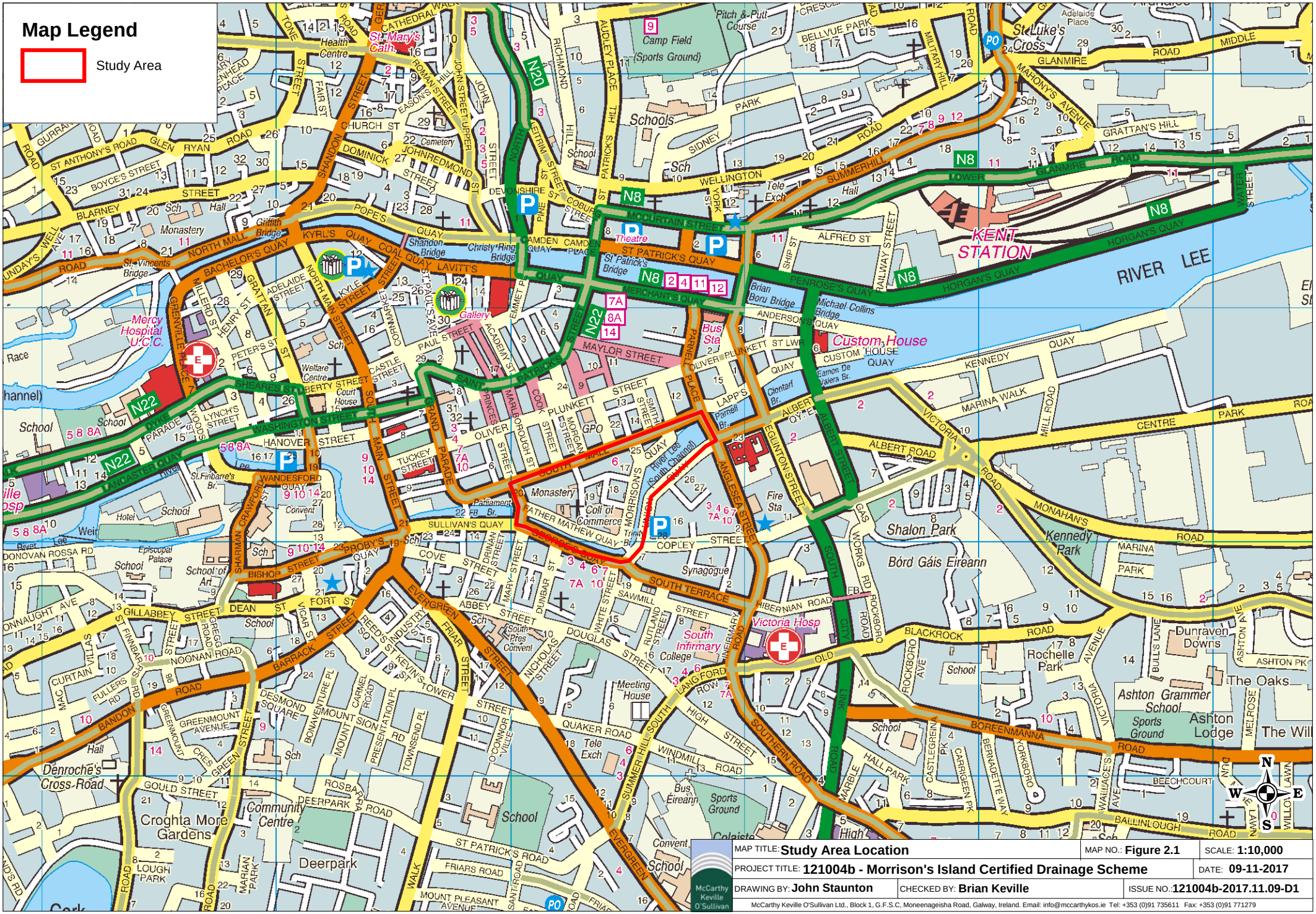
An interactive display was made available at the public exhibition in both City and County Hall. This received very positive feedback from the public as being a useful tool to better understand the scheme and the proposals. The Exhibition was advertised to the public in advance through a variety of media including local and national newspapers, local radio, and social media. A series of four open days were also held in the Millennium Hall, Cork City Hall, Cork City to enable members of the public, including persons who had received notices, to discuss issues or raise questions with representatives of the Office of Public Works (OPW) and the engineering design and environmental teams. Members of the public who attended these open days were encouraged to write to the OPW with their comments and observations on the scheme. The open days were held on the following dates:

- Monday 12 December 2016
- Tuesday 13 December 2016
- Tuesday 20 December 2016
- Thursday 19 January 2017

The deadline for submissions on the proposed scheme was extended from 17 February to 7 April 2017 to allow further time for the public to provide feedback. A total of 185 people attended the public exhibition open days over the course of the four days. The majority of attendees in the early sessions were landowners who had received interference notices in relation to the scheme, and who had questions in relation to their specific lands/properties. In general, the feedback received in relation to the scheme as a whole was predominately positive. A total of 1,162 submissions were received during the public exhibition period. These are summarised in the Exhibition Report, available on the project website (http://www.lowerleefrs.ie/).

Landowner and stakeholder consultation has been undertaken throughout all stages of the scheme development, to ensure that those who are directly impacted by the project remain informed and are provided with the opportunity to provide feedback. The consultations included site meetings, correspondence, public presentations and community meetings.

Presentations and engagement with various representative groups including Cork Chamber, Cork Business Association, Cork Public Participation Network etc. allowed for in-depth discussion on the proposed scheme. Design workshops were also undertaken with major stakeholders such as Cork City Council to ensure that the progressed design was in keeping with the future objectives for the city. A number of presentations were made to elected representatives of both Cork City Council and Cork County Council at critical stages of the projects. A presentation was also made in Leinster House to interested Members of both houses of the Oirechtas.



MAP TITLE: **Study Area Aerial**		MAP NO.: **Figure 2.2**	SCALE: **1:2,500**
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3 DESCRIPTION OF THE PROPOSED DEVELOPMENT

Morrison's Island Public Realm improvements works comprise of a combination of flood walls, regrading of road and pavement sections, creation of civic amenity space and other minor works. The Morrisons Island Flood Alleviation Works will provide greater protection against high frequency tidal events and will raise the threshold of tidal flooding for South Mall, Oliver Plunket Street etc from cira 1 in 2 years to 1 in 10 years.

The Morrison's Island Public Realm project will provide greater protection against high frequency tidal events and will raise the threshold of flooding for South Mall, Oliver Plunkett Street etc. The design of the proposed works is adaptable for future climate change in accordance with Office of Public Works guidance in relation to climate change and also includes an allowance for freeboard.

The proposed works are detailed on the scheme drawings MOR-0001 to MOR-6000 and are described as follows:

3.1 PROPOSED WORKS

The key features for the Morrison's Island Flood Alleviation Works as listed in Chapter 1 will comprise the following:

3.1.1 Site Investigation

Preliminary and detailed site investigations have been carried out to inform the design process. However further targeted detailed site investigation may be required in advance of construction to inform the detailed design. Trial pits, slit trenches, boreholes, rotary cores and dynamic probes in addition to utility identification may be required.

3.1.2 Flood Defence Works

The proposed flood defence works comprise of the following:

- Significant remedial works to the existing quay walls, including cleaning, repointing and grouting;
- Construction of reinforced concrete backing wall behind existing quay walls;
- Grouting of foundation below RC backing wall;
- Provision of demountable Flood Gates at Trinity Bridge and Parnell Plaza;
- Extension (i.e. raising) of existing limestone steps to 3.5mOD.

3.1.3 Design Layout and Landscaping Works

- Changing the traffic flow system within Morrison's Island to one-way only;
- Pedestrianisation of Morrison's Quay Lower and provision of an enhanced plaza area at eastern end of Morrison's Quay;
- High quality paved pedestrian riverside walkway with a minimum width of 3m with associated landscaping;
- Existing right-angle parking along the quays will be removed and replaced with parallel parking.
- Construction of two pumping stations.

3.1.4 Regrading

It is proposed to raise existing ground levels by re-grading the roads and footpaths in order to reduce the relative height of the flood defence wall relative to the proposed ground levels on the dry side. This will increase the social amenity relationship with the river.

Such regrading is generally limited to changes in elevation of less than 1m.

3.1.5 Drainage and Pumping Stations

In the study area, surface water drainage is primarily overland and discharges to the River Lee through discrete regular outfalls through the quay walls. The construction of flood defence walls and associated ground regrading will require a new surface water drainage system to allow surface water to be discharged at all times. To ensure that pluvial flooding is not worsened on the dry side of flood defences during fluvial/tidal flooding, new 'collector' drains and pumping stations will need to be constructed to safely discharge surface water during a flood event. Pumping stations will incorporate permanent submersible pumps in underground wet wells with only control kiosks as above ground elements. The greatest impact of these pumping stations is therefore likely to be in terms of traffic and noise restrictions during construction as they will require deep excavations of up to 5m in depth. Wet wells will typically be rectangular with dimensions 3m long by 3.5m in width. Two No. pumping stations are proposed for Morrison's Island at Fr. Mathews Quay near Trinity Bridge and on the west side of the plaza. The sites of pumping stations have been chosen to minimise disruption during construction and to provide access locations for maintenance that will require minimum future traffic management. See MOR-6000for Pumping Station Locations.

3.1.6 Services/Utility Diversions.

It will be necessary to locate, uphold or divert numerous existing services/utilities. The full extent of such work cannot be known until detailed design stage, but every effort will be made to minimise the impact to existing services and the need for any diversions or outages.

3.1.7 Landscaping - Streetscape

The proposed works includes the provision of high quality street furniture, lighting and tree planting/soft landscaping. See Appendix MOR-1000 to MOR-1004 and MOR-5006 for further details. The following tree planting/soft landscaping works will be provided:

- Liquid Amber trees proposed at Plaza along south Mall.
- *Betula ermanii* trees proposed at the Plaza end of Morrisons Quay.
- *Platanus x hispanica* tree proposed at the at the church adjacent to Trinity bridge.
- *Crataegus prunifolia* small trees proposed for use in the plaza planters.

3.2 ANTICIPATED CONSTRUCTION METHODS

3.2.1 Pre-Construction Works

The construction works have been preceded by geotechnical investigations. It is anticipated that a small amount of additional geotechnical works may be required which will consist of a mixture of shell and augur boreholes, cable percussive boreholes, rotary drilled boreholes, trial pits and slit trenches at the locations of the proposed structures. In addition, it is proposed that archaeological investigation works including testing and any follow-on resolution works will be undertaken prior to the main works contract commencing on site.

Pre-construction works will also include certain diversion works of services and utilities, including electricity, gas, telecommunications, watermains and other sanitary services. Due to the nature of some of the diversions a number of these service diversions will only be possible during the main construction works.

3.2.2 Main Construction Works

The main construction will involve the excavation and placement of material for the construction of walls, pump stations and as well as the haulage of material and importation of materials to complete the flood scheme. Material will be required for the following:

- Structures – the construction of /flood walls and parapets, quay wall remedial works
- The diversion and construction of utilities and services.
- Road works – sub base and base construction, bituminous pavement surfacing
- Ancillary reinstatement roadworks including the installation of public lighting, signage and road marking.
- Piling works

3.2.2.1 Quay Wall Remedial Works

The remediation of existing quay flood defence walls is likely to be carried out by traditional methods comprising the following activities:

- Isolation of works area, including traffic management;
- Scaffolding and temporary propping to be erected on the wet site of the quay wall as required. Where scaffolding is installed, it will typically stand on the river bed (assuming that adequate bearing is available). It will be restrained laterally by temporary anchors into the quay wall where possible, and/or temporary anchor blocks sitting on the quay.
- Construction to commence with excavation of existing backfill material for foundations. Construction of the new reinforced concrete backing wall is to be carried out in short lengths (circa 5m).
- Blinding of formation, Fixing of reinforcement, placing of formwork, placing of concrete, and stripping of formwork.
- Addition of security fencing if required.
- Concrete backing wall to be poured in short lifts to minimise pressure on the existing quay wall.
- Proposed new quay wall back drainage to be installed. Backfill to top of existing quay wall.
- Face of all joints to be raked out, cleaned and repointed by hand. Face of existing quay to be thoroughly cleaned with high pressure water jetting with all dirt and marine growth to be completely removed.
- Grouting of foundation zone and existing quay wall to begin. The wall is to be gravity grouted initially, through holes drilled c/c 2m down through the centre of the wall.
- When the wall gravity grouting has set, the wall and foundation zone to be pressure grouted holes drilled c/c 1m through the body of the wall, down into the foundation zone. Galvanised Reinforcement stitching bars to be installed and grouted into cored hole.
- Reinstatement of works area.

Works to the Quay walls may result in the removed of some of the existing timber fenders. It is the intention to retain as many of the existing timber fender piles as possible. However, it should be noted:

- At Trinity Bridge and Parnell Plaza, a limited number of fenders will need to be removed due to clashes with the proposed structures. These fenders are identified on the Planning Drawings.

- It is further noted that the remainder of the existing fenders are generally in very poor condition, with many in state of partial collapse. To ensure that that proposed remedial works to the face of the existing quay wall can proceed without undue risk to health and safety, the condition of the fenders will be further assessed during the detailed design stage and any element which are deemed to be at high risk of collapse will be identified for removal.

3.2.2.2 Flood Defence Walls Construction

The construction of the reinforced concrete flood defence walls is likely to be carried out by traditional methods comprising the following activities:

- Remove existing railings and parapet walls.
- Dowel connections to be drilled in to RC backing wall to ensure connection of Flood wall to backing wall.
- Tie back rebar to be fixed.
- Shuttering for base of L-Wall to be fixed.
- Base of L-Wall poured.
- Upstand of L-wall poured.
- Granite Columns to be erected.

The plan area/ extent of in stream work is indicated on the working areas shown on the scheme drawings.

3.2.2.3 Pumping Stations

The footprint of the pumping station is set out. The excavation will take place to the required depth. Sheet piling will likely be required in order to facilitate construction of deep excavations. Excavated material unsuitable for use as backfill material will be disposed of to an approved waste management facility. Lean mix concrete blinding will be placed, followed by formwork and steel fixing. Once concrete has been poured and has cured, the formwork will be stripped and the area outside the pumping station will be backfilled. Excavations in paved areas will be backfilled with granular material and reinstated as proposed. Mechanical and electrical fit out of pumping stations will take place following backfilling.

3.2.2.4 Drainage Works

The drains/ surface water sewers will be constructed by one of two methods as follows:

- Where the trench does not overlap with the footprint of the excavation for the flood wall, the trench of the drainage pipe will be set out. All existing road and footpaths will be excavated before works in a given area begins. The trench will then be excavated to the required depth. Excavated material unsuitable for use as backfill material will be disposed of to an approved waste management facility. Pipe bedding will be placed, followed by the pipe and granular pipe surround. Trenches in roads will be backfilled with granular material or lean mix concrete, depending on its location in accordance with the Guidelines for Managing Openings in Public Roads.
- Where the trench overlaps with the footprint of the excavation for the flood wall, the steps outlined above will be taken. The order of excavation, pipelaying, backfilling and reinstatement will depend on the sequence of construction of the retaining wall and the proximity of the proposed retaining wall to the pipe trench. The pipe may be laid and partially backfilling prior to pouring of concrete for the wall. Pipelaying may alternatively take place following pouring of the base of the wall or following construction of the wall.

3.2.2.5 In River Works at Parnell Plaza and Trinity Bridge

As part of the works required to Trinity Bridge, the Union Quay Boardwalk and Parnell Plaza, instream support works are required. The piling works consist of the supply and installation of approximately 17 no. piles into the river bed. Piling and column construction will be carried out in two stages.

- Stage 1 Steel tubular piles will be installed in the river channel (possibly from a barge)
- Stage 2 Steel columns will be fixed to the piles (possibly by setting in a cement grout).

3.2.2.6 Layout/Finishes

The following landscaping works are proposed:

- Place new surface drainage channel with gullies;
- Road surface to be laid;
- General finishes to structures, junctions, traffic lights, signage, road markings, bike share station etc.;
- Installation of stainless steel railing and cable system;
- Road opened to full traffic.

3.3 CONSTRUCTION PROGRAMME AND SEQUENCING OF PROPOSED WORKS

The construction works will be preceded by a small number of geotechnical and archaeological investigations as necessary. The construction works themselves will be subject to the following programme constraints:

- To avoid impacting on bird nesting sites, the vegetation removal within the defined working area will not be carried out during the peak bird nesting season of March to August (inclusive) prior to the onset of works.
- Christmas non-working time is from the beginning of the second week of December to the end of the second week of January.

It is proposed to undertake the work in three phases as follows:

- Phase 1 – 2.5 months (Father Matthews Quay)
- Phase 2 – 4.0 months (Morrison's Quay adjacent to Cork College of Commerce)
- Phase 3 – 5.5 months (Morrison's Quay)

3.4 CONSTRUCTION COMPOUNDS AND TEMPORARY WORKS FACILITIES

The selection of the site compound will be by the Contractor appointed to construct the works in consultation with Cork City Council. Site compounds will be bound by the mitigation measures identified within this ER in particular with regard to traffic management, ecology, archaeology and noise and air mitigation measures.

3.5 ESTIMATED COST OF PROPOSED WORKS

The estimated cost of the Morrison's Island Flood Alleviation Works is circa €6.4 M, excluding VAT, and Non-Contract Costs.

4. HUMAN BEINGS, POPULATION & HUMAN HEALTH

4.1 INTRODUCTION

This section of the Environmental Report (ER) describes the potential impacts of the proposed development on human beings, population and human health.

One of the principle concerns in the development process is that people, as individuals or communities, should experience no diminution in their quality of life from the direct or indirect impacts arising from the construction and operation of a development. Ultimately, all the impacts of a development impinge on human beings, directly and indirectly, positively and negatively. The key issues examined in this section of the ER include population, employment and economic activity, land-use, residential amenity, community facilities and services, tourism, and health and safety.

Reference is also made, in this ER Section, to nuisance impacts on human beings that are dealt with in other sections of this ER such as flooding from Section 7 - Hydrology and Hydrogeology; dust and noise from Section 8 - Air and Climate, Noise and Vibration; and traffic from Section 11 - Material Assets.

4.2 RECEIVING ENVIRONMENT

Methodology

The following sources of information and literature pertinent to the area were used in the preparation of this section:

- Central Statistics Office (CSO),
- Cork City Development Plan 2015 – 2021,
- Fáilte Ireland
- Local club/group websites

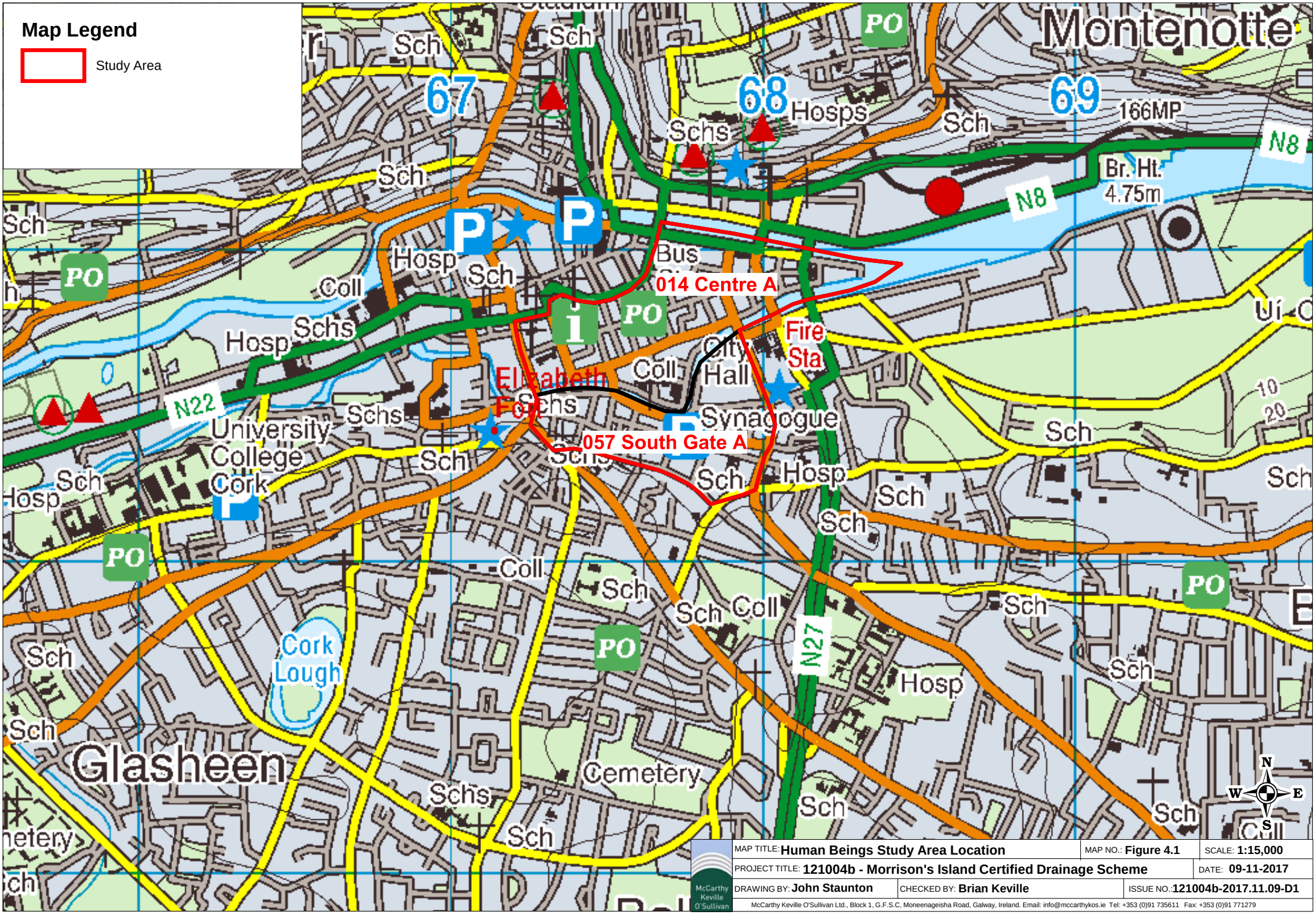
The study included an examination of the population and employment characteristics of the area. This information was sourced from the most recent census, the Census of Ireland 2016, the Census of Agriculture 2010 and from the CSO website, www.cso.ie. Census information is divided into State, Provincial, County, Major Town and District Electoral Division (DED) level.

4.3 HUMAN BEINGS IN THE EXISTING ENVIRONMENT

Study Area

Definition of Study Area

In order to make inferences about the population and other statistics in the vicinity of the proposed development site, the Study Area for the Human Beings section of the ER was defined in terms of the relevant District Electoral Divisions (DEDs). The Study Area for the ER lies within several DEDs, as shown in Figure 4.1. It has been decided to define the Study Area for the Human Beings Section of this ER as the Cork City South Central and South Gate A DED in which the ER Study Area is located. The Study Area has a combined population of 3,031 persons, and comprises of a total land area of 0.54 square kilometers. (Source: CSO Census of the Population 2011).



MAP TITLE: **Human Beings Study Area Location**		MAP NO.: **Figure 4.1**	SCALE: **1:15,000**
PROJECT TITLE: **121004b - Morrison's Island Certified Drainage Scheme**			DATE: **09-11-2017**
DRAWING BY: **John Staunton**	CHECKED BY: **Brian Keville**		ISSUE NO.: **121004b-2017.11.09-D1**

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Settlements and Planning Policy

The Study Area is within the environs of Cork City centre. The N22 and N27 National Primary Roads run through the city centre near the site.

In the period 2011 – 2016 the Cork City Electoral Area population increased from 119,230 to 125,657; an increase of 5.4%. In the same period, the Morrisons Island area (Centre A and South Gate A DEDs), experienced positive population growth of 6.7% (from 2,840 to 3,031 persons).

Overall, the Cork Area Strategic Plan Update (2006 to 2020) proposes an increase in the population of Cork City of 25% (to 150,000 persons) by 2020 from the 2006 population of 119,418.

Population

Population Trends

In the years between the 2011 and 2016 Censes, the population of Ireland increased by 3.8%. Between 2011 and 2016, the population of County Cork grew by 4.4% to 417,211 persons while Cork City increased 5.4% to 125,657. Other population statistics for the State, Cork and the Study Area have been obtained from the Central Statistics Office (CSO) and are presented in Table 4.1.

Table 4.1 Population 2011 – 2016 (Source: CSO)

Area	Population		% Population Change
	2011	2016	2011-2016
State	4,588,252	4,761,865	3.8%
County Cork	399,802	417,211	4.4%
Cork City	119,230	125,657	5.4%
Study Area	2,840	3,031	6.7%

The data presented in Table 4.1 shows that the population of the Study Area increased by 6.7% between 2011 and 2016. This rate of population growth is higher than that recorded at State and County level during the same period. When the population data is examined in closer detail, it shows that the rate of population increase within the Study Area has been unevenly spread through the District Electoral Divisions (DEDs). The highest rate of population increase between 2011 and 2016 occurred within South Gate A DED, which experienced a 8.0% population increase, while Centre A DED increased by only 3.7% during the same time period.

The population densities recorded within the State, County Cork and the Study Area during the 2016 Census are shown in Table 4.2.

Table 4.2 Population Density in 2016 (Source: CSO)

Area	Population Density (Persons per square kilometre)
State	69.6
County Cork	57.1
Cork City	3244.4
Study Area	5,259.3

The population density of the Study Area recorded during the 2016 Census was 5,259.3 persons per square kilometre. This figure is significantly higher than the national, county and city population densities listed in Table 4.2.

Similar to the trends observed in population, the population density recorded across the Study Area varies between DEDs. Centre A DED has the lowest population density, at 2,630 persons per square kilometre, while South Gate A DED has the highest population density, at 10,300 persons per square kilometre.

Household Statistics

The number of households and average household size recorded within the State, County Cork and the Study Area during the 2011 and 2016 Censuses are shown in Table 4.3.

Table 4.3 Number of Households and Average Household Size 2011 - 2016 (Source: CSO)

Area	2011		2016	
	No. of House-holds	Avg. Size (persons)	No. of House-holds	Avg. Size (persons)
State	1,654,208	2.8	1,697,665	2.8
County Cork	172,042	2.32	158,090	2.64
Cork City	55,633	2.14	51,468	2.44
Study Area	1,316	2.5	1,414	2.5

In general, the figures in Table 4.3 show that while the number of households at State, County, City and Study Area level has increased, the average number of people per household has remained steady at state level and increased slightly at other levels, i.e. there are more households and slightly more people per house. Average household size recorded within the Study Area during the 2011 and 2016 Censuses is in line with that observed at State, County and City level during the same time period.

Age Structure

Table 4.4 presents the percentages of the State, County Cork and Study Area population within different age groups as defined by the Central Statistics Office during the 2016 Census.

Table 4.4 Population per Age Category in 2016 (Source: CSO)

Area	Age Category				
	0 - 14	15 – 24	25 - 44	45 - 64	65 +
State	21.1%	12.1%	29.5%	23.8%	13.4%
County Cork	22.9%	11.2%	28.4%	24.6%	13.0%
Cork City	14.3%	16.4%	31.3%	22.3%	15.7%
Study Area	6.5%	18.5%	56.3%	13.7%	5.0%

The proportion of the Study Area population within each age category is quite different to those recorded at national, County and City level. The most significant difference occurs where 56.3% of the population within the study area falls into the 25-44 age category, this may indicate the movement of this age group into the area for employment. Within the Study Area, the lowest population percentage occurs within the 65+ age category.

Employment and Economic Activity

Sources of Employment

The Morrison's Island area is located in the centre of Cork City, which is the second largest city in the state, and is the designated gateway city of the south-west region. This location within an employment centre therefore influences the employment opportunities available to inhabitants of Morrison's Island and surrounding areas. The primary types of employment provided in the study area are service and office based employment.

Proposed Employment

It is estimated that the proposed Morrison's Island Public Realm and Flood Defence Works will provide employment during the construction phase, which is expected to be approximately 12 months in duration and split over three sequential construction phases as described in Section 3.3 of this ER. It is likely that at least some prospective employees will be sourced from the local area, therefore benefitting the local economy and skill base to some extent. There will also be indirect employment during the construction phase of the proposed development such as hauliers and waste contractors among others.

Economic Status of the Study Area

The labour force consists of those who are able to work, i.e. those who are aged 15+, out of full-time education and not performing duties that prevent them from working. In 2016, there were 2,304,037 persons in the labor force in Ireland. Table 4.5 shows the percentage of the total population aged 15+ who were in the labor force during the 2016 Census. This figure is further broken down into the percentages that were at work, seeking first time employment or unemployed. It also shows the percentage of the total population aged 15+ who were not in the labor force, i.e. those who were students, retired, unable to work or performing home duties.

Table 4.5 Economic Status of the Total Population Aged 15+ in 2016 (Source: CSO)

	Status	State	County Cork	Cork City	Study Area
% of population aged 15+ who are in the labor force		61.4%	61.6%	65.1%	72.4%
% of which are:	At work	87.1%	90.8%	85.0%	86.4%
	First time job seeker	1.4%	9.9%	1.5%	1.5%
	Unemployed	11.5%	8.3%	13.5%	12.0%
% of population aged 15+ who are not in the labour force		38.6%	38.4%	34.9%	27.6%
% of which are:	Student	29.4%	29.1%	51.3%	56.4%
	Home duties	21.1%	22.7%	23.9%	10.9%
	Retired	37.6%	36.9%	53.3%	16.8%
	Unable to work	10.9%	10.5%	21.0%	15.0%
	Other	1.0%	0.8%	1.8%	1.0%

Overall, the principal economic status of those living in the Study Area is different to that recorded at national, County and City level. The main difference is the 16.8% in the 'Retired' category. This is in line with the low population percentage found within the 65+ age group.

Employment by Socio-Economic Group

Socio-economic grouping divides the population into categories depending on the level of skill or educational attainment required. Figure 4.2 shows the percentages of those employed in each socio-economic group in the State, County Cork, Cork City and the Study Area during 2016.

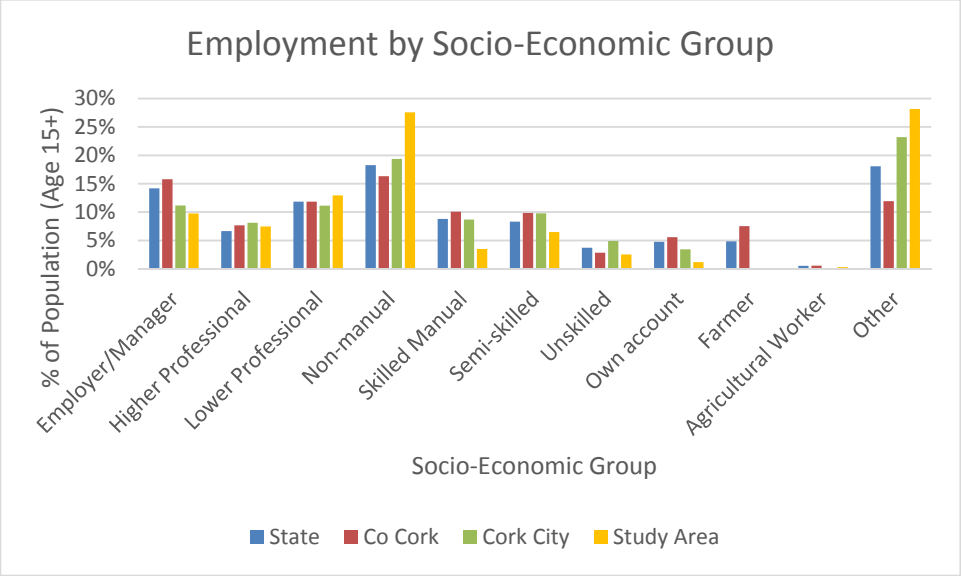


Figure 4.2 Employment by Socio-Economic Group in 2016 (Source: CSO)

The highest level of employment within the Study Area was recorded in the Other category (28.2%). After Other, the next highest levels of employment within the Study Area are in the Non-manual and Lower Professional categories. The categories in which the lowest percentage of the Study Area population was recorded are Farmer (0.0% of the Study Area population) and Agricultural Worker (0.3% of Study Area population).

The CSO figures for socio-economic grouping have a limitation of including the entire population, rather than just those who are in the labour force. It is likely that this is what gives rise to the high proportion of the population shown to be in the "Other" category in Figure 4.2.

Land-use

The study area of the proposed development is located in an urban area, in Cork city centre. There are no agricultural land uses in the area. Land-use in the area is primarily associated with commercial, residential, educational, transport & car parking and recreational activities.

Services

There are several National Schools located near the proposed development works site including three located approximately 250 metres to the west, southwest and southeast. The nearest secondary schools are located approximately 250 metres to the west and southeast of the proposed development site. Cork College of Commerce is located adjacent to the site of the proposed works along Morrison's Quay, and CIT Cork School of Music is located on union Quay near the proposed development.

The proposed development site is accessed via the R848 Regional Road and local roads. The N22 and N27 National Roads pass to the north and east of the proposed development site. There are several other national roads within a ten-kilometre radius of the site, including the N20, N71, N28, N40, N8 and the M8 Motorway. These generally run from the city centre outwards, with all but the N8 and M8 being on the southern side of the city.

The site of the proposed development is served by public transport. The nearest train station to the proposed development site is Kent Station, located in Cork City Centre, located approximately 0.9 kilometres northeast of the site. Local city bus services operate through the city, including the Morrison's Island area. From the main bus station, located approximately 300 metres north of the site, there are Bus Eireann connections to a significant number of destinations including Dublin, Limerick and Waterford. Cork Airport is located approximately 5.3 kilometres south of the proposed development site.

There are numerous amenities and community facilities, including sports clubs, youth clubs and recreational areas available within a short distance of the Morrison's Island area and throughout the wider Cork City.

Retail and personal services within the vicinity are provided in Cork City Centre. There are a large number of retail and commercial units. The Morrison's Island area also enjoys some community facilities in the form of public houses, community centres, shops, and places of worship.

4.4 TOURISM

Tourist Numbers and Revenue

Tourism is one of the major contributors to the national economy and is a significant source of full time and seasonal employment. During 2016, total tourism revenue generated in Ireland was €8.4 billion, an increase

of approximately 9.2% from the previous year. Overseas tourist visits to Ireland in 2016 grew modestly by 8.8% to 8.7 million. ('Tourism Facts 2016', Fáilte Ireland, August 2017)

Ireland is divided into seven tourism regions. Table 4.7 shows the total revenue and breakdown of overseas and domestic tourist numbers to each region in Ireland during 2015. ('Regional Tourism Performance in 2015', Fáilte Ireland, October 2016)

Table 4.7 Preliminary Overseas Tourists Revenue and Numbers 2015 (Source: Fáilte Ireland)

Region	Total Revenue (€m)	Total Number of Overseas Tourists (000s)
Dublin	€1,726 m	4,937
East & Midlands	€324 m	922
South-East	€259 m	876
South-West	€792 m	2,104
Shannon	€367 m	1,148
West	€575 m	1,590
North-West	€224 m	694

The South-West region, in which the site of the proposed development is located, comprises County Cork and County Kerry. This Region benefited from approximately 17% of the total number of overseas tourists to the country and approximately 19% of the total tourism income generated in Ireland in 2015. Table 4.8 shows the breakdown of overseas tourist numbers to the South West Region during 2015 and the associated revenue generated. The regional data shows that County Cork had the highest tourism revenue and the highest number of overseas tourists within the Region during 2015.

Table 4.8 Overseas Tourism to South-West Region during 2015 (Source: Fáilte Ireland)

County	Revenue Generated by Overseas Tourists (€m)	No. of Overseas Tourists (000s)
Cork	558	1,449
Kerry	234	1,026

Figure 4.3 provides Fáilte Ireland figures showing the type of activities that domestic tourists engaged in during 2015 throughout Ireland. From these figures it can be seen that hiking/hillwalking visits form the majority of all activities enjoyed followed by visits to houses and castles. Activities with the least interest include angling and attending horse racing.

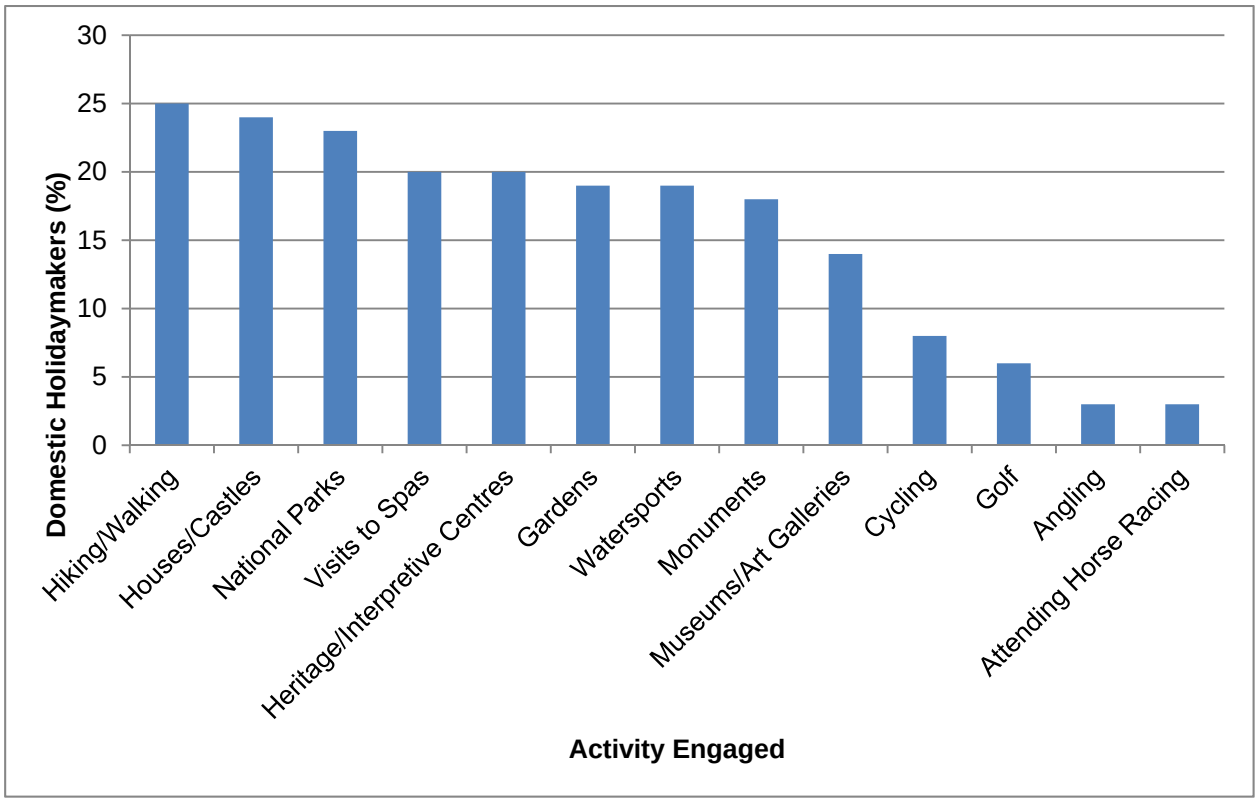


Figure 4.3 Activities undertaken by domestic visitors in Ireland in 2015 (Source: Fáilte Ireland)

Tourist Attractions

The nearest tourist information centre to the proposed development site is located approximately 250 metres northwest of the site. Tourist attractions near the Morrisons Island area include Cork City hall, English Market, Cork City Library, and Bishop Lucey Park, along with many more listed on the Discover Ireland website within Cork City centre area. Within the greater area of Cork City golf, horse riding, cycling and angling are available.

The most recent report on Angling tourism in Ireland found that €121 million was spent by the 150,000 angling visitors to the country in 2012. Sections of the River Lee further upstream of Cork City are used for angling.

4.5 HUMAN HEALTH AND SAFETY

There has been an extensive history of flooding in the Morrison's Island area of Cork City in recent years. Flooding poses a risk to human health and safety. The OPW document 'The Planning System and Flood Risk Management: Guidelines for Planning Authorities' (OPW, 2009) states that flooding can cause physical injury, illness and loss of life. Deep, fast flowing or rapidly rising flood waters can be particularly dangerous, with increased risk if the floodwater is carrying debris. Some of these impacts may be immediate, the most significant being drowning or physical injury due to being swept away by floods. Floodwater contaminated by sewage or other pollutants (e.g. chemicals stored in garages or commercial properties) can potentially cause illness, either directly as a result of contact with the polluted floodwater or indirectly as a result of sediments left behind. Flood water may also hide other hazards for wading pedestrians, such as manhole openings where the covers have been lifted by flood flows.

The impact on people and communities as a result of the stress and trauma of being flooded, or even of being under the threat of flooding, can be immense. Long-term impacts can arise due to chronic illnesses and the stress associated with being flooded and the lengthy recovery process. The ability of people to respond and recover from a flood can vary. Vulnerable people, such as those who are old, disabled or have a long-term illness, are less able to cope with floods than others. Some people may have difficulty in replacing household items damaged in a flood and may lack the financial means to recover and maintain acceptable living conditions after a flood.

Construction of the proposed development will necessitate the presence of a construction site. Construction sites and the machinery used on them pose a potential health and safety hazard to construction workers if site rules are not properly implemented.

4.6 LIKELY AND SIGNIFICANT IMPACTS AND ASSOCIATED MITIGATION MEASURES

This section deals with the impacts of the proposed development on the Study Area with regard to population, employment and economic activity, land use, services and tourism. As well as these the human health and safety, dust, noise and traffic impacts will be dealt with. Noise and traffic impacts will be dealt with in more detail in Sections 8 and 11 respectively.

'Do-Nothing' Scenario

If the proposed development were not to proceed, the existing area along the Father Mathew Quay and Morrison's Quay would remain as it is, resulting in many of the same potential impacts on human beings as have occurred previously.

There would also be potential for impact on:

- Residential and commercial properties
- Potential public health risk
- Pedestrian walkways
- Roads and Transportation Network
- Wastewater Collection Network
- Surface Water Collection Network
- Water Distribution Network
- Bord Gáis Distribution Network
- Electricity Network
- Telecommunications Network

If the proposed development were not to proceed, the opportunity to protect the Morrison's Island area in Cork City centre from future flooding events would be lost, as would the opportunity to create employment during the construction phase and improve the existing public realm spaces.

Construction Phase

Employment, Economic and Investment Impacts

Potential Impacts

The construction cost of the project will be in the region of €6.4 million. The construction phase of the proposed development will last approximately 12 months. Many construction workers and materials will be sourced locally, thereby helping to sustain employment in the construction trade. This will have a **short-term significant positive impact.**

The injection of money in the form of salaries and wages to those employed during the construction phase of the proposed project has the potential to result in an increase in household spending and demand for goods and services in the local area. This would result in local retailers and businesses experiencing a short-term positive impact on their cash flow. **This will have a short-term slight positive indirect impact.**

The proposed development will result in an influx of skilled people into the area, bringing specialist skills for both the construction and operational phases that could result in the transfer of these skills into the local workforce, thereby having a long-term positive impact on the local skills base. Up-skilling and training of local staff in the particular requirements of flood relief and drainage works is likely to lead to additional opportunities for those staff as additional river drainage schemes are implemented in Ireland. **This will have a long-term moderate positive indirect impact.**

There is also the potential for short term disruption to economic activity due to the proposed construction activities. This would predominantly be as a result of traffic and access issues which could have the potential to reduce footfall into local businesses, with noise and dust from the works adding to this impact on local businesses. **This will have a short-term moderate negative indirect impact.**

Mitigation Measures

A traffic management plan (such as rolling traffic management) will be prepared and implemented for the duration of the works in order to ensure that any impacts on traffic mobility are minimised. This will also result in a minimised potential impact on local businesses, as traffic management will only implement restrictions to local businesses only when necessary and only for the shortest possible time. In addition, works will be limited to normal working hours, and will account for peak business periods, such as the Christmas shopping period. For this period, it is recommended that works would be paused from the beginning of the second week in December until the end of the first week in January. An Environmental Management Plan will be implemented during the construction phase to ensure that environmental nuisances relating to the works are minimised. This will include measures to avoid and reduce noise and dust.

Residual Impacts

The residual impacts will be short term and slight. The implementation of a Traffic Management Plan and Environmental Management Plan to reduce traffic and environmental nuisance impacts on the receiving environment during the construction phase will minimise the impact on local businesses. By ensuring that works account for busy periods for local businesses (e.g. Christmas), the impact on times of peak economic turnover will be greatly minimised.

Population

Those working on the construction phase of the proposed development will travel daily to the site from the wider area. The construction phase will have no impact on the population of the Study Area in terms of

changes to population trends or density, household size or age structure. **There will be no impact on population.**

Tourism

Potential Impacts

The proposed works will have little impact on the tourism industry in Morrison's Island and the wider Cork City Centre Angling does not form a significant part of the industry in the area of the proposed works. Angling in areas upstream of Cork City and elsewhere in the catchment will not be affected by the proposed works and thus the impact is considered to be **imperceptible**. Potential increases in noise and dust levels, traffic issues and temporary impacts on visual amenity related to the works are likely to deter and/or disturb visitors during the construction phase. **There could be a potential short-term slight negative impact on tourism.**

Mitigation Measures:

Works will be designed to minimise impacts upon the amenity value of the study area during the construction period. Mitigation will include measures to minimise pollution of the river, minimise impacts on fish, limit working hours and prevent un-necessary damage to aquatic and riverside habitats.

The implementation of a Traffic Management Plan and Environmental Management Plan to reduce traffic and environmental nuisance impacts on the receiving environment during the construction phase will minimise the impact on tourism.

Residual Impacts:

Upstream stretches of the River Lee will remain unaffected by the works and impacts on the water quality of the river downstream of the works will be negligible due to the implementation of suitable construction methodologies and mitigation measures. The amenity value of the River Lee within sections of the work area will be diminished for tourists for the duration of the works. Therefore, the nature of the impact on tourism overall will remain slight during the construction phase of the scheme.

Noise

Potential Impacts

There will be an increase in noise levels in the vicinity of the proposed development site during the construction phase, as a result of machinery and construction work. These impacts will be short-term in duration on any particular day and temporary (for the duration of the construction phase). The primary noise producing activities associated with the proposed works include:

Noise Sensitive Locations (NSLs) across the river and at South Mall are highly unlikely to receive noise levels which exceed the 70 dB criterion, except where driven or vibratory piling is required. On Father Matthew Quay, Morrison's Quay and Union Quay, certain works may give rise to noise levels above 70 dB over short periods at immediately adjacent NSLs, although such works are likely to move on after 1-2 days. A number of buildings (Friary, College of Commerce, the hotel (which is currently vacant and likely to remain so in the medium-term) on Morrison's Quay, the office buildings on both Morrison's Quay and George's Quay and the CIT Cork School of Music on Union Quay), have extensive quay frontage, and thus may be exposed to elevated levels for several days, due to the time taken to pass these receptors.

In addition to the sources discussed above, noise emissions will also arise from HGV movements across the study area associated with import of materials and export of subsoil, etc. HGV access to work zones will be facilitated using the local road network.

Construction noise at any given noise sensitive location will be variable throughout the construction project, depending on the activities underway and the distance from the main construction activities to the receiving properties. At properties fronting the quay, impacts will range from slight negative to noticeable negative, however given the benefit which will accrue to these properties in particular, the overall long term impact is expected to be positive. The potential noise impacts that will occur during the construction phase of the proposed development are further described in Section 8 of this ER. **This will have a short-term negative slight impact.**

Mitigation

With respect to 70 dB exceedances identified above, consaw operations may be readily controlled by erecting a hoarding around the cutting area. In addition, wall and localised street works may be similarly treated by erecting a hoarding along the boundary of the works zone. Use of hoarding may also be beneficial with respect to receptors close to sheet piling operations, particularly where driven or vibratory piling is required.

Best practice measures for noise control will be adhered to onsite during the construction phase of the proposed development in order to mitigate the slight short-term negative impact associated with this phase of the development. The measures include:

- Sensitive location of equipment, taking account of local topography, existing structures (i.e. walls, buildings, etc.) and natural screening.
- Working methods: construction noise will be controlled by prescribing that standard construction work will be restricted to the specified working hours. Any construction work carried out outside of these hours shall be restricted to activities that will not generate noise of a level that may cause a nuisance.
- Plant will be selected taking account of the characteristics of noise emissions from each item. All plant and machinery used on the site shall comply with E.U. and Irish legislation in relation to noise emissions. The timing of on- and off-site movements of plant near occupied properties will be controlled.
- Operation of plant: all construction operations shall comply with guidelines set out in British Standard documents 'BS 5338: Code of Practice for Noise Control on Construction and Demolition Sites' and 'BS5228: Part 1: 1997: Noise & Vibration Control on Construction and Open Sites'. The correct fitting and proper maintenance of silencers and/or enclosures, the avoidance of excessive and unnecessary revving of vehicle engines, and the parking of equipment in locations that avoid possible effects on noise-sensitive locations will be employed.
- Training and supervision of operatives in proper techniques to reduce site noise, and self-monitoring of noise levels, if appropriate.

Residual Impacts

Noise and vibration impacts during the construction phase, inclusive of mitigation, are expected to be temporary and localised at most locations. At NSLs fronting the quay, impacts are likely to be slight negative to noticeable negative. Impacts may increase to noticeable negative or substantial negative where piling

methods other than pressed-in piles are used. However, it should be noted that these impacts will be entirely short term in nature, lasting several days or weeks locally in most cases. Implementation of mitigation measures described above will further reduce impacts. Moreover, the long-term impact is expected to be positive, given the elimination of flood risk in these areas.

Dust

Potential Impacts

Potential dust emission sources during the construction phase of the proposed development include excavation activites, backfilling with aggregate, and resurfacing works. This may cause nuisance to residents and local businesses as well as road users. These impacts will not be significant given the localised nature of the proposed works and will be relatively short-term in duration. **There is the potential to have a short-term slight negative impact.**

Mitigation

In periods of extended dry weather, dust suppression (localised wetting of surfaces) may be necessary within and around the site to ensure dust does not cause a nuisance.

Residual Impacts

The residual impacts will be imperceptible

Traffic and Transport Infrastructure

The proposed scheme has the potential to impact on the transport infrastructure in the area, most significantly during the construction phase. This impact is likely to occur where road closures and diversion are put in place to allow the construction works to be carried out.

The construction phase will have a temporary impact on traffic volumes in Morrison's Island and the immediate surrounds due to the increase in additional traffic movements associated with the constructon phase of the project. Road closures and diversions will also be put in place on several of the roads in and around Morrison's Island which is likely to have a temporary impact on the local road network. However, taking into account the large numbers of vehicles using the road network in the the area, it is unlikely that traffic generated during the construction phase will have a significant impact on traffic flow in general. It is not anticipated that the construction traffic will significantly affect the flow of traffic through the Morrison's Island area, Cork City Centre and its wider surrounds.

Although the proposed scheme will result in a net loss of approximately 115 car-parking spaces along both Quays it will result in the Morrison's Island area becoming more attractive to pedestrian and cyclist usage and it is anticipated that the scheme will aid to induce additional city centre trips by sustainable modes.

A Transport Assessment (TA) of the proposed development has been carried out which quantifies and asseses the potential impacts and concludes that the proposed development will not have a negative impact on the surrounding road network. The full results of the TA are presented in Section 11 of this ER.

Mitigation

A Construction Traffic Management Plan (CTMP) will be prepared by the appointed contractor and agreed with Cork City Council in advance of the proposed works. The CTMP will outline the appropriate mitigation measures that will be implemented in order to reduce possible impacts that may occur during the construction phase of the works.

A complete schedule of road closures should be published in advance of the works commencing to facilitate residents and businesses in making alternative arrangements where necessary.

Residual Impact

Taking into account the abovementioned mitigation measures, the residual impact of the proposed scheme on the transport infrastructure will be imperceptible.

Services

The majority of proposed works pertaining to the Morrison's Island Public Realm and Flood Defence Works, described in detail in Section 3, are located in or in the vicinity of the River Lee along Father Mathew Quay, orrison's Quay and a short section of Union Quay. As such there is limited interaction between the scheme and existing services in the area. Section 11.3 gives further details on the predicted impacts on services for drainage networks, water, gas, electricity broadband and telecommunications distribution networks. Locations where potential impacts are predicted are discussed in section 11.3. Impacts on each service will vary, but overall the proposed flood alleviation works will have a **short-term moderate negative impact** on services.

Mitigation Measures:

The depth of the service networks (e.g. surface water and wastewater collection pipework) close to the proposed works areas will be assessed. Should it be anticipated that any proposed excavations will impact on these networks, this will be taken into consideration at detailed design stage and replaced or deepened prior to excavation if necessary.

Prior to excavation, the Contractor will assess record drawings and the results of the Site Investigation in order to determine the exact depth and location of the existing service networks within the works area. The Contractor will carry out additional site investigation to confirm the location of the existing services. This will reduce the risk of striking them and causing interruption to the systems during the construction phase.

Residual Impact:

Taking into account the above-mentioned mitigation measures the residual impact of the proposed scheme on the local service networks will be **neutral**.

Amenity (including Visual Amenity)

Potential Impacts

During the construction phase the existing amenity uses along the river will be impacted negatively although the extent of the disruption will be limited and will be temporary in nature. There is the potential for a **short-term moderate negative impact** during the construction phase.

The impact on visual amenity of the construction phase is assessed in full in Chapter 10 (Landscape) of this ER. Overall, the works will have a generally transient nature, lasting only for several weeks (or up to several months in some instances) in any one location. The areas with the most significant works will have the greatest impact. Overall this has the potential to have a **short-term moderate negative impact.**

Mitigation Measures:

Works will be designed to minimise impacts upon the amenity value of the study area during the construction period. Mitigation will include measures to minimise pollution of the river, minimise impacts on fish, limit working hours and prevent un-necessary damage to bankside habitats. Full details of this mitigation is provided in Chapter 5.

The mitigation measures relating to visual amenity impacts are discussed in Chapter 10 (Landscape) of this EIAR.

Residual Impact:

Although upstream stretches of the river will remain unaffected by the works and impacts on the water quality of the river downstream of the works will be minimised through implementation of mitigation measures, the amenity value of the proposed works areas (while under construction) will be inaccessible to the public. Therefore, the nature of the impact will remain moderate within and downstream of the works area for residents and visitors during the construction phase of the scheme.

Provided that the mitigation measures discussed in Chapter 10 of this ER are implemented correctly, the residual impact on visual amenity will be a temporary to short term slight negative impact.

Human Health and Safety Impacts

Potential Impacts

Construction of the proposed development will necessitate the presence of a construction site. Construction sites and the machinery used on them pose a potential health and safety hazard to construction workers if site rules are not properly implemented. **This will have a short-term potential significant negative impact.**

Mitigation Measures

During construction of the proposed development, all staff will be made aware of and adhere to the Health & Safety Authority's 'Guidelines on the Procurement, Design and Management Requirements of the Safety, Health and Welfare at Work (Construction) Regulations 2006'. This will encompass the use of all necessary Personal Protective Equipment and adherence to the site Health and Safety Plan.

Heras fencing will be erected around any excavations to prevent uncontrolled access to this area. Appropriate health and safety signage will also be erected on this fencing and at locations around the site.

Residual Impact:

The implementation of the Health & Safety Plan will ensure any potential risks are minimised.

Operational Phase

Health and Safety

Flooding poses a risk to human health and safety. The risks and impacts of floods are discussed in detail in Section 4.5 above. Flooding can cause physical injury, illness and loss of life.

The Morrisons Island Flood Alleviation Works will provide greater protection against high frequency tidal events and will raise the threshold of tidal flooding for South Mall, Oliver Plunket Street etc from cira 1 in 2 years to 1 in 10 years. The Morrison's Island Public Realm project will provide greater protection against high frequency tidal events and will raise the threshold of flooding for South Mall, Oliver Plunkett Street etc. The design of the proposed works is adaptable for future climate change in accordance with Office of Public Works guidance in relation to climate change and also includes an allowance for freeboard.

The impact on people and communities as a result of the stress and trauma of being flooded, or even of being under the threat of flooding, can be immense. Some people may have difficulty in replacing household items damaged in a flood and may lack the financial means to recover and maintain acceptable living conditions after a flood. **The proposed relief scheme will have a long-term significant positive impact.**

Employment and Investment

The flood relief scheme will provide increased protection to residential and commercial premises and businesses in Morrison's Island and surrounding areas. This will be likely to encourage future inward investment in the area, creating further employment and a stronger local ecomony. **The proposed relief scheme will provide a long-term significant positive impact.**

Land-use

The development of a large riverside walking and recreation area along with seating and plaza areas will result in increased land area to use for recreational purposes. This will have a long-term slight positive impact.

Amenity (including Visual Amenity)

Potential Impacts

The scheme proposes to enhance the public realm along Fr. Mathew Quay, Morrison's Quay and a short section of Union Quay, creating a more pedestian friendly space, and incorporating open plaza spaces at Parnell Plaza and Trinity Bridge, as well as incorporating flood defence works. The proposed work involves raising the existing ground levels and providing an effective continuous flood defence along the left (north) bank of the South Channel of the River Lee at Morrison's Island, and a short section of flood defence works at Union Quay side of Trinity Bridge. Riverside walks for residents and visitors alike are of importance to the area and this will be enhanced by the proposed works. This has the potential to have a **short-term moderate positive impact** during the operational phase.

The redevelopment of the area along Father Mathew Quay, Morrison's Quay and short section along Union Quay will improve the appearance of the area, and the proposed development will, through the use of riverside walks, improve the visual connection with the river. The use of high quality finishes on the structures will also ensure that the visual appearance of the area is maintained to high standard. **This will have a long-term moderate positive visual impact.**

Tourism

The operational phase of the proposed development will have **a potentially positive effect** on tourism in the area.

Traffic and Transportation Infrastructure

The Transport Assessment, as presented in Section 11, calculates that the proposed streetscape enhancement scheme will be adequately accommodated by the existing road network. **The operational phase of the proposed development is likely to have a long-term slight negative impact.**

Property Values

The flood relief scheme will provide increased flood protection to residential and commercial premises in Morrison's Island and surrounding areas. This will be likely to increase the value of properties in the area. **The proposed scheme will provide a long-term significant positive impact.**

5. FLORA AND FAUNA

5.1 INTRODUCTION

This section of the Environmental Report (ER) describes the potential impacts of the proposed Morrison's Island Public Realm Project incorporating flood defence works on biodiversity, flora and fauna and has been completed with regard for the following guidance documents:

- Chartered Institute of Ecology and Environmental Management (CIEEM) (2006). Guidelines for Ecological Impact Assessment.
- Chartered Institute of Ecological and Environmental Management (CIEEM) (2012). Preliminary Ecological Appraisal.
- Fossitt JA (2000). A Guide to Habitats in Ireland.
- The Heritage Council (2011) Habitat Survey Guidelines: A Standard Methodology for Habitat Survey and Mapping in Ireland.

The chapter discusses the existing ecological environment, the potential impacts of the scheme and avoidance and mitigation measures in relation to habitats, flora and fauna in the zone of influence of the Morrison's Island Flood Alleviation Works.

5.2 METHODOLOGY AND LIMITATIONS

5.2.1 Desk Study

A desk study was undertaken to determine the proximity of the project to designated areas of conservation utilising the National Parks and Wildlife Service (NPWS) website database. Site synopses, conservation objectives, conservation management plans, site reports etc. were reviewed to identify qualifying interests of relevant sites. The NPWS database and Biodiversity Ireland database were also consulted regarding the occurrence of protected species of flora and fauna in the vicinity of the proposed scheme. Consultations were carried out with the NPWS and Inland Fisheries Ireland (IFI) for the Lower Lee (Cork City) Flood Scheme including the area of Morrison's Island, requesting information on protected species and habitats within the study area as well as comments on the proposed project in relation to survey, assessment and specific mitigation requirements. A review of aerial photography over the study was undertaken to prepare a preliminary habitat map and to identify potential ecologically important habitats. The review also aimed to determine the proximity of the proposed scheme to ecologically important sites in the general vicinity that may be subject to indirect impacts through severance of connecting corridors, pollution run-off during construction, etc. Existing sources of information and records on ecological interests were sourced and reviewed.

5.2.2 Field Survey

Following on from the desk study and as part of the Lower Lee (Cork City) Flood Relief Scheme (including Morrison's Island) a series of site surveys were undertaken of the study area, encompassing the River Lee main channel. During the survey, habitat mapping was undertaken and the suitability of the works area to support plants, animals or habitats of note was considered. The river within the proposed works areas was examined with a view to determining presence of species of note and potential ecological risks associated with the proposed scheme. The flora was surveyed through direct observation on-site and the habitats were classified initially from aerial photographs and subsequently ground-truthed at the site. Fauna were surveyed through direct observation of bird and mammal species or of their signs and calls.

As part of the Lower Lee (Cork City) Flood Relief Scheme (including Morrison's Island), a number of site specific targeted surveys were carried out following consultation with NPWS and IFI for the following: bats, otter (*Lutra lutra*), kingfisher (*Alcedo atthis*), floating river vegetation, fish species and Japanese knotweed (*Fallopia japonica*) and other invasive plant species.

5.2.3 Designated Areas in the Vicinity of the Study Area

The NPWS publish synopses of the information regarding areas designated for conservation.

5.2.3.1 Natura 2000 Sites

Screening for Appropriate Assessment (AA) under Article 6(3) of the EU Habitats Directive has been completed and is included in Appendix 5A. The following summarises the information from the AA Screening Document. The nearest Natura 2000 sites (cSAC's or SPA's) are:

- Great Island Channel SAC (Site Code:004219)
- Cork Harbour SPA (Site Code 004030)

Great Island Channel SAC and Cork Harbour SPA are located within 15km of the proposed Morrison's Island and the Lower Lee (Cork City) Drainage Scheme and therefore required screening for Appropriate Assessment (AA). This was carried out for the entire project to ensure that cumulative impacts were considered in full for the entire flood alleviation, including the proposed works at Morrison's Island. The assessment and recommendations made as part of the AA Screening are also considered a requirement of this scheme.

Cork Harbour SPA is a large, sheltered bay system, with several river estuaries - principally those of the Rivers Lee, Douglas, Owenboy and Owennacurra. The SPA site comprises most of the main intertidal areas of Cork Harbour with the following designated as conservation interests: Little Grebe (*Tachybaptus ruficollis*), Great Crested Grebe (*Podiceps cristatus*), Cormorant (*Phalacrocorax carbo*), Grey Heron (*Andea cinerea*), Shelduck (*Tadorna tadorna*), Wigeon (*Anas Penelope*), Teal (*Anas crecca*), Pintail (*Anas acuta*), Shoveler (*Anas clypeata*), Red-breasted Merganser (*Mergus serrator*), Oystercatcher (*Haematopus ostralegus*), Golden Plover (*Pluvialis apricaria*), Grey Plover (*Pluvialis squatorola*), Lapwing (*Vanellus vanellus*), Dunlin (*Calidris alpine*), Blacktailed Godwit (*Limosa limosa*), Bar-tailed Godwit (*Limosa lapponica*), Curlew (*Numenius arquata*), Redshank (*Tringa tetanus*), Black-headed Gull (*Chricocephalus ridibundus*), Common Gull (*Larus canus*), Lesser Black-backed Gull (*Larus fuscus*) and Common Tern (*Sterna hirundo*). Cork Harbour is an internationally important wetland site, regularly supporting in excess of 20,000 wintering waterfowl.

The Great Island Channel SAC is located >8 km downstream of the works area. It stretches from Little Island to Middleton, with its southern boundary being formed by Great Island. The site is a Special Area of Conservation (SAC) selected for the following habitats:

- [1140] Tidal Mudflats and Sandflats
- [1330] Atlantic Salt Meadows

The Appropriate Assessment screening report concluded that impacts on the above listed European Sites could be precluded on the basis of their distance from the proposed Lower Lee (Cork City) Drainage Scheme and the nature and scale of the proposed works. This assessment is still considered valid in light of the proposed works at Morrison's Island.

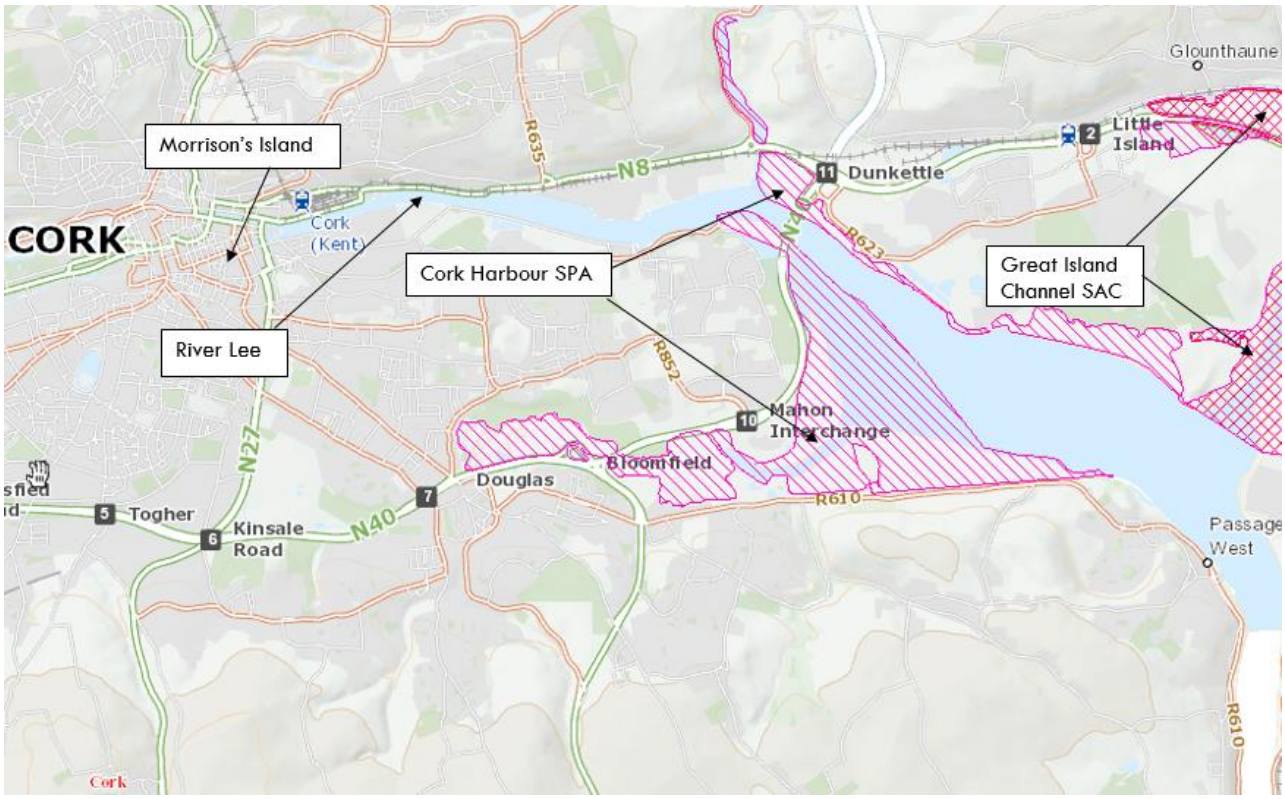


Figure 5.1 Designated Sites within the Study Area

5.2.4 Non-Designated Features of Ecological Interest

5.2.4.1 River Lee

The River Lee with a catchment area of approximately 2000 km^2, rises in the Shehy Mountains on the western border of County Cork and flows eastwards through Cork City and flows into the sea at Cork Harbour.

Outside of the Gearagh to the west and the coastal transitional European Sites to the east, the aquatic habitats of the River Lee are not designated for nature conservation purposes. The River Lee main channel from source to Cork City waterworks at Lee Road (upstream of Morrison's Island) is a designated salmonid fishery under the EC (Quality of Salmonid Waters) Regulations of 1988 (SI 84 of 1988). The Lee is also known to contain populations of Brown trout (*Salmo trutta*), Lamprey (*Lampetra* sp. and *Petromyzon* sp.) and European eel (*Anguilla anguilla*).

The Lee supports a number of other Annex I habitats and Annex II species listed under the European Habitats Directive (Council Directive 92/43/EEC) and a number of Annex I bird species listed under the EU Birds Directive (Directive 2009/147/EC). The entire length of the River Lee provides a suitable foraging/commuting corridor for Otter. A survey by IWT et al (2012) to evaluate the Otter population in the inner city and the adjacent suburban areas identified a minimum population of 11 No. otters in the city area (River Lee and its tributaries).

Ranunculus vegetation which corresponds to the Annex I habitat 'Watercourses of Plain to Montane Levels with the *Ranunculion fluitantis* and Callitricho-Batrachion vegetation [3260]' also occurs within the River Lee although to a lesser extent around Morrison's Island.

Many of the stone walls in Cork City support a diverse array of species including two listed under the Flora (Protection) Order, 1999, i.e. Roundleaved cranesbill (*Geranium rotundifolium*) and Little robin (*Geranium purpureum*). Little Robin is absent however, from Cork City's quay walls. Roundleaved cranesbill is found in waste ground areas around the city but absent from the Morrison's Island Study Area.

According to Cork City Council (2009) the River Lee running west from the City to the Lee Fields is an excellent area for bats.

The Annex I bird species Kingfisher (*Alcedo atthis*) is known to occur on the River Lee along with Irish Dipper (*Cinclus hibernicus*). The River Lee supports a number of bird species of Special Conservation Interest listed for the coastal marine habitats of Cork Harbour SPA e.g. Cormorant (*Phalacrocorax carbo*) and Grey Heron (*Ardea cinerea*).

5.2.5 Flora

5.2.5.1 New Flora Atlas

A search was made in the *New Atlas of the British & Irish Flora* (Preston *et al.*, 2002) to find which rare or unusual plant species had been recorded in the 10 km squares in which Morrison's Island Flood Alleviation Works is located, i.e. W67. In addition, the NPWS records of protected species in the area of the proposed development were obtained for the relevant 10 km squares. Of the species identified, no suitable habitat exists within the footprint of Morrison's Island.

5.2.5.2 NPWS Records of Protected Species

The NPWS records of protected species in the area of the proposed development were obtained for the relevant 10 km squares. In addition to those listed above, the NPWS database also contained records for a number of rare plant species not protected under the Flora Protection Order. The species which have potential to be present in the environment around Morrison's Island, together with their status on the Irish Red Data List of Vascular Plants (Curtis and McGough 1988) are listed below:

- Little Robin (*Geranium purpureum*) Endangered (E). Formerly protected under 1980 FPO. Rocks and walls.
- Round-leaved Cranesbill (*Geranium rotundifolium*) Endangered (E). Walls and roadsides.
- Greater Broomrape (*Orobanche rapum-genistae*). Vulnerable (V) Rare (R). Formerly protected under 1980 FPO.

5.2.5.3 Quay Walls Cork City Local BSBI recorder information

The flora of Cork's quay-walls is very diversified in places (mainly upstream of the proposed Project). The Lee at Morrison's Island is tidal, the Quay walls at this location are reflective of this and are mainly made up of seaweeds and / or bare walls of limited ecological significance. It is noted that the quay walls at Wandesford Quay (upstream of Morrison's Island) adjacent to the South Gate and at St Vincent's River Bridge on the North Mall are known to support a diverse colourful flora as identified by O'Mahony (2009) in Flora of Cork City and County, however these areas are a significant distance away from the works and the assemblage of species is not apparent in this area. There are no known nationally-protected plant species present on the Cork City quay walls.

5.2.5.4 Bryophytes

According to the NPWS Rare and Protected Species Records there are 3 No. records for Tufted Feather-moss (*Scleropodium cespitans*), listed as Near Threatened (NT) in the Irish Red List of Bryophytes in Cork City, however none are located in proximity to Morrison's Island.

5.2.6 Fish and Shellfish

5.2.6.1 Freshwater Pearl Mussel

The works along the River Lee are not located in a *Margaritifera* Sensitive Area.

5.2.6.2 Lamprey

According to the NPWS Rare and Protected Species Records and the National Biodiversity Data Centre there are records for brook lamprey (*Lampetra planeri*) and sea lamprey (*Petromyzon marinus*) from the River Lee. Fish stock surveys carried out in the River Lee in 2013 identified records of lamprey upstream of Morrisons Island. There is no suitable spawning habitat at Morrisons Island.

5.2.6.3 Atlantic Salmon

The River Lee is a designated salmonid watercourse under S.I. No. 293/1988 - European Communities (Quality of Salmonid Waters) Regulations, 1988. Atlantic salmon is listed on Annex II of the EU Habitats Directive. The designation extends from source to upstream of the water works at Lee Road and does not include Morrisons Island.

5.2.6.4 European Eel

According to the National Biodiversity Data Centre (2014) there are records for European eel (*Anguilla anguilla*) from the Study Area.

5.2.6.5 Brown Trout

Brown trout was recorded from the River Lee in 2013 during fish stock surveys undertaken as part of the Water Framework Directive but only upstream of Morrisons Island.

5.2.6.6 Twaite Shad

According to the NPWS Rare and Protected Species Records there is 1 No. record for Twaite Shad (*Alosa fallax*) from the Study Area within the 10km grid square.

5.2.6.7 Other species

Numerous estuarine species are known from the lower reaches of the River Lee, from where the main channel splits into the north and south channels as far as Tivoli Docks. Species include flounder, thick-lipped grey mullet (*Chelon labrosus*), plaice (*Pleuronectes platessa*), juvenile pollock (*Pollachius pollachius*), juvenile cod (*Gadus morhua*), common goby (*Pomatoschistus microps*), sand goby (*Pomatoschistus minutus*), five-bearded rockling (*Ciliata mustela*), fifteen-spined stickleback (*Spinachia spinachia*), Nilsson's pipefish (*Syngnathus rostellatus*), scad (*Trachurus trachurus*) and sea trout (*Salmo trutta trutta*).

5.2.7 Birds

A number of birds listed on Annex I of the EU Birds Directive have been recorded as breeding and wintering within the 10km square that encompasses the Study Area. In particular, the River Lee itself is known to support kingfisher and Cormorant. However, there is limited opportunity for roosting birds using Morrisons Island.

5.2.8 Mammals

5.2.8.1 Otter

The River Lee is known as an important habitat for Otter (*Lutra lutra*) and the species are found from the upper reaches of the River Lee as far downstream as Cork Harbour. Otter are protected under Annex II & IV of the EU Habitats Directive (92/43/EEC). The Cork Urban Otter Survey was conducted between 2011 and 2012 identified a minimum population of 11 otters in the city area.

5.2.8.2 Bats

According to the National Biodiversity Data Centre there are records for Common Pipistrelle (*Pipistrellus pipistrellus*), Soprano Pipistrelle (*Pipistrellus pygmaeus*), Daubenton's Bat (*Myotis daubentoni*), Leisler's Bat (*Nyctalus leisleri*),

Natterer's Bat (*Myotis nattereri*), Brown Long-eared Bat (*Plecotus auritus*) and Lesser Horseshoe Bat (*Rhinolophus hipposideros*) from Cork. However, the opportunity for suitable habitats is limited at Morrisons Island and Environs.

5.2.8.3 Harbour Seal and Grey Seal

There are records for harbour seal (*Phoca vitulina*) and grey seal (*Halichoerus grypus*) from the 10km Grid Square W67. The species are listed on Annex II and V of the EU Habitats Directive.

5.2.8.4 Other Mammals

There are also records for Badger (*Meles meles*), Irish stoat (*Mustela erminea*), Red squirrel (*Sciurus vulgaris*), Eurasian pygmy shrew (*Sorex minutus*) and Irish Hare (*Lepus timidus*) from the Cork City, however Morrisons Island has limited habitat suitability.

5.2.9 Other Aquatic Species

According to the National Biodiversity Data Centre (2016) and the NPWS Rare and Protected Species database there are records for both Smooth newt and Common frog (*Rana temporaria*) within W67. Although suitable habitat is unlikely at Morrison's Island.

5.2.10 Water Quality

The EPA website, http://gis.epa.ie/Envision, contains information regarding water quality in selected Irish rivers based on surveys carried out by the EPA as part of the Water Framework Directive (WFD) Monitoring Programme. Biological information is provided in the form of Q values.

Information was gained on the River Lee, including monitoring within or very close to the study area. The lower reaches of the River Lee, has "moderate" status under the Transitional Waterbody Water Framework Directive Status (2010-2012 monitoring results).

5.3 FIELD SURVEYS

The wider study area was first visited on the 18th June 2013. A further and more detailed survey of the River Lee was carried out in April and May 2014 and in April 2015. The river was systematically walked and each feature (e.g. riffle, pool or glide) was defined visually and mapped using GPS technology. These features were then described in terms of substrate conditions, flow path aquatic macrophytes, invertebrate communities and habitat variation and quality. Substrates were classified by particle size and named in accordance with the EPA, Rivers and Streams Ecological Assessment Field Sheet. Surveys of the terrestrial bankside habitats and mammalian and avifaunal activity were also undertaken. Suitability of habitats for Lamprey species (*Lampetra* sp and *Petromyzon* sp.) and salmonids was also assessed during this survey.

5.3.1 Habitats and Flora

The study area for this chapter encompasses the channel, floodplain and immediate surrounding areas of the River Lee at Morrison's Island. The ecological character of the study area is described below in terms the habitats (as per Fossitt, 2000. A Guide to Habitats in Ireland) present within and adjacent to the footprint of the proposed works. Where habitats are found to have links to or correspond to Annex I habitat the habitats are described in accordance with EC (2007). The habitats within the study area along the works corridor are described below.

5.3.1.1 Old Sea Walls (CC1) & Tidal Channel (CW2)

The Lower reaches of the River Lee can be considered a tidal channel between Wellington Bridge on the North Channel and the Gillabey Rock on the South Channel to the Port of Cork where the channels converge. The brackish

water permits the presence of Channel Wrack and abundant Ulva sp. that attach to the tidal walls along the water line. The upper walls at Morrison's Island have localised patches of terrestrial species including Maiden Hair Spleenwort, Wall rue, Pellitory of the wall & Dandelion with occasional Pedulous sedge & Common Figwort as understory, giving way to Buddlia and American Willowherb as river progresses.

5.3.1.2 Treelines

Planted treelines along the South Mall are present within the study area. Treelines in the city centre have been planted within the concrete structure of the footpath. The majority of the treelines comprise Small Leaved Lime.

5.3.1.3 Buildings and Artificial Surfaces (BL3)

Concreted and man-made structures are present throughout the works area adjoining many of the habitats.

5.3.1.4 Floating River Vegetation

A floating river vegetation (FRV) survey was undertaken on the Lower River Lee catchment in Cork City in order to assess its distribution along the lower reaches of the Lee.There are no areas of high cover in proximity to Morrison's Island, adjoining the work area FRV is absent or at very low levels of cover (0-4%).

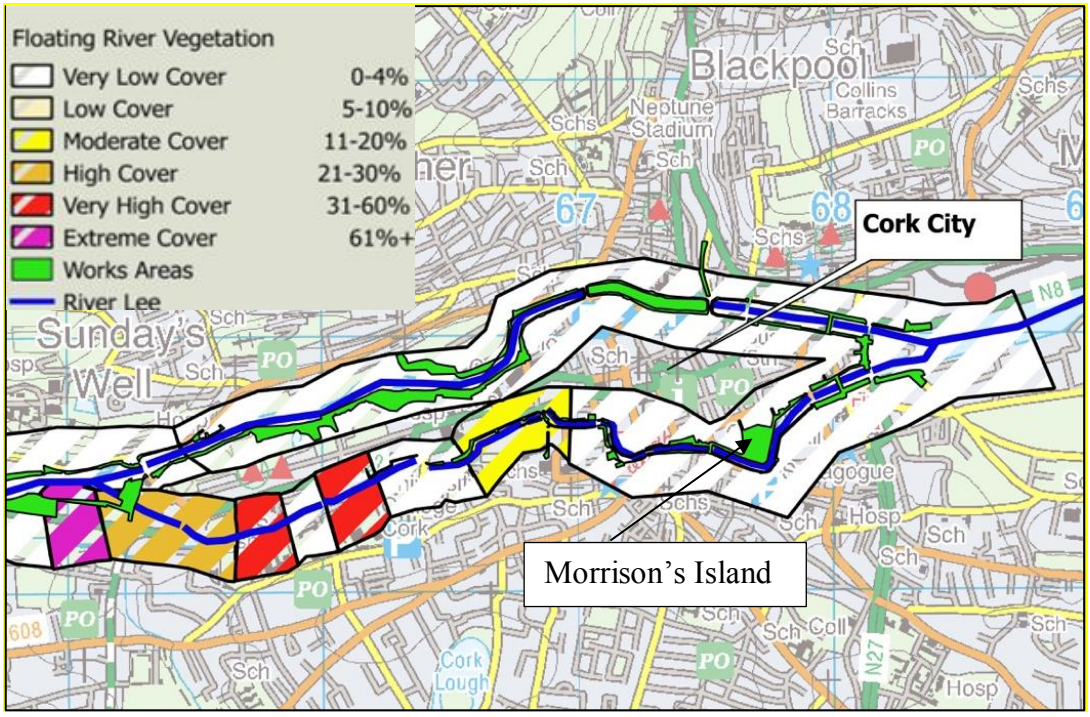


Figure 5.2 Percentage cover of Floating River Vegetation (FRV) along the River Lee

5.3.1.5 Invasive Plant Species

A targeted invasive plant species survey was carried out in 2014. Invasive species were widespread throughout Cork City. 3 No. terrestrial invasive species were recorded within the River Lee (Japanese knotweed, Himalayan Balsam and Giant Rhubarb). No invasive species were recorded within the confines of Morrison's Island works area.

5.3.1.6 Rare and Protected Flora

No Annex II listed plant species or Flora Protection Order (FPO) species were recorded during the field surveys.

5.3.2 Significance of the Flora

The sections of the river that correspond to the Annex I Habitat '*Watercourses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation (3260)*' lie upstream of Morrison's Island. Smaller strands with poorer quality, diversity and density are found at Morrison's Island and are classified as of **Low Local Importance.**

Sea walls (CC1) and tidal channels (CW2) may be considered of Low Local Importance within the study area.

5.3.3 Fauna

5.3.3.1 Birds

Bird species seen or heard during the field surveys were mostly typical of garden habitats with notable exceptions described below.

During field surveys potential habitat for Dipper (*Cinclus* hibernicus) was identified in the River Lee South channel tidal zone in Cork city centre. Nest sites are often found beneath bridges in crevices or in rocks or trees. Grey wagtail is also known to occur on the River Lee, however the species was not recorded during field surveys. No other species listed on the Birds of Conservation Concern in Ireland (BoCCI) Red List were recorded during the field surveys.

Feeding Grey heron (*Ardea cinerea*) was recorded on the River Lee south channel upstream of the sharp bend in the river at the western end of Sullivans Quay.

No Annex I bird species were recorded during field surveys.

5.3.3.2 Mammals

The study area was searched for signs of mammal activity with dedicated surveys undertaken for Otter (*Lutra lutra*).

Otter

A series of targeted Otter (*Lutra lutra*) surveys were carried out on the Lower River Lee between 2014 and 2016 in order identify the distribution pattern of otters in the catchment of the flood relief works and to identify active and/or breeding holts. The River Lee within the city environs is known to support a population of foraging/commuting Otters. Numerous signs of Otter activity were recorded in the form of spraints and prints throughout the city. Overall Otter records were widespread. Otter signs as far downstream as the Port of Cork were recorded. There are hotspots of Otter activity which are likely as a result of concentrations of available food resources, better breeding habitat opportunities and cover.

Otters have been noted at O' Sullivan's Quay where old storm culverts in the quay walls are used by otters. It is unknown whether otters have holted in these manmade structures. During September 2014 the survey team observed an otter entering the large tunnel opposite the Beamish & Crawford brewery. Work at Morrisons Island is sufficient distance from otter activity on Sullivan's Quay.

On the south channel between the college of commerce at Morrison's Island and the Port of Cork, otters are occasionally seen at night.

Bats

Although many of the city quays have crevices and holes of various sizes suitable for use as roosting features, all are subject to inundation during flood events so are unlikely to be used by bats due to the risk of drowning.

5.3.3.3 Fish

A number of fisheries surveys were undertaken on the River Lee to assess the overall fisheries habitat value, particularly in relation to Annex II lamprey and salmonid species. However, no spawning potential for fish is present in proximity to Morrison's Island. Fish identified upstream included salmonid, lamprey minnow, roach, gudgeon, perch, stone loach and European eel.

Where surveys were located within the upper tidal reaches of the River Lee, several Flounder (*Platichthys flesus*) were recorded.

Downstream of the surveys and in proximity to Morrison's Islandnumerous estuarine species are known to occur.

5.3.4 Significance of Fauna

The River Lee is of considerable significance for a number of faunal species.

Two fish species listed on Annex II of the EU habitats directive were recorded in the River Lee and it was also found to support an overall high diversity of fish species. The River Lee was found to support good stocks of Atlantic Salmon parr and migrating adults.

Although Lamprey were not recorded in the River Lee, good lamprey habitat is present in the River Lee and Brook and River lamprey were recorded on the Lee Tributaries. Although no works are proposed in these locations as part of this scheme, the presence of the above species indicate potential for the species to occur in the main River Lee and to use the channel for migration.

European eel was recorded in the River Lee. European eel is critically endangered and is considered to be the most threatened fish species in Ireland.

In addition, the river provides habitat for Otter (Annex II, Habitats Directive).

The River Lee is a very good habitat for otters, given it has healthy fish stocks and good water quality in the main channel. Otter are protected under Annex II of the EU Habitats Directive.

Grey wagtail, listed on the Birds of Conservation Concern Ireland (BoCCI) redlist are known to nest on the River Lee as well as the Irish Dipper, a subspecies unique to Ireland.

The River Lee is considered to be of **High County/Regional Importance**, given that it is a designated salmonid watercourse and for the fauna it supports.

5.4 IMPACTS AND MITIGATION MEASURES

The classification of impacts in this ER will follow the definitions provided in the Glossary of Impacts contained in the (EPA, 2017) *Draft Guidelines on the Information to be contained in Environmental Impact Assessment Reports.*

5.4.1 Do nothing Scenario

In a do-nothing scenario it is likely that the current regime of management and maintenance on the river would continue with the nature of the river being maintained essentially as it is. It is possible that maintenance works would include quay wall protection works where necessary. It is likely that these works would be undertaken in consultation with the IFI to minimise impacts on fisheries.

5.4.2 Impact on Loss of Habitat

5.4.2.1 Instream Habitats

Temporary Slight Negative

The construction phase will involve works in the terrestrial environment and on the quay walls of the River Lee. Instream works will be required for the proposed pile which are to be constructed in the river to support the viewing platform at Parnell Plaza and Trinity Bridge with Trinity Bridge with a boardwalk. Piling will consist of approximately 17 No. Piles in the river bed. The piles will be injected and filled with grout. Works will be carried out in the dry using a cofferdam or sealed column to prevent release of concrete into the aquatic environment. Work on the quay wall will be from, scaffolding set in the river or alternatively overhanging scaffolding, cherry picker or pontoon. There will be no significant loss of instream habitat during the construction and operation of the works. There is potential for water quality related impacts on instream habitats. Silt and concrete release and pollution incidents during construction which could adversely impact on the river and its habitats, this could result in temporary decline in water quality, increased turbidity, fine sediment redistribution and nutrient enrichment. Given the pollution control measures in place as part of the design of the scheme it is expected that the impact will be slight temporary negative.

5.4.2.2 Terrestrial Habitat

Permanent Slight Negative

Terrestrial construction works are largely confined to the River Lee Quay Walls and adjoining built lands including roads, parking and footpaths, as well as temporary construction compounds and access routes.

Tree / Treelines (**Moderate – High local importance**)

Non-riparian trees or treelines are present at Father Mathew's Quay or Morrison's Quay. Trees along the South Mall will be removed and replaced. Where trees are lost it is proposed to replace them by replanting with tree species that suit the cityscape. Tree replacement will include planting of Sweet gum (Liquidamber) along the south Mall and Erman's Brich (*Betula ermanii*), Broad leaved cockspur thorn (*Crataegus prunifolia*) and (London Plane) *Plantanus x hispanica*.

Quay walls (**Low local importance**)

All quay walls are considered to be of low local importance. There is potential for loss of quay wall flora due to grouting and the construction of parapet flood defence walls built upon refurbished existing quay walls. Although no rare or protected species are known from the quay walls, the walls do support floral communities.

5.4.2.3 Mitigation Measures for Habitats

General

- See also Chapter 7 Water Quality
- A Project Ecologist will be appointed for the duration of the works.
- A bird, otter and bat survey will be carried out prior to commencement of works. Should it be required a derogation licence should be applied for and granted prior to the commencement of works.
- The footprint of works will be identified at the onset and will be demarcated to avoid unnecessary disturbance outside the works area. Method Statements detailing the construction footprint and access routes to the proposed works will be approved prior to construction.
- A minimum of one week's notice will be sent to NPWS and IFI of the commencement of the works.

- The Contractor will provide Toolbox talks for all construction staff regarding the importance of best practice and the protection and sensitive nature of the River Lee.

Aquatic habitats

- Inland Fisheries Ireland (IFI) shall be consulted with on the method statement for proposed instream works.
- In channel working will be minimised, where possible, method statements will identify access routes and works areas prior to commencement in consultation with the Project Ecologist.
- Upon completion of the works channel vegetation will be allowed to recolonise naturally.
- At locations where there will be temporary loss of river bed habitat as a result of instream construction works, gravel beds, cobble and boulder refugia will be removed prior to the commencement of works and retained for habitat re-establishment post-completion of the works.
- Concrete pouring will be carried out in the dry avoid impact on the aquatic environment.
- Appropriate mitigation measures will be implemented prior to the construction phase to ensure that water quality is not adversely affected through pollution incidents, cement release and silt mobilisation. This mitigation will include:
    - Siltation traps (e.g. SedimatsTM) will be installed in any drains in the vicinity of excavations.
    - Where there is risk of falling debris and silts entering the watercourse netting will be employed to prevent them from entering the watercourse.
    - Ingress of river water into excavations by lateral intrusion or precipitation will require the deployment of pumps. The pumps shall be integrated pump or shall sit on an appropriately sized drip tray which is monitored and emptied regularly. Where required submersible pumps shall be deployed. The maintenance and refuelling of pumps shall be undertaken in accordance with standard best practice.
    - Measures shall be deployed for silt removal from pumped water. The discharge of suspended solids should not exceed 25mg/l. A baseline threshold for suspended solids and turbidity levels shall be identified by the site ecologist (and approved by the employer's representative).
    - Where possible vehicles will be refuelled away from watercourses (at a minimum of 50m) in a designated bunded refuelling area away from surface water gullies, drains and water bodies. A drip tray will be used for all refuelling. In the event of refuelling outside of this area, any storage of oils and diesel on site will be in steel or plastic tanks of good integrity and bunded to 110% of tank capacity.
    - It is important to prevent any escapement of chemicals such as hydrocarbons, hydraulic fluids and concrete. This will be dealt with specifically in a construction method statement that will be signed off on by the contractor.
    - Spill kits and hydrocarbon absorbent packs will be available and drip trays will be used during refuelling.
    - All relevant personnel will be fully trained in the use of this equipment.
    - Where soil/made ground and subsoil stripping occur, the resulting excavated soil fractions will be segregated into inert, non-hazardous and /or hazardous fractions (in accordance with Council Decision 2003/33/EC, the EPA water classification criteria at certain licensed landfills in Ireland).

- The excavation and handling of inert material will be carefully managed in such a way as to prevent any potential negative impact on the receiving water environment.
- Where possible the excavated spoil would not be stored beyond the working day, however in the event that this is not practical appropriate precautions in relation to the material will be taken. These precautions will include appropriate storage and covering.
- All associated hazardous construction waste will be stored within temporary bunded storage areas prior to removal by an appropriate EPA or Local Authority approved waste management contractor.
- There will be no release of concrete or grout released into the River Lee.
- The guidelines provided by the Department of the Marine and Natural Resources, with respect to concrete wash waters, CIRIA, the UK Environment Agency and Environment and Heritage Service, the UK Department of the Environment and Inland Fisheries Ireland will be adhered to in order to ensure that there is a neutral impact on the water environment during the construction phase of the proposed development.
- During all works the weather forecast will be monitored and a contingency plan developed to prevent damage or pollution during extreme weather and high flow events.
- All machinery and plant used will be regularly maintained and serviced and will comply with appropriate standards to ensure that leakage of diesel, oil and lubricants is prevented.

Terrestrial habitats

- Working hours will generally be restricted to normal working hours (8:00am – 6:00pm). However, these hours may be extended to take advantage of favourable tides, works at busy junctions etc.
- Tree line planting will be undertaken to replace tree lost.

5.4.2.4 Residual Impact

Temporary Slight Negative Impact

The proposed mitigation will ensure that habitat diversity is maintained as much as possible within the channel and adjoining terrestrial habitat. Pollution control measures will ensure, as much as possible, the protection of the aquatic environment. The residual impact is considered temporary slight negative.

5.4.3 Impact on Floral Species

Permanent Slight Negative

No protected flora or rare flora of conservation interest have been identified within the study area.

The Quay Walls at the location of the proposed works are poorer in diversity than the habitats of note upstream of the site. There will be some loss of this diversity as a result of grouting and refurbishment works to the quay walls/ other structures, however the impact is not significant. Complete vegetation removal from the quay walls is considered necessary to allow for repointing of the walls as, if the walls are not thoroughly cleaned and regrouted, repointed grout can leak through open joints and into the river during the grouting process. Cementitious grout is the preferred technical solution.

5.4.3.1 Mitigation

- As for General Habitats (See 5.4.2.3)

5.4.3.2 Residual Impact

It is considered that, there will be a Temporary Slight Negative Impact on the Quay Walls at the location of the proposed Scheme.

5.4.3.3 Invasive Species

Long Term Imperceptible Negative

There is no current infestation of Invasive species in the study area, while this could change prior to works commencing the risk is low given the built-up nature of the site.

5.4.3.4

5.4.4 Impact on Fauna

5.4.4.1 Terrestrial Animals

Permanent Slight Negative Impact

There will be a potential impact on mammals and birds as a result of the proposal and during the construction phase in particular Otter.

Otter were widespread on the River Lee with numerous spraints and prints recorded. Impacts relating to the Otter from the proposed scheme include disturbance, the removal of habitat and reduction of forage resource.

Otter have been known to historically holt in old storm culverts in the quay walls and otter were observed entering the large tunnel opposite the Beamish and Crawford Brewery in 2014. However, all culverts to be impacted by the Morrison Island Scheme are well below the normal high tide and therefore are not considered to be suitable for otter usage.

Otter are known to forage in the area, they are generally nocturnal foragers and as construction works will be undertaken during daylight hours it is unlikely that there will be significant disturbance related impacts to foraging Otter.

In the absence of mitigation, impacts on Otter are **Temporary Slight Negative.**

5.4.4.2 Otter Mitigation

- See also mitigation measures for protection of habitats (Section 5.4.2)

5.4.4.3 Residual Impacts on Otter

With appropriate mitigation in place it is anticipated that there will be a **Temporary Slight Negative/Neutral Impact** on Otter in the River Lee as a result of disturbance

5.4.4.4 Birds

By the nature of the construction works involved in this scheme, a degree of disturbance to birds present in the vicinity of the works areas is small but inevitable.

The works proposed in this scheme will be conducted in a relatively localised area where the level of disturbance is already relatively high as result of its urban location. This, in combination with the substantial amounts of similar habitats outside the likely zone of influence, should minimise the potential for long-term population impacts from disturbance throughout the construction phases.

There is potential for impacts on Grey wagtail and dipper breeding sites due to proximity to Trinity Bridge.

The removal of treelines required prior to construction has the potential to impact on nesting birds. Impact on nesting birds in the absence of mitigation is **Slight Temporary Negative Impact.**

5.4.4.5 Birds Mitigation

- See also mitigation measures for protection of habitats (Section 5.4.2)
- All vegetation clearance works and site preparatory works will be conducted outside of the bird nesting season (March to September inclusive). If this is not possible, a breeding bird survey will be undertaken in advance of the works to ensure that there will be no impacts on nesting birds. If nests are found, they will be safeguarded, with an appropriate buffer, until the chicks have successfully fledged.
- Timber hoarding will be used on all works where there is likely visual and noise related disturbance.
- If/where encountered, any Grey wagtail or dipper nests will be safe-guarded with an appropriate buffer until the chicks have successfully fledged.

5.4.4.6 Residual Impact

With mitigation in place it is anticipated that impacts on bird species will be **Slight Temporary Negative.**

5.4.5 Impact on Fisheries

The impact of the works on fisheries overall is a **Temporary Moderate Negative Impact**.

The proposed works for Morrison's Island Flood Alleviation Works consists of works to the Quay Walls, where during construction phase some works which may involve the provision of scaffolding. In addition, piling and column construction under the proposed boardwalk and bridge balcony will be required, comprising 17 no piles in the river bed and column installation. Works identified within the scheme can potentially result in direct impact due to loss of habitat, disturbance including noise, visual and vibrations which would displace fish from the works area and result in a temporary impediment to fish passage on the River Lee. In addition, release of sediment and pollutants into the system pose a risk to fish.

The impact on fisheries habitat is considered **Temporary Moderate Negative** due to temporary risk from pollution and sediment release during instream and bankside works.

5.4.5.1 Fisheries Mitigation

- See also mitigation measures for protection of habitats (Section 5.4.2).
- All instream works will be carried out in consultation with Inland Fisheries Ireland.
- In channel working will be minimised, where possible, method statements will be developed prior to commencement in consultation with the Project Ecologist.
- In-channel working during the salmonid spawning season will not be permitted (October to June inclusive) except under exceptional circumstances and with agreement from IFI.

During the construction phase, fish passage will be maintained in areas of in-channel working.**5.4.5.2 Residual Impact**

Mitigation measures will minimise the impact on fisheries from the construction phase. The residual impact on Fisheries within the main channel is considered to be a **Temporary Slight Negative**.

6 LAND, GEOLOGY AND SOILS

This chapter of the Environmental Report (ER) presents available information on the Land, soils and geology of the Study Area in the vicinity of the proposed Morrison's Island Public Realm project. It investigates how the existing land, soil and geological environment may be altered in both the short and long-term by the construction and operation of the proposed scheme. Should significant impacts be identified on the land, soil and geology, mitigation measures are proposed insofar as practicable.

6.1 METHODOLOGY AND LIMITATIONS

A desktop study was carried out in order to ascertain a comprehensive baseline for the Study Area and give a description of the existing environment. This information was then used in assessing the potential impact the proposed Morrison's Island Public Realm project will have on land, geology and soils within the Study Area. It was then possible to propose practicable mitigation measures to ensure that any potential impacts identified will not have a significant impact on the environment during the construction and operational phase.

No difficulties were encountered in the compilation of this Chapter.

6.1.1 Published Material

The baseline study of the existing soil and geological environment throughout the proposed Study Area was prepared using the Geological Survey of Ireland's (GSI) online database and the GSI publication; 'Geology of South Cork' (1994), along with additional source material. A comprehensive list is included below;

- The Geology of South Cork (Sleeman and Pracht, GSI, 1994);
- The GSI online database;
- Cork City Development Plan (2015 - 2021);
- Cork County Council Development Plan (2014);
- Cork City Council Planning and Development (Applications for Registration of Quarries under Section 261, Planning and Development Act 2000);
- Cork County Council Planning and Development (Applications for Registration of Quarries under Section 261, Planning and Development Act 2000);
- Cork County Council Internal Geographical Information System (IGIS);
- Concrete Products Directory (Irish Concrete Federation);
- Aerial Photographs (2015);
- ENVision Mines Site, the EPA's online Historic Mines Inventory;
- General Soil Map of Ireland;
- Explanatory Bulletin to Soil Map of Ireland 1980.

A ground investigation contract was carried out which consisted of boreholes, trial pits and rotary core sampling throughout the Study Area. The recorded data was used to confirm and verify information obtained from the above sources.

A draft report prepared by JBA Consulting for the OPW in October 2013 entitled 'Hydromorphic audit of the Lower Lee watercourse' was also consulted.

6.2 LAND

The assessment of land use generally considers land take or acquisition and changes in land use. The land in the Study Area is publically owned and not used for agriculture. The subject land is made up of roadway, footpaths and parking along with quay walls and river access points. These functions will remain as part of the Public Realm and Flood Defence works. General improvements will be made to the civic amenity of the general area with seating available, public space and improved pedestrian and cyclist facilities.

6.3 GEOLOGY

6.3.1 Geomorphology

The topography of the Cork region is controlled by its geological structure, with the anticlines forming upland areas and the synclines occupied by valleys. These valleys were formed during the Pleistocene glaciations, which occurred 2 million to 10 thousand years ago. Prior to this, the regional topography sloped southwards and the region was drained by southerly flowing rivers. This Tertiary drainage was truncated by glaciers advancing outwards from the mountainous regions of western Ireland, preferentially exploiting the weaker shales resulting in the development of a large number of broad u-shaped valleys, where previously there has only been north-south drainage patterns. Superimposed on these u-shaped valleys are a number of buried valleys infilled with sand and gravel.

At the peak of the last glaciation, 15,000 years ago, when much of Europe was covered in ice, sea levels fell to approximately 130m lower than present day. As a result the rivers eroded down to the new base level cutting new steep sided gorges. When temperatures subsequently improved the ice sheets receded, sea levels rose and the gorges rapidly became infilled with fluvioglacial sand and gravels as the rivers responded again to the changing base level. The south of Ireland continues to sink and so sea levels are still rising. Milenic & Allen, 2002, estimate this rise as being 16m over the past 8,000 years.

6.3.2 Bedrock Geology

The bedrock of South Cork is much less varied than in many parts of the country. With one exception all the rocks exposed are sedimentary and were deposited during the late Devonian and Carboniferous Periods, between about 310 to 370 million years ago.

The Geology of South Cork (Sleeman and Pracht, GSI, 1994) and the 'Geological Survey of Ireland Online Database' (GSI.ie) indicates that the Study Area is underlain by Waulsortian Limestone.

The findings of the ground investigation (based on available results), which was carried throughout the proposed Study Area are broadly in line with the bedrock as described above. The ground investigations confirm the presence of limestone overlain by gravels within the study area.

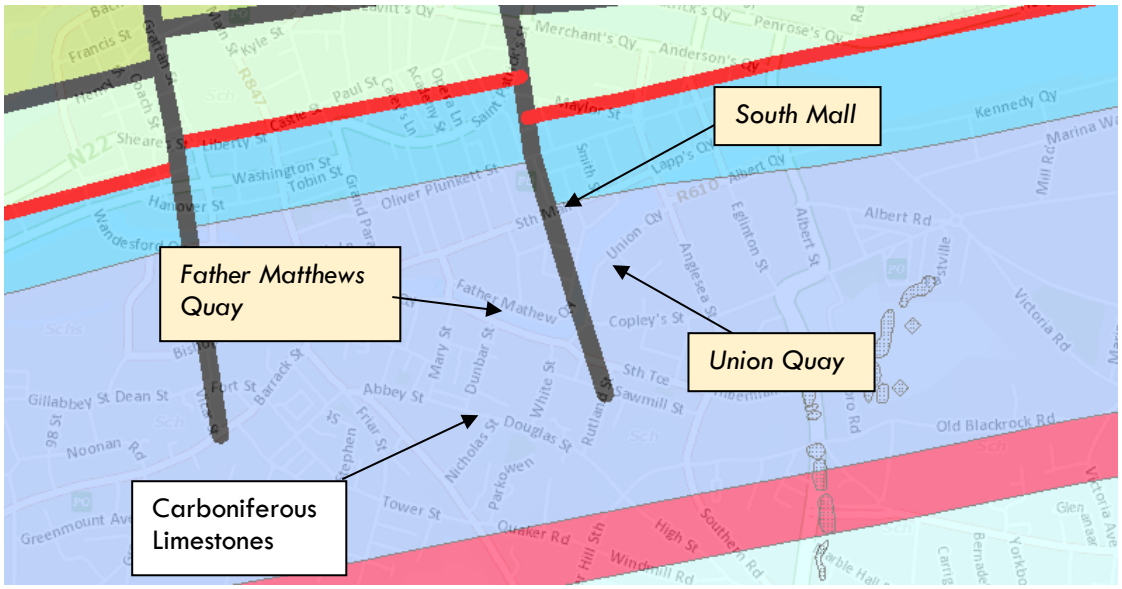


Figure 6.1 Bedrock Geology

6.3.3 Geological Heritage

Geological heritage encompasses the earth science component of nature conservation. The identification of geological heritage is achieved by finding sites or areas that best demonstrate particular types of geology, processes or phenomena that rank as noteworthy. A site selection process is being undertaken by the Geological Survey of Ireland (GSI), through the Irish Geological Heritage (IGH) Programme.

The IGH programme is a partnership between GSI and the National Parks and Wildlife Service (NPWS) and aims to identify and document the wealth of geological heritage, to protect, conserve and promote its value with landowners and the public. The primary national site designation for geological heritage (and nature conservation in general) is the Natural Heritage Area (NHA) designation. The second-tier designation is that of County Geological Site (CGS). While a County Geological Site is not statutorily protected, the designation is intended to provide recognition for the site and there is some protection through incorporation in the County/ City Development Plan.

No sites of geological and geomorphological interest of the sites are located in proximity to Morrison's Island.

6.3.4 Economic Geology

The term 'economic geology' refers to commercial activities involving soil and bedrock. The activities involved principally comprise aggregate extraction (sand and gravel pits and quarries) and mining. A number of sources were examined for information on such commercial activities within the Study Area, including:

- Cork City Council Planning Department (Application for Registration of Quarries under Section 261, Planning and Development Act 2000)
- Cork County Council Planning Department (Application for Registration of Quarries under Section 261, Planning and Development Act 2000)
- Cork City Development Plan (2015 - 2021)
- Cork County Council Development Plan (2014)
- Cork County Council Internal Geographical Information System (IGIS)
- Concrete Products Directory (Irish Concrete Federation)

- Aerial Photographs (2005)
- ENVision Mines Site, the EPA's online Historic Mines Inventory
- EPA Map Viewer

The sources consulted above indicate that there no active quarries within the Study Area.

6.3.5 Geohazards

Upon consultation with the GSI National Landslide Database for Ireland, it was found that there are no recorded landslides in the area. There are no known geohazards within or in the immediate vicinity of the Study Area.

6.3.6 Quaternary Geology (Subsoil)

Given the urban nature of the Study Area and according to the

'Geological Survey of Ireland Online Database' the Study Area is comprised of the Made Ground.

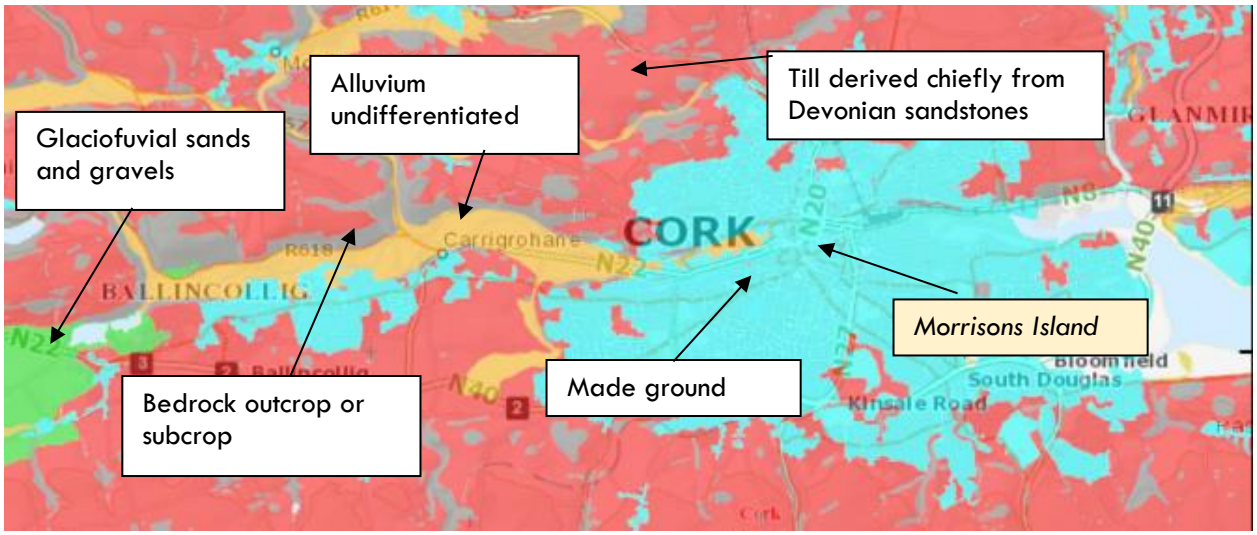


Figure 6.2 Subsoils

Made Ground is defined as material, including soil, which has been deposited on land and/or altered by anthropogenic (human) activity. Made Ground is shown in the urbanised areas of the Study Area (colour turquoise on map). The key risk associated with made ground is its uncertain origin and potential for contamination. However, no evidence of historical activities which could potentially have contributed to soil contamination was identified along or in the vicinity of the proposed scheme.

6.3.7 Potential Impacts on Geology

The key impact associated with the construction phase of the Morrison's Island Public Realm Project is the excavation, handling, storage, processing and transport of earthworks materials. The estimated volume of excavation anticipated during the construction phase is approximately 8,150m^3.

There are a number of potentially negative environmental impacts associated with the handling of excavated materials. These impacts can arise directly as a result of on-site excavation and construction activities or indirectly, due to placement of excess unsuitable materials at off-site locations.

Detailed site investigation works will also be carried out prior to the construction stage. These works will include intermittent coring of the bedrock, but impact is predicted to be imperceptible and as such has not been assessed below.

6.3.7.1 Loss of Geological Heritage

Imperceptible Impact

There is no proposed National Heritage Area (pNHA) or County Geological Heritage feature within in the vicinity of the proposed works. As there no works prosed within the vicinity of the pNHA and it is not anticipated that rock will be excavated the potential impact is regarded as being imperceptible.

6.3.7.2 Loss of Quaternary Geology

Potential Permanent Slight Negative Impact

As described in Section 6.2.6 above, the Study Area is predominantly underlain by Made Ground. It is likely that the majority of excavations for flood defences are to be in Made Ground. The site investigation recorded that gravels are also present. It may be possible to reuse excavated gravels, as recorded during site investigation. The impact of the removal of excavated material from the proposed works will be minimal as these subsoils are in abundance throughout the Study Area.

A large portion of the proposed flood defence measures are underlain by made ground and therefore there is a risk that contaminated material may be encountered. No evidence of historic activities which could potentially have contributed to soil contamination were identified in the immediate vicinity of the proposed scheme. Although the key risk with Made Ground is its uncertain origin, on the basis of available evidence and taking into consideration the small volume of made ground to be excavated, the potential impact is regarded as being imperceptible.

Mitigation Measures

Excavated subsoils will be reused as fill where possible. Any remaining volumes of unsuitable materials will be transported to the closest suitably licensed facility.

Residual Impact – Potential Permanent Imperceptible Impact

It is likely that, with the mitigation in place this impact will constitute a Permanent Imperceptible Impact. This residual impact will be fully identified as the works method statement become finalised.

6.3.7.3 Quarry

Potential Permanent Imperceptible Impact

During the construction phase there is potential that the proposed works may impact quarrying activities.

The following potential **positive impacts** have been identified:

- Local source of concrete/fill materials for construction for proposed works
- Possible disposal site for excavated material which is surplus to requirements or unsuitable for reuse in construction

Residual Neutral Impact

It is likely that this impact will constitute a Permanent Imperceptible Impact. This residual impact will be fully identified as the works method statement become finalised.

6.4 SOILS

As described in Section 6.2.6 above, the Study Area is predominantly underlain by Made Ground. The impact on soils is not relevant to the proposed works. Soils may be imported on site for landscaping purposes. The quantities of imported soils are not considered significant.

6.4.1 Contaminated Land

Potential Temporary Moderate Negative Impact

Potential impacts that may result from the improper management, storage and handling of fuels and lubricants for plant and machinery and of non-hazardous or hazardous liquid and solid wastes during the construction phase of the proposed scheme. Localised contamination of soils could result from an accident, spill or leak.

Mitigation Measures

In order to reduce the risk of soil contamination as a result of accidents spill or leaks the following measures will be implemented:

- Fuels, chemicals, liquids and solid wastes will be stored on impermeable surfaces.
- Plant refuelling should be undertaken on impermeable surfaces within a suitably constructed bund in accordance with best practice guidelines. No refuelling will be permitted in or near soil or rock cuttings.
- All hydrocarbons and other potential contaminants will be stored within suitably constructed bunds in accordance with best practice guidelines.
- Spill kits will be provided at refuelling areas and at high risk/sensitive sites.

Residual Impact – Potential Temporary Slight Negative Impact

It is likely that, with the mitigation in place this impact will constitute a **Potential Temporary Slight Negative Impact**. This residual impact will be fully identified as the works method statements become finalised.

6.5 IMPORT OF MATERIALS

Sourcing and Importing of Concrete and Fill Materials

There will be a requirement to import suitable fill materials for roadways, footpaths, civic space, RC wall foundations, etc. In addition concrete will be required. In so far as is possible it is desirable that these materials be sourced locally to reduce environmental impacts associated with transport.

Surplus excavated materials may be used in earthworks provided that they satisfy certain acceptability criteria detailed in the NRA (TII) Specification. In general these criteria relate to moisture content, plasticity, density, CBR, strength and grading. The Sand and Gravels will be classified for re-use as General Granular Fill, Class 1A, 1B or 1C, depending upon the actual grading of the materials. Some of these deposits may also be suitable as selected granular fill to structures and possibly for capping and road sub-base materials. Sandy Gravely Clays will be classified for re-use as General Cohesive Fill, predominantly as Class 2C. These Class 2 materials will be susceptible to deterioration due to increases in moisture content and poor handling. Made Ground encountered along the route will most probably be classified as U1 unacceptable material. However, much of the made ground may be suitable for use as general fill if it meets the acceptability criteria specified by the NRA (TII) in the 'Specification for Road

Works Series 600 – Earthworks' (CC-SPW-00600). It should be noted that the above recommendations are an assessment based upon the ground investigations carried out to date and used to inform the Preliminary Design

process for the Scheme. The results of the ground investigation are sufficient to make a reasonable assessment on the extent of re-use of earthworks materials and the resulting overall earthworks balance which is anticipated for the scheme. Some adjustments to the balance may occur during construction. However, these adjustments will not generate a significant environmental impact.

Mitigation

The site will be subject to ecological assessment with particular regard for the presence of invasive species prior to the works commencing.

Residual Impact – Potential Temporary Imperceptible Impact

It is likely that, with the mitigation in place this impact will constitute a Potential Temporary Imperceptible Impact. This residual impact will be fully identified as the works method statements become finalised.

7 WATER

7.1 INTRODUCTION

This Chapter of the Environmental Report covers the potential impact of the proposed Morrison's Island Public Realm and Flood Defence project. The chapter discusses the existing aquatic environment, the potential impacts of the scheme and remedial measures on both surface water and groundwater along with the hydrological and hydrogeological regimes of the Study Area. Impacts on Water: Hydrology and Hydrogeology are broken down into the following sections:

- Surface Water Quality;
- Hydrogeology.

7.2 SURFACE WATER QUALITY

7.2.1 Surface Water Quality Legislative Review

7.2.1.1 Water Framework Directive

The EU Water Framework Directive (WFD) was adopted on the 23rd of October 2000 came into effect on the 22nd December 2000. It is the most significant piece of water legislation to be introduced by the European Commission in twenty years.

The Directive takes a broad approach to the protection, enhancement and restoration of all coastal waters, rivers, lakes, estuaries and groundwaters in Europe. It requires all countries to control, manage and protect their water resources from all impacts – physical, polluting or otherwise. Under the Directive, all waters within Europe must achieve at least 'Good' status by December 2015 unless otherwise agreed upon by the relevant authority and the European Commission and the status of any waters must not deteriorate.

7.2.1.2 The European Communities Environmental Objectives (Surface Water) Regulations, 2009 and Amendment Regulations 2012 and 2015

The European Communities Environmental Objectives (Surface Waters) Regulations, 2009 and Amendment Regulations 2012 and 2015 have a significant effect on the Water Framework Directive and the Dangerous Substances and Priority Substances Directives.

The Directive, similar to the requirements of the Water Framework Directive, requires that all waters must be maintained at or improved to at least 'Good Status' by 22 December 2021. No deterioration in quality is permitted.

The European Communities Environmental Objectives (Surface Waters) Regulation, 2009, specify the conditions and physico-chemical concentrations that should be considered in the assessment of Status.

The 2012 Regulations set standards for a range of pesticide, herbicide and heavy metals in surface waters. It clarifies the role of public authorities in the protection of surface waters, include standards and sets limits for priority hazardous substances. The 2015 Regulations amend the Biological quality requirements conditions and concentrations of priority substances.

Table 7.1 overleaf shows the surface water quality standards applied with regard the Regulations.

Table 7.1 Mandatory levels for physiochemical parameters for specific legislation

Parameter	Units	European Communities Environmental Objectives (Surface Water) Regulations (S.I. No. 272 of 2009)
BOD	mg/l	High status ≤1.3 (mean) or ≤2.2 (95%ile) Good status ≤1.5 (mean) or ≤2.6 (95%ile)
Suspended Solids	mg/l	N/A
pH	-	4.5-9.5 (Soft Water) 6.0-9.0 (Hard Water)
Conductivity	µS/cm	N/A
Phosphates	mg/l P_2O_5	N/A
Molybdate Reactive Phosphorus (MRP)	mg/l P	High status ≤0.025 (mean) or ≤0.045 (95%ile) Good status ≤0.035 (mean) or ≤0.075 (95%ile)
Chloride	mg/l Cl	N/A
Ammonium	mg/l NH_4	N/A
Total Ammonia	mg/l N	High status ≤0.040 (mean) or ≤0.090 (95%ile) Good status ≤0.065 (mean) or ≤0.140 (95%ile)
Nitrate	mg/l NO_3	N/A
Nitrite	mg/l NO_2	N/A
Dissolved Oxygen	-	Lower limit: 95%ile>80% saturation Upper limit: 95%ile<120 %saturation
Total Hardness	mg/l $CaCO_3$	N/A
Copper	mg/l Cu	5 - water hardness ≤100mg/l $CaCO_3$ 30 – water hardness >100mg/l $CaCO_3$
Zinc	mg/l Zn	0.008 - water hardness ≤10mg/l $CaCO_3$ 0.05 - water hardness>10 ≤100mg/l $CaCO_3$ 0.1- water hardness >100mg/l $CaCO_3$
Total coliforms	no/100ml	N/A
Faecal coliforms	no/100ml	N/A

[1] At water hardness 10 mg/l CaCO3; [2] At water hardness 50 mg/l CaCO3.; [3] At water hardness 100 mg/l CaCO3 ; [4] At water hardness 300 mg/l CaCO3; [5] At water hardness 500 mg/l CaCO3; [6] To be conformed with by 95% of samples over a period of 12 months where sampling is carried out at least once a month; where sampling is less frequent, to be conformed with by all samples.

*S.I. No. 294/1989 is superseded by S.I. No. 272 of 2009. If a particular parameter is not found in SI 272 of 2009 then the 1989 value applies.

7.2.2 Methodology

7.2.2.1 Desk Study

A desk study of relevant hydrological data was conducted. The following documentation and sources were reviewed:

- Environmental Protection Area (EPA) water quality database and maps (http://gis.epa.ie/Envision)
- Cork County Council Surface Water Results for the River Lee
- South Western River Basin District Management Plan (2009 – 2015)

- The Water Framework Directive website www.WFD.ie

7.2.2.2 Field Assessment

The Study Area is located along the south channel, as this area is tidal and are outside the scope of the EPA Q-Value system.

7.2.3 Description of the Study Area

The River Lee flows into the Study Area from the west. The Study Area is located on the south channel in the city centre which is influenced by the tide. This transitional waterbody is known as the Lee (Cork Estuary Upper) (IE_SW_060_0950)

7.2.3.1 EPA Water Quality Data

The EPA website, http://gis.epa.ie/Envision, contains information regarding water quality in selected Irish rivers based on surveys carried out by the EPA. Information was obtained from EPA monitoring stations on the River Lee.

Information obtained for the River Lee from the EPA monitoring points upstream of the Study Area indicate that the current water quality (2014) ranges from moderately polluted to unpolluted (Q3-4 to Q4-5) as shown in Table 7.4.

The EPA water quality assessment highlighted the River Lee Assessment as a whole as:

River Lee – Water quality "continuing mostly satisfactory, with High and Good ecological quality, and with a slight improvement from Poor to Moderate quality, at Inniscarra".

For the Lee Upper Estuary, the EPA have identified the Transitional Water Quality 2010 – 2012 for this area as of Intermediate Water Quality.

7.2.3.2 Water Framework Directive

The Study Area is located within the Water Framework Directive (WFD) South Western River Basin District (SWRBD) and the management plan for this area was consulted. The main objectives of this management plan were to prevent deterioration, restore good status, reduce chemical pollution in surface waters and to achieve protected areas objectives.

Within the Water Management Unit (WMU) sub catchments are for the study area is the Lee (Cork) Upper Estuary. The Transitional Waterbody WFD Status for 2010 – 2015 is Moderate. The WFD has scored the waterbody as (1b) At Risk of not achieving good status.

The transitional water of the Lee Estuary is classified as a Nutrient Sensitive Area. These areas comprise nitrate vulnerable zones designated under the Urban Waste Water Treatment (Amendment) Regulations 2010 for the Lee Estuary / Lough Mahon – from the salmon weir (downstream of waterworks intake) to Monkstown (excluding North Channel and Great Island).

7.2.4 Impacts on Water Quality and Mitigation

As identified in Section 7.2.4.1 the Study area is located within the WDF South Western River Basin District. The main objectives of this management plan are to prevent deterioration, restore good status, reduce chemical pollution in surface waters and to achieve protected areas objectives. The following impact assessment and mitigation measures will ensure that the objectives of the Waters Framework Directive are not delayed or obstructed. Chapter 5 Biodiversity, Flora and Fauna further details the ecological impact and mitigation for the scheme on the River Lee.

7.2.4.1 Generation of Silt-Laden Run-off & Increase in Suspended Solids

Temporary Moderate Negative Impact

The preparation phase, site clearance and preparatory groundworks including site compound set-up etc. will lead to exposure of bare ground and the potential for the generation of silt-laden run-off in works areas along the quay. The potential for the generation of silt-laden surface run-off is likely to continue through the construction phase of the works and until the ground is reinstated. Stockpiled excavated material also poses an increased threat of increased siltation in the watercourse.

Excessive suspended sediment in the water column can clog and cause abrasions to fish gills, interfere with fish navigation and feeding, affect development, while also affecting populations of aquatic invertebrates, on which the fishes' diet is based. Once deposited, excessive amounts of silt may damage fish habitat by clogging interstices between gravels in spawning grounds, resulting in diminished flow of oxygenated water to eggs and rendering these gravels unsuitable for egg incubation. Deposited sediment may also impact on the habitat of bottom dwelling aquatic invertebrates and damage nursery habitat for young fish.

Mitigation Measures

- Measures to minimise the suspension and transfer of sediment downstream will be implemented. These measures may include the use of silt barriers where appropriate, downstream of the works areas and removal of any accumulated silt, construction of silt sumps downstream of the works areas.
- An Environmental Management Plan (EMP) will be prepared prior to the commencement of any works in order to ensure all works are carried out in a manner designed to avoid and minimise any adverse impacts on the receiving environment.

Residual Impact - Temporary Slight Negative Impact

It is likely that, with mitigation measures in place this impact will constitute a **Temporary Slight Negative** Impact.

7.2.4.2 Use of Potential Water Contaminants

Potential Temporary Moderate to Significant Negative Impact

Numerous substances used on construction sites have the potential to pollute both ground and surface water if not properly managed and treated. Such substances include fuels, lubricants, cement, mortar, silt, soil and other substances which arise during construction. The washing of construction vehicles and equipment also poses a pollution risk to watercourses. The spillage or leaking of fuel or oil from fuel tanks or construction vehicles has the potential to contaminate soils, groundwater and surface water. Such substances entering the River Lee could damage the habitat of local populations of fish and aquatic invertebrates and also cause direct harm to aquatic fauna.

Mitigation Measures

- See also Chapter 5 for mitigation measures in the aquatic environment.
- Where concrete works are proposed in-stream these will be dealt with specifically in a construction method statement that will be signed off on by the contractor.
- Appropriate mitigation measures will be implemented prior to the construction phase to ensure that water quality is not adversely affected through pollution incidents, cement release and silt mobilisation. See Chapter 5.4 for further details on mitigation for the aquatic environment.

- Refuelling will take place at designated locations at distances of greater than 30 metres from the watercourse were possible. However, refuelling of piling rig may be required on a barge in the river. Fuel will be stored in a bunded container and drip trays will be used in refuelling.
- No vehicles will be left unattended when refuelling and a spill kit including an oil containment boom and absorbent pads will be on site at all times.
- Any fuel that is stored on the site will be in a double skinned, bunded container that will be located within a designated works compound at a location that is removed from the river. All other construction materials and plant will be stored in this compound. The compound will also house the site offices and portaloo toilets. This compound will either be located on ground that is not prone to flooding or will be surrounded by a protective earth bund to prevent inundation.
- All vehicles will be regularly maintained and checked for fuel and oil leaks.

Residual Impact – Neutral Impact

It is likely that with proper implementation of the above mitigation this impact will constitute a Temporary slight negative impact.

7.3 HYDROGEOLOGY

This section describes the existing hydrogeological environment within the Study Area and assesses the potential impacts of Morrison's Island Public Realm project.

7.3.1 Methodology

A desktop study was carried out in order to ascertain a comprehensive baseline for the Study Area and give a description of the existing environment. This information was then used in assessing the potential impact the proposed works will have on the hydrogeology within the Study Area.

The following documents were consulted during the preparation of this section:

- The Geology of South Cork (1994)
- The Geological Survey of Ireland (GSI) online database

7.3.2 Hydrogeology in the Existing Environment

The Geological Survey of Ireland (GSI) online database shows the Study Area as being underlain by dinantian mudstone and sandstone and dinantian pure unbedded limestone. The site is locally important aquifer with bedrock which is moderately productive only in Local Zones. Groundwater flows though fractures, fissures or joints in the bedrock. The groundwater body is generally covered by till derived from its sandstone parent material. An extract from the GSI Online Database is provided.

The direction of groundwater flow is likely to be influenced by the topography of the surrounding area. Groundwater within the Study Area is more than likely hydraulically connected to the River Lee and its tributaries.

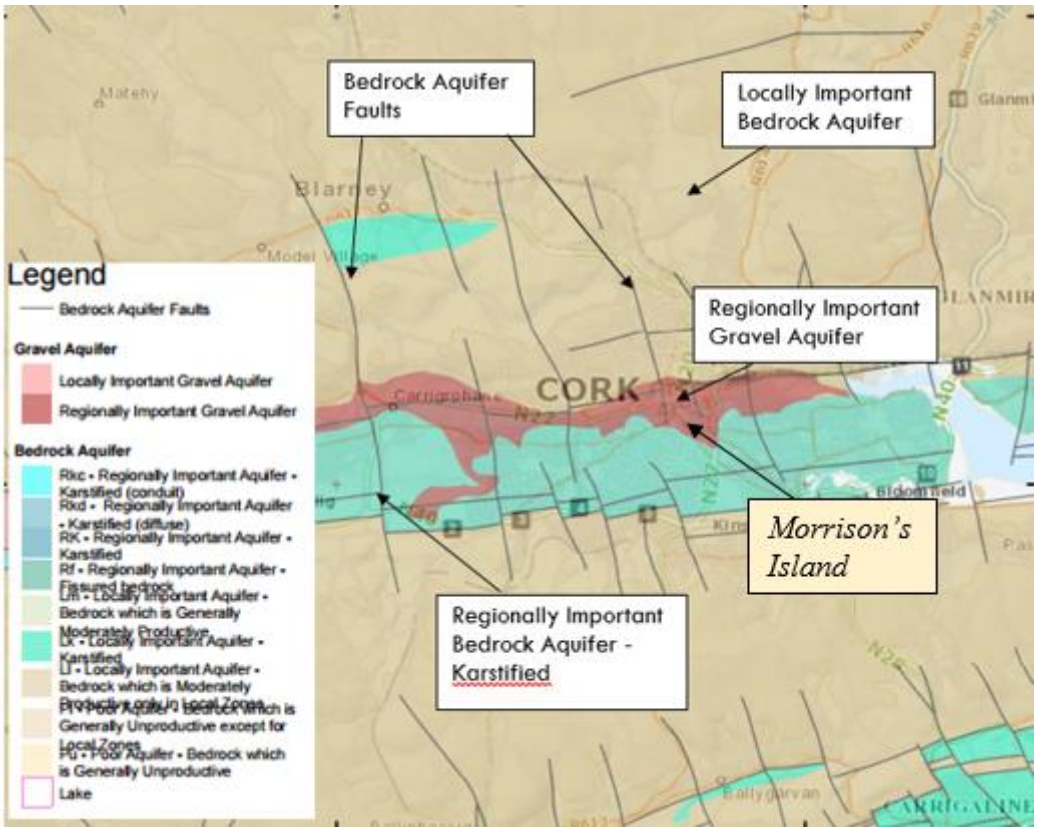


Figure 7.4 GSI Groundwater Resources (Aquafers) (www.gsi.ie)

7.3.2.1 Ground Water Vulnerability

Groundwater vulnerability is a term used to represent the intrinsic geological and hydrogeological characteristics that determine the ease with which groundwater may be contaminated by human activities.

The Geological Survey of Ireland (GSI) online database was referenced regarding the vulnerability of the local aquifers to contamination from ground waters. The vulnerability mapping indicates that the local aquifers around Morrison's Island range from Moderate to High. An extract from the GSI Online Database is included below.

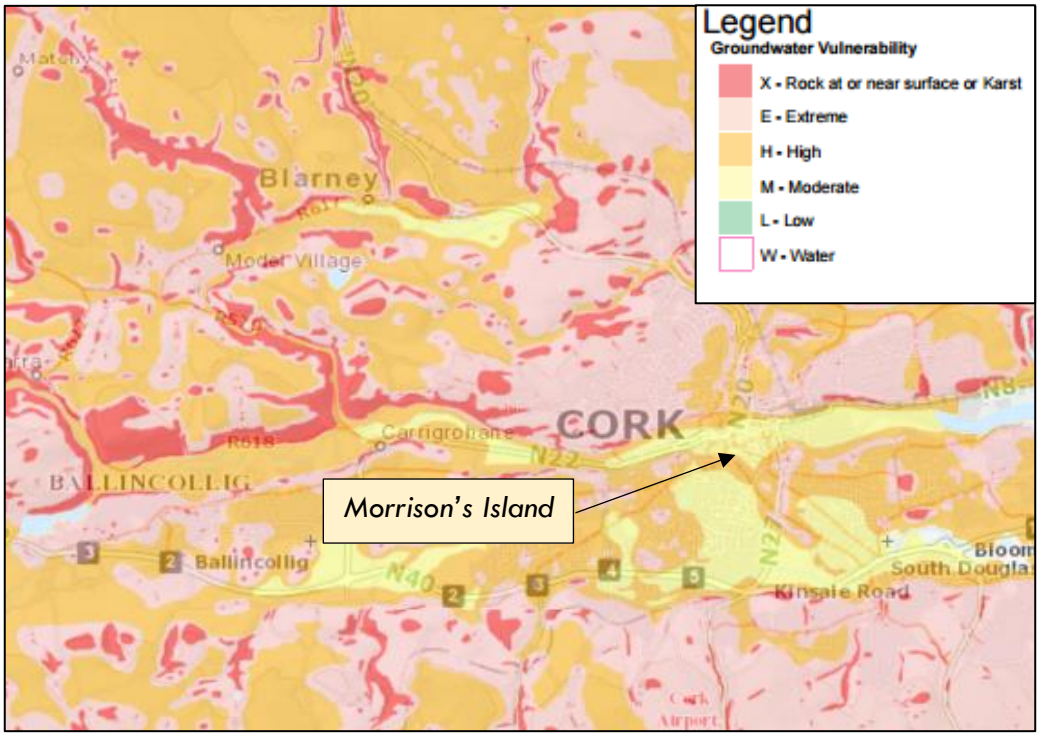


Figure 7.5 GSI Aquafer Vulnerability (www.gsi.ie)

7.3.2.2 Ground Water Abstractions and Wells

The well card data by the Geological Survey of Ireland (GSI) indicates that 1No well is present within the proposed works area. The well is identified as a Borehole drilled in 1964 a depth of 42.7m in the townland of Holy Trinity.

7.3.3 Potential Impacts on Hydrogeology

Potential Slight Negative Impact

There are numerous substances that will be used during the construction phase such as fuel, oil, lubricants, cement, silt, soil and other hydrocarbons which have the potential to pollute ground water. Washing of construction vehicles and machinery also poses a risk of polluting ground water. The impacts to hydrogeology as a result of Morrison's Island Public Realm project are temporary and significant. Any impacts associated with the scheme will occur during the construction phase.

As set out in Section 7.3.2 above, the aquifers in the study area are classified as moderate to vulnerable to infiltration. Should any of the above-mentioned substances contaminate the ground water in the study area then there is a risk to groundwater quality. However, given the urban nature and the currently availability of potable water in the area suggests this source is unlikely to be a drinking source. Nevertheless, best practice construction measures will be put in place to ensure that the risk to ground water quality is limited and ground water quality will be maintained.

Mitigation Measures

A bunded area will be constructed within the site compound in order to avoid any polluting substances infiltrating the ground water during the construction and operation phase of the Scheme. All plant refuelling, maintenance and washing will be carried out within the bunded area. Spill kits will be available at the bunded area in order to ensure the quick and effective cleaning of any substances.

Site compounds will not be located in an area classified as 'highly' vulnerable to infiltration of ground water to further reduce the risk of pollution to the groundwater.

Residual Impact - Potential Negligible Impact

Taking into account the abovementioned mitigation measures, it is considered that the impact will constitute a Potential Negligible Impact.

8 AIR QUALITY & CLIMATE / NOISE & VIBRATION

This section, prepared by McCarthy Keville O'Sullivan Ltd. with Damian Brosnan Acoustics, assesses both the air quality & climate and the likely noise & vibration impact of the proposed works, in the context of current relevant standards and guidance, and identifies any requirements or possibilities for mitigation.

The proposed works will not have any air quality or noise and vibration impact during its operational phase. As a result, it is only considered necessary to assess the potential noise and vibration impact on the surroundings during the construction phase.

The construction phase will be short term in nature and a full description of the proposed works is given in Section 3.1 of this Environmental Report.

8.1 AIR QUALITY & CLIMATE – EXISTING ENVIRONMENT

Meteorological Data

A key factor in assessing temporal and spatial variations in air quality is the prevailing meteorological conditions. Depending on factors such as wind speed, individual receptors may experience very significant variations in pollutant levels under the same source strength (i.e. traffic levels).

County Cork has a temperate oceanic climate, resulting in mild winters and cool summers. The Met Éireann weather station at Cork Airport is the nearest weather and climate monitoring station to the proposed development site located approximately 5.4 kilometres south of the site. Meteorological data recorded at Cork Airport over the 30-year period from 1981-2010 is shown in Table 8.1 overleaf. The wettest months are October and December, and July is usually the driest. July is also the warmest month with an average temperature of 18.7° Celsius.

Table 8.1 Data from Met Éireann Weather Station at Cork Airport, 1981 to 2010

	Monthly and Annual Mean and Extreme Values												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
TEMPERATURE (degrees Celsius)													
Mean daily max	8.2	8.3	9.9	11.8	14.4	17	18.7	18.5	16.5	13.2	10.3	8.5	12.9
Mean daily min	3	3.1	4	4.9	7.4	10	11.8	11.8	10.2	7.7	5.2	3.7	6.9
Mean temperature	5.6	5.7	6.9	8.4	10.9	13.5	15.3	15.2	13.3	10.5	7.8	6.1	9.9
Absolute max.	16.1	14	15.7	21.2	23.6	27.5	28.7	28	24.7	21.4	16.2	13.8	28.7
Absolute Min.	-4.3	-1.6	1.4	5	7.6	10.7	12.8	11.9	10.4	6	0.6	-3.2	-4.3
Mean No. of Days With Air Frost	10.6	10.6	10.9	11.4	15.1	16.2	19	18.4	17.3	15.4	12.8	11.6	19
Mean No. of Days With Ground Frost	-8	-4.7	-4.3	-2.3	-0.9	3.7	6.7	5.3	2.3	-0.9	-3.3	-7.2	-8
RELATIVE HUMIDITY (%)													
Mean at 0900UTC	89.8	89.4	87.8	83.1	80.6	81.3	83.2	85.4	88.4	90.1	90.7	90.5	86.7
Mean at 1500UTC	83.7	78.9	75.5	71.3	70.9	71.5	72.9	72.8	75.4	80.4	83.4	85.4	76.8
SUNSHINE (Hours)													
Mean daily duration	1.8	2.4	3.3	5.3	6.2	5.8	5.4	5.2	4.3	3	2.3	1.7	3.9
Greatest daily duration	8.5	10	11.5	13.6	15.5	16	15.3	14.4	11.9	10.3	8.7	7.6	16
Mean no. of days with no sun	10.1	7.9	6.3	3.1	2.1	2.5	2	2.6	3.6	6.4	8.6	11.9	67.1
RAINFALL (mm)													
Mean monthly total	131.4	97.8	97.6	76.5	82.3	80.9	78.8	96.8	94.6	138.2	120	133.1	1227.9
Greatest daily total	45.7	49.9	55.2	34.2	34.9	59.7	73.2	60.9	58.9	52.1	47.9	41.9	73.2
WIND (knots)													
Mean monthly speed	12.1	12	11.6	10.3	10.1	9.4	9	9	9.4	10.7	10.9	11.6	10.5
Max. gust	78	83	70	62	59	49	57	54	58	75	66	80	65.9
Max. mean 10-minute speed	52	54	43	40	40	33	40	38	39	48	46	56	44.1
Mean num. of days with gales	2.3	1.8	1.3	0.3	0.3	0	0.1	0.2	0.3	1	1.2	1.9	10.8
WEATHER (Mean No. of Days With:)													
Snow or sleet	3.1	3.1	2	0.7	0	0	0	0	0	0	0.3	2.2	11.3
Snow lying at 0900UTC	0.7	0.5	0.2	0.1	0	0	0	0	0	0	0	0.5	2
Hail	1	1.1	1.4	1.9	0.7	0.2	0.1	0	0.1	0.3	0.2	0.4	7.4
Thunder	0.2	0.1	0.1	0.1	0.6	0.5	0.8	0.3	0	0.4	0.1	0.1	3.3
Fog	7.8	6.8	8.5	7.5	7.6	7.6	8.4	8.8	9.1	8.7	7.6	8.4	96.8

Available Background Data

Air quality monitoring programs have been undertaken in recent years by the EPA and Local Authorities. The most recent annual report on air quality "Air Quality Monitoring Report 2010", details the range and scope of monitoring undertaken throughout Ireland. The Environmental Protection Agency (EPA) has designated four Air Quality Zones for Ireland:

- Zone A: Dublin City and environs
- Zone B: Cork City and environs
- Zone C: 16 urban areas with population greater than 15,000
- Zone D: Remainder of the country.

These zones were defined to meet the criteria for air quality monitoring, assessment and management described in the Framework Directive and Daughter Directives. The site of the proposed development lies within Zone B, which represents Cork city and its environs.

The EPA publishes Air Monitoring Station Reports for monitoring locations in all four Air Quality Zones. The ambient air quality monitoring carried out closest to the proposed development site is at Blackpool, Co. Cork, located approximately 1.3 kilometres north of the proposed development site. EPA air quality data is available for Blackpool in the report '*Ambient Air Monitoring at Blackpool, Cork City 19th January 2000 to 31st May 2000*', as detailed below. This monitoring location also lies within Zone B. Similar measurement values for all air quality parameters would be expected for the proposed development site as it lies directly adjacent to this monitoring location.

Sulphur Dioxide (SO2)

Sulphur dioxide data for the 2000 monitoring period in Blackpool is presented in Table 8.2. A technical problem with the monitor meant that no data was collected between 29th March and 18th May 2000.

Table 8.2 Sulphur Dioxide Data Blackpool January to May 2000

Parameter	Measurement
No. of hours	3,188
No. of measured values	1,952
Percentage Coverage	61.2%
Maximum hourly value	161.3 µg/m3
98 percentile for hourly values	96.1 µg/m3
Mean hourly value	25.3 µg/m3
Maximum 24-hour mean	58.3 µg/m3
98 percentile for 24-hour mean	47.3 µg/m3

During the period of operation there were no exceedences of the 350 µg/m3 hourly limit for the protection of human health. There were two exceedences of the 50 µg.m-3 lower assessment threshold. The directive stipulates that the lower assessment threshold should not be exceeded more than three times in the calendar year. The mean hourly value of 25.1 µg/m3 exceeds the limit value for the protection of ecosystems. However, the report states that this limit may not be relevant to monitoring in an urban environment. It would be expected that SO2 values at the proposed development site (approximately 1.3 kilometres south of this monitoring location) would be similar to those recorded at the Blackpool monitoring site.

Particulate Matter (PM10)

Particulate matter (PM_{10}) data for the 2000 monitoring period in Blackpool is presented in Table 8.3.

Table 8.3 Particulate Matter (PM10) Data Blackpool January to May 2000

Parameter	Measurement
No. of days	133
No. of measured values	117
Percentage Coverage	87.9%
Maximum daily value	239.4 µg/m3
98 percentile for daily values	111.5 µg/m3
Mean daily value	49.1 µg/m3

The 24-hour limit for the protection of human health was breached 46 times during the measurement period; the Directive permits the limit value to be exceeded only 35 times in a calendar year. The mean of the daily values during the measurement period (49.1 µg/m3) also exceeds the annual limit value for the protection of human health (40.0 µg/m3). It would be expected that PM_{10} values at the proposed development site would be similar to those recorded during the 2000 Blackpool monitoring period.

Nitrogen Dioxide (NO2)

Nitrogen dioxide and oxides of nitrogen (NOx) data for the 2000 monitoring period in Blackpool is presented in Table 8.4. No data was collected between 29th February and 18th May because of a technical problem with the monitor.

Table 8.4 Nitrogen Dioxide and Oxides of Nitrogen Data Blackpool January to May 2000

Parameter	Measurement
No. of hours	3,188
No. of measured values	1,254
Percentage Coverage	39.3%
Maximum hourly value (NO2)	107.1 µg/m3
98 percentile for hourly values (NO2)	72.9 µg/m3
Mean hourly value (NO2)	26.8 µg/m3
Mean hourly value (NOx)	55.4 µg/m3 NO2

All hourly mean NO2 values were below the lower assessment threshold (100 µg/m3) except for one exceedence. The Directive stipulates that the lower assessment threshold should not be exceeded more than 18 times in a calendar year. The mean hourly NO2 value (26.9 µg/m3) during the period of measurement was below the annual limit for the protection of human health (40 µg/m3) but just above the annual lower assessment threshold for the protection of human health (26 µg/m3). The mean hourly value of NOX (55.1 µg/m3 NO2) during the measurement period exceeds the annual limit value for the protection of vegetation (30 µg/m3 NOX). However, the report states that the applicability of this limit to urban air pollution monitoring is questionable. It would be expected that NO2 and NOx values at the proposed development site would be similar to those recorded during the 2000 Blackpool monitoring period.

Carbon Monoxide (CO)

Carbon monoxide data for the 2000 monitoring period in Blackpool is presented in Table 8.5. A limited dataset from 19th January until 13th February is available due to a technical problem with the carbon dioxide monitor.

Table 8.5 Carbon Monoxide Data Blackpool January to February 2000

Hourly Values	Result
No. of hours	3,188
No. of measured values	601
Percentage Coverage	18.8%
Maximum hourly value	21.8 mg/m3
98 percentile for hourly values	2.9 mg/m3
Mean hourly value	0.9 mg/m3
Maximum 8-hour mean	10.9 mg/m3
98 percentile for 8-hour mean	3.8 mg/m3

During the monitoring period there was an exceedence of the 10 mg/m3 limit. This was an isolated result and may have been attributable to a local effect at the sampling location. Otherwise, all data is below the lower assessment threshold for the protection of human health. It would be expected that carbon monoxide values at the proposed development site would be similar to those recorded during the 2000 Blackpool monitoring period.

Dust

A study by the UK ODPM(13) gives estimates of likely dust deposition levels in specific types of environments. In open country a level of 39 mg/(m2*day) is typical, rising to 59 mg/(m2*day) on the outskirts of town and peaking at 127 mg/(m2*day) for a purely industrial area. As a worst-case, a level of 127 mg/(m2*day) can be estimated as the existing dust deposition level for the current location.

8.2 NOISE & VIBRATION – BASELINE SCENARIO

8.2.1 Noise receptors

The study area, for the purposes of the noise impact assessment, follows the northern bank of the southern channel of the River Lee between Parliament Bridge and Parnell Bridge, a distance of approximately 540 m (Figure 8.1) along with a short section of Union Quay on the southern river bank at the Millenium Bridge. This route consists of Father Matthew Quay, Morrison's Quay, Union Quay, and Parnell Plaza adjacent to Parnell Bridge.

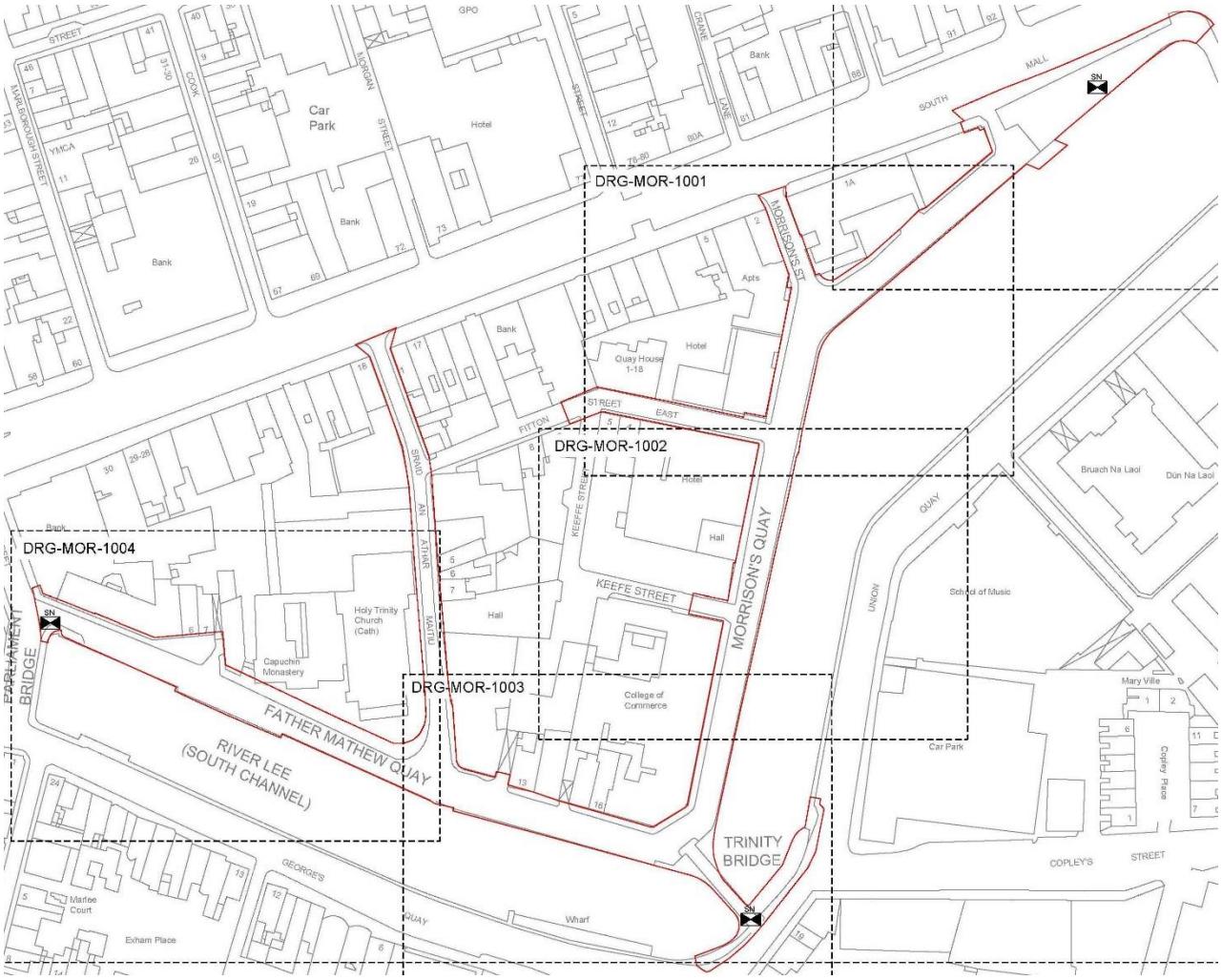


Figure 8.1: Study site. N

The character of the study site changes gradually from upstream to downstream. Near Parliament Bridge, at the upstream (western) end of the study site, buildings on the quay consist of older period structures, including a small number of dwellings and a former grain store which appears to be at least partly vacant. East of these lies Holy Trinity Church and the adjacent Capuchin Friary. The eastern end of Father Matthew Quay consists of a terrace of new and period buildings in residential and commercial use. These include RTE's Cork City studios.

Much of Morrison's Quay is occupied by the College of Commerce. Downstream of the college lie two hotel buildings and a large office building extending to six storeys. One of the hotels (the former Moore's Hotel) is currently vacant. Parnell Plaza, at the eastern end of the study site, occupies an elongated triangular plot between the river and the South Mall.

The EPA defines a noise sensitive location (NSL) as:

> '*Any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or area of high amenity which for its proper enjoyment requires absence of noise at nuisance levels.*'

NSLs along the study site consist of the following:

- Small number of dwellings on Father Matthew Quay.
- Friary at Father Matthew Quay.

- Church on Father Matthew Quay.
- Other buildings in residential use on Father Matthew Quay.
- RTE studios at Father Matthew Quay.
- College of Commerce on Morrison's Quay.
- Hotel at Morrison's Quay.
- Buildings in residential/apartment use at Morrison's Quay.
- Apartment buildings on Union Quay.
- School of Music on Union Quay.
- Apartment buildings on Georges Quay.
- Other buildings in residential use at Georges Quay.
- Buildings in residential use at eastern end of Sullivan's Quay.
- Buildings in residential use immediately upstream of Parliament Bridge, backing onto river.

While the EPA definition of an NSL does not include any reference to offices, it is arguable that buildings used for offices also require some degree of protection. The list of NSLs above may therefore be extended to include offices located on the surrounding quays, including purpose built offices, and former period buildings now converted to office use. In addition to those located on the quays, there are a number of office buildings at the eastern end of the South Mall. Being located in a busy urban environment, most offices here are likely to include acoustic-grade glazing.

Given the wide variety of NSL types located in the vicinity of the study site, and given their varied locations, the most practical approach is to assume that surrounding quays and streets are flanked by NSLs on both sides.

8.2.2 Noise environment

The noise environment across the study site is dominated entirely by road traffic. While Father Matthew Quay and Morrison's Quay are not main thoroughfares, being used chiefly for parking and local access, the quays on the opposite side of the river are busy traffic routes. In particular, Georges Quay opposite Father Matthew Quay provides an important link between the South Link Road and the city centre, and thus sees a high volume of traffic throughout the day. As a result, Parliament Bridge also sees a consistently high volume of traffic. Although Union Quay, opposite Morrison's Quay, is less busy, the soundscape in this area remains dominated due to traffic flow over Parnell Bridge, which also forms a key part of the city's road network. At the downstream end of the study site, traffic on the South Mall and at Parnell Place dominates the soundscape.

Outside of traffic, there are no other noise sources of significance, although noise from construction projects may arise from time to time. Such projects, when they arise, tend to be significant in scale, often occupying entire blocks. Current construction projects in this area include works at the former Beamish site, just upstream of the study area, and the courthouse renovation project at Anglesea Street.

Previous inspections undertaken across the study site indicate that, due to the continuous stream of traffic, the evening soundscape is similar to the daytime soundscape. Traffic volumes decrease significantly after midnight, although local quays and streets continue to see traffic throughout the night.

As part of the wider Cork City flood relief project assessment in 2016, existing noise levels were measured across the wider city area. The monitoring programme included a measurement on Wednesday November 2

2016 at Morrison's Quay, at the northeast corner of the College of Commerce (station N18, at grid ref. 567713 571629) (Figure 8.2 and Photograph 8.1).

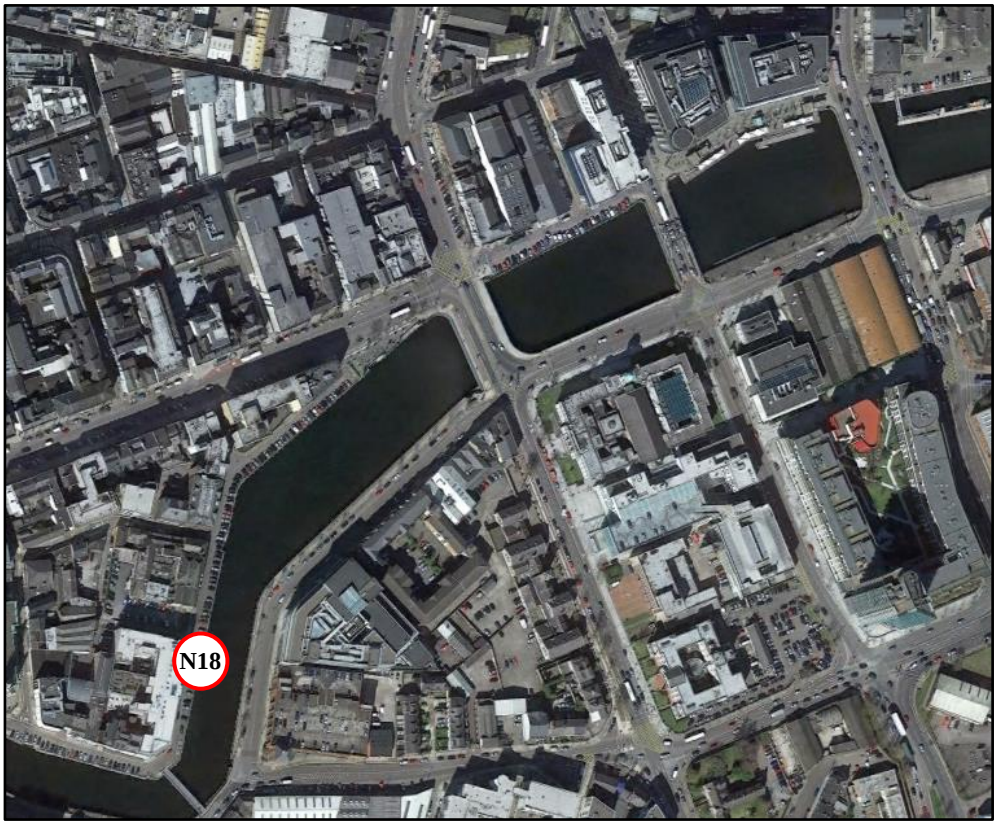
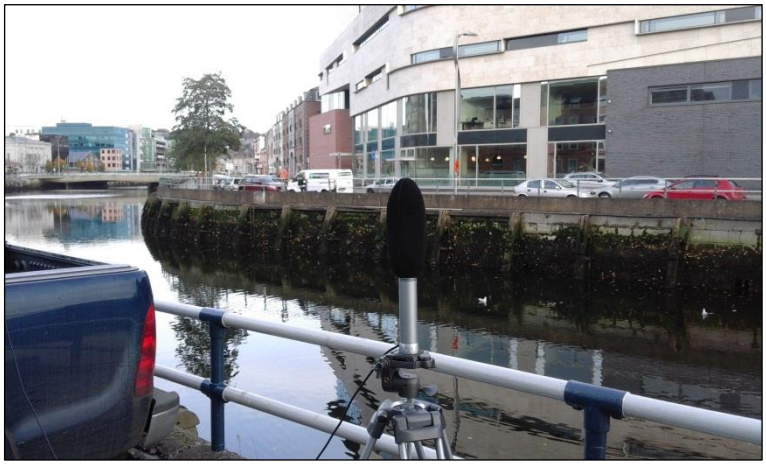


Figure 8.2: Location of station N18 N



Photograph 8.1: N18
Morrison's Quay, looking E towards the School of Music.

Recorded noise levels are presented in Table 8.1. Although the survey represents a single snap shot of the local soundscape, levels recorded are considered reasonably representative of longer term noise levels, and are consistent with data measured on other quays which are not thoroughfares.

Table 8.1: Ambient noise data at N18.

Location	Start Time	$L_{Aeq\ 15\ min}$ dB	$L_{AF90\ 15\ min}$ dB	Dominant noise sources
Morrison's Quay	1542	56	50	Intermittent quay traffic and traffic on opposite quays dominant. Distant traffic and pedestrian voices.

8.3 ASSESSMENT CRITERIA

8.3.1 Air Quality & Climate

In order to reduce the risk to health from poor air quality, national and European statutory bodies have set limit values in ambient air for a range of air pollutants. These limit values or "Air Quality Standards" are health or environmental-based levels for which additional factors may be considered. For example, natural background levels, environmental conditions and socio-economic factors may all play a part in the limit value which is set. Air quality significance criteria are assessed on the basis of compliance with the appropriate standards or limit values.

In 1996, the Air Quality Framework Directive (96/62/EC) was published. This Directive was transposed into Irish law by the Environmental Protection Agency Act 1992 (Ambient Air Quality Assessment and Management) Regulations 1999. The Directive was followed by four Daughter Directives, which set out limit values for specific pollutants:

- The first Daughter Directive (1999/30/EC) deals with sulphur dioxide, oxides of nitrogen, particulate matter and lead.
- The second Daughter Directive (2000/69/EC) addresses carbon monoxide and benzene. The first two Daughter Directives were transposed into Irish law by the Air Quality Standards Regulations 2002 (SI No. 271 of 2002).
- A third Daughter Directive, Council Directive (2002/3/EC) relating to ozone was published in 2002 and was transposed into Irish law by the Ozone in Ambient Air Regulations 2004 (SI No. 53 of 2004).
- The fourth Daughter Directive, published in 2007, deals with polyaromatic hydrocarbons (PAHs), arsenic, nickel, cadmium and mercury in ambient air.

The Air Quality Framework Directive and the first three Daughter Directives have been replaced by the Clean Air for Europe (CAFE) Directive (Directive 2008/50/EC on ambient air quality), which encompasses the following elements:

- The merging of most of the existing legislation into a single Directive (except for the Fourth Daughter Directive) with no change to existing air quality objectives.
- New air quality objectives for PM2.5 (fine particles) including the limit value and exposure concentration reduction target.
- The possibility to discount natural sources of pollution when assessing compliance against limit values.
- The possibility for time extensions of three years (for particulate matter PM10) or up to five years (nitrogen dioxide, benzene) for complying with limit values, based on conditions and the assessment by the European Commission.

Table 8.8 below sets out the limit values of the CAFE Directive, as derived from the Air Quality Framework Daughter Directives. Limit values are presented in micrograms per cubic metre (µg/m3) and parts per billion (ppb). The notation PM10 is used to describe particulate matter or particles of ten micrometres or less in aerodynamic diameter. PM2.5 represents particles measuring less than 2.5 micrometres in aerodynamic diameter.

Table 8.8 Limit values of Directive 2008/50/EC, 1999/30/EC and 2000/69/EC (Source: EPA)

Pollutant	Limit Value Objective	Averaging Period	Limit Value (µg/m³)	Limit Value (ppb)	Basis of Application of Limit Value	Attainment Date
Sulphur dioxide (SO2)	Protection of Human Health	1 hour	350	132	Not to be exceeded more than 24 times in a calendar year	1st Jan 2005
Sulphur dioxide (SO2)	Protection of human health	24 hours	125	47	Not to be exceeded more than 3 times in a calendar year	1st Jan 2005
Sulphur dioxide (SO2)	Protection of vegetation	Calendar year	20	7.5	Annual mean	19th Jul 2001
Sulphur dioxide (SO2)	Protection of vegetation	1st Oct to 31st Mar	20	7.5	Winter mean	19th Jul 2001
Nitrogen dioxide (NO2)	Protection of human health	1 hour	200	105	Not to be exceeded more than 18 times in a calendar year	1st Jan 2010
Nitrogen dioxide (NO2)	Protection of human health	Calendar year	40	21	Annual mean	1st Jan 2010
Nitrogen monoxide (NO) and nitrogen dioxide (NO2)	Protection of ecosystems	Calendar year	30	16	Annual mean	19th Jul 2001
Particulate matter 10 (PM10)	Protection of human health	24 hours	50	-	Not to be exceeded more than 35 times in a calendar year	1st Jan 2005
Particulate matter 2.5 (PM2.5)	Protection of human health	Calendar year	40	-	Annual mean	1st Jan 2005
Particulate matter 2.5 (PM2.5) Stage 1	Protection of human health	Calendar year	25	-	Annual mean	1st Jan 2015
Particulate matter 2.5 (PM2.5) Stage 2	Protection of human health	Calendar year	20	-	Annual mean	1st Jan 2020
Lead (Pb)	Protection of human health	Calendar year	0.5	-	Annual mean	1st Jan 2005
Carbon Monoxide (CO)	Protection of human health	8 hours	10,000	8,620	-	1st Jan 2005
Benzene (C6H6)	Protection of human health	Calendar Year	5	1.5	-	1st Jan 2010

The Ozone Daughter Directive 2002/3/EC is different from the other Daughter Directives in that it sets target values and long-term objectives for ozone rather than limit values. Table 8.9 presents the limit and target values for ozone.

Table 8.9 Target values for Ozone Defined in Directive 2008/50/EC

Objective	Parameter	Target Value for 2010	Target Value for 2020
Protection of human health	Maximum daily 8 hour mean	120 mg/m3 not to be exceeded more than 25 days per calendar year averaged over 3 years	120 mg/m3
Protection of vegetation	AOT40 calculated from 1 hour values from May to July	18,000 mg/m3.h averaged over 5 years	6,000 mg/m3.h
Information Threshold	1 hour average	180 mg/m3	-
Alert Threshold	1 hour average	240 mg/m3	-

There are no statutory guidelines regarding the maximum dust deposition levels that may be generated during the construction phase of a development in Ireland. Furthermore, no specific criteria have been set in respect of this development. Recommendations outlined by the Department of the Environment, Health & Local Government, apply the Bergerhoff limit of 350 mg/(m2*day) to the site boundary of quarries. These can be implemented with regard to dust emissions from the proposed construction sites.

The concern from a health perspective is focused on particles of dust which are less than 10 microns. EU ambient air quality standards (Council Directive 2008/50/EC transposed into Irish law as S.I. 180 of 2011) centres on PM10 (particles less than 10 microns) as it is these particles which have the potential to be inhaled into the lungs and cause some adverse health impact. The Directive also sets an ambient standard for PM2.5 (particles less than 2.5 microns) which came into force in 2015 (see Table 8.8).

Climate Agreements

Ireland is a Party to the Kyoto Protocol, which is an international agreement that sets limitations and reduction targets for greenhouse gases for developed countries. It is a protocol to the United Nations Framework for the Convention on Climate Change. The Kyoto Protocol came into effect in 2005, as a result of which, emission reduction targets agreed by developed countries, including Ireland, are binding.

At Kyoto in 2007, the European Union committed to an average annual greenhouse gas (GHG) emission reduction of 8% below the 1990 levels, over the five year period 2008-2012, with the reductions to be shared between EU Member States. Ireland negotiated an increase of 13% above the 1990 level for the period 2008-2012. Other Member States committed to a reduction of more than 8% to facilitate Ireland's increase in emissions.

In Doha, Qatar, on 8th December 2012, the 'Doha Amendment to the Kyoto Protocol' was adopted. The amendment includes new stricter commitments for Annex I Parties (reduction for emmisions to 18% below 1990 levels), and a revised list of greenhouse gases (GHG) to be reported on by Parties, in addition to amendments to several articles of the Kyoto Protocol.

COP21 was the 21st session of the Conference of the Parties (COP) to the United Nations Convention and was organised by the United Nations in Paris and held from 30th November to 12th December 2015. COP21 closed on 12th December 2015 with the adoption of the first international climate agreement (concluded by 195 countries and applicable to all). The twelve-page text, made up of a preamble and 29 articles, provides for a

limitation of the temperature rise to below 2°C above pre-industrial levels and even to tend towards 1.5°C. It is flexible and takes into account the needs and capacities of each country. It is balanced as regards adaptation and mitigation, and durable, with a periodical ratcheting-up of ambitions.

8.3.2 Noise criteria

The proposed flood relief works will not give rise to any noise emissions following commissioning. Noise emissions from a proposed pumping station are expected to be entirely negligible. Operational noise emissions may therefore be discounted. In contrast, construction phase emissions are of greater significance.

There are no mandatory noise limits applicable to the construction phase of projects in Ireland. In granting permission for projects, regulatory authorities may specify maximum noise limits at receptors which construction works are required to meet. In selecting suitable limits, authorities may refer to two guidance documents.

British Standard BS 5228:2009 Code of practice for noise and vibration control on construction and open sites Part 1: Noise (2009) sets out a procedure which may be used to determine the impacts of construction noise at surrounding receptors. The procedure involves setting threshold values based on ambient $L_{Aeq\ T}$ levels. Table 8.2 lists threshold levels determined using the methodology set out in the standard, taking into account ambient noise levels measured across the study site. The standard recommends that, during the construction phase, total noise levels including construction emissions should not exceed these threshold levels.

Table 8.2: Noise threshold levels ($L_{Aeq\ T}$) determined in accordance with BS 5228:2009.

Period	Receptors adjacent to busy streets	Receptors on quieter quays and in sheltered positions
Weekdays 0700-1900 h	75 dB	65 dB
Weekdays 1900-2300 h	65 dB	55 dB
Saturdays 0700-1300 h	75 dB	65 dB
Saturdays 1300-2300 h	65 dB	55 dB
Sundays 0700-2300 h	65 dB	55 dB
Night-time 2300-0700 h	65 dB	45 dB

The National Roads Authority (NRA) document Guidelines for the treatment of noise and vibration in national road schemes (2004) also recommends limits applicable to the construction phase of projects. Although the guidance is applicable specifically to road construction projects, the limits are widely applied in Ireland to other construction projects. The limits are presented in Table 8.3.

Table 8.3: Noise limits recommended by the NRA (2004).

Period	$L_{Aeq\ 1\ h}$	L_{ASmax}
Weekdays 0700-1900 h	70 dB	80 dB
Weekdays 1900-2200 h	60 dB	65 dB
Saturdays 0700-1630 h	65 dB	75 dB
Sundays & bank holidays 0800-1630 h	60 dB	65 dB

BS 5228:2009 and NRA guidance differs in several ways:

- The NRA document does not include night-time or weekend evening limits.
- The NRA document includes L_{Amax} criteria. It is noted that the L_{ASmax} parameter is specified rather than the more common L_{AFmax}.

- Evening cut-off times differ by one hour (2200 h v 2300 h).
- BS 5228:2009 specifies standard Saturday limits up to 1300 h. In contrast, the NRA document specifies a standard limit up to 1630 h.
- BS 5228:2009 guidance relates to free field levels (measured more than 3.5 m from any wall), whereas NRA limits are façade levels (usually measured at 1 m from the façade). Due to reflections, façade levels are typically 3 dB higher than free field levels.

On the basis of the foregoing, Table 8.4 suggests limits considered suitable for the proposed project. Given the importance of the project, and the long term benefit which will accrue to all receptors, including those in more secluded positions, criteria are adopted from midrange levels. In the absence of any NRA L_{ASmax} criteria for night-time hours, L_{ASmax} limits are adopted from L_{AFmax} limits included in the World Health Organisation document Guidelines for community noise (1999).

Table 8.4: Suggested noise limits at all receptors, based on BS 5228:2009 and NRA guidance.

Period	$L_{Aeq\ 1\ h}$	L_{ASmax}
Weekdays 0700-1900 h	70 dB	80 dB
Weekdays 1900-2300 h	60 dB	65 dB
Saturdays 0700-1630 h	65 dB	75 dB
Saturdays 1630-2300 h	60 dB	60 dB
Sundays & bank holidays 0700-2300 h	60 dB	65 dB
Night-time 2300-0700 h	50 dB	60 dB

Given the project's importance to the long term welfare of residents across the study site, it is suggested that limits proposed in Table 8.4 should be free field rather than façade levels. On this basis, levels measured at facades may be up to 3 dB higher than Table 8.4 limits.

It is expected that most construction activity will be undertaken during daytime hours Monday-Saturday. Indeed the NRA document notes that construction activities outside of these times, other than emergency works, will 'normally require the explicit permission of the relevant local authority'.

8.3.3 Vibration criteria

The proposed flood relief works are not expected to give rise to ground borne vibration post-commissioning. Vibration emissions, however, may arise during the construction phase. As with noise, there are no mandatory vibration limits, and reference may instead be made to a number of standards, all of which refer to peak particle velocity (PPV, measured in mm/s) which is usually used to quantify ground borne vibration

British Standard BS 5228:2009 Code of practice for noise and vibration control on construction and open sites Part 2: Vibration (2009) notes that human beings are highly sensitive to vibration, and will detect vibration at levels far lower than those which may cause building damage. Examples of human reactions described by the standard are summarised in Table 8.5.

Table 8.5: Human reactions to vibration, from BS 5228:2009.

PPV	Effect
0.14 mm/s	Just about perceptible in the most sensitive situations for typical construction frequencies.
0.3 mm/s	Just perceptible in residential environments.
1 mm/s	Likely to cause complaint in residential environments, although will be tolerated if

	prior warning and explanation is given.
10 mm/s	Likely to be intolerable for any more than a very brief exposure.

In contrast to the markedly low levels presented in Table 8.5, PPV levels which may cause cosmetic or structural damage to buildings are considerably higher. On the basis of extensive studies, limits recommended by the two most respected international authorities are presented in Table 8.6. The limits are those below which cosmetic damage (hairline cracking, etc.) to buildings is unlikely to occur. Limits relating to structural damage are significantly higher.

Table 8.6: Recommended vibration limits.

Source	Structure	Lower frequencies	Higher frequencies
1	Modern dwellings	<40 Hz: 19 mm/s	>40 Hz: 51 mm/s
	Older dwellings	<40 Hz: 12.7 mm/s	>40 Hz: 51 mm/s
2 & 3	Industrial & heavy commercial	4-15 Hz: 50 mm/s	>15 Hz: 50 mm/s
	Residential & light commercial	4-15 Hz: 15-20 mm/s	>15 Hz: 20-50 mm/s

Sources:
[1]US Bureau Of Mines report RI 8507: Structural response and damage produced by ground vibration from surface mines blasting (1980).
[2]British Standard BS 5228:2009 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration (2009).
[3]British Standard BS 7385:1993 Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration (1993).

The strictest limit included in Table 8.6 is 12.7 mm/s reported by the US Bureau Of Mines with respect to older dwellings (typically plaster on wood lath in the US). Limits reported for newer buildings by both US and British authorities are 15 mm/s or higher. With respect to older buildings, such as period dwellings across the study site, British Standard BS 7385:1993 Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from groundborne vibration (1993) states that 'a building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive'.

The NRA's 2004 guidance document includes vibration criteria relevant to the construction phase of road projects, reproduced in Table 8.7. The NRA limits were drawn up taking international guidance into account, and appear to incorporate significant safety margins. It is suggested that the NRA criteria be applied to the proposed development.

Table 8.7: Construction phase vibration criteria recommended by the NRA (2004).

Frequency	<8 Hz	10-50 Hz	>50 Hz
PPV limit	8 mm/s	12.5 mm/s	20 mm/s

8.4 LIKELY SIGNIFICANT EFFECTS AND ASSOCIATED MITIGATION MEASURES

8.4.1 'Do-Nothing' Scenario

If the proposed development were not to proceed, the opportunity to protect the Morrison's Island area and surrounding areas in Cork City centre from future flooding events would be lost. There would be no change to the existing local air quality and noise environment, and there would be no impact on climate.

8.4.2 Construction Phase

8.4.2.1 Air Quality

Potential Impacts

Material handling activities on site may typically emit dust. Dust is characterised as encompassing particulate matter with a particle size of between 1 and 75 microns (1-75 µm). Deposition typically occurs in close proximity to each site and potential impacts generally occur within 500 metres of the dust generating activity as dust particles fall out of suspension in the air. Larger particles deposit closer to the generating source and deposition rates will decrease with distance from the source. Sensitivity to dust depends on the duration of the dust deposition, the dust generating activity, and the nature of the deposit. Therefore, a higher tolerance of dust deposition is likely to be shown if only short periods of dust deposition are expected and the dust generating activity is either expected to stop or move on.

The potential for dust to be emitted will depend on the type of activity being carried out in conjunction with environmental factors including levels of rainfall, wind speed and wind direction. It is typical to assume no dust is generated under "wet day" conditions where rainfall greater than 0.2 mm has fallen. Information collected from Cork Airport Meteorological Station (1962-1991) identified that typically 204 days per annum are "wet". Thus for greater than 55% of the time no significant dust generation will be likely due to meteorological conditions.

Whilst construction activities are likely to produce some level of dust during earth moving and excavating phases of the project, these activities will mainly be confined to particles of dust greater than 10 microns. Particles of dust greater than 10 microns are considered a nuisance but do not have the potential to cause significant health impacts. For instance, bulldozing and compacting operations release 84% of particles which are greater than PM10 with only 16% of particles being less than 10 microns.

It is envisaged that the construction of the development will occur in distinct phases. As such, the potential for dust nuisance and significant levels of PM10 & PM2.5 concentrations will vary both temporally and spatially as the construction develops.

Worst-case truck movements during the peak construction period would be about 4 inward and 4 outward / hour, though these numbers may only be sustained for short periods. Construction traffic of this level will lead to dust emissions of the order of 3 g/m2 each hour along the haul roads based on no mitigation being implemented. However, provided vehicle speeds are restricted to less than 40 km/hr, this level of construction traffic will lead to dust emissions of the order of 2 g/m2 each hour along the haul roads. Thus, it is unlikely that the emissions of this magnitude will lead to dust deposition levels at the site boundary which exceed the TA Luft limit value for dust nuisance of 350 mg/(m2*day).

The loss of approximately 115 no. parking spaces in the Morrison's Island area will likely reduce the volume of vehicular traffic using the area, which will in turn reduce the amount of locally produces car emmissions. Short-term parking is the main reason for vehicular access to the area. This is likely to have a long-term slight positive impact on local air quality.

Mitigation Measures

A dust minimisation plan will be formulated for the construction phase of the project, as construction activities are likely to generate some dust emissions. In order to ensure that no dust nuisance occurs, a series of measures will be implemented. Site roads shall be regularly cleaned and maintained as appropriate. Hard surface roads shall be swept to remove mud and aggregate materials from their surface. Furthermore, any road that has the potential to give rise to fugitive dust must be regularly watered, as appropriate, during dry and/or windy conditions.

Speeds shall be restricted on hard surfaced roads as site management dictates. Vehicles delivering material with dust potential shall be enclosed or covered with tarpaulin at all times to restrict the escape of dust.

Public roads in the vicinity of the site shall be regularly inspected for cleanliness, and cleaned as necessary.

At all times, the dust mitigation measures put in place will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, movement of materials will be immediately terminated and satisfactory procedures implemented to rectify the problem before the resumption of the operations.

The dust minimisation plan shall be reviewed at regular intervals during the construction phase to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust through the use of best practice and procedures.

Residual Impact

There are no residual impacts expected on air quality and climate from the proposed development

Significance of Effect

Based on the assessment above there will be no significant effects.

8.4.2.2 Climate

Potential Impacts

The use of machinery during the construction of the proposed development will result in the emission of greenhouse gases. Operations such as the transport of equipment and materials as well as construction personnel are typical examples of machinery use. This impact is considered to be slight only, given the insignificant quantity of greenhouse gases that will be emitted. This is expected to have a short-term imperceptible negative impact.

Mitigation Measures

All construction vehicles and plant will be maintained in good operational order while onsite, thereby minimising any emissions that arise.

Residual Impact

There will be imperceptible residual impacts expected on climate from the proposed development

Significance of Effect

Based on the assessment above there will be no significant effects.

8.4.2.3 Noise and Vibration

Noise sources

The proposed development will not give rise to audible noise emissions following commissioning. While 2 no. proposed pumping kiosks will include pumps which will operate during high flow events, noise emissions from these are expected to be entirely negligible at the nearest receptors. Occasional maintenance works following commissioning will not be audible beyond their immediate vicinity due to masking by road traffic noise. Accordingly, operational noise emissions may be discounted.

Construction phase emissions, albeit occurring over a confined period, have greater potential to cause local noise intrusion. The construction phase will involve installation of a number of public realm and flood defence measures. The measures will include the following:

- Significant remedial works to the existing quay walls, including cleaning, repointing and grouting.

- Construction of reinforced concrete backing wall behind existing quay walls.
- Provision of demountable Flood Gates at Trinity Bridge and Parnell Plaza.
- Potential extension (i.e. raising) of existing limestone steps to 3.5mOD.
- Viewing platform supported by piles in the river bed
- Raised bridge deck at Trinity Bridge with flared entances supported by piles in the river bed
- Boardwalk on south side of Trinity Bridge at Union Quay supported by piles in the river bed

Implementation of the above works is likely to require the following activities:

- Concrete breaking and road excavation may be required, involving either hydraulic breakers on tracked excavators, or handheld pneumatic breakers powered by compressors. Concrete saws may also be required.
- Wall and parapet wall improvement works are likely to involve a number of activities, including blockwork and concrete pours. Plant such as telescopic handlers and mini-excavators may be required. Various activities are likely to require mobile generators to power equipment, lights and pumps. Larger works areas are likely to be surrounded by temporary hoarding to a height of 2.4 m.
- Piling will be required. The selection of piling method will not be determined until site specific investigations are undertaken in due course. Piling may involve use of driven or pressed-in piles, or use of vibratory techniques. For the purposes of this noise impact assessment, it will assumed that any of these methods could be used at any location, therefore all will be assessed.
- Installation of the pumping station will require use of one or more excavators, in addition to ancillary plant such as pumps, compressors and lifting equipment.
- Removal of excavated material, and deliveries of concrete and other materials, will require a number of HGV movements throughout the project. These will be concentrated at specific areas where easements are available.

The overall duration of the construction phase is expected to be approximately 12 months.

Noise impacts

The noise impacts of the proposed construction works have been assessed on the basis of the scheme as it currently proposed, notwithstanding the fact that further minor alterations may be made following detailed site inspections and detailed engineering design. Although the works required at each location are unlikely to change significantly, the methodologies, plant and timeframes used in this assessment have been selected based on knowledge of construction practices followed during the implementation of similar flood defence schemes, and may change further based on the appointed contractor(s) suggested construction methods. Moreover, prediction of noise impacts associated with the construction phase of any project is complicated by several additional factors:

- The timing, duration and amplitude of emissions associated with activity in each individual works zone will vary considerably.
- Construction details and plant requirements will alter on a daily basis as construction progresses.
- Plant requirements and activities may vary considerably due to unforeseen changes in the construction program.

- There will be extended periods when little or no construction noise emissions arise e.g. during concrete drying periods.
- Each individual source may be relocated frequently e.g. excavators.
- The overall construction period will be relatively short. The duration of individual stages will be limited, lasting days or weeks at most e.g. excavation.

Due to the foregoing, it is not possible to accurately calculate the noise output which will arise onsite throughout the construction phase at every noise sensitive receptor within the study site. An alternative approach here is to calculate likely noise levels expected to arise in the vicinity of work zones. The calculation is presented in Table 8.8, based on typical plant sound pressure levels at 10 m provided by British Standard BS 5228:2009 Code of practice for noise and vibration control on construction and open sites Part 1: Noise (2009). The worst case scenario assumed in each zone is unlikely to occur routinely, if at all.

Table 8.8: Expected sound pressure level (SPL) in work zones.

Activity	Worst case scenario	SPL at 10 m	Total SPL at 10 m
Concrete breaking	Hydraulic breaker x1 Consaw x1	72 dB (143 kW) 91 dB (3 kW)	72-91 dB
Wall improvement works	Telescopic handler x1 Discharging mixer truck x1 Generator x1	71 dB (60 kW) 75 dB 65 dB	77 dB
Piling method 1	Pressed-in piling rig x1 Mobile crane x1 Ancillary activities	60-70 dB 70 dB 60-70 dB	60-75 dB
Piling method 2	Driven piling rig x1 Mobile crane x1 Ancillary activities	80-88 dB 70 dB 60-70 dB	80-88 dB
Piling method 3	Vibratory piling rig x1 Mobile crane x1 Ancillary activities	88 dB 70 dB 60-70 dB	88 dB
Underground pumping station excavation	Tracked excavator x1 Pump x1 Generator x1	75 dB (134 kW) 65 dB (150 mm) 65 dB	76 dB
Trinity Bridge works	Mobile crane x1 Telescopic handler x1 Various power tools	70 dB 71 dB (60 kW) 60-80 dB	74-81 dB
Street works	Tracked excavator x1 Telescopic handler x1 Consaw x1	75 dB (134 kW) 71 dB (60 kW) 91 dB (3 kW)	91 dB

Noise impacts at receptors associated with emissions presented in Table 8.8 are assessed in Table 8.9 in light of the 70 dB daytime $L_{Aeq\ 1\ h}$ criterion discussed above. The table does not take into account screening provided by possible hoarding panels around each work zone.

Table 8.9: Noise impacts at receptors.

Activity	Total SPL at 10 m	Impacts
Concrete breaking	72-91 dB	Where required, concrete breaking is unlikely to exceed the 70 dB criterion. Cutting of concrete using a consaw will reach 91 dB $L_{Aeq\ 1\ h}$ at 10 m when undertaken continuously over 1 h. Any NSLs within approximately 100 m of consaw operations will receive emissions over 70 dB.
Wall improvement works	77 dB	$L_{Aeq\ 1\ h}$ levels at NSLs within 20 m may exceed 70 dB on occasion. There are few NSLs within 20 m of quay walls, and only NSLs in immediate proximity to works areas are likely to be affected.
Piling	60-88 dB	Piling is unlikely to give rise to levels which exceed the 70 dB criterion at most receptor where pressed-in piles are used, and only NSLs in immediate proximity may be affected here. Where other methods are proposed, noise levels are likely to exceed the 70 dB criterion at receptors within a range of approximately 80-100 m and which do not benefit from screening by intervening buildings, depending on proximity and piling method. Driven piling emissions will be impulsive.
Underground pumping station excavation	76 dB	There are few NSLs located close to the proposed pumping station location. These works are unlikely therefore to exceed the 70 dB criterion at NSLs.
Trinity Bridge works	74-81 dB	The loudest operations here may exceed 70 dB at the College of Commerce. However, sustained operations at 70 dB will be infrequent, and thus the 70 dB $L_{Aeq\ 1\ h}$ criterion is unlikely to be exceeded regularly.
Street works	91 dB	As street works such as paving and kerbing progress, NSLs immediately adjacent to the works zone are likely to experience noise levels which exceed 70 dB from time to time. However, sustained exceedances of 70 dB are unlikely, and thus breaches of the 70 dB $L_{Aeq\ 1\ h}$ criterion are likely to be infrequent. Works will pass each NSL after 1-2 days.

On the basis of the foregoing, the 70 dB criterion may be exceeded in the following cases:

- Any NSL within approximately 100 m of consaw operations, and with a direct line of sight, may be exposed to levels above 70 dB.
- NSLs in immediate proximity (i.e. <20 m) to quay walls and street works may receive $L_{Aeq\ 1\ h}$ levels above 70 dB during certain operations.
- Sustained operations which exceed 70 dB at Trinity Bridge are likely to exceed the $L_{Aeq\ 1\ h}$ criterion at the College of Commerce.
- Where driven or vibratory piling is undertaken, the 70 dB criterion is likely to be exceeded at local receptors, extending out to a distance approaching 80-100 m, with a direct line of sight. This range extends across the river to Georges Quay, and includes the School of Music and Bruach na Laoi

apartment complex on Union Quay. Piling operations at the eastern end of the study site may also affect South Mall NSLs including offices. Piling may result in exceedance of L_{Amax} criteria included in Table 8.11.

In summary, NSLs across the river and at South Mall are highly unlikely to receive $L_{Aeq\ 1\ h}$ levels which exceed the 70 dB criterion, except where driven or vibratory piling is required. On Father Matthew Quay and Morrison's Quay, certain works may give rise to $L_{Aeq\ 1\ h}$ levels above 70 dB over short periods at immediately adjacent NSLs, although such works are likely to move on after 1-2 days. A number of buildings (friary, College of Commerce, and the hotel and offices on Morrison's Quay), have extensive quay frontage, and thus may be exposed to elevated levels for several days, due to the time taken to pass these receptors.

With respect to 70 dB exceedances identified above, consaw operations may be readily controlled by erecting a hoarding around the cutting area. In addition, wall and localised street works may be similarly treated by erecting a hoarding along the boundary of the works zone. In each case, the hoarding should extend to a height of 2.4 m, and should consist of plywood boarding on both sides of timber framework, with waterproofed cavity to be filled with mineral wool or similar. Gaps at partition interfaces should be boarded. If such measures are installed, consaw and wall construction operations are expected to meet the 70 dB $L_{Aeq\ 1\ h}$ criterion. However, the benefit of such hoarding will be reduced where NSLs extend to several floors which overlook the works area.

Use of hoarding may also be beneficial with respect to receptors close to sheet piling operations, particularly where driven or vibratory piling is required. However, such hoarding will again be of limited value where receptors overlook the proposed piling zone, such as the College of Commerce, the hotel (currently vacant and likely to remain so in the medium-term) and offices at Morrison's Quay, and Union Quay receptors. Here, use of acoustic enclosures around the pile hammer will be beneficial, as recommended by British Standard BS 5228:2009 Code of practice for noise and vibration control on construction and open sites Part 1: Noise (2009). It is noted that such operations will be confined to a limited period.

In addition to the sources discussed above, noise emissions will also arise from HGV movements across the study area associated with import of materials and export of subsoil, etc. HGV access to work zones will be facilitated using the local road network. The number of HGV movements required has not been accurately quantified at this point. On the basis of experience with other large scale construction projects, the number of movements at most work zones is unlikely to exceed two per hour. Where civil engineering works are required, such as embankment construction, this may increase to five per hour.

Noise levels attributable to HGV movements may be determined using:

$L_{Aeq\ 1\ h} = L_{AE} + 10\log N - 10\log T$

L_{AE} Sound exposure level from vehicle pass. Truck L_{AE} will vary. Typical L_{AE} value of 83 dB at 5 m is assumed, based on experience at other sites.

N: Number of passes.

T: 1 hour.

On this basis, $L_{Aeq\ 1\ h}$ levels associated with up to five movements per hour will be 54 dB at 5 m. It follows that $L_{Aeq\ 1\ h}$ levels will be significantly lower than the 70 dB criterion at all receptors. Given the dominance of existing traffic noise in the local environment, HGV movements are highly unlikely to alter existing traffic noise levels.

During the construction phase, noise impacts at all receptors will be temporary and localised. At most of these, impacts will be imperceptible. At NSLs fronting the quay, impacts will range from slight negative to noticeable negative. Given the benefit which will accrue to these NSLs in particular, the overall long term impact is expected to be positive.

Vibration impacts

Three potential sources of ground borne vibration may arise during the construction phase: vibratory compaction, concrete breaking, and piling.

Vibratory compaction of infill may be required over small areas prior to the laying of finished surfaces. This source is unlikely to be significant offsite due to the small areas involved and the limited time present. Moreover, the fluidic nature of infill when vibrated tends to attenuate ground vibration; most of the vibration energy is lost through particle settlement before reaching underlying strata. Low peak particle velocity (PPV) levels in the order of 1.5 mm/s have been reported at a distance of 25 m at some sites. At the nearest receptors, PPV levels are therefore likely to be significantly lower than criteria presented in Tables 8.6 and 8.7.

Concrete breaking, where required, will involve hydraulic breaker units fitted to tracked excavators, or pneumatic handheld units. Although this activity may give rise to high levels of ground vibration in proximity to the breaking area, the vibration tends to contain relatively little energy in the lower frequencies at which buildings and occupants are most vulnerable. In addition, higher frequencies attenuate more rapidly than low frequencies, thus minimising the impact zone. For this reason, most vibration guidance documents such as British Standard BS 5228-1:2009 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration (2009) ignore concrete breaking vibration. Table 8.10 lists various PPV levels reported in literature at sites where hydraulic rock breaking has been undertaken. The range in levels noted reflects variations in equipment power and rock type.

Table 8.10: Reported rock breaking vibration levels.

Distance	5 m	10 m	20 m	50 m
PPV	0.2-4.5 mm/s	0.06-3.0 mm/s	0.02-1.5 mm/s	0.1-0.3 mm/s

The highest PPV level presented in Table 8.10 is 4.5 mm/s, measured at 5 m from the breaking operation. This level is considerably lower than criteria presented in Tables 8.6 and 8.7. It should be noted that levels presented in Table 8.10 relate to rock breaking. PPV levels associated with concrete breaking are likely to be lower.

Piling may be required at one or more locations, with the type of piling to be confirmed at detailed design stage. Traditional piling methods such as driven piling may generate high levels of ground borne vibration. Vibratory piling may also give rise to elevated PPV levels. If either of these is deemed necessary, it is recommended that real time monitoring of PPV levels is undertaken at surrounding receptors. It is also recommended that prior test piling be undertaken, with concurrent PPV measurement, to determine piling parameters required to meet criteria presented in Tables 8.6 and 8.7.

Where ground conditions allow, it is possible that pressed-in piling could be a considered methodology. British Standard BS 5228:2009 Code of practice for noise and vibration control on construction and open sites Part 2: Vibration (2009) notes that vibration levels associated with pressed-in piling are minimal. The document refers to PPV levels measured in the vicinity of two separate pressed-in piling projects where the following levels were measured: 2.5-4.3 mm/s at 4.5 m, 0.3-0.7 mm/s at 7.1 m, and <0.5 mm/s at 24 m.

In summary, vibration impacts are expected to be imperceptible where pressed-in piles are used. Any other piling methods are likely to result in temporary local impacts, ranging from noticeable negative to substantial negative depending on separation distance.

Mitigation Measures

Following completion of the proposed flood relief works, noise emissions are expected to be satisfactory, and no specific mitigation measures are required.

Noise emissions associated with the construction phase will in general be satisfactory at most receptors. Operations will be confined to a relatively short period at each work zone. Apart from a small number of exceptions, noise emissions at each zone will comply with the daytime 70 dB $L_{Aeq\ 1\ h}$ criterion. Exceptions to this are as follows:

- Any NSL within approximately 100 m of consaw operations, and with a direct line of sight, may be exposed to levels above 70 dB. This may be readily mitigated by erecting hoarding between the operations area and nearby receptors.
- NSLs in immediate proximity (i.e. <20 m) to quay walls and street works may receive $L_{Aeq\ 1\ h}$ levels above 70 dB during certain operations. While every effort will be made to limit and reduce construction noise levels, where an exceedance of the 70dB level is likely, the appointed contractor shall notify the occupants of these NSLs of the period and duration of works likely to exceed the noise threshold. Hoarding may also be used at these locations to screen receptors.
- Sustained operations which exceed 70 dB at Trinity Bridge are likely to exceed the $L_{Aeq\ 1\ h}$ criterion at the College of Commerce. The appointed contractor will liaise with college management in this regard.
- Where driven or vibratory piling is undertaken, the 70 dB criterion is likely to be exceeded at local receptors, extending out to a distance approaching 80-100 m, with a direct line of sight. This range extends across the river to Georges Quay, and includes the School of Music and Bruach na Laoi apartment complex on Union Quay. Piling operations at the eastern end of the study site may also affect South Mall NSLs including offices. Piling may result in exceedance of L_{Amax} criteria included in Table 8.11. Use of hoarding will benefit receptors located at or close to ground level, and receptors across the river. At more elevated receptors, use of an acoustic enclosure around the hammer will assist in curtailing emissions from driven piling. The appointed contractor shall provide advance notification to the occupants of receptors within 100 m where driven or vibratory piling is required.

Where hoarding is required, it is recommended that hoarding panels should extend to a height of 2.4 m, and should consist of plywood boarding on both sides of timber framework, with waterproofed cavity to be filled with mineral wool or similar. Gaps at panel interfaces should be boarded. If such measures are installed, consaw and wall construction operations are expected to meet the 70 dB $L_{Aeq\ 1\ h}$ criterion at receptors.

It is recommended that appointed contractor(s) be required to adopt practices set out in British Standard BS 5228:2009 Code of practice for noise and vibration control on construction and open sites Part 1: Noise and Part 2: Vibration (2009). Measures recommended in the standard include:

- Appointing a project representative responsible for noise and vibration issues, and for liaising with local representatives. A clear communication channel should be established between all parties prior to project commencement.
- Requiring that contractors ensure that site personnel are familiar with potential noise and vibration issues, and that personnel apply a common-sense approach to eliminating unnecessary noise emissions.
- Use of quieter plant and methods where possible.
- Installation of temporary barriers or enclosures around local sources such as compressors and generators.
- Limiting times of activities which may generate elevated noise or vibration emissions.

With respect to piling, no mitigation measures are considered necessary where pressed-in piles are used. If ground conditions require an alternative piling method, it is recommended that real-time monitoring of PPV levels is undertaken at surrounding receptors. It is also recommended that prior test piling be undertaken, with

concurrent PPV measurement, to determine piling parameters required to meet criteria presented in Tables 8.6 and 8.7.

The assessment above relates to daytime operations. Where evening or night-time operations are required, it is recommended that noise impacts associated with proposed works be assessed in advance.

Three premises in particular require the absence of intrusive noise during daytime hours: the College of Commerce, the School of Music, and the RTE studios. It is recommended that the appointed contractor liaise with the management of these facilities prior to commencement of the project.

Residual Impact

Noise and vibration impacts during the construction phase, inclusive of mitigation, are expected to be temporary and localised at most locations. At NSLs fronting the quay, impacts are likely to be slight negative to noticeable negative. Impacts may increase to noticeable negative or substantial negative where piling methods other than pressed-in piles are used. However, it should be noted that these impacts will be entirely short term in nature, lasting several days or weeks locally in most cases. Implementation of mitigation measures described above will further reduce impacts. Moreover, the long term impact is expected to be positive, given the elimination of flood risk in these areas.

Monitoring

Monitoring of noise and vibration levels at receptors may be undertaken at specified locations while certain operations are in progress. The following monitoring criteria are suggested:

- Noise monitoring in accordance with International Standard ISO 1996-2 Acoustics – Description, measurement and assessment of environmental noise, Part 2: Determination of environmental noise levels (2007). Attended measurement of $L_{Aeq\ 15\ min}$, $L_{AF10\ 15\ min}$, $L_{AF90\ 15\ min}$, and L_{AFmax} (and, if possible, L_{ASmax} to assess compliance with NRA criteria). Monitoring locations should be selected to represent the nearest receptors to work zones at the time of the survey.

Vibration monitoring in accordance with British Standard BS 7385:1993 Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from groundborne vibration (1993). Maximum PPV levels to be measured over 15 min at each location. Monitoring locations should be selected to represent the nearest and/or most vulnerable receptors to work zones at the time of the survey.

8.4.3 Operational Phase

The proposed works will not have any air quality or noise and vibration impact during its operational phase. As a result, it is only considered necessary to assess the potential noise and vibration impact on the surroundings during the construction phase.

9 LANDSCAPE

9.1 INTRODUCTION

This section of the Environmental Report addresses the landscape and visual aspects of the proposed public realm and Flood Defence works at Morrison's Island. The relevant sections of the River Lee South Channel have been described with reference to Landscape Character and the relevant landscape policy recommendations that have been set out for this area by the Cork City Development Plan 2015-2021, in terms of landscape and visual characteristics are also addressed. A number of photomontages are included to assist the assessment of landscape and visual effects. This chapter should be read in conjunction with the drawings for the proposed drainage scheme (MOR-001 to MOR-600).

While this report does not comprise an EIAR, or form part of an Environmental Impact Assessment, the description of landscape and visual effects uses the standard impact classification terminology recommended by the Environmental Protection Agency in 'Guidelines on the Information to be contained in Environmental Impact Assessment Reports – Draft August 2017 (EPA, 2017).

This chapter focuses on the works described in Chapter 3 which are most relevant from a landscape and visual point of view.

9.1.1 Study Area

The study area for the Landscape and Visual Assessment was defined following the desk study and again following site visit, and the examination of the proposed works.

The proposed works are located along the southern section of Morrison's Island, primarily the streets of Father Matthew Quay, Morrison's Quay, and Morrison's Street, the junctions with Father Matthew Street, Keefe Street and Fitton Street East. Works to Trinity Bridge are also proposed, as well as a short section of Union Quay, and at the public plaza between Morrison's Street and Parnell Bridge.

For the Landscape and Visual Impact Assessment, the Study Area takes in these streets, as well as views towards them from across the river on Union Quay and George's Quay, as well as views form the bridges - Parliament Bridge, Trinity Bridge and Parnell Bridge. The nature of the works is such that the landscape and visual effects are of a localised nature and the study area reflects both the works and the visual and landscape receptors.

This follows the LI/IEMA (2013) Guidance referenced below which proposes that the level of detail in the landscape baseline studies should be "*appropriate and proportionate to the scale and development*." The Guidelines also state that for the landscape baseline the aim is to provide an understanding of the landscape in the area that may be visually affected.

9.2 METHODOLOGY

This section broadly outlines the methodology used to undertake the landscape and visual assessment of the proposed development, and the guidance used in the preparation of each section. There are four main sections to the assessment:

- Outline of guidance followed;
- Baseline landscape and visual assessment;
- Nature and visibility of the proposed development;

- Assessment of potential effects.

9.2.1 Guidance Documents

In 2000, the Department of the Environment and Local Government produced 'Landscape and Landscape Assessment: Consultation Draft of Guidelines for Planning Authorities', which recommended that all Local Authorities adopt a standardised approach to landscape assessment for incorporation into Development Plans and consideration as part of the planning process.

Although the DoEHLG 2000 guidance remains in draft form, this section of the ER has been informed by the landscape assessment guidelines presented in the DoELHG document, as well as other guidelines which include:

- Guidelines for Landscape and Visual Impact Assessment (The Landscape Institute/Institute of Environmental Management and Assessment, UK, 2013)

9.2.2 Baseline Landscape Assessment

One of the first stages of carrying out a Landscape and Visual Impact Assessment is to establish the baseline landscape and visual conditions. In order to carry out this assessment, an initial desk study was undertaken which identified relevant policies and guidelines, both at national and local level. This includes any relevant Cork City Council policies on landscape and landscape character, designated landscapes, and scenic views and routes.

The Study area consists of the area to which works are to be carried out is described in Section 9.1.2 and are described in general terms of Landscape Character Areas, and as defined in the Cork City Development Plan 2015-2021 and the Cork County Development Plan 2014-2020. In addition, a number of field visits were undertaken in winter 2017 to assess the landscape character and elements both in the Study area and in the wider landscape. A further primary source of information consulted during the course of the desk study included the Cork City Landscape Study 2008.

A number of site visits were conducted to gain familiarity with the Study Area and to ascertain the limits of the visual unit and a walkover survey of the Study Area to assess the landscape character and verify the extents of the Study Area. Photographs illustrating the landscape attributes of the Study Area were taken and notes were taken on landscape features and views in the Study Area.

9.2.3 Visibility of the Proposed Development

The locations of viewpoints for photographs (described further in Section 9.5) were informed by the nature of the proposed development, and the landscape context, maps and aerial images, with actual visibility being verified on the ground by a site visit.

In addition, a number of photomontages representing the likely visual effects of the development were prepared. These were based on an artist's impression and give an indication rather than the specific description of the likely appearance of the proposed flood relief works as well as improvements to the public realm. Images were taken at varying locations along the river.

9.2.4 Assessment of Potential Effects

Landscape and Visual Impact Assessment

Landscape and Visual Impact Assessment, though related, can be described separately. Descriptions based on the LI/IEMA Guidelines on Landscape and Visual Impact Assessment (2013) define each as follows:

Landscape Impact Assessment: This can be described as deriving from changes to the physical landscape, and which may result in changes to the landscape character and how it is experienced, as well as changes **to the landscape as a resource.**

Visual Impact Assessment: The assessment which relates to the changes in the composition of views available to groups of people a result in changes to the landscape, including human response to the change and the overall changes to visual amenity.

The potential landscape and visual effects of the proposed development are informed by both the desktop study, the site visit which outlines current visibility from chosen viewpoints, and study of the proposed works. The assessment of effects is also assisted by the production of photomontages or artist's impressions which show the likely appearance of the proposed works. Although this is an Environmental Report, the assessment uses the terminology recommended by the EPA (2017) as set out in Chapter 1 Introduction.

9.3 RECEIVING ENVIRONMENT - POLICY

This section contains a review of relevant landscape policies and objectives, as well as designations. The Cork City Development Plan and Cork City Landscape Study contain information on landscape character, views and prospects and landscape policies and designations.

9.3.1 Cork City Landscape Study 2008

The Cork City Landscape Study was prepared in 2008 and has been incorporated into Chapter 10 of the Cork City Development Plan 2015-2021 (see below). The Study establishes principles for protecting and enhancing the City's natural environment. The Study includes a Landscape Character Assessment, Analysis of Key Landscape Elements, identification of Key Landscape Elements and Formulation of Policy Recommendations and the elements which are contained in the Development Plan are outlined in Section 9.2.2 below. The Study also refers to the historical development of Cork City which developed on several islands and in the River Lee. The Strategy recognises the River Lee as a key element in the character of the City.

9.3.2 Cork City Development Plan 2015-2021

The Cork City Development Plan 2015-2021 refers to policies and objectives for landscape in Chapter 10. These policies and objectives are based on the Cork City Landscape Study 2008.

The Council seeks to enhance the landscape through the development of a framework including developing and enhancing primary green links along the river Lee Corridor (both North and South channels), extending public access along Secondary Green links along the other river tributaries, developing and improving Key Landscape areas in the City and creating new urban woodlands.

Landscape Character Areas

Eight Landscape Character areas were identified in the Study. These are shown in Figure 9.1 below and include:

- Estuarine/Riverine
- Natural harbour
- Historic urban core
- Fine-grained inner city residential

- Suburban residential
- Urban sylvan character
- Urban industrial/commercial
- Rural agricultural

The proposed works are to be carried out in the area characterised as Historic Urban Core which is defined as follows:

Historic Urban Core

The built environment of Cork City has overcome the physical and topographical challenges that the landscape presents. The iconic visual landscape of the city's central core is associated with historical buildings located on prominent hillside locations of the city's north and south hillsides. In a wider context, the city profile is dominated by church spires, tall office blocks and the silos, cranes and built form of the docklands landscapes.

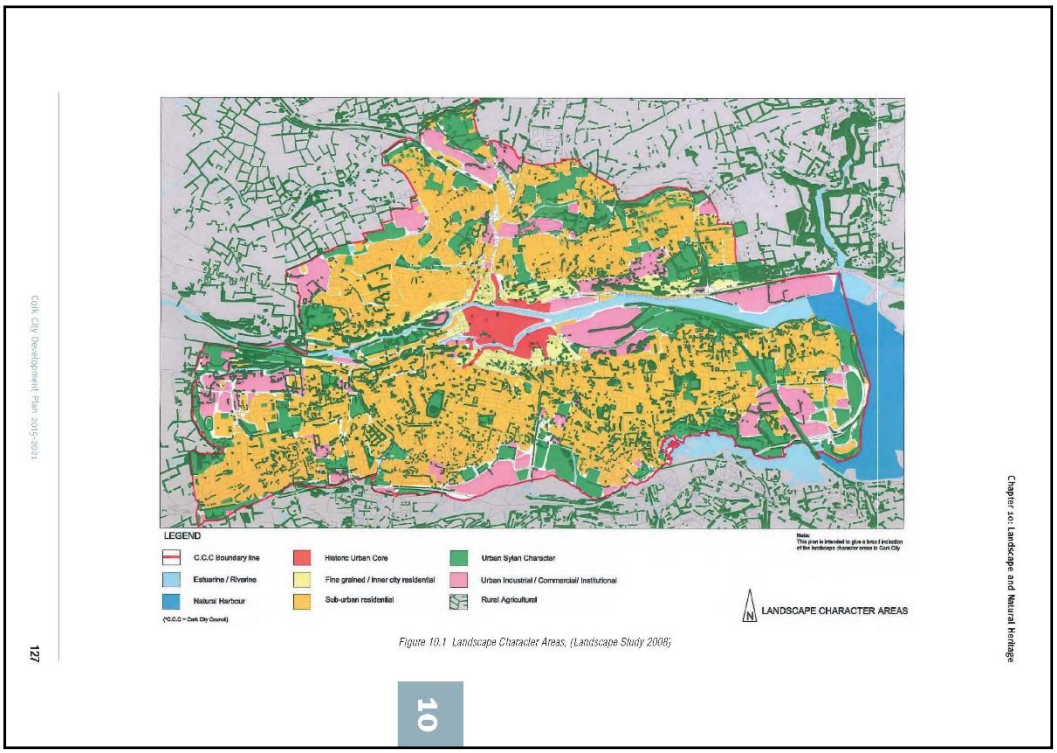


Figure 9. 1 Cork City Landscape Character Areas

9.3.3 Key Landscape Assets

The Landscape Study identifies a number of landscape assets which combine to create Cork's unique cityscape. The Key landscape assets are included in Table 10.1 in the Development Plan and are summarised below:

- Topography (ridges, slopes and escarpments).
- Water/River Corridors (river, estuary, harbour)
- Tree Canopy
- Ecology
- Visually Important Land (includes views and prospects)
- Historic Core
- Landmarks

- Public or Private Open Space
- Institutional Open Space
- Historic Landscapes
- Rural Character Green Belt
- Built Form
- Public Realm
- Gateways to the City
- Bridges
- Pedestrian/Cycle Routes in the City
- Vehicular Access
- The Railway in the City

Key Landscape Assets which are potentially relevant to the areas of the proposed drainage works include river corridors, visually important land, Historic Core, Public Realm, and Bridges.

- **Objective 10.1**: Landscape Strategic Objectives: To preserve and enhance Cork's landscape character and key landscape assets, and to preserve and enhance Cork's views and prospects of special amenity value.
- **Objective 10.2:** Cork City Landscape: To preserve Cork's unique and distinctive landscape character through appropriate management and enhancement of Key Landscape Assets as set out in Table 10.1)
- **Objective 10.3**: To preserve and enhance Cork's landscape and where appropriate, to increase access to and utilise the landscape for recreational purposes through the implementation of the Landscape Structure Plan.

9.3.4 Landscape Protection Designations

The Development Plan includes several categories of landscape designations which aim to preserve and enhance the significant landscape elements of the city. These include Areas of High Landscape Value and Landscape Preservation Zones. However these are not present in the areas around Morrison's Island and the surrounding study area.

9.3.5 Protected Views

Chapter 10 of the Development Plan lists a number of Views and Prospects. There are several types of views, and these include Linear Views of Landmark Buildings, Panoramic Views, River Prospects, Townscape and Landscape Features and Approach Road Views.

The views which relate to the Study Area are shown on Figure 9.2. The views relevant to the study area are categorised as River Prospects, Landscape and Townscape as follows:

Table 9.1 Views (listed in Tables 1-7 from Map 2 and 13, Volume 3 of the Development Plan 2015-2021.

View	Description
View RP4	View from Parliament Bridge downstream to Holy Trinity Church
View LT4	View from Father Matthew Quay /Father Matthew St to George's Quay*

*Note Table 4 has different description

It should be noted that the views listed in Table 4 Landscape and Townscape Views, do not correspond with those illustrated on Map 13 of the current Development Plan. The viewing location and view appear to be

in the opposite direction to the text description. The viewing location for LT4 is described as George's Quay, with a view to Fr. Matthew Quay, which is the opposite to Map 13. However a review of the other text descriptions in Table 4, and comparisons with the Mapped Objectives, indicate that the Mapped Objectives in Map 13 are correct and therefore these are followed. RP4 and LT4, which concern this development, appears correct in Map 13, and this is referred to above in Table 9.1 above.

A number of these views are shown in Section 9.4 Landscape Character, and these are also represented by photomontages in Section 9.5.

The Objective associated with protection of the views and prospects is as follows:

> ***Objective 10.6 Views and Prospects***
> *To protect and enhance views and prospects of special amenity value or special interest and contribute to the character of the City's landscape from inappropriate development, in particular those listed in the development plan. There will be a presumption against development that would harm, obstruct or compromise the quality or setting of linear views of landmark buildings, panoramic views, rivers prospects, townscape and landscape views and approach road views.*
> *To identify and protect views of local significance through the preparation of local area plans, site development briefs and the assessment of development proposals on a case-by-case basis.*

9.4 LANDSCAPE CHARACTER

The character of the study area, the area around Morrison's Island, is a relatively small area within the historic urban core along the South Channel of the River Lee. Landform, Landcover, Settlement patterns and cultural elements all combine to create landscape character. This is in an urban context, and elements such as the river itself, and landcover in the form of buildings and structures forms an important part of the character of the area.

9.4.1 Landform

Present-day landscapes owe their form to the geological materials from which they were carved. Landform is the term used to describe the spatial and formal arrangement of landscape components as a natural product of geological and geomorphologic processes in the past, and refers primarily to topography and drainage

The physical landscape unit in which the Study Area is located is within the existing city landscape fabric, along the south channel of the River Lee. The land is flat and the ridges to the north are visible.

Topography

The topography of the study area consists of part of the South Channel corridor of the River Lee, between Parliament Bridge and Parnell Bridge. The land on either side of the South Channel in this part of the study area is generally flat as shown in Plate 9.1:

Plate 9.1: View from George's Quay towards Morrison's Island

Drainage

The study area is located close to the mouth of the River Lee South Channel, and in the vicinity of the site, which is bordered by George's Quay, Union Quay and Fr. Matthew Quay and Morison's Quay. The river is contained by walls and fendering is visible in this area.

Plate 9.2: View of South Channel from Parliament Bridge

Geological Processes

Chapter 6 refers to the geomorphology of the South Cork region, where uplands and valleys are characteristic of the region. The Study Area is underlain by Devonian 'Old Red Sandstone'. (The geology of Cork City is reflected in the use of sandstone and limestone in the buildings and walls in the city).

9.4.2 Landcover and Landuse

Landcover

Landcover is the term used to describe the combinations of vegetation and land-use that cover the land surface. It comprises the more detailed constituent parts of the landscape and encompasses both natural and man-made features. Landcover includes vegetation, structures and built form. The river channel itself is one of the main elements of the landscape character. In this case, landcover in the study area includes the built form and river which defines the streets, as well as the streets themselves. It also includes bridges and other features which contribute to a sense of place.

Buildings and Streetscape

The study area is defined by the river channel and buildings which create the streets, the buildings serve to enclose and define the views somewhat. The river banks are edged with low walls and railings, or with sections of railings, in these areas, which allows some permeability and views to the river. There are several buildings which are landmarks in the area, including Holy Trinity Church (as seen in Plate 9.2 above).

The image above shows the streetscape along Morrison's Quay and the high level of on-street parking along the quayside. There are views across to George's Quay. To the eastern end of the study area, Parliament Bridge joins Morrison's Island to George's Quay.

Plate 9.4 below shows the view from Father Matthew Quay looking west towards Georges Quay and Parliament Bridge with a pavement, road and car parking in the foreground. Pedestrian movement is restricted to the side of the road adjacent to the buildings but no footpath adjacent to the river.

Plate 9.3: View of Father Matthew Quay and George's Quay

Plate 9.4 shows the low wall and railings along this section.

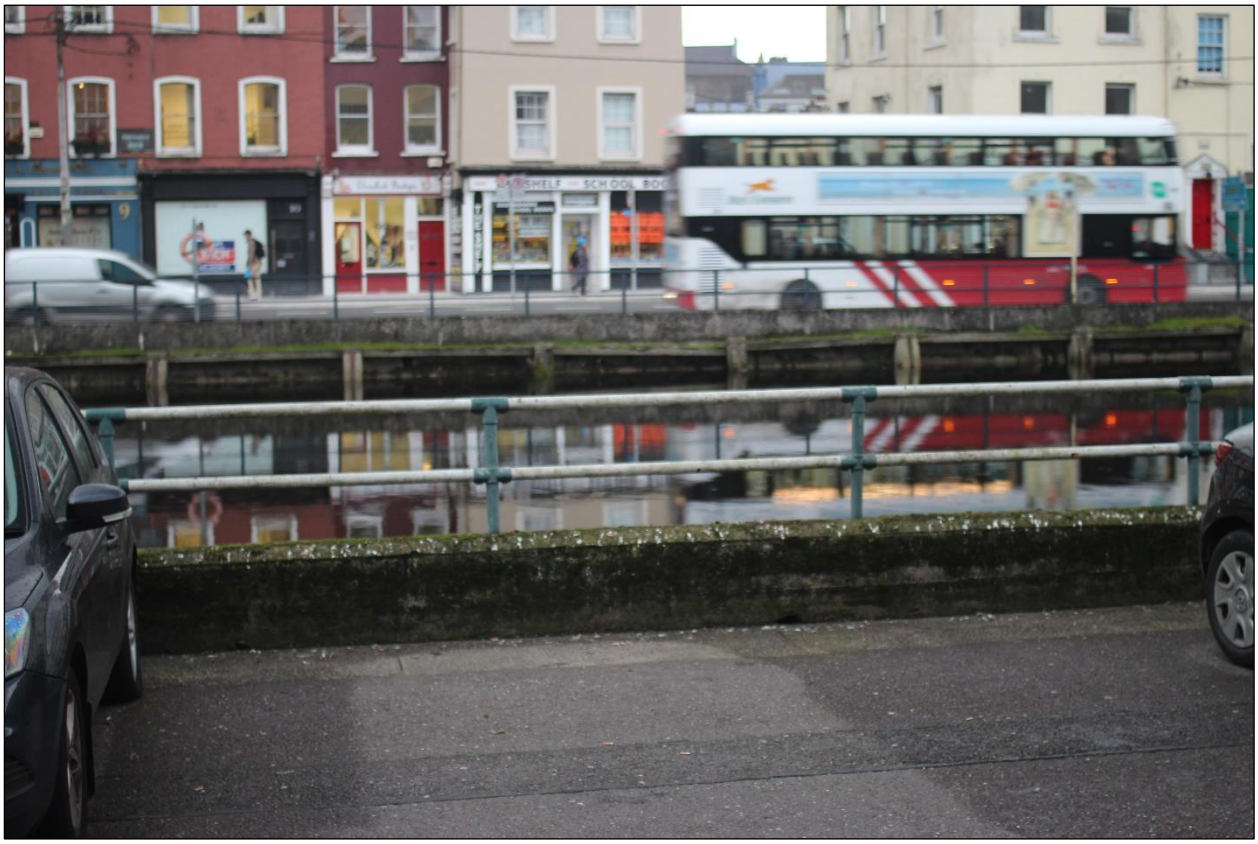


Plate 9.4: low wall and railings along Father Matthew Quay

Plate 9.5 below shows the view from Morrison's Quay looking south towards Trinity Bridge. Buildings, road and car parking are the main elements visible, and the railings to the river bank are visible. Across the river, the buildings of Union Quay are visible, where the Cork School of Music provides a landmark.

Plate 9.5: View of Morrison's Quay

To the eastern end of the study area, between Parnell Bridge and Morrison's Street, there is a public plaza, Parnell Plaza, with some distinctive features, shown in Plate 9.6. This forms a pedestrian link between the end of Morrison's Quay and Parnell Bridge. The plaza contains planting, seating and sculptures, and elements such as distinctive lamp posts. Railings separate the plaza from the river. Trees lining the South Mall also give some character to the space and help to separate it from the street.

Plate 9.6: View of Parnell plaza from east

Plate 9.7: View of lampposts which are distinctive features

Other elements Bridges, steps and railings

Three bridges, Parliament Bridge, Parnell Bridge and Trinity Bridge connect Morrison's Island to George's Quay/Union Quay. Trinity Bridge is a pedestrian bridge, as seen in the image below:

Plate 9.8: View of Trinity Bridge and the College of Commerce from across the river

There are three sets of steps which access the river, from Morrison's Quay and Father Matthew Quay. Plate 9.9 below shows two of these. The steps are not clearly visible or accessible due to the parking and street layout.

Other features of the area include elements include the quay walls, railings, and fendering along the river bank.

Plate 9.9 View of river steps along Morrisson's Quay/Father Matthew Quay

Land Use

The land uses are that of a city centre location, and combine commercial, education, institutional land uses both on Morrison's Island and across the river.

Plate 9.10 View of Morirsson's Quay and Union Quay and river from Parnell Bridge

9.4.3 Landscape Value

In order to determine the landscape value, which feeds into the assessment of landscape sensitivity, and ultimately the likely significance of the effects, assessments of landscape value for the proposed development site and wider (LVIA) study area were carried out. Landscape value includes designations such as scenic views and sensitivity designations found in Development Plans, as well as values which are attached to undesignated landscapes. A number of criteria were developed in order to assess the landscape values of the study area. These then contribute to the assessment of landscape sensitivity which is described in Section 9.5.1.

Table 9 .2 Features of Landscape Value

Feature	Description
Landscape Designations	There are two protected view in the Study Area, as noted in Section 9.2.
Landscape/Townscape Quality/Condition	This refers to the physical state of the landscape, and the condition of individual elements. The quality of the landscape in this area can be described as modified and in moderate condition. While there are a number of distinctive features and buildings, certain elements such as the streetscape and pavements are of medium to low quality.
Aesthetic Qualities	The aesthetic qualities include the river views, especially from the three bridges, and views of the landmarks including the Holy Trinity Church and Parliament Bridge and the ACA on George's Quay
Wildness/Naturalness	This is a built up urban context, however the river brings some sense of naturalness.

Feature	Description
Rarity	Details on conservations interests and habitats are contained in Chapter 5 Flora and Fauna
Cultural Meaning	A sense of cultural meaning arises where a site or features within a site are deemed to explain, represent or inspire cultural values. There are a number of noteworthy buildings, collections of buildings and monuments and landscape elements in the Study Area which are detailed in the Cultural Heritage Chapter – such as the bridges, river steps and buildings. The River Lee itself can also be said to have cultural value, associated as it is with songs and poems (The Banks of my own Lovely Lee) and is associated with the City of Cork. The area across the river in George's Quay is an Architectural Conservation Area (ACA).
Recreation Value	The study are currently has little in terms of recreation value however the Parnell Plaza is a public space and has potential for public use.

9.5 LANDSCAPE AND VISUAL IMPACT ASSESSMENT METHODOLOGY

A full methodology is contained in Appendix 9.1 of this document and summarised briefly below.

9.5.1 Assessing Landscape Effects

Landscape Effects: This can be described as changes which affect the landscape as a resource. This includes how the proposal will affect the elements that make up the landscape, the aesthetic and perceptual aspects, and its landscape character. Landscape effects also relate to changes in the structure of the landscape. Under the GLVIA (2013), the assessment of likely significant effects on landscape receptors includes a judgement on both the sensitivity of the receptor as well as magnitude of the change.

Assessing Landscape Sensitivity

Landscape Sensitivity, which is described in the GLVIA (2013) as a combination of the landscape's susceptibility to change as well as the value attached to the landscape, as shown in Table 9.4 below. Susceptibility to change can be described as the ability of the landscape receptor (either the overall character or quality of the landscape, or a particular landscape feature), to accommodate the proposed development without undue consequences for the maintenance of the baseline (existing) landscape situation, and/or the achievements of landscape planning policies and strategies. Landscape value is a combination of values which are assessed in the landscape baseline (see table 9.2 above) combining any formal landscape designations with the criteria included in Table 9.3 below.

Assessing Magnitude of the change

This is then combined with the magnitude of the impacts, which is a combination of the visual presence - size and scale - of the change, the extent of the area to be affected, and the duration and reversibility of the impact. Significance is then calculated by combining the magnitude and sensitivity judgements.

Visual Effects - Assessing Magnitude and Sensitivity

Visual Receptor Sensitivity depends on the occupation or activity of the people, as well the extent to which the attention is focused on views and visual amenity, according to the GLVIA Guidelines (2013). Value of the visual receptor is a combination of values are assessed in the baseline, combining any formal landscape designations with the criteria such as those included in Table 9.2. This is then combined with the Magnitude

of the effect, which is a combination of size and scale of the change, the extent of the area to be affected, and the duration and reversibility of the effect.

9.6 VIEWS TO AND FROM THE SITE

This section of the ER describes the views of the surrounding landscape that are available to and from the Study Area, with particular reference to the views from areas where the development is visible by a high proportion of viewers.

9.6.1 Views towards the study area

Views to the study area are generally localised i.e. from the streets within the study area, and from the bridges (Parnell and Parliament Bridge) at the east and west of the study area. Some views are possible further upstream and downstream however these are relatively distant, for example from Nano Nagle bridge.

Though the South Mall lies north of the study area, and a number of streets link to Morrison's Quay and Father Matthew Quay, there are no open views from the South Mall, apart from the Parnell Plaza at the eastern end. The main views from the wider city are views of certain tall landmark buildings (e.g. Holy Trinity Church). Thus the photomontage locations reflect the localised nature of the views. The photomontages are included in Section 9.6 below.

9.6.2 Views from the study area

Views from the study area include views up and downstream from the streets and bridges. The buildings on Union Quay/George's Quay and Morrison's Quay/Father Matthew Quay generally restrict most views to the wider cityscape.

9.7 PHOTOMONTAGES

9.7.1 Limitations of Photomontages

Photomontages are visualisations that superimpose an image of a proposed development upon a photograph or series of photographs. They are intended as graphical representations of the likely appearance of the proposed development in the existing landscape.

Visualisations such as photomontages are tools that can represent the likely effect of a development at a particular time and are used to inform the viewer's prediction of how that development will appear. In terms of quality however, i.e. whether a visual effect is deemed to be positive, negative or neutral, this involves a degree of subjectivity.

9.7.2 Location of Photomontages

A series of 8 photomontages has been prepared as part of the ER, which show the proposed scheme from different locations in the receiving environment. The photo-locations are illustrated in Figure 9.2. These locations were chosen to represent a number of views throughout the study area, from a number of directions, and include streetscape views, bridge views, views from across the river towards Morrison's Island, and views of the public space.

The photomontages represent views which are generally available to a large number of people from public areas such as roads and walkways and bridges. They also represent a range of the proposed works types,

and include images of proposed flood defence walls, railings, streetscape and public spaces, and removal of certain elements from the existing environment.

An existing view is shown from each photo-location to provide a representation of the current view, and then a proposed view is presented in order to illustrate the difference. A brief description of each view is also included. These photomontages contribute to the assessment of visual effects, and the visual effect of each photomontage is assessed, using the methodology outlined in Section 9.5.

Note: The Photomontages do not reflect changes to the timber fenders. As set out in Chapter 3, timber fenders at Trinity Bridge and Parnell Plaza will be removed, and may need to be removed in other locations. As the extent of fendering to be retained/removed at other locations cannot be determined at this stage, the photomontages show the fenders as retained.

Photo Location 1: Parliament Bridge

Plate 9.11: Photo Location 1 – Existing View

Plate 9.12: Photo Location 1 – Proposed View

Photo Location 1 - Existing View

The existing view looks towards Morrison's Island, Holy Trinity Church and Father Mathew Quay from Parliament Bridge. The river is clearly visible in the image, and in the background, the buildings of Union Quay and Trinity Bridge are just visible. This is a protected view as shown in Map 13 of the Development Plan.

Photo Location 1 - Proposed View

The proposed view shows the replacement of the railings, with railings and low concrete flood defence walls.

It is considered that the visual receptors in this location are of high sensitivity, as this is a protected view, and are a combination of people who are walking and driving adjacent to the river. They may be engaged in travel, recreation, or enjoyment of the surrounds. The magnitude of change is considered to be Slight to Medium. The visual impact is considered to be Slight neutral visual impact.

Photo Location 2

Plate 9.13: Photo Location 2 – Existing View

Plate 9.14: Photo Location 2 – Proposed View

Photo Location 2 - Existing View

The existing view is taken from Fr. Matthew Quay, towards George's Quay across the river Lee from Father Mathew Quay on Morrison's Island close to Holy Trinity Church. This is a protected view on Map 13 of the Development Plan.

Photo Location – 2 Proposed View

The proposed view shows the existing railings and concrete wall are replaced by a viewing platform with cut stone and steel railings. The view across the river is not affected. Access to the river is maintained.

It is considered that the visual receptors in this location are of high sensitivity, as this is a protected view, and are a combination of people who are walking and driving adjacent to the river. They may be engaged in travel, recreation, or enjoyment of the surrounds.

The magnitude of change is considered Low as it is of limited extent and does not affect a large proportion of the view. The protected view across the river is not affected. The visual effect is considered Imperceptible, positive effect.

Photo Location 3

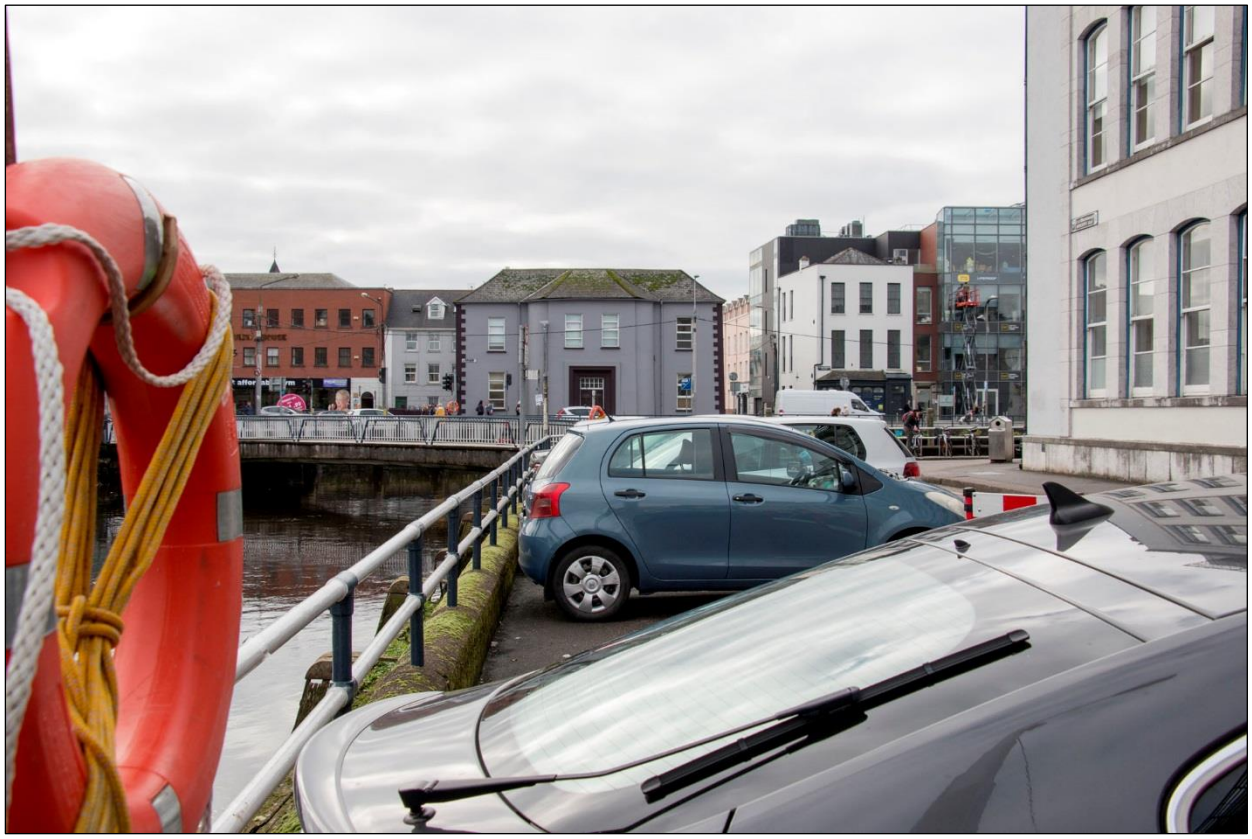


Plate 9.15: Photo Location 3 – Existing View

Plate 9.16: Photo Location 3 –Proposed View

Photo Location 3 - Existing View

The existing view looks south down Morrison's Quay, with the river to the left, and the building of Union Quay and George's Quay as well as Trinity Bridge visible. In the foreground parked cars partly obstruct the view.

Photo Location – 3 Proposed View

The proposed view shows the replacement of the railings with a low wall and railing. Car parking is removed, and will be replaced with a wide pavement and street lighting will be introduced. Both the new and existing pavement on the opposite side of the road will be paved with flagstones.

It is considered that the visual receptors in this location are of high sensitivity and are a combination of people walking or driving slowly adjacent to the river. They may be engaged in travel, recreation or enjoyment of their surroundings. The magnitude of change is considered to be Medium. The visual effect is considered to be Medium, and is regarded as a positive visual effect.

Photo Location 4

Plate 9.17: Photo Location 4 – Existing View

Plate 9.18: Photo Location 4 –Proposed View

Photo Location 4 - Existing View

The existing view looks north up Morrison's Quay. In the foreground, a footpath is located adjacent to the buildings to the left of the image, with a roadway and car parking adjacent to the riverbank. In the background, more buildings, the river and Parnell Bridge is visible.

Photo Location – 4 Proposed View

The proposed view shows the replacement of the railings with a low wall and railing. Car parking will be changed to parallel parking spaces to allow for introduction of a pavement. Both the new and existing pavement on the opposite side of the road will be paved with flagstones. New street lighting and street tree planting further down the quay will be introduced.

It is considered that the visual receptors in this location are of high sensitivity and are a combination of people walking or sitting adjacent to the river. They may be engaged in travel, recreation or enjoyment of their surroundings. The magnitude of change is considered to be Medium. The visual effect is considered to be Slight, positive visual effect.

Photo Location 5

Plate 9.19: Photo Location 5 – Existing View

Plate 9.20: Photo Location 5 –Proposed View

Photo Location 5 - Existing View

The existing view shows the existing Parnell Plaza, looking towards Morrison's Quay and Island from the junction of South Mall and Parnell Place. The plaza is at a lower level than the street, and steps lead to the plaza. A number of sculptures, benches and planters are visible, with street trees at the edge of the South Mall.

Photo Location 5 – Proposed View

The proposed view shows the redesigned plaza, with a viewing platform. The paving has been replaced and the levels changed somewhat, and the steps removed. The planting at the river's edge is removed which opens up the view, and the planters are enlarged and replaced, with integrated seating. Statues and old gas lighting columns s have been moved, and reinstated. The street trees are removed and replaced and stone bollards divide the space form the South Mall. Seating is integrated into the plaza, with more circulation space. Access to the river steps is maintained. The lighting columns have been moved.

It is considered that the visual receptors in this location are of high sensitivity and are a combination of people walking or sitting adjacent to the river. They may be engaged in travel, recreation or enjoyment of their surroundings. The magnitude of change is considered to be Medium. The visual effect is considered to be Medium overall. Effect qualities range from negative to positive visual effects. Slight, Negative visual effects result where any elements and are removed without being replaced, and where street trees are removed. The replacement of the street trees will mitigate the negative effects, once they have established. The re-instatement of statues/sculptures and gas lighting columns is a neutral effect. Positive effects will result where the view to the river is opened up, the viewing area introduced, provision of high quality plaza seating, surfacing and layout is improved.

Photo Location 6

Plate 9.21: Photo Location 6 – Existing View

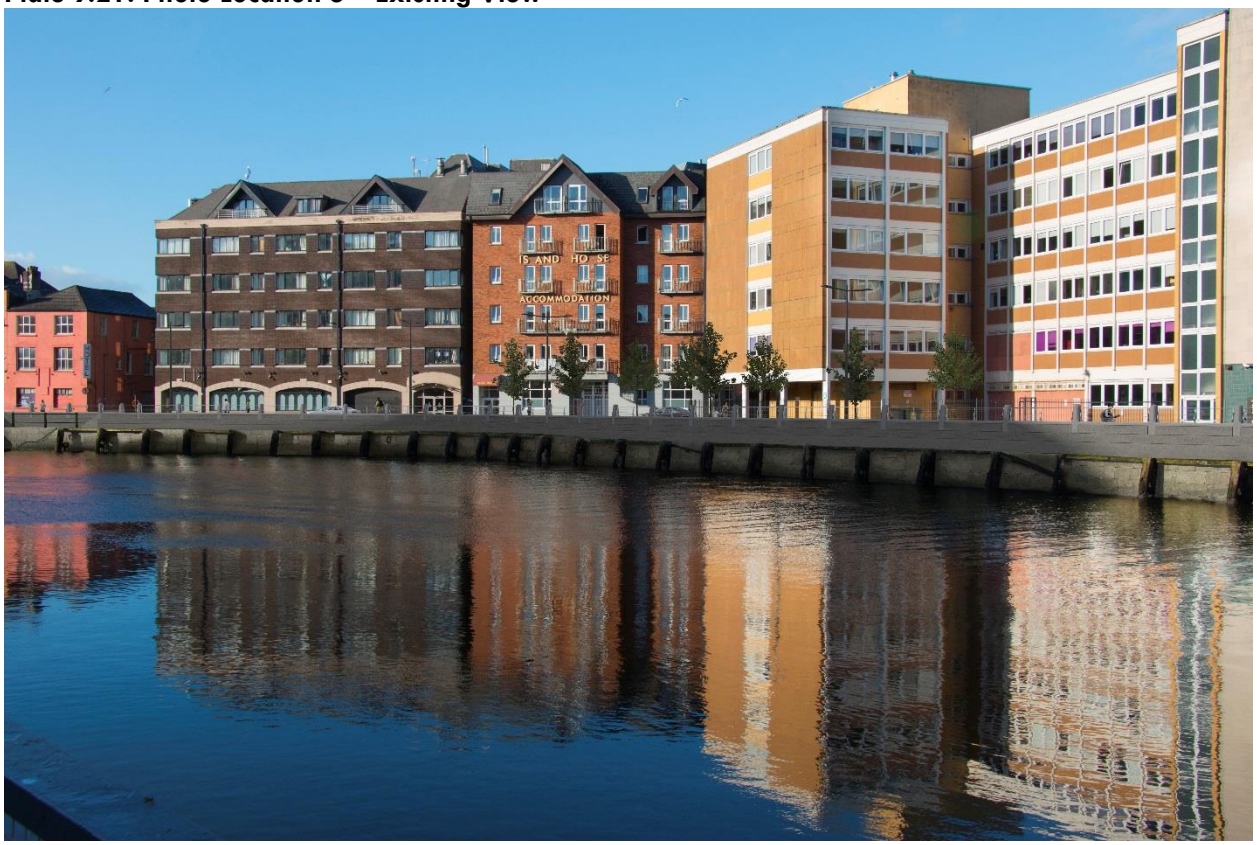


Plate 9.22: Photo Location 6 –Proposed View

Photo Location 6 - Existing View

The existing view looks towards Morrison's Quay and Island from Union Quay with the river in the foreground.

Photo Location 6 – Proposed View

The proposed view shows the replacement of the railings with a low wall and railing, with the existing fendering is to be retained where possible (see notes in Section 97.2 above) at this location.

It is considered that the visual receptors in this location are of medium to high sensitivity, combining groups of people who are walking and driving in close proximity to the river, and may be engaged in travel, recreation, or enjoyment of their surroundings. The magnitude of change is considered to be Low. The visual impact is considered to be Slight, neutral visual effect.

Photo Location 7

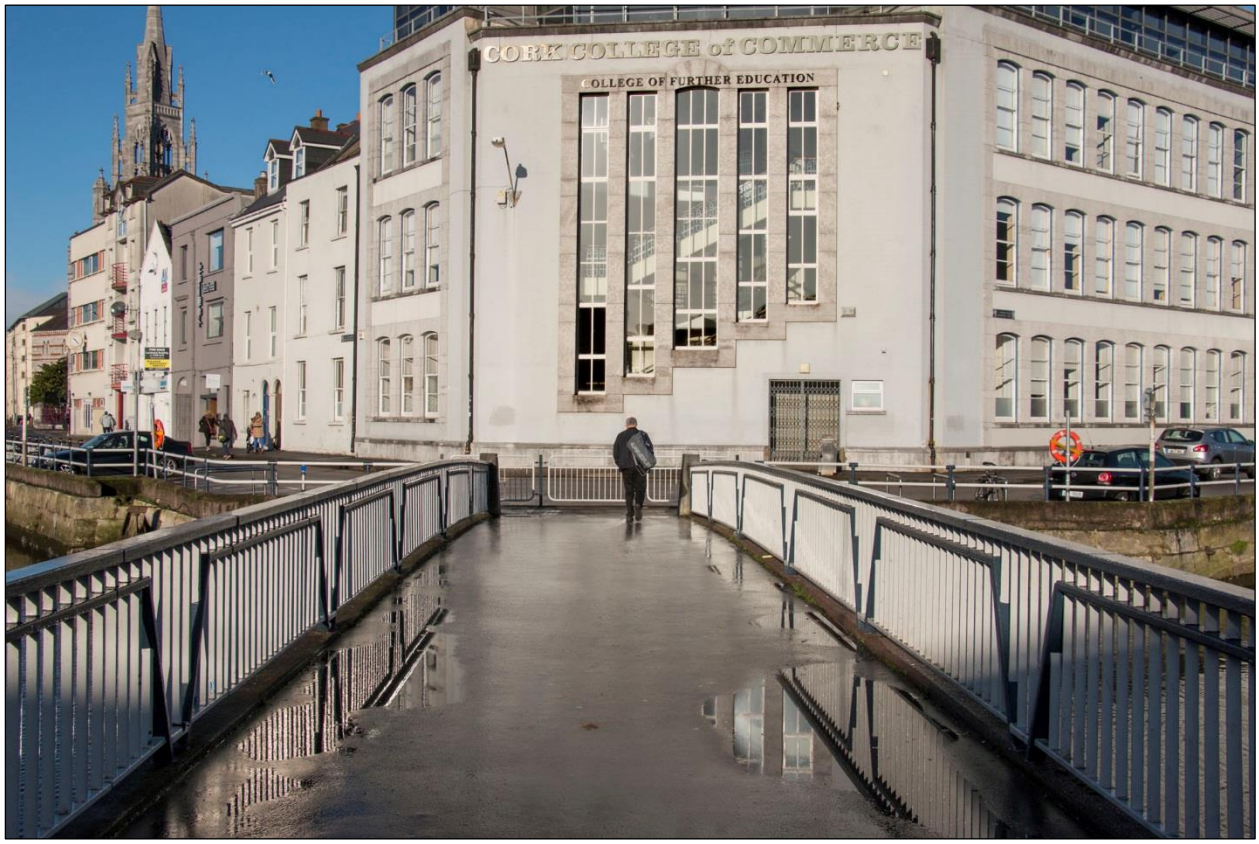


Plate 9.23: Photo Location 7 – Existing View

Plate 9.24: Photo Location 7–Proposed View

Photo Location 7 - Existing View

The existing view looks towards Morrison's Island from the centre of Trinity Bridge. The College of Commerce is visible immediately ahead, while the Holy Trinity Church and adjacent buildings are seen to the left. The railings do not allow open views of the river.

Photo Location 7 – Proposed View

The proposed view shows the redesigned and widened bridge entrance, with timber surfacing and stainless steel railings and curved abutments where the bridge meets Morrison's Island. The revised railings allow more views of the river. Seating is also provided on the bridge and at the junction with Morrison's Island.

It is considered that the visual receptors in this location are of high sensitivity, combining groups of people who are walking along the bridge in close proximity to the river and may be engaged in travel, recreation, or enjoyment of their surroundings. The magnitude of change is considered to be Medium. The visual effect is considered to be Slight to Moderate, positive visual impact. There is more space for pedestrians at the entrance to the bridge, the views to the river are opened up and seating space is provided. Street trees are also evident and the barrier restricting movement at the end of the bridge has been removed. The timber surfacing has an improved visual effect.

Photo Location 8

Plate 9.23: Photo Location 8 – Existing View

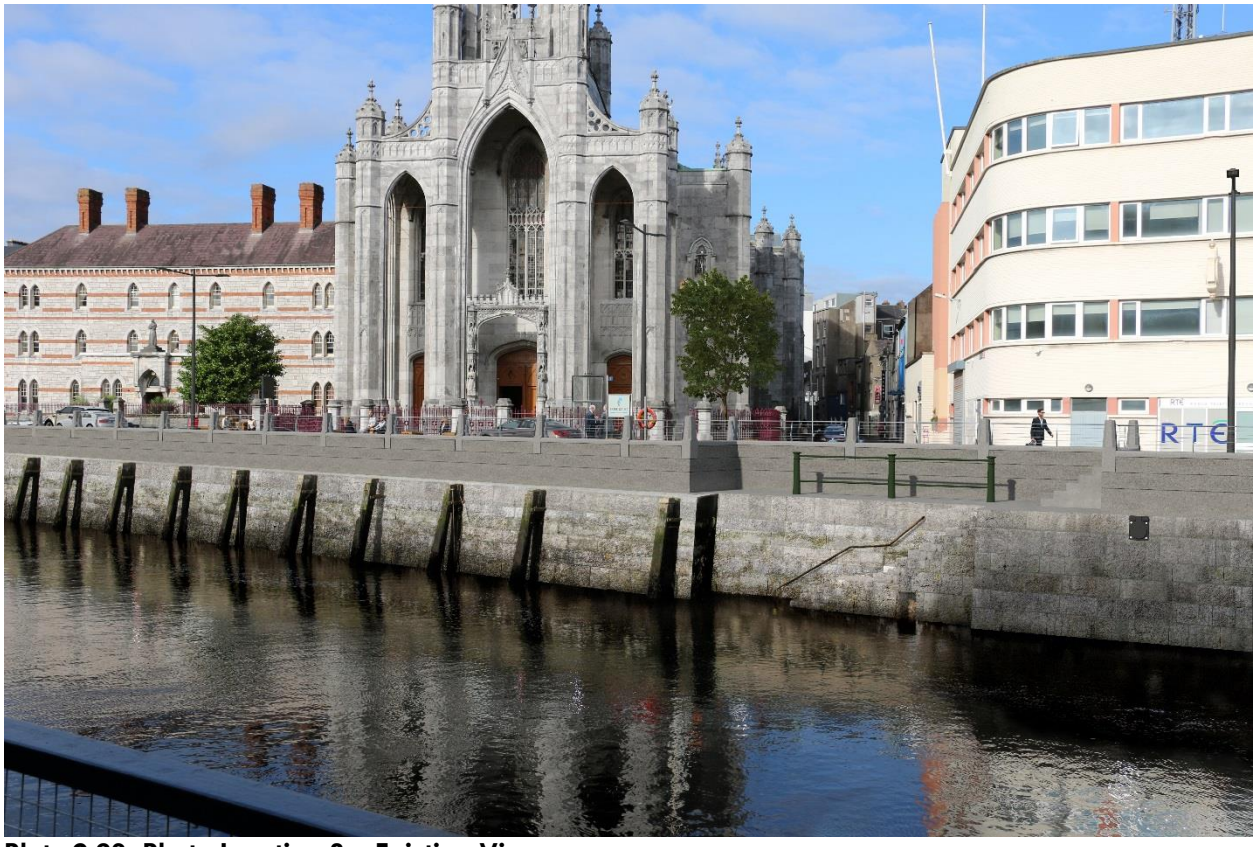


Plate 9.23: Photo Location 8 – Existing View

Photo Location 8 - Existing View

The existing view looks towards Holy Trinity Church and Friary, and the RTE building, across the south channel from George's Quay. Railings and a low concrete wall are visible above the quay wall, while cars are parked directly adjacent to this. The steps which access the river are visible.

Photo Location – 8 Proposed View

The proposed view shows the replacement of the railings and new stone bollards, while the fendering is to be retained where possible. (Note that as referred to in Chapter 3, apart from Trinity Bridge and Parnell Plaza, the extent of fendering to be retained/removed cannot be determined at this stage, and the photomotnages show the fenders as retained.) The steps which access the river are to be retained, and additional steps added to allow access over the proposed wall. The quay walls have been cleaned. A street tree is located to the front of Holy Trinity Church, and seating is located along the widened pedestrian path adjacent to the river, which replaces the car parking.

It is considered that the visual receptors in this location are of high sensitivity, and are a combination of people who are walking and driving adjacent to the river. They may be engaged in travel, recreation, or enjoyment of the surrounds. The magnitude of change is considered to be Medium. The visual impact is considered to be Slight neutral to positive visual effect. The replacement of the railings with bollards and stainless steel railings, the removal of car parking and street tree planting all have a positive visual effect.

9.8 LIKELY AND SIGNIFICANT IMPACTS AND ASSOCIATED MITIGATION MEASURES

9.8.1 'Do-Nothing' Scenario

If the proposed development were not to proceed, the existing river channel would remain as it is, resulting in many of the same potential impacts on human beings as have occurred previously.

There would also be potential for impact on:

- Residential and commercial properties
- Educational facilities
- Pedestrian walkways
- Open spaces

In the event that the proposed scheme were not to proceed, the landscape of the Study Area would evolve based on current trends. In the event of further major flood events, the visual amenity of the area would be temporarily affected as flood levels increase and flood damage affects the study area. Potential landscape impacts caused by flooding include flood damage to structures may also occur.

9.8.2 Impacts During the Construction Phase

The construction works have been preceded by geotechnical investigations. However, a small number of additional geotechnical investigations may be required to confirm ground conditions, which will consist of a mixture of shell and augur boreholes, cable percussive boreholes, rotary drilled boreholes, trial pits and slit trenches at the locations of the proposed structures. In addition, it is proposed that archaeological investigation works including testing and any follow-on resolution works will be undertaken prior to the main works contract commencing on site.

As outlined in Chapter 3, the main construction will involve the excavation and placement of material for the construction of walls, pump stations and as well as the haulage of material and importation of materials to complete the flood scheme. Construction is expected to last approximately 12 months.

Mitigation Measures

Any negative impact associated with the proposed works on the visual amenity and landscape within the study area, will be minimised through the implementation of an Environmental Management Plan (EMP) and a Traffic Management Plan. A construction compound will be used to house materials, plant and machinery, welfare facilities and site offices as part of the EMP and traffic movements will be subject to regulation through the traffic management plan. Best practice measures for noise control will be adhered to onsite during the construction phase of the proposed development, as described in Chapter 8 of this ER on Air Quality and Climate/Noise and Vibration.

Residual Effects

In terms of visual effects, the construction phase will involve machinery on site, and the location of temporary construction compounds as well as works along the roads in the study area, on Trinity Bridge, and in the river channel to construct piling. **This will have a Temporary Slight to Moderate Negative residual visual effect.** The construction phase will involve the movement of machinery on the site and the removal of some elements, such as railings and concrete walls, street trees and some small amounts of vegetation, mainly in and around Parnell Plaza, but is not expected to affect the wider landscape character. **The construction phase will result in a Temporary, Slight Negative landscape residual effect.**

9.8.3 EffectsDuring the Operational Phase

The works described in Chapter 3 which are relevant in terms of potential landscape and visual impacts are grouped into a number of categories below. All effects are residual effects.

9.8.3.1 Quay Wall Remedial Works

The remedial works on the quay walls will involve both structural works and cleaning and repointing of the walls, as described in Chapter 3. This will result in an overall **Medium Term, Slight neutral to positive visual effect. This is expected to result in an Imperceptible Landscape effect.** As stated in Chapter 3, a number of fenders at Trinity Bridge and Parnell Plaza will be removed. There is also the possibility that other timber fenders may be removed - this will be assessed during the detailed design stage. Removal of some of the fenders would have a **Permanent Imperceptible to Slight negative visual effect,** depending on the amount of fenders to be removed, and a **Permanent Imperceptible negative Landscape Effect.**

9.8.3.2 Removal of Railings, Concrete Walls and Construction of Flood Defence Walls and Railings

The removal of existing low concrete walls and railings, and their replacement with low poured concrete walls and steel railings with granite columns will have a generally neutral to positive visual effect along the edge of the South Channel, as shown in the Photomontages. The predicted effect is **Slight Permanent, Positive visual and landscape effect.**

9.8.3.3 Redesign of vehicular and pedestrian traffic and removal of car parking spaces

The removal of 115 car parking spaces and the re-configuring of parking to parallel parking in certain areas will open up views to the river and the creation of pedestrian pathways adjacent to the river will improve pedestrian accessibility to Morrison's Island. **This will have a Long Term, Slight to Moderate positive visual effect and Long Term Slight positive landscape effect.**

9.8.3.4 Redesign of Parnell Plaza

The redesign of Parnell Plaza involves the removal of street trees and vegetation, removal of statues seating and old gas light posts, and relocation of same. The seating is integrated into the plaza design, and the surface is to be repaved with steps removed so the plaza is at a higher level, similar to the South Mall. Granite columns are proposed and vegetation removal along by the river opens up the views to the river. A viewing platform is proposed. The removal of the street trees and the moving and re-instatement of the lamp posts, and the statues will have are **Short term Slight negative visual and landscape effect**. This will be mitigated once the trees are replanted and have matured to a Slight neutral effect. The creation of a new plaza, seating areas, planting of street trees and viewing platform will have **Permanent, Slight to Moderate positive visual and landscape effects.**

9.8.3.5 Construction of boardwalk, viewing platforms and amendments to Trinity Bridge

These works comprise a new boardwalk on Union Quay, and the widening of the bridge entrances, and replacing of the surface and railings on Trinity Bridge. These will increase the pedestrian circulation space and access to the river, and are considered to improve the views to the river. These are considered **Permanent, Slight to Moderate positive visual and landscape effects.**

9.8.4 Conclusion - Visual Effects

As set out above, visual effects will occur during the construction phase as well as the operational phase. During the construction phase, a Temporary Slight to Moderate Negative visual effect is expected.

During the operational phase, the visual effects involve the creation of increased pedestrian areas and viewing areas along the river, a new boardwalk, a reduction in parking, the provision of cycle parking, seating, and the widening of the ends of Trinity Bridge as well as a redesigned Parnell Plaza. Some vegetation is removed and other trees are proposed. Along the river bank, low concrete walls and railing will be replaced with concrete wall, steel railings and granite columns. The visual effects are set out above for the 8 photomontage locations, and the effects range from Slight negative, neutral to positive. The negative effects associated with removal of trees will be mitigated over time to neutral effects as the replacement trees mature, and the majority of the overall visual effect are positive. Views to the river will be opened up and the pedestrian spaces along the river will be improved, allowing the public greater enjoyment of the river and associated public spaces. The protected views RP4 and LT4 will not be negatively affected. The view in the foreground of LT4 as seen in Photomontage 2, will be improved.

9.8.5 Conclusion - Landscape Effects

The landscape effects will occur during construction and result in a Temporary, Slight Negative landscape residual effect. During the operational phase, the proposed development will have an overall positive effect on the localised landscape character and landscape fabric, improving the public realm, the sense of connection to the river, and increased circulation and seating spaces for pedestrians. Removal of landscape elements such as timber fenders would have an imperceptible negative effect. While there is some removal of trees and vegetation, these will be mitigated by new planting.

APPENDIX 9-1

Landscape and Visual Impact Assessment Methodology

Assessing Landscape Effects

Landscape Effects: This can be described as changes which affect the landscape as a resource. This includes how the proposal will affect the elements that make up the landscape, the aesthetic and perceptual aspects, and its landscape character. Landscape effects also relate to changes in the structure of the landscape. Under the GLVIA (2013), the assessment of likely significant effects on landscape receptors includes a judgement on both the sensitivity of the receptor as well as magnitude of the change.

Assessing Landscape Sensitivity

Landscape Sensitivity, which is described in the GLVIA (2013) as a combination of the landscape's susceptibility to change as well as the value attached to the landscape, as shown in Table 1 below. Susceptibility to change can be described as the ability of the landscape receptor (either the overall character or quality of the landscape, or a particular landscape feature), to accommodate the proposed development without undue consequences for the maintenance of the baseline (existing) landscape situation, and/or the achievements of landscape planning policies and strategies. Landscape value is a combination of values which are assessed in the landscape baseline, combining any formal landscape designations with the criteria included in Table 1 below.

Assessing Magnitude of the change

This is then combined with the magnitude of the impacts, which is a combination of the visual presence - size and scale - of the change, the extent of the area to be affected, and the duration and reversibility of the impact. Significance is then calculated by combining the magnitude and sensitivity judgements.

Table 1 Assessing Landscape Sensitivity

Susceptibility of landscape to change	Description and example criteria
High	This includes landscapes where the overall landscape character or condition is highly susceptible to change, and where the landscape receptor has a low ability to accommodate the proposed development without undue consequences for the maintenance of the landscape character and the achievement of planning policies/strategies.
Medium	This includes landscapes where the overall landscape character has a moderate ability to accommodate the proposed development without undue consequences for the maintenance of the landscape character and the achievement of planning policies/strategies.
Low	This includes landscapes where the overall landscape character has a strong ability to accommodate the proposed development without undue consequences for the maintenance of the landscape character and the achievement of planning policies/strategies.
Value attached to Landscape elements	Description and example criteria
High	This includes landscapes which are designated as high value, or are designated as (e.g. Areas of High Landscape Value/, Scenic Routes/Views) in the Development Plan, or areas designated at a national or International level.
Medium	This includes landscapes where value is not formally designated, but are of value as they display good examples of good quality, intact

Susceptibility of landscape to change	Description and example criteria
	landscapes, and areas deemed to be of relatively high scenic quality, landscapes which contains some rare elements, which have areas which are wild or have a sense of naturalness, strong cultural associations or which have recreational value.
Low	This includes landscapes which are not formally designated and which are considered to be modified. These include areas which do not have particular scenic qualities and do not include rare elements or landscape features and do not have strongly evident cultural or heritage associations.

Table 2 Assessing Magnitude of Landscape Effects

Magnitude of Change	Description
High	This includes landscapes which will experience a loss of landscape features over a large extent, and where this has an impact on the overall landscape character, and where there this results in a high degree of change to the aesthetics of the landscape. This includes landscapes where the impacts affect key characteristics of the landscape's character. The geographical extent of these changes is evident over a wide area.
Medium	This includes landscapes where there is some loss of landscape features over a medium extent which will result in some change to landscape features and aesthetics. This includes landscapes where there is a moderate impact on the overall landscape character but does not affect key characteristics.
Low	This includes landscapes where these is loss of or change to landscape features of limited extent, and where these changes do not have an impact on the overall landscape character and does not affect key characteristics. Changes to the overall aesthetics of the landscapes are low. Changes to the landscape are more evident at a local level and not over a wide geographical area.

Visual Effects - Assessing Magnitude and Sensitivity

Visual Receptor Sensitivity depends on the occupation or activity of the people, as well the extent to which the attention is focused on views and visual amenity, according to the GLVIA Guidelines (2013). Value of the visual receptor is a combination of values are assessed in the baseline, combining any formal landscape designations with the criteria such as those included in Table 3. This is then combined with the Magnitude of the effect, which is a combination of size and scale of the change, the extent of the area to be affected, and the duration and reversibility of the effect.

Table 3 Assessing Visual Receptor Sensitivity

Susceptibility of visual receptor	Description and example criteria
High	These include viewers at designated views or landscapes; Viewers such as residents which are focused to a large extent on the development due to location in close proximity; viewers at well-known heritage or popular tourist or recreational areas, viewers along scenic or tourist routes
Medium	These include viewers who may have some susceptibility to a change in view, such as those from views which are not designated but may have

	local recreational uses or those travelling along routes or at view which are considered moderately scenic.
Low	These include viewers engaged in activities where the focus is not on the landscape or view. These including those travelling along a busy route, viewers at work or engaged in sport not related to views or experience of the landscape.
Value attached to the view	Description and example criteria
High	These include protected views of views from designated landscapes of national or international importance, and views indicated on tourist/cultural publications, or views considered of high scenic quality, naturalness, tranquility or the presence of rare elements in the view.
Medium	Views which are not designated but which include panoramic views or views judged to be of some scenic quality, which demonstrate some sense of naturalness, tranquility or some rare element in the view.
Low	Views which are not designated and which are not judged to be panoramic views, of particular scenic quality as described above. These are views which have no distinctive features.

Table 4 Assessing Magnitude of Visual Effects

Magnitude of Change	Description
High	This includes viewpoints where the proposed development results in a large scale change of the view and its composition, and creates a high degree of contrast. This includes viewpoints where the proposed development is fully or almost fully visible over a wide extent, at close proximity to the viewer. The duration of the effect is long term or permanent and have a low level of reversibility.
Medium	This includes viewpoints where the proposed development results in a moderate scale change of the view and a moderate degree of contrast with the existing view. This includes viewpoints where the development is partially visible over a moderate or medium extent, and viewpoints which are not in close proximity to the development.
Low	This includes viewpoints where the proposed development results in a low level of change in the view and its composition and a low degree of contrast. This includes viewpoints where the development is partially or barely visible, and over a small extent, and includes viewpoints at a distance from the proposed development.

10 ARCHAEOLOGY, ARCHITECTURAL AND CULTURAL HERITAGE

10.1 INTRODUCTION

This section of the Environmental Report (ER) describes the potential impacts of the proposed Morrison's Island Public Realm Project incorporating Flood Defence Works on the cultural heritage resource which for the purposes of this assessment includes archaeology, architectural heritage, folklore and history.

10.2 METHODOLOGY

Desktop Study

The principal sources reviewed for the assessment of the known archaeological resource were the Sites and Monuments Record (SMR) and the Record of Monuments and Places (RMP) for County Cork. The Record of Protected Structures (RPS) and the National Inventory of Architectural Heritage (NIAH) were the main sources consulted for assessing the recorded architectural heritage resource. The legal and planning policy framework that has been established to ensure the protection of these resources was consulted and is clearly presented within the report. The following sources were also consulted:

- Excavation Database: this contains summary accounts of all archaeological excavations carried out in Ireland from 1970 to 2017.
- Topographical Files of the National Museum of Ireland: The assessment included an inspection of the files held by the National Museum of Ireland in Kildare Street, Dublin.
- Development Plan: these outline local authorities' policies for the conservation of the archaeological and architectural heritage resource and designate Records of Protected Structures (RPS) and Architectural Conservation Areas (ACA). The relevant development plan for the study area is the Cork City Development Plan (2015-2021).
- Cartographic and Photographic Sources: The detail on historic cartographic sources can indicate past settlement and land use patterns in recent centuries and also often highlight the impact of modern developments. This information can aid in the identification of the location and extent of unrecorded, or partially levelled, features of archaeological or architectural interest. A range of available cartographic sources were examined for the study area and included the various historic maps depicting the expansion of the city into this area during the 18th and 19th centuries. A number of historic photographic sources were also consulted, including the Digital Photograph online database of Cork City Library (www.corkpastandpresent.ie/) and the National Library of Ireland (http://www.nli.ie/).
- Literary sources: These are a valuable means of completing the written archaeological, historical and architectural record of study areas and gaining insight into the history of the environs of proposed developments. A list of all literary sources consulted as part of this assessment is provided in the bibliography.

Site Inspection

A number of inspections of the subject area were carried out between 2015 and 2017 in order to confirm the presence and extent of known cultural heritage assets, and to identify undesignated assets. A photographic record was compiled at each occasion. A licensed underwater archaeological survey of the subject area was undertaken by ADCO in July 2016. This included a visual inspection of the River Lee at Morrison's Island across the riverbed

and attendant bankside/ quayside areas associated with the proposed Flood Alleviation Works and an underwater survey of its subtidal channel. The archaeological assessment sought to record riverbed and bankside/ quayside topography, assess the potential of riverbed deposits to retain archaeological material, and identify any features/structures of archaeological or historic significance that are present. In addition, targeted metal-detection was employed to help assess the riverbed and highlight any metallic concentrations present within those deposits. An underwater survey of the sub-tidal channel of the South Channel between Parliament Bridge and Parnell Bridge was undertaken, using Surface Supplied Diving Equipment. A full copy of the ADCO report is presented as Appendix 10.5 and this provides the results of a survey of the quay walls within the study area.

10.3 RECEIVING ENVIRONMENT

General Context

The cultural heritage features identified within this section have been assigned Heritage Asset Numbers are these are included in all tables within the chapter and are cross-referenced to various designations (e.g. RPS, NIAH and RMP). The overall list of the identified Heritage Assets within the environs of the proposed scheme is presented in Appendix 10.1 which also provides their locations and cross-references to their designations and, where relevant, their ADCO feature numbers.

The subject area is located along the north bank of the south channel of the River Lee to the east of the medieval walled town and extending from Parliament Bridge and encompasses Father Mathew and Morrison's Quays. This area of the city saw little development until the late 18th and early 19th centuries when it was reclaimed as part of the expansion of the city undertaken during this period. While an important area of the city docks during the 19th century, this role gradually declined in significance and the docks were no longer in use by the mid-20th century. The quaysides throughout much of the subject area are now occupied by tarmac streets with car parking spaces flanking the river's edge. The river's edge in this area is now defined by 20th century metal railings that stand on low concrete walls built on top of the 19th century ashlar quay walls. This modern intervention replaced the 19th century stone bollards and chains that previously flanked the quays.

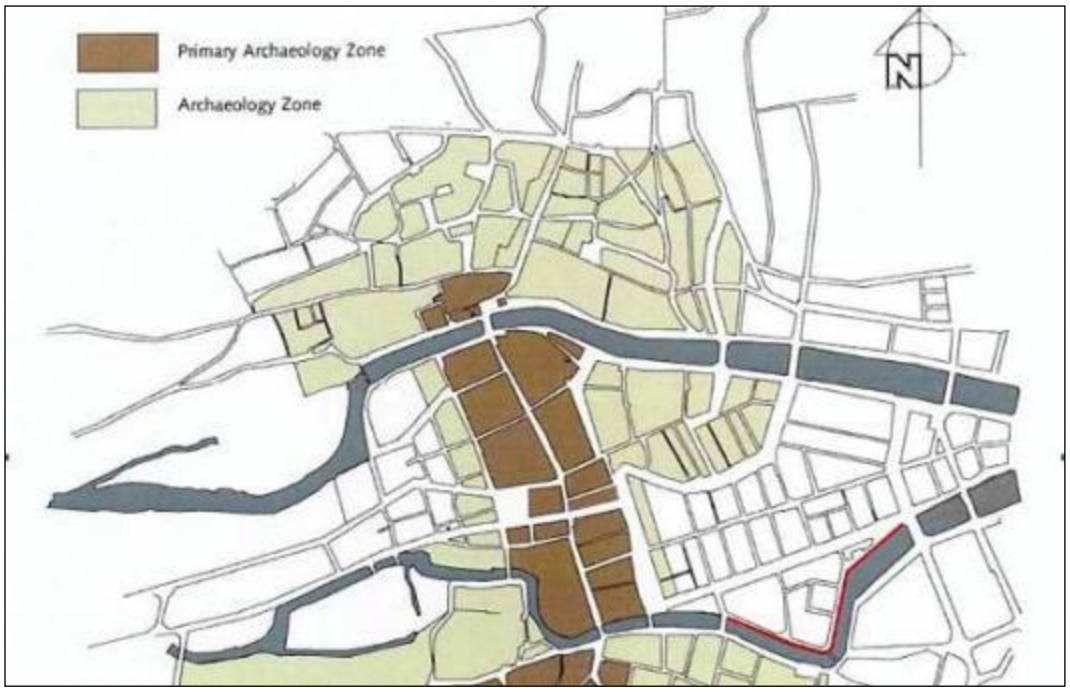


Figure 10.1: Subject Area (red) in relation to zones of archaeological potential for Cork City (source: www.corkcity.ie)

Legal and Policy Context

The management and protection of cultural heritage in Ireland is achieved through a framework of international conventions and national laws and policies, in accordance with the provisions of the European Convention on the Protection of the Archaeological Heritage (Valletta Convention) and European Convention on the Protection of Architectural Heritage (Grenada Convention).

Archaeological Legislation and Cork City Council Policies

The National Monuments Acts 1930 to 2004, the Heritage Act 1995 and relevant provisions of the National Cultural Institutions Act 1997 are the primary means of ensuring the satisfactory protection of archaeological remains, which include all man-made structures, of whatever form or date, except buildings habitually used for ecclesiastical purposes. A national monument is 'a monument or the remains of a monument the preservation of which is a matter of national importance by reason of the historical, architectural, traditional, artistic or archaeological interest attaching thereto' (Section 2, National Monument Act, 1930).

Under the National Monuments Act, monuments are protected under the Register of Historic Monuments, the Record of Monuments and Places (RMP) and the placing of Preservation Orders and Temporary Preservation Orders on endangered sites. There are no recorded archaeological sites located in the vicinity of the proposed flood defence works and the area is outside the Zones of Archaeological Potential for the city as defined by the Cork City Council.

As noted above the Cork City Development Plan 2015-2021 does not identify the study area to be within the primary or secondary zone of archaeological potential for the city. However, the Development Plan contains a wide range of policies and objectives in relation to the protection of archaeological heritage within the city and examples relative to the present assessment include the following:

Objective 9.7: Preservation of archaeological remains in-situ

In accordance with national policy (and in the interests of sustainability) impacts on the buried archaeological environment should be avoided where possible.

Objective 9.16: Large-scale Development (outside the boundaries of a RMP)

Outside the Zone of Archaeological Potential of a RMP, where in the opinion of the City Council a development involves major ground disturbance; archaeological conditions may be applied particularly in the vicinity of known monuments.

Objective 9.18: Industrial Archaeology

All development proposals for industrial buildings and sites of industrial archaeological importance must be accompanied by an archaeological assessment of the building(s) and their surrounding environment. Retention and/or incorporation of industrial buildings will be encouraged.

Objective 9.20: Underwater Archaeology

All development proposals which will impact on riverine, intertidal and sub-tidal environments should be accompanied by an archaeological assessment.

Objective 9.29 Protection of Underwater Archaeology

Under the National Monuments (Amendment) Act 1930-2004 all shipwrecks over one hundred years, underwater archaeological structures, features and objects are protected.

Architectural Heritage Legislation and Cork City Council Policies

The protection of architectural heritage is provided for through a range of legal instruments that include the Heritage Act, 1995, the Architectural Heritage (National Inventory) and National Monuments (Misc. Provisions) Act, 1999, and the Local Government (Planning and Development) Act 2000.

The Heritage Act 1995 protects all heritage buildings owned by a local authority from damage and destruction. Section 2.1 describes architectural heritage as 'all structures, buildings, traditional and designed, and groups of buildings including streetscapes and urban vistas, which are of historical, archaeological, artistic, engineering, scientific, social or technical interest, together with their setting, attendant grounds, fixtures, fittings and contents, and, without prejudice to the generality of the foregoing, includes railways and related buildings and structures and any place comprising the remains or traces of any such railway, building or structure'.

The Local Government (Planning and Development) Act 2000 obliges planning authorities to keep a Record of Protected Structures (RPS) of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest. As of the 1st January 2000, all structures listed for protection in current Development Plans, have become 'protected structures'.

The Architectural Heritage Act 1999 (National Inventory) requires the Minister to establish a survey to identify record and evaluate the architectural heritage of the country. The function of the National Inventory of Architectural Heritage (NIAH) is to record all built heritage structures within the Republic of Ireland. While inclusion in the NIAH does not provide statutory protection to a structure the inventory is used to advise local authorities on compilation of a Record of Protected Structures (RPS) as required by the Local Government (Planning and Development) Act, 2000. The Cork City Development Plan states that it is an aim of the City Council to protect features listed in the NIAH (Objective 9.28).

The Father Mathew and Morrison's Quay walls and their associated features are not listed in the RPS or NIAH. The buildings, bridges and features located within the environs of the proposed works that have been included in the RPS and NIAH are identified in Appendix 10.1, which also identifies the unlisted heritage assets identified in the environs of the proposed scheme, and the published NIAH descriptions are provided in Appendix 10.2.

The Cork City Development Plan 2015-2021 presents a wide range of policies and objectives in relation to the protection of the architectural heritage within the city and those relevant to the present assessment include the following:

Objective 9.23: Record of Protected Structures

The Council will maintain a Record of Protected Structures, which shall include structures or parts of structures and their curtilage which are of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest, and which it is an objective to protect

Objective 9.28: Protection of NIAH and other structures of built heritage interest

The City Council as planning authority aims to protect structures of built heritage interest.

Section 9.61: Other Elements of Built Heritage

Of immense importance are the 19th century elements associated with the north and south channel. Important features include quay walls, bollards, kerbing etc.

The Architectural Conservation Areas (ACAs) within Cork City are defined in the City Development Plan 2015-2021 as places, areas, groups of structures or townscape that are of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest or contributes to the appreciation of protected structures. **The subject area is not located within any of the designated Architectural Conservation Areas as defined in the Development Plan.**

Archaeological and Historical Context

There are no recorded archaeological sites located in the vicinity of the proposed flood defence works and the area is outside the Zones of Archaeological Potential for the city as defined by the Cork City Council. The nearest section of the study area is located approx. 170m west of the southeast corner of the medieval walled city and no significant impacts to the Zones of Archaeological Potential, including the medieval settlement are predicted. Prior to extensive 18th and 19th century reclamation works, the subject area comprised the margins between a marsh island and the river channel and was likely prone to daily tidal flooding. While this environment would not have presented conditions amenable to long term settlement until the completion of the reclamation work, the possibility of human activity of a more transient nature in the area cannot be discounted. Riverine contexts were, for example, attractive to hunter-gatherer groups in the early prehistoric period and during the Bronze and Iron Ages, rivers and marshes were occasionally the sites of ritual deposition. The NMI topographical files do not record the discovery of any archaeological artefacts along Father Mathew Quay or Morrison's Quay.

As discussed by Rynne (1999, 197), the deep channels of the sheltered lower Cork harbour were well suited for shipping traffic but this attribute steadily decreased in the increasingly shallower approaches to the city where water depths as shallow as 3 feet were recorded. Prior to the early 19th century the construction and maintenance of the city quay walls was undertaken on a piecemeal basis and to varying quality by the private sector and were described by Alexander Nimmo in 1815 as "*imperfect masses of rubble stone*". From the early 18th century onwards extensive works were being made to reclaim the marshlands outside the historic city core and by the second half of that century concurrent works were commissioned to improve shipping access to the quays being developing within the newly reclaimed areas. The works undertaken during the 18th and 19th centuries were immense in scale and have been usefully summarised within various publications in recent decades (e.g. Rynne 1999 & Leland 2001). The following account is largely based on these sources. As vessel sizes increased during the 19th century it became necessary to dredge the upper harbour and city channels in order to facilitate access to the city. The poor condition of the city quays formed a constraint to this work as the poorly built walls were built directly on top of estuarine muds and dredging led to their collapse. The formation of the Cork Harbour Commissioners in 1813 concentrated

responsibility for the improvement and maintenance of the shipping channels and quays into one organisation. During the following decades the Commissioners instigated an extensive programme of repairing and re-building the quays in limestone ashlar construction and this included the insertion of 8,000 timber toe-piles driven to depths of 21 feet in order to facilitate dredging close to the quays. Timber wharfs began to be constructed along a number of the quays in the second half of the 19th century, including Albert, Union, Victoria, Patrick's and Penrose Quays. There were no wharfs constructed along Father Mathew and Morrison's Quays.

The existing city quay walls, including those on Father Mathew and Morrison's Quays, are in the ownership of Cork City Council and they, along with their associated mooring features, are typically of 19th century date. While the survival of these masonry features in a riverine location for almost 200 years is a testament to the engineering skill involved in their design and construction, sections have required extensive programs of remedial works in recent decades. An extensive program of quay repairs and complete rebuilding of sections along Albert, Penrose and Anderson's Quays was commissioned by the Council in the late 20th century and was, in part, instigated by a collapse of a section of the quayside along Albert Quay during the 1970s. While none of the quay walls within the subject area were rebuilt at that time, a section of the quays along Lapp's Quay to the east was removed and later reconstructed as part of an early 2000s commercial development along the quayside.

The RMP, RPS and NIAH do not list any of the Father Mathew or Morrison's Quay walls or their associated features.

Morrison's Island was formerly known as the East Marsh, Dunbar's Marsh and Lavitt's Island up to the late 18th century when the undeveloped marshy island was reclaimed and named after a prominent Cork family of the period. The expansion of the city into this area began during the 1750s when a row of houses were built along the south side of the area now occupied by the South Mall which was an open river channel at that time. The existing street layout on Morrison's Island was completed during the early decades of the 19th century. This newly reclaimed area of the city began to attract commercial enterprises along the new quaysides. The Church of the Holy Trinity (HAN 10) dominates the streetscape along Father Mathew Quay and while its construction began in 1832 it was not finally completed until the early 20th century. Shipping continued to dock as far Father Mathew Quays until the 1950s and the importance of maintaining shipping access in this area is attested to by the removable nature of the bridges constructed downriver during the 19th and early 20th centuries including the swivel Parnell Bridge (HAN 16).

There are three bridge crossings adjoining the subject area: Parliament Bridge (HAN 4), Trinity Bridge and Parnell Bridge. Two of these structures (Trinity and Parnell Bridge) are modern in date although the latter is built on the former sites of Angelsea Bridge and the Parnell swivel bridge (HAN 16). The summary descriptions of each structure presented in Table 10.1 are sourced from the following publications: *National Inventory of Architectural Heritage* (Dept. of Arts, Heritage and the Gaeltacht), *The Industrial Archaeology of Cork City and its Environs* (Rynne 1999) and *Where Bridges Stand: The River Lee Bridges of Cork City* (O' Callaghan 2012).

Table 10.1: Summary of published descriptions of bridges within the subject area

HAN ref	Bridge	Status	Context
4	Parliament Bridge	RPS 270	Single-arch limestone bridge, with cut limestone balustrade, fine voussoirs and modillion cornice, opened in 1806 and replaced an earlier structure dating 1760s, which was damaged by a flood in 1804. Designed by Andrew Hargrave & constructed at a cost of £4,000. The bridge was re-furbished in the 1990s and there is also evidence that it was damaged in 1922 during the Civil War, after which damaged limestone balustrades were replaced with concrete.

HAN ref	Bridge	Status	Context
-	Trinity Bridge	None	Footbridge constructed in 1977 to connect Morrison's Island with Union Quay, named after the nearby Holy Trinity Church. Designed by Cyril Roche and built by Public Works Ltd, a concrete, iron-railed structure.
16	Parnell Bridge	None	Previously featured the Sir Thomas Deane built, stone-arched, Anglesea Bridge which opened in the 1830s and was replaced by a steel lattice girder bridge of 1882 construction, designed by T. Claxon Fiddler of London (a swinging central span and 2 fixed ends). The existing Parnell Bridge was opened in 1971 and comprises a concrete-built structure. Original, round limestone abutments of the previous bridge were retained as were two lamp standards which are now located in the open public area to the north west of the bridge at the east end of Morrison's Quay. The existing bridge rests on newly reconstructed stone abutments and features limestone cladding over the concrete ends and the railing plinth of the parapet. The asphalt-surfaced bridge carries two lanes of traffic in each direction with flagged footpaths on both sides and a concrete central reserve. Parnell Bridge has three unequal spans, the northernmost span being significantly shorter than the other two. The deck is made up of precast concrete beams and in-situ concrete slab simply supported on profiled concrete piers and concrete abutments cast into the quay walls. There are approximately 25 precast beams per span, each discretely supported at each end on elastomeric bearing pads. There are buried joints at the end of each span. A flight of steps down to the river forms part of the south west abutment of the bridge. A gate, which formerly restricted access from the street to the steps and the small paved landing beside the bridge has been removed.

While no archaeological excavations have been undertaken within the environs of the subject area a number of investigations have been undertaken in the surrounding area of the city in recent years. Archaeological monitoring of construction works within properties close to the sections of the south river bank opposite the subject area was also undertaken in recent decades. The site investigations at each location uncovered deep deposits of 18th and 19th centuries reclamation material overlying natural clays and gravels and nothing of archaeological significance was uncovered. The excavation of a geotechnical trial pit on Father Mathew Quay was carried out under archaeological supervision in 2014 (T. Cummins; Licence Ref. 140E139). Nothing of archaeological significance was noted during an inspection of the upcast material or during inspection from street level of the exposed sections within the confined excavation area which contained the following stratigraphic sequence:

Trial Pit 12 (Father Mathew Quay)

0.0 to 0.7m: Road surface and fill

0.7m to 2.1m: Soft to firm, blue/grey silt with occasional brick inclusions

2.1m to 3.4m: Slightly silty sandy gravel with low sub-rounded cobble content. A roughly cut limestone plinth extended inwards from near the base of the adjacent quay wall at a depth of approx. 3.2m below modern ground level

3.4m to 4.2m: Firm, blue/grey, slightly gravelly silt/clay present to base of excavation

The detail on a copy of a Harbour Commission construction section of the quay wall at Father Matthew Quay (provided courtesy of Cork Archives) indicates that the base of the wall was constructed on existing sloping ground along the river bank and the gap behind the structure and the upper section of the slope was subsequently infilled (Appendix 10.3; Figure 10.14).

Cartographic and Photographic Sources

The development of the subject area is demonstrated annotated extracts from the historic cartographic and photographic images presented in Appendix 10.3. These images were sourced from the Cork City Library online database of historical images (www.corkpastandpresent.ie). The historic photographic images are from the Lawrence Collection and while not individually precisely dated; broadly fall into a date range between 1880 and 1914.

Site Inspection

Appendix 10.4 presents the annotated photographic record of the inspection of the subject area undertaken by JCA archaeological and built heritage specialists. The annotated photographs comprise a combination of general views of the quays and their environs with more detail specific imagery of individual quay features of architectural heritage significance. Further details on the inspection of the subject area are presented in the ADCO report which is presented as Appendix 10.5.

10.4 IMPACT ASSESSMENT

This section provides a summary of **a)** a Do Nothing Scenario; **b)** the proposed scheme interventions which may have adverse impacts; **c)** a consideration of the Construction Phase impacts, including a table outlining impacts to the identified heritage assets, or elements thereof; and **c)** Operational Phase impacts. The assessments of the significance of, and impacts on, the identified heritage assets that are presented within this section (see Table 10.2 below) are based on guidelines published by the Environmental Protection Agency (EPA) and the International Council on Monuments and Sites (ICOMOS).

Do-Nothing Scenario

A 'Do Nothing Scenario' will see to the continued preservation of recorded and potential cultural heritage features within the study area albeit with the continuation of potential flooding risks to the Heritage Asset buildings within the proximity of the subject area and the wider streetscape.

Summary of Construction Works

The following presents the details on the proposed works available at the time of the compilation of this chapter. The defences will comprise an architecturally designed quayside parapet wall (flood defence wall) and railing which reflects and respects the historic bollards which historically adorned these quays, whilst maximising view of the river and protecting against extreme tidal flooding. Ground levels along both quays will be regraded to ensure that the solid wall component will be no higher than 600mm (2 feet) above the new walkway level. Significant remedial works will be undertaken to the existing quay walls, including cleaning, repointing and grouting and the existing limestone river steps will be raised to flood defence level (3.5mOD). A riverside walkway with a minimum width of 3m will be created and Morrison's Quay Lower will be pedestrianised. To facilitate the proposed riverside walkway, the existing right-angle parking along the quays will be removed and replaced with parallel parking. The existing public plaza at the east end of Morrison's Quay will be retained and enhanced.

The following is the construction sequence provided for the proposed works:

Quay Wall Remedial Works

- Scaffolding and temporary propping to be erected on the wet site of the quay wall as required.

- Construction of the new reinforced concrete backing wall is to be carried out in short lengths (circa 5m). Construction to commence with excavation of existing backfill material. The depth and width of excavations has not been specified.
- Concrete backing wall to be poured in short lifts to minimise pressure on the existing quay wall
- Proposed New quay wall back drainage to be installed
- Backfill to top of existing quay wall
- All joints to be raked out, cleaned and repointed by hand
- Face of existing quay to be thoroughly cleaned with high pressure water jetting. All dirt and marine growth to be completely removed
- Grouting of foundation zone and Existing quay wall to begin
- The wall is to be gravity grouted initially, through holes drilled c/c 2m down through the centre of the wall
- When the wall gravity grouting has set, the wall and foundation zone to be pressure grouted holes drilled c/c 1m through the body of the wall, down into the foundation zone. Galvanised Reinforcement stitching bars to be installed and grouted into cored hole.

Flood Defence Walls Construction

- Remove existing railings and parapet walls
- Dowel connections to be drilled in to RC backing wall to ensure connection of Flood wall to backing wall.
- Tie back rebar to be fixed.
- Shuttering for base of L-Wall to be fixed
- Base of L-Wall poured
- Upstand of L-wall poured

Pumping Stations

- Pumping stations to be installed as required. The footprint of the pumping station will be set out. Where the proposed excavation is located in a paved area, the pavement will be saw cut. The excavation will take place to the required depth. Sheet piling will likely be required in order to facilitate construction of deep excavations in an urban area.

Drainage and Finishes

- Place new surfacing drainage
- Road surface to be laid
- General finishes to structures, junctions, traffic lights, signage, road markings, bike share station etc.
- Installation of Stainless steel railing and Wire Rope system
- Road opened to full traffic

Construction Phase

The following section provides general comments on the proposed scheme based on the existing cultural heritage context of the subject area and then presents the impacts of the proposed scheme on the identified Heritage Assets in table format (Table 10.2).

There are no recorded archaeological monuments in close vicinity to the areas to be impacted by the proposed development and it is located outside the Zones of Archaeological Potential identified in the City Development Plan (Figure 10.1). The nearest section of the subject area is located 170m to the east of the medieval city in an area occupied by marshlands until it was subject to extensive reclamation works during the late 18th and early 19th centuries as part of the eastwards expansion of the city. The positions of the quayside edges in this area have remained unchanged since their construction in the decades following the completion of the reclamation works. It is noted that archaeological monitoring of extensive ground excavation works within riverside development sites in the surrounding streetscape has in all instances encountered deep deposits of late 18th and 19th century reclamation material that have directly overlay natural subsoils and contained nothing of archaeological significance. The proposed flood defence works will require excavation works along the inner edge of the quay walls. The width and depth of these excavations was not available at the time of compilation of this chapter. While nothing of archaeological significance was noted during monitoring of a geotechnical trial pit on Father Mathew Quay in 2014, the potential exists that unrecorded archaeological features or artefacts may be present on the footprint of these proposed works.

The subject area is not located within any of the designated or proposed Architectural Conservation Areas published in the City Development Plan (2015). While the 19th century quay walls (HAN 1 and 2) and their associated features (river steps, mooring rings, timber fenders and surviving original rails) are not listed in the RPS or NIAH they do constitute physical remains of the maritime trade industry that formed the mainstay of the economic development of Cork and are deemed to be of local architectural heritage significance.

The assessment of the scheme prepared by ADCO (Appendix 10.5) concludes that the proposed interventions to the lower components of the quay structures constitute, in the main part, localised maintenance and repair of the quay-façade and the insertion of micro-piles along their foundations. This intervention work does not have a significant impact on the existing structures, and is considered to have a slight positive impact. The ADCO assessment also concludes that the proposed scheme will have no predicted impacts on Parliament Bridge (HAN 4), a culvert in the Morrison's Quay wall (HAN 3) and remnant traces of Anglesea Bridge (HAN 16) noted under the modern Parnell Bridge (HAN 16). The proposed flood defences will require a tie-in with Parliament Bridge and this will require the input of a conservation specialist during the detailed construction design for this area.

The removal of the existing 20th century railings and their concrete base wall will be somewhat negated by the installation of the 600mm high flood defence wall. The proposed defences will be set slightly back from the river edge side of the quay wall coping stones and will not result in the removal of any of the fabric of the limestone ashlar walls. The proposed works will include the creation of a concrete backing wall to road surface along the inner face of the quay wall. This will not result in the loss of any of the quay wall structure. The proposed flood defence wall will be set into the backing wall and will rest on top of the coping stones. This proposed intervention will be reversible without necessitating any removal of the masonry units that make up the quay wall. The proposed works will involve the installation of galvanised reinforcement stitching bars stitching bars into the quay walls in order to improve their stability. The works will require the removal of the three stone bollards and a fluted metal bollard adjacent to Parliament Bridge which will result in a slight negative direct impact on Father Mathew Quay. The flood defences will be set back from the river steps on both quays and the surviving historic rails around these features will be retained.

The RPS and NIAH both include a number of buildings on the opposite (north) side of the street from the quaysides in this area including the Holy Trinity Church (HAN 10), Capuchin Monastery (HAN 9), various townhouses (HAN 6, 7, 8, 13), a corn store warehouse (HAN 5) and a post box (HAN 12). While the proposed road regrading works extend towards these buildings, no proposed works to their structures, or associated curtilage features, are

indicated on the scheme drawings. The proposed flood relief measures in this area will result in the alleviation of water damage to the architectural heritage resource within the immediate and wider vicinity of the scheme.

The modern public plaza (HAN 14), and associated street furniture and sculptures, located at the intersection of Morrison's Island and the South Mall is not listed in the NIAH or RPS. However, this area is a good example of 20th century public space that also contains historic street lamps set on raised plinths and, as a combined feature, it is deemed to be of general cultural/architectural heritage significance. A proposed river balcony platform will extend over the quay wall in the west end of the plaza in the section to the west of the river steps. This feature will be supported on the dry side of the wall and will not result in any in-channel impacts or direct impacts on the quay wall or river steps.

The plaza contains the recorded location of the former Parnell Bridge engine house (HAN 15) which formerly stood on the proposed line of the flood defences and excavations behind the quay wall. This structure is not listed in the RPS or NIAH and was demolished in the 20th century but any surviving subsurface remains will be deemed to be of cultural heritage significance.

The timber piles/fenders that line Father Matthew Quay and Morrison's Quay walls form an integral visual element of both quays and are to be retained in-situ apart from four examples at the location of the Parnell Plaza river balcony platform and fourteen examples adjacent to Trinity Bridge, including ten on opposite (south) side. The project engineers have also noted that some of the fenders along the quays are in poor condition and that localised, small-scale interventions to remove collapsing elements of these features will be need to be determined during the detailed construction design. It is also understood the river-access ladders (two in number) and river-access steps (three in number) will remain unaffected by the proposed development. It is anticipated that a cast-iron mooring bollard and a number of sections of cast-iron railings, currently adorn the quayside area, will be subject to removal. However, it is also noted that these are to be sympathetically incorporated back into the streetscape/ quayside on completion of the proposed works.

In summary, the assessment of the proposed scheme has not identified any predicted significant adverse effects on any elements of the cultural heritage resource.

Table 10.2: Summary of Construction Impacts on identified heritage assets

Heritage Asset Number	Name	Significance of element of Asset (including receiving element)	Summary of Intervention	Impact
HAN 1	Father Matthew Quay railings	Negligible	Replacement of 20th century railings with flood defences and retention of quay features	Neutral
HAN 1	Father Matthew Quay wall	Medium	Repair works to quay wall	Slight positive direct impact
HAN 1	Father Matthew Quay fenders	Medium	Removal of fourteen fenders in area of Trinity Bridge, including ten on opposite (south) side. Assessment of stability of other individual fenders to be undertaken during detailed construction design with potential removal of elements in danger of collapse	Localised removal of fenders will result in a minor negative direct impact
HAN 1	Father Matthew Quay roadside	Negligible	Excavation in road along inner side of wall	Negative direct impact on any unrecorded archaeological features that may exist on footprint of works
HAN 1	Father Matthew Quay bollards	Low	Removal of quay bollards in vicinity of Parliament Bridge	Slight negative direct impact
HAN 2	Morrison's Quay railings	Negligible	Replacement of 20th century railings with flood defences and retention of quay features	Neutral
HAN 2	Morrison's Quay wall	Medium	Repair works to quay wall	Slight positive direct impact
HAN 2	Morrison's Quay roadside	Low	Excavation in road along inner side of wall	Negative direct impact on any unrecorded archaeological features that may exist on footprint of works
HAN 2	Morrison's Quay fenders	Medium	Removal of four fenders on footprint of Parnell Plaza platform. Assessment of stability of other individual fenders to be undertaken during detailed construction design with potential localised removal of elements in danger of collapse	Localised removal of fenders will result in a minor negative direct impact
HAN 3	Culvert; Morrison's Quay	Low	None	Neutral
HAN 4	Parliament Bridge	Medium	Tie-in with flood defences	Slight indirect negative impact
HAN 5	Fr Mathew Quay, Warehouse	Low	None	Slight positive indirect impact through alleviation of flood events
HAN 6	5 Fr Mathew Quay, house	Low	None	Slight positive indirect impact through alleviation of flood events

Heritage Asset Number	Name	Significance of element of Asset (including receiving element)	Summary of Intervention	Impact
HAN 7	6 Fr Mathew Quay, house	Low	None	Slight positive indirect impact through alleviation of flood events
HAN 8	7 Fr Mathew Quay, house	Low	None	Slight positive indirect impact through alleviation of flood events
HAN 9	Capuchin Monastery, Fr. Mathew Quay	Medium	None	Slight positive indirect impact through alleviation of flood events
HAN 10	Holy Trinity Church	Medium	None	Slight positive indirect impact through alleviation of flood events
HAN 11	College of Commerce	Low	None	Slight positive indirect impact through alleviation of flood events
HAN 12	Post-box, Morrison's Quay	Low	None	Neutral
HAN 13	Assembly Rooms, 11 Morrison's Quay	Low	None	Slight positive indirect impact through alleviation of flood events
HAN 14	Morrison's Quay Public Plaza	Low	Construction of flood defences and redesign	Slight negative direct impact
HAN 15	Former location of engine house for the Parnell Bridge swivel bridge	Low	Excavations behind quay wall	Negative direct impact on any subsurface remains that may survive on footprint of works
HAN 16	Former location of Angelsea Bridge / Parnell swivel bridge	Low	None	Neutral

Operational Phase Impacts

The implementation of the mitigation measures outlined in Section 10.6 shall provide for either the avoidance of the cultural heritage resource or the proper and adequate recording of this resource (including currently unknown archaeological features). The proposed scheme will result in a slight positive indirect impact to the Heritage Asset buildings in the vicinity of the subject area by the alleviation of flooding events (HAN 5, 6, 7, 8, 9, 10, 11 and 13).

10.5 MITIGATION MEASURES

The following section provides general itemised comments on the overall mitigation measures for the proposed scheme then presents individual mitigation measures for proposed interventions to identified Heritage Assests in table format (Table 10.3).

Archaeological Resource

- An archaeologist should be retained for the duration of the relevant works. The archaeologist should be familiar with and experienced in river/estuarine environments.
- Archaeological monitoring in accordance with the terms of Section 5 of the National Monuments Act (2004 Amendment) is recommended during riverbed and bankside/quayside disturbances associated with the proposed flood alleviation works.
- The paving stones at the former location of the Parnell Bridge swivel bridge engine house (HAN 15) will be manually lifted and the archaeologist will examine the area to ascertain if any subsurface traces of the structure survive.
- In the event that any unrecorded archaeological features, deposits or artefacts are identified the monitoring archaeologist will consult with the OPW Project Archaeologists - Archaeological Management Solutions (AMS), Cork City Council Archaeologist and the National Monuments Service in order to determine the appropriate mitigation strategy
- The archaeologist will be given the location and time scale of all proposed ground disturbances.
- The developer must give sufficient notice to the archaeologist/s in advance of the construction works commencing. This will allow for prompt arrival on site to monitor the ground disturbances.
- If archaeological features or material being uncovered during the construction phase, then machine work will cease in the immediate area to allow the archaeologist to inspect any such material.
- Once the presence of archaeologically significant material is established, full archaeological recording of such material is required. If it is not possible for the construction works to avoid the material, full excavation would be recommended.
- The extent and duration of excavation would be a matter for discussion between the client and the statutory authorities.
- Secure site offices and facilities should be provided on or near those sites where excavation is required.
- Fencing of any such areas would be necessary once discovered and during excavation.
- Adequate funds to cover excavation, post-excavation analysis, and any testing or conservation work required will be made available.
- Machinery traffic during construction must be restricted as to avoid any of the Heritage Assests identified in this assessment and their environs.
- Spoil will not be dumped on any of the identified Heritage Assets or in their environs

Architectural Heritage Resource

- All proposed interventions in close vicinity to the historic quay walls will be overseen by a conservation specialist both prior to and during the construction phase. This will be to ensure that a pre-works record of the quaysides, in written, drawn and photographic formats as appropriate, of these structures is compiled and that proposed interventions are undertaken to conform to appropriate conservation standards.
- The appointed conservation specialist will submit a method statement outlining proposed interventions/repairs to the quays to the Cork City Council Conservation Officer for approval in advance of works. This will include details on proposed methods for removal of existing modern railings and concrete base from the upper course of the quay walls, any proposed interventions (including repairs/conservation measures) to the quay walls and associated features and subsequent installation of flood defences. The method statement will identify measures that will be used to avoid/mitigate potential negative impacts to the quay walls during the construction phase.
- The historic bollards at the west end of Father Mathew Quay will be recorded by the conservation specialist in advance of works and arrangements will be made with the City Council to ensure to their safe removal and storage during the course of the works and their appropriate resetting/reuse at an alternative location.

Table 10.3: Mitigation and Monitoring measures for identified heritage assets

Heritage Asset Number	Name	Intervention	Impact	Mitigation	Monitoring
HAN 1	Father Matthew Quay	Replacement of 20th century railings with flood defences and retention of quay features	Neutral	Works to be supervised by conservation specialist	Pre-works method statement and a post-works report to be submitted to CCC and OPW Project Archaeologist (AMS)
HAN 1	Father Matthew Quay	Repair works to quay wall	Slight positive direct impact	Works to be supervised by conservation specialist	Pre-works method statement and a post-works report to be submitted to CCC and OPW Project Archaeologist (AMS)
HAN 1	Father Matthew Quay	Excavation along inner side of wall	Negative direct impact on any unrecorded archaeological features that may exist on footprint of works	Works to be monitored by archaeologist	Licence to be obtained from NMS and post-works report to be submitted to CCC and OPW Project Archaeologist (AMS)
HAN 1	Father Matthew Quay	Removal of quay bollards in vicinity of Parliament Bridge	Slight negative direct impact	Works to be supervised by conservation specialist	CCC Conservation Officer to be consulted in relation to appropriate integration into quayside
HAN 1	Father Matthew Quay	Removal of fourteen fenders in area of Trinity Bridge, including ten on opposite (south) side of bridge. Assessment of stability of fenders to be undertaken as part of detailed construction design	Localised removal of fenders and collapsing elements will result in a minor negative direct impact	Conservation specialist will contribute to assessment of fenders and record interventions in consultation with CCC Conservation Officer	Pre-works method statement and a post-works report to be submitted to CCC and OPW Project Archaeologist (AMS)
HAN 2	Morrison's Quay	Replacement of 20th century railings with flood defences and retention of quay features	Neutral	Works to be supervised by conservation specialist	Pre-works method statement and a post-works report to be submitted to CCC and OPW Project Archaeologist (AMS)
HAN 2	Morrison's Quay	Repair works to quay wall	Slight positive direct impact	Works to be supervised by conservation specialist	Pre-works method statement and a post-

Heritage Asset Number	Name	Intervention	Impact	Mitigation	Monitoring
					works report to be submitted to CCC and OPW Project Archaeologist (AMS)
HAN 2	Morrison's Quay	Excavation along inner side of wall	Negative direct impact on any unrecorded archaeological features that may exist on footprint of works	Works to be monitored by archaeologist	Licence to be obtained from NMS and post-works report to be submitted to CCC and OPW Project Archaeologist (AMS)
HAN 2	Morrison's Quay	Removal of a four fenders on footprint of Parnell Plaza viewing platform. Assessment of stability of individual fenders to be undertaken as part of detailed construction design	Localised removal of individual fenders and other collapsing elements will result in a minor negative direct impact	Conservation specialist will contribute to assessment of fenders and record interventions in consultation with CCC Conservation Officer	Pre-works method statement and a post-works report to be submitted to CCC and OPW Project Archaeologist (AMS)
HAN 3	Culvert; Morrison's Quay	None	Neutral	None required	None required
HAN 4	Parliament Bridge	None	Neutral	Works in vicinity of bridge to be supervised by conservation specialist	Pre-works method statement and a post-works report to be submitted to CCC and OPW Project Archaeologist (AMS)
HAN 5	Fr Mathew Quay, Warehouse	None	Slight positive indirect impact through alleviation of flood events	None required	None required
HAN 6	5 Fr Mathew Quay, house	None	Slight positive indirect impact through alleviation of flood events	None required	None required
HAN 7	6 Fr Mathew Quay, house	None	Slight positive indirect impact through alleviation of flood events	None required	None required
HAN 8	7 Fr Mathew Quay, house	None	Slight positive indirect impact through alleviation of flood events	None required	None required
HAN 9	Capuchin Monastery, Fr. Mathew Quay	None	Slight positive indirect impact through alleviation of flood events	None required	None required
HAN 10	Holy Trinity Church	None	Slight positive indirect impact through alleviation of flood events	None required	None required

Heritage Asset Number	Name	Intervention	Impact	Mitigation	Monitoring
HAN 11	College of Commerce	None	Slight positive indirect impact through alleviation of flood events	None required	None required
HAN 12	Post-box, Morrison's Quay	None	Neutral	None required	None required
HAN 13	Assembly Rooms, 11 Morrison's Quay	None	Slight positive indirect impact through alleviation of flood events	None required	None required
HAN 14	Morrison's Quay Public Plaza	Construction of flood defences and redesign	Slight negative direct impact	Works to be supervised by conservation specialist	Pre-works method statement and a post-works report to be submitted to CCC and OPW Project Archaeologist (AMS)
HAN 15	Former location of engine house for the Parnell Bridge swivel bridge	Excavations behind quay wall	Negative direct impact on any subsurface remains that may survive on footprint of works	Works to be monitored by archaeologist	Licence to be obtained from NMS and post-works report to be submitted to CCC and OPW Project Archaeologist (AMS)
HAN 16	Former location of Angelsea Bridge / Parnell swivel bridge	None	Neutral	None required	None required

10.6 RESIDUAL IMPACTS

All identified impacts will be addressed by mitigation during the pre-construction and construction phases of the proposed scheme. Should the archaeological mitigation measures be followed, this shall provide for the avoidance of the known archaeological resource as well as the avoidance or recording of currently unknown archaeological features that may be encountered as part of the proposed scheme. Should the architectural mitigation measures be followed, this shall provide for any required repairs/interventions to the architectural heritage resource to be undertaken to professional conservation standards. As a result, there shall be no likely significant adverse impacts on the cultural heritage resource.

APPENDIX 10.1: ***List of Identified Heritage Assets within vicinity of proposed scheme***

Heritage Asset Number	Name	RMP	RPS ref	NIAH Ref.	ADCO ref.	NGR E	NGR N
HAN 1	Father Matthew Quay wall and associated features	-	-	-	F01	167621	71525
HAN 2	Morrison's Quay wall and associated features	-	-	-	F02	167778	71662
HAN 3	Culvert; Morrison's Quay	-	-	-	F02a	167844E	71717N
HAN 4	Parliament Bridge	-	PS270	20515061	F04	167523	71554
HAN 5	Fr Mathew Quay, Warehouse	-	PS079	20514320	-	167551	71577
HAN 6	5 Fr Mathew Quay, house	-	PS083	20514321	-	167570	71575
HAN 7	6 Fr Mathew Quay, house	-	PS084	20514322	-	167577	71575
HAN 8	7 Fr Mathew Quay, house	-	PS085	20514323	-	167583	71574
HAN 9	Capuchin Monastery	-	PS086	20514325	-	167613	71565
HAN 10	Holy Trinity Church	-	PS078	20514326	-	167638	71568
HAN 11	College of Commerce	-	-	20514333	-	167726	71546
HAN 12	Post-box, Morrison's Quay	-	PS998	20514337	-	167757	71595
HAN 13	Assembly Rooms, 11 Morrison's Quay	-	-	20514336	-	167748	71598
HAN 14	Morrison's Quay Public Plaza	-	-	-	-	167854	71735
HAN 15	Former location of engine house for the Parnell Bridge swivel bridge	-	-	-	-	167898	71762
HAN 16	Former location of Angelsea Bridge / Parnell swivel bridge	-	-	-	-	167920	71747

APPENDIX 10.2: NATIONAL INVENTORY OF ARCHITECTURAL HERITAGE

HAN	Name	NIAH Ref.	NGR	Date	Category	Rating	Description	Appraisal
4	Parliament Bridge	20515061	167523, 71554	1800-10	Architectural, Artistic, Technical	Regional	Single-arch limestone bridge, 1806; with cut limestone balustrade, fine voussoirs and modillion cornice; reconstructed and repaired, 1992. Span is a recorded 65'6", with an overall width of 44', having an 8' path to either side	Early nineteenth century single span bridge of high quality limestone, having a decorative balustrade and modillion cornice. Significant in its own right for the quality of its design and construction, as well as to the urban landscape of this part of the city
5	Fr Mathew Quay, Warehouse	20514320	167551, 71577	1830-70	Architectural	Regional	Terraced ten-bay six-storey warehouse, c. 1850. Now vacant, with many boarded up openings. Corrugated asbestos cement pitched roof, cast iron gutter, hopper and downpipe. Camber headed openings to ground, second and fifth floors, square headed elsewhere, all with cills. Loading doors to first floor; mix of round headed and square headed door openings to ground floor, all doors timber sheeted. Large industrial folding door to ground floor opening, c. 1975. Plain render finish throughout.	Highly important early nineteenth century industrial building, which is lent even more significance as the largest surviving corn store within the city. More typical grain stores in the city from the same period were three to four storeys high, but all had the feature of multi-level, closely spaced openings to maximise ventilation necessary for the process of drying.
6	5 Fr Mathew Quay, house	20514321	167570, 71575	1790 - 1810	Architectural	Regional	Terraced two-bay four-storey over raised basement Georgian house, c. 1800; one of three. Basement level entrance closed up	Characteristic Georgian building on a prominent quayside site. Significant as part of a group, and in

							and building incorporated with 20514322, c. 1975. Currently appears at least partially vacant. Double pitched, overlaid with bituminous felt, stack truncated, parapet wall to facade. Plain render finish. Extended cills to first, second and third floors, moulded to first. Plain string course below ground floor cills. Openings to upper floors are square headed, altered to ground, being round headed and camber headed. Moulded architraves to openings. Quoins to ground floor. Basement has two closed up openings, retaining some architrave detail. Remaining opening is square headed with a moulded architrave and timber panelled door. Missing one window to the third floor, otherwise timber sliding sash windows to third and second floors, timber casement to first and ground.	its own right for remaining almost intact superficially, apart from alteration to the ground floor openings.
7	6 Fr Mathew Quay, house	20514322	167577, 71575	1790 - 1810	Architectural	Regional	Terraced three-bay four-storey over semi-basement Georgian house, c. 1800; one of three; much altered and now incorporating 20514321; basement at quay level in part use as offices. Slate pitched roof, chimney stack removed from left party wall, chimney stack removed from left party wall, rendered stack, parapet wall to facade. Plain render finish. Extended cills to first, second, and third floors, moulded to first.	Distinctive Georgian building on a prominent quayside site. Significant as part of a group, and in its own right for remaining almost intact superficially, apart from minor alterations to openings and replacement of windows.

							Plain string course below ground floor cills. Window openings are square headed, having moulded architraves to first, second and third floors; ground floor openings have lintel and keystone detail, and cills. Access to ground floor by flight of stone steps, shared with adjoining building in terrace. Later timber doorcase to ground floor having a double leaf timber panelled door, plain frieze, pilasters and fanlight. Round headed entrance opening with quoin detail to basement. Replacement windows throughout.	
8	7 Fr Mathew Quay, house	20514323	167583, 71574	1790 - 1810	Architectural	Regional	Terraced three-bay three-storey over semi-basement Georgian house, c. 1800; one of three; and originally having fourth storey; in use as offices. Double pitched hipped roof, slated, hipped roofed dormer to front elevation, parapet with plain coping, probably re-roofed following removal of top floor, c. 1890. Painted render finish, with plain string course to parapet. Extended cills to first and second floors, moulded to first. Plain string course below ground floor cills. Window openings are square headed, having moulded architraves to first and second floors; ground floor openings have lintel and keystone detail, and cills. Access to ground	Important Georgian building on a prominent quayside site. Significant as part of a group, and in its own right for remaining appropriately maintained and almost intact despite the removal of its upper floor.

							floor by flight of stone steps, shared with adjoining building in terrace. Later painted timber doorcase to ground floor having a double leaf timber panelled door, plain frieze, pilasters and fanlight. Two camber headed openings to basement, swept brick camber headed entrance opening and two over two timber sliding sash window. One over one timber sliding sash windows elsewhere.	
9	Capuchin Monastery, Fr. Mathew Quay	20514325	167613, 71565	1880 - 1900	Architectural	Regional	Semi-detached seven-bay three-storey monastery, c. 1888, with three-bay single-storey flat-roofed entrance projection, having slate hipped roof, brick chimney stacks with oversailing courses and moulded bricks, cast iron chamfered gutter, hoppers and downpipes and brick bellcote at rear, random limestone ashlar finish with brickwork to eaves and limestone brackets supporting gutter, limestone surrounds and cills, retaining timber sliding sash windows to pointed arched openings, recessed entrance with pointed arched fanlight over entrance door, projecting limestone hood above entrance surmounted by statue of monk with inscription "Presented by the Members/of The Third Order/1932", timber panelled double-leaf door and decorative iron bell-push; garden area to	Substantial monastery building, retaining much original external fabric. Having prominent quay-side location and being clearly visible along this stretch of the river, building is very important to this part of the city. Design attributed to Robert Walker

							front with limestone wall and iron railings, limestone gate piers.	
10	Holy Trinity Church	20514326	167638, 71568	1830 - 1840	Architectural	Regional	Regency Gothic-style Holy Trinity church, begun 1832; Gothic-Revival portico added, 1889; memorial chapel added, 1906, having slate pitched roof, copper roof vent to ridge and stone spire, dressed limestone finish with buttresses and carved pinnacles, Gothic arched windows with curvilinear cusped tracery and hood mouldings, four-centred arched doorway, hood moulding on corbels carved with masks, twinned doors with overpanels having quatrefoil glazed panels and three stained glass panels by Harry Clarke studios in east wall, other windows glazed with plain and coloured glass with undulating lead rods, c. 1960; low limestone boundary wall with iron railings and gates, car park area to rear.	Elegant Regency Gothic-style church with Gothic-Revival portico, having prominent quay-side location. It's site, on the river, being clearly visible to the surrounding area, has great importance to the city centre. This church also derives significance from its original internal and external fabric, including the stained-glass panels in the east wall by the Harry Clarke studios and the stained glass window memorial to Daniel O'Connell behind the high altar. Designed by George Richard Pain - Pain's original design now in R.I.B.A. collection.
11	College of Commerce	20514333	167726, 71546	1930 - 1940	Architectural	Regional	Terraced three-storey technical college, c. 1935, with entrance breakfront and splayed corner to south; various later extensions. Flat roof not visible for inspection, cast iron hoppers and downpipes. Rendered finish with limestone ashlar plinth, bas-relief plaques flanking entrance, limestone ashlar surrounds and continuous cills, retaining timber sliding sash windows with horizontal glazing bars in	The College of Commerce is a substantial and well-maintained purpose built institutional building, having significance for its prominent site on the river. Although altered and modernised it retains much of its original external fabric including all of the original timber sliding sash and metal casement windows to the front façade intact. Design details

							bands in camber headed openings, tripartite metal casement arrangements to openings over main entrance and splayed front, retaining recessed entrance screen and glazed timber double-leaf door; quay frontage with internal courtyard off Catherine Street.	include bas-relief plaques flanking the entrance and incised lettering over the entrance, while internally the original stairs and terrazzo floors remain intact. The fact that the building remains entirely in its original use adds to its significance.
12	Post-box, Morrison's Quay	20514337	167757, 71595	1910 - 1920	-	Regional	Cast-iron wall-mounted post box with raised G.R. insignia, c. 1915, set in facade of A.O.H. hall	Well maintained, functioning post box with raised G.R. insignia. Significant as a fine example of early twentieth century industrial design
13	Assembly Rooms, 11Morrison's Quay	20514336	167748, 71598	1840 - 1850	Architectural	Regional	Terraced four-bay three-storey building, c. 1845; meeting hall of Ancient Order of Hibernians, having pitched fibre-cement tiled roof with rendered chimney stack and parapet wall to façade, painted render finish with shaped plain render surrounds to first and second floor openings, retaining hood moulding with decorative bosses to camber headed door opening with three-paned fanlight and tripartite door screen with side panels, having camber headed window openings with replacement uPVC casement windows, although retaining decorative cill guard to one ground floor window opening; street frontage	Substantial mid nineteenth-century building, although having alterations, remains intact in terms of scale and massing. Retaining significance for its important and prominent site on the river, and including other features such as the early twentieth-century cast-iron wall-mounted post box with raised G.R. insignia, set into its façade

APPENDIX 10.3: ANNOTATED HISTORIC MAPS AND PHOTOGRAPHS

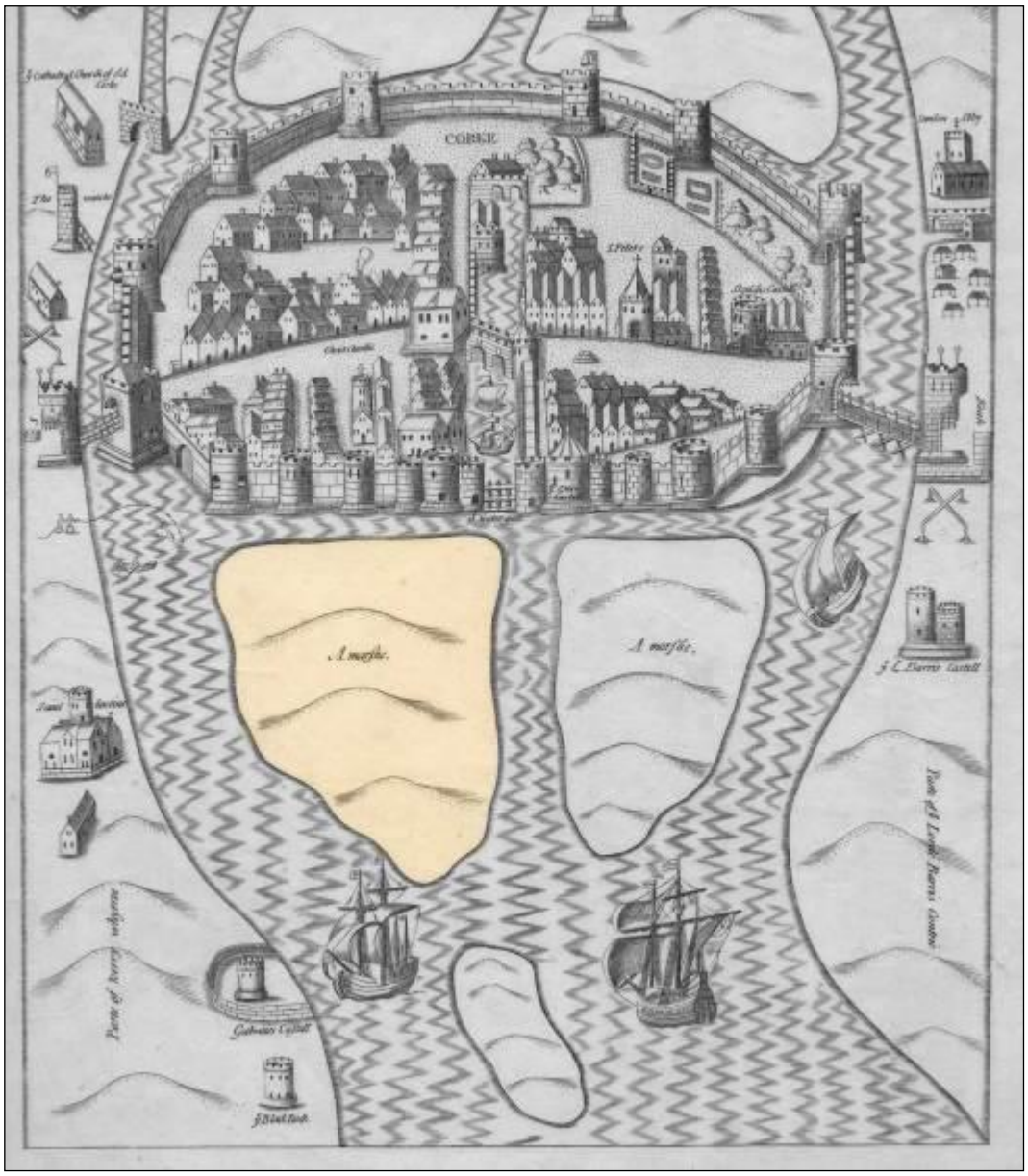


Figure 10.2: *Pacata Hibernia Map of Cork c.1601. While pictorial in form this map presents a broadly accurate depiction of the extent of the walled city and its environs at the end of the Late Medieval period. The general environs of Morrison's Island are highlighted and it is shown as an undeveloped island to the east of the city which is still confined to the walled area*

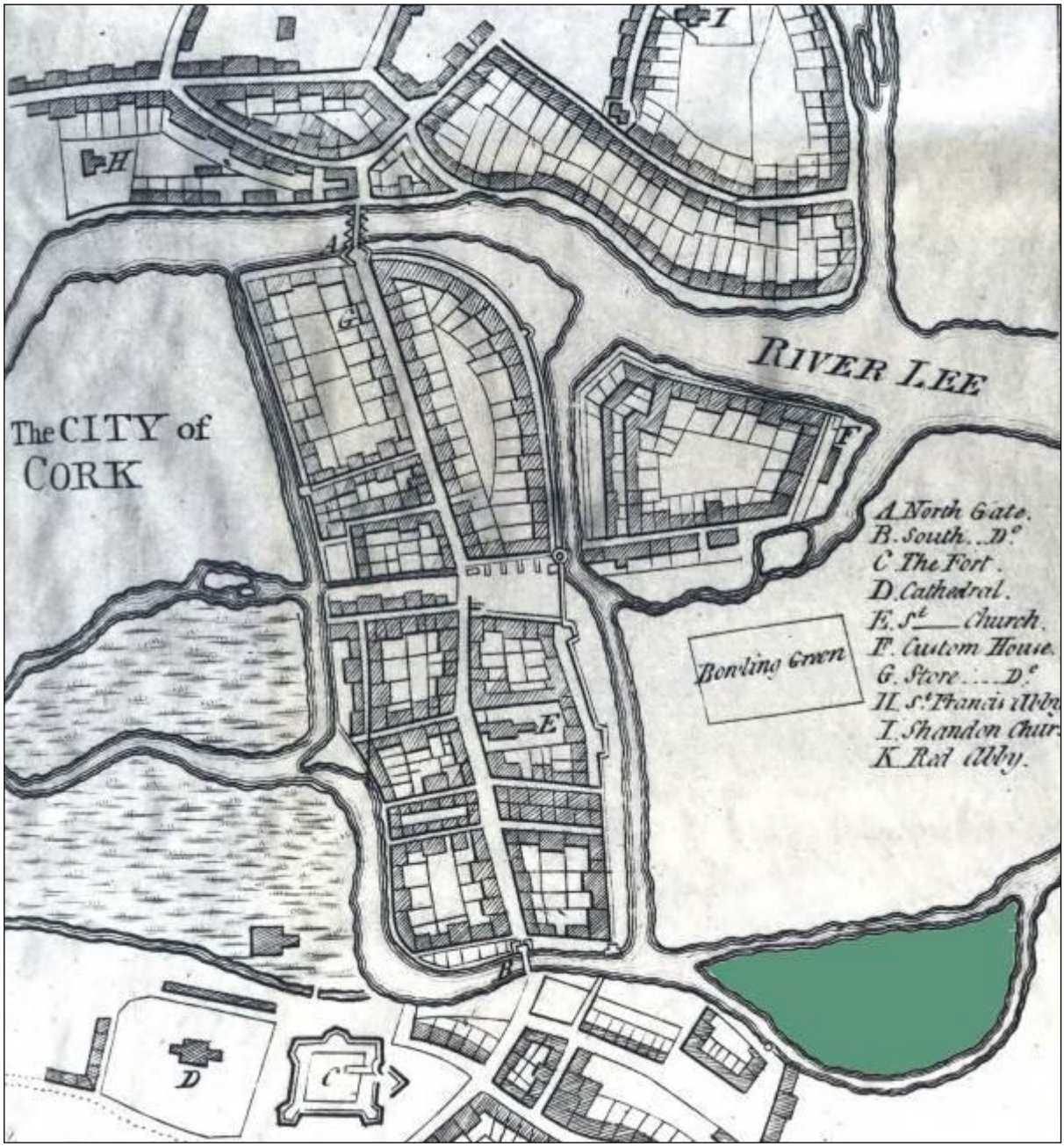


Figure 10.3: *Map of Cork c.1690 with Morrison's Island (shaded green) shown as an undeveloped island bounded by river channels at north and south. The city has begun to expand beyond the walled area by this time, with extra-mural suburbs shown extending into the Shandon Street area at north and Barrack's Street/George's Quay at south. This map also shows the early phase of expansion of the city into the marshlands outside its east walls within the area now occupied by Paul Street*

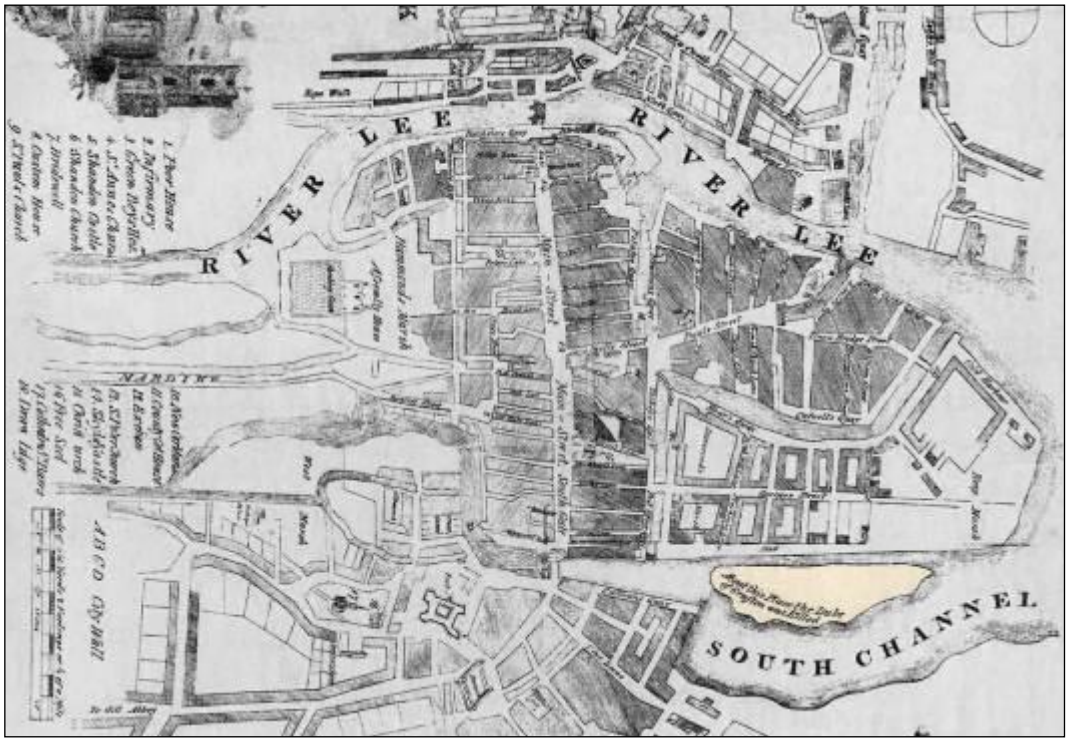


Figure10. 4: *Smith's map of Cork c.1750 with the Morrison's Island area highlighted. This demonstrates the dramatic expansion of the city in the first half of the 18th century. The development of the streets and quays had now reached the north side of the South Mall, which remained as an open channel. The study area remains undeveloped but is annotated "About this place the Duke of Grafton was killed"*

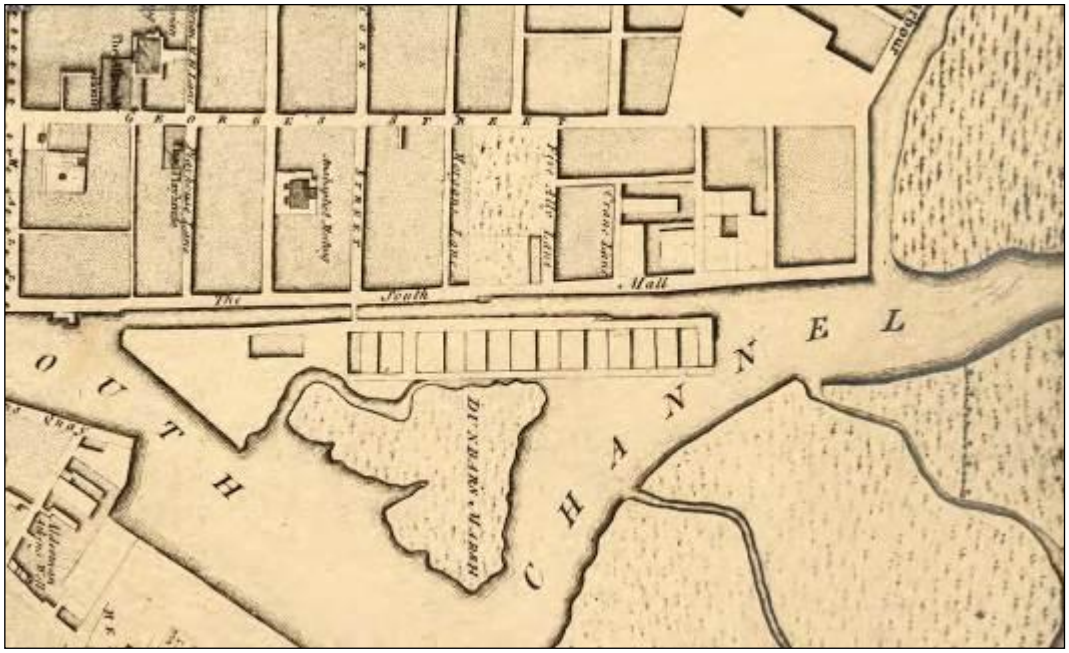


Figure 10.5: *Extract from Beauford's 1801 map showing initial phase of development along the north end of Morrison's Island while the river's edge is still depicted as an undeveloped area labelled as 'Dunbar's Marsh*

Figure 10.6: *Extract from Holt's 1832 map demonstrating that the broad outline of the existing quays and streetscape within the study area had been completed in the early decades of the 19th century. Father Mathew Quay (HAN 1) was named Charlotte Quay at that time while the quay to the east is already named Morrison Quay (HAN 2). The former Angelsea Bridge (HAN 16) to the east of the subject area is also present on this map*

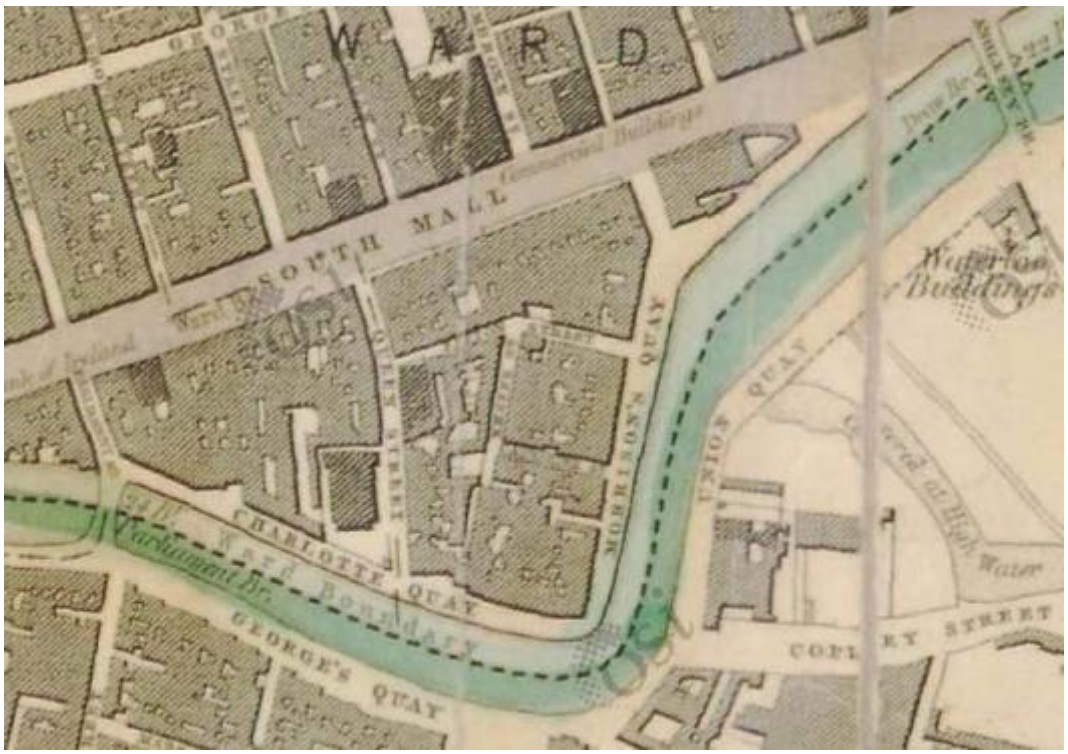


Figure 10.7: *Extract from 6" OSI map (1888-1913 series) showing Charlotte's Quay (now Father Mathew Quay) (HAN 1) and Morrison's Quay (HAN 2) (OSI Licence No. SU 0003317)*

Figure 10.8: *1843 pictorial depiction of east end of South Mall from west showing the former Anglesea Bridge (HAN 16) and an open quayside delimited by bollards and chains in the area now occupied by the public plaza (HAN 14) at the east end of Morrison Quay.*

Figure 10.9: *Extract from Goad's 1897 fire insurance map (Sheet 14) showing Charlotte's Quay (now Father Mathew Quay) (HAN 1) and the west end of Morrison's Quay*

Figure 10.10: *Extract from Goad's 1897 fire insurance map (Sheet 15) showing east end of South Mall and Morrison's Quay (HAN 2). The former Parnell swivel bridge (HAN 16) and the engine house to the west of the north end are also present on this map*

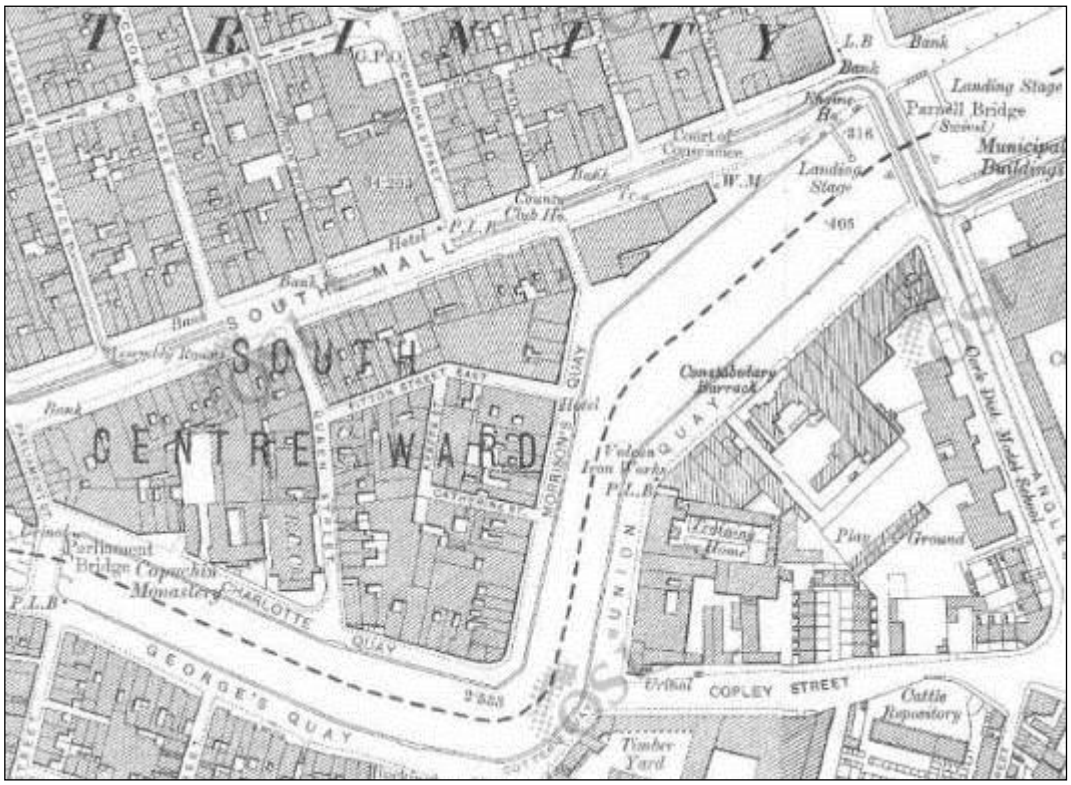


Figure 10.11: *Extract from 25" OSI map (1888-1913 series) showing Charlotte's Quay (now Father Mathew Quay) (HAN 1) and Morrison's Quay (HAN 2). The former Parnell swivel bridge (HAN 16) and the engine house to the west of the north end are also present on this map (OSI Licence No. SU 0003317)*

Figure 10.12: *View of west end of Father Mathew Quay (HAN 1) from southwest showing the bollards and mooring posts that have been replaced by the modern railings and concrete base wall*

Figure 10.13: *View from west of ship berthing at east end of Morrison's Quay (foreground) (HAN 2) showing bollards and chains extending along the quayside.*

Figure 10.14: *View of east end of Morrison's Quay (foreground) (HAN 2) from west showing various quayside structures and mooring posts in vicinity of the former Parnell Bridge (HAN 16) as well as the former riverside engine house (HAN 15) on the west side of the structure. The presence of an electric tram running along South Mall demonstrates that the photograph dates to the period post-1898. This area is now occupied by the modern public plaza (HAN 14) and no surface traces of the quayside features shown in the photograph remain.*

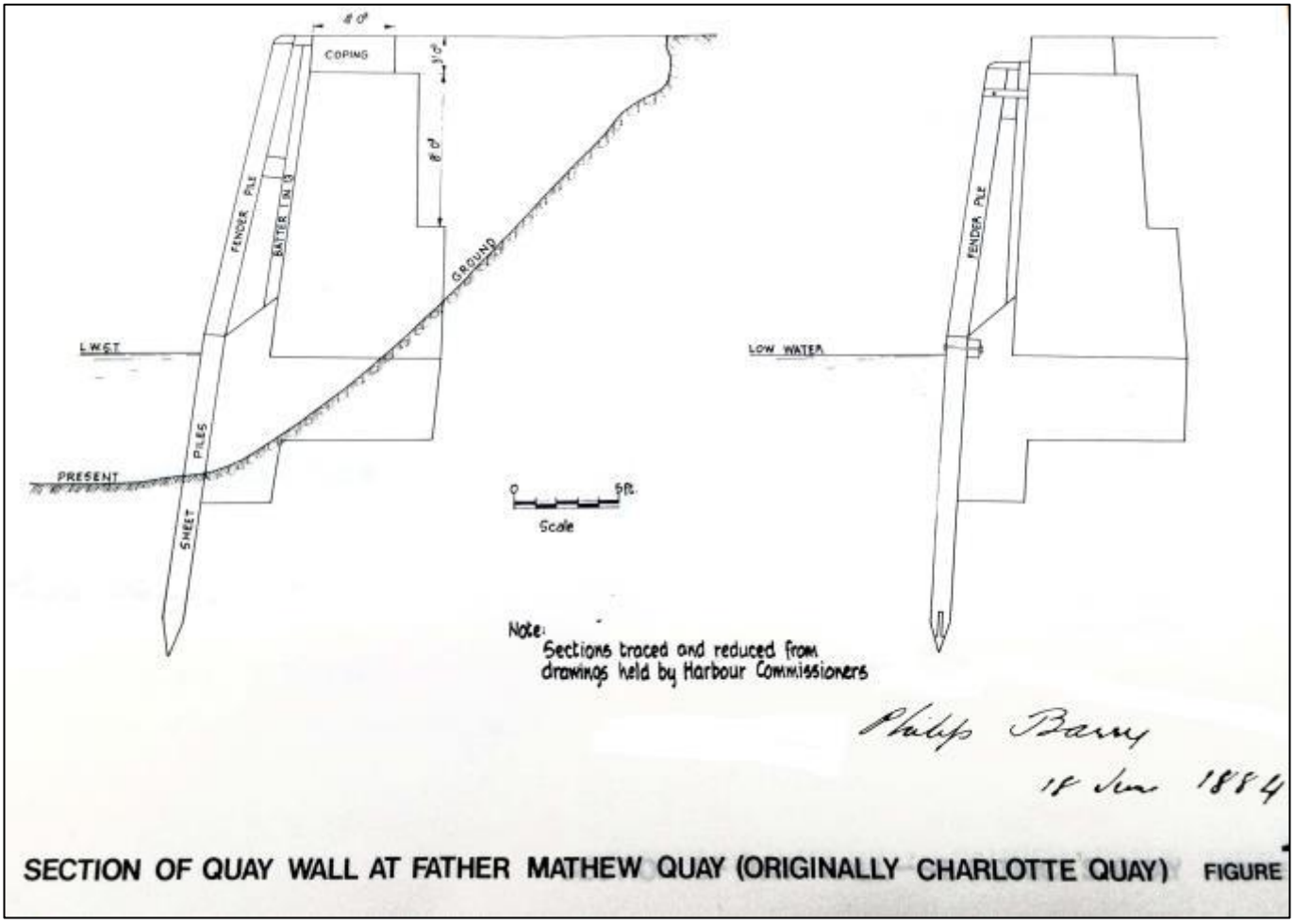


***Figure 10.15**: Copy of Harbour Commission construction section of quay wall at Father Matthew Quay (courtesy of Cork Archives). This indicates that the base of the wall was constructed on existing sloping ground and the gap behind the structure was subsequently infilled.*

APPENDIX 10.3: ANNOTATED PHOTOGRAPHIC RECORD OF SITE INSPECTION

Father Mathew Quay

Plate 10.1: *View of east elevation of Parliament Bridge (HAN 4) from George's Quay. The proposed works will involve no interventions to this structure. The intersection of the limestone ashlar quay wall at the west end of Father Mathew Quay (HAN 1) can be seen abutting the bridge structure and the wall is topped by a combination of modern railings and 19th century bollards in this area.*

Plate 10.2: *General view from east of Father Mathew Quay (taken from Trinity Bridge) (HAN 1) showing quay walls and buildings at north of the quayside*

Plate 10.3: *General view of Father Mathew Quay (HAN 1) from west (taken from Trinity Bridge). The quay walls along Father Mathew Quay were subject to City Council remedial works that included repointing, grouting and support works (Evening Echo May 29, 2012).*

Plate 10.4: *View from southeast towards central area of Father Mathew Quay (HAN 1) showing Holy Trinity Church (HAN 10) and protected structures to west (HAN 5, 6, 7, 8 and 9)*

Plate 10.5: *View of west end of Father Mathew Quay with (from left) Parliament Bridge, re-developed corn store (HAN 5), Georgian houses (HAN 6, 7 and 8) and Capuchin monastery (HAN 9) also visible.*

Plate 10.6: *View of surviving section of railing at west end of Father Mathew Quay (HAN 1) from west. A small section of modern walling has been inserted into a railing gap at the east end of the bollards*

Plate 10.7: *View of surviving bollards at west end of Father Mathew Quay (HAN 1) from east with Parliament Bridge (HAN 4) in background. These have been incorporated into a modern pathway and tarmac from recent road surface works directly abuts the easternmost example.*

Plate 10.8: *View of modern railings and concrete base along west end of Father Matthew Quay (HAN 1). Sections of damage and repairs to upper course of quay wall are also visible. The section of the adjacent road was subject to re-surfacing works in 2015*

Plate 10.9: *View of rough break recently inserted into upper course of Father Matthew quay wall (HAN 1), perhaps to facilitate drainage of rainwater*

Plate 10.10: *View of line of granite blocks set along top of quay walls in localised area in west half of quay, broadly opposite the Holy Trinity Church (HAN 10). This is the only section containing this stone type and may indicate localised repairs, perhaps involving inserting a heavier stone type to consolidate the underlying masonry*

Plate 10.11: *View from north of metal bollards extending around Father Matthew (HAN 1) quay steps. The steps are located opposite the area where the quay intersects with Father Mathew Street and are indicated on the 25" OSI map (1888-1913 series)*

Plate 10.12: *View of bollards extending around Father Matthew Quay steps from east (HAN 1). These have been incorporated into the modern railing concrete base and it is unclear whether they were left in situ while this feature was installed or if they were removed and then reset afterwards*

Plate 10.13: *View of quay steps from west showing side rail inserted into Father Matthew quay wall (HAN 1) and sections of repair to upper steps with both limestone and concrete insertions. Traces of modern repairs to the quay walls are also visible, e.g. upper course to right of steps.*

Morrison's Island

Plate 10.14: *General view from east towards east end of Morrison's Quay (HAN 2)*

Plate 10.15: *General view from east towards west end of Morrison's Quay (HAN 2) with College of Commerce (HAN 11) on right side*

Plate 10.16: *View of elevation of Morrison's Quay wall (HAN 2) showing fenders and modern railings. An example of one of the mooring rings set into the wall is visible near centre of the photograph and the Assembly Rooms and associated post-box (HAN 13 and 12)) are visible in the background*

Plate 10.17: *View from southwest towards western steps and side rail on Morrison's Quay (HAN 2). A mooring ring is also visible along the top of the section of quay wall to the left*

Plate 10.18: *View from north of bollards surrounding western river steps on Morrison's Quay (HAN 2)*

Plate 10.19: *View from east towards western steps on Morrison's Quay (HAN 2) with a small mooring ring visible on the opposite wall section*

Plate 10.20: *View from west towards western river steps Morrison's Quay (HAN 2) and also depicting extent of car parking adjacent to the quay side*

Plate 10.21: *View from south towards eastern steps on Morrison's Quay (HAN 2) with boundary of public plaza (HAN 14) along top of quay wall*

Plate 10.22: *View from west towards eastern steps on Morrison's Quay (HAN 2)*

Plate 10.23*: View from east of public plaza (HAN 14) with approx. former location of engine house (HAN 15) in foreground*

11 MATERIAL ASSETS

Material assets are generally considered to be the physical resources in the environment, which may be of human or natural origin. This chapter details the impact of the proposed Morrison's Island Public Realm project incorporating flood defences on these resources, namely subterranean infrastructure, management of waste, access to river/land and land use.

This impact assessment is based on a desk study, with details of major utilities taken from information supplied by Cork City Council, Arup (Scheme Designers) and the service providers. The road network was identified using Ordnance Survey Ireland (OSi) discovery series mapping along with an examination of aerial photography.

A number of documents were consulted in the preparation of this assessment, as follows:

(i) Cork City Development Plan, 2015 – 2021
(ii) Cork City Waste Management Plan, 2004

11.1 RECEIVING ENVIRONMENT

The Morrison's Island Public Realm project, described in Chapter 3, comprises mainly of works in the vicinity of the Morrison's Island adjacent to the South Channel of the River Lee. As such, potential impacts to material assets are restricted to these areas. The proposed scheme will have potential to impact on the following:

- Drainage Network;
- Water Distribution Network;
- Bord Gáis Distribution Network;
- Electricity Network;
- Broadband Network;
- Telecommunications Network;
- Access to lands;
- Land Use.

11.2 POTENTIAL IMPACTS ON SERVICES AND PROPOSED MITIGATION MEASURES

The proposed works for Morrison's Island Public Realm project are described in detail in Chapter 3. This section will explore the potential impact the scheme could have on existing services, and propose necessary mitigation measures.

11.2.1 Potential Impacts on Drainage Network

Potential Temporary Significant Impact

Waste Water infrastructure in the Study Area consists of Sewerage Collection Network infrastructure. In the absence of mitigation measures, sewer pipes may be exposed or damaged during excavation works. This would lead to pollution of the River Lee and disruption of the wastewater collection system. The design of appropriate mitigation measures will form part of the detailed design. There are no major pipes in the area or crossing the River Lee in this area.

Mitigation Measures

Prior to tendering the Contract, the Employer's Representative (Consultant Engineer) will assess the drainage network drawings and the detailed site investigation reports in order to determine the approximate location of the drainage network within the works area. Site Investigation carried out by the Contractor will further reduce the risk of striking the drainage network and causing interruption to the system during the construction phase. Should

it be anticipated that the excavation for the proposed works will impact on this pipework, this will be taken into consideration at detailed design stage and any necessary or unavoidable diversions will be designed, planned and agreed with Irish Water and Cork City and County Councils in advance of the construction phase. Planned diversions will be included in the works requirements or carried out in advance as appropriate.

Residual Impact – Neutral Impact

Taking into account the abovementioned mitigation measures the residual impact of the proposed scheme on the wastewater collection network and treatment process will be imperceptible.

11.2.2 Potential Impact to the Water Distribution Network

Potential Temporary Moderate Impact

The proposed scheme will potentially impact the water distribution network in the locations adjacent to work areas. Watermains may be encountered during excavation works for the proposed flood defence walls and pumping stations. It is possible that watermains could be damaged during the construction phase, resulting in distribution to the potable water supply in the area. The impacts are predicted to be moderate and temporary. There is a watermain crossing the River Lee at Parliament Bridge.

Mitigation Measures

The Employer's Representative (Consultant Engineer) will assess the water distribution drawing and detailed site investigation in order to determine the approximate location of watermains relative to the proposed works as part of the Design Phase. Site Investigation carried out by the Contractor will further reduce the risk of striking the water supply network and causing interruption to the system during the construction phase. Any anticipated clashes between the water distribution network and the proposed works will be identified during the design phase and any necessary or unavoidable diversions will be designed, planned and agreed with Irish Water in advance of the construction phase of the Scheme.

Residual Impact - Neutral Impact

Taking into account the abovementioned mitigation measures, no residual impact to the watermains following the construction phase is predicted.

11.2.3 Potential Impact to the Gas Network

Potential Temporary Moderate Impact

The proposed scheme will potentially impact the gas distribution network in the locations adjacent to work areas. It is possible that gas mains could be damaged during the construction phase, affecting the supply to properties in the area and potentially causing a fire or explosion. Bord Gáis were consulted and based on preliminary information provided there are no high-pressure transmission mains (7 to 85bar) in the study area. There are low and medium pressure distribution pipelines (up to 7bar) present, however, the risks associated with working in close proximity to these pipelines are significantly lower as is the scale of impact.

The impacts described above are predicted to be temporary and significant.

Mitigation Measures

The locations of the gas pipelines relative to the proposed works will be confirmed as part of the Design Phase. The Employer's Representative (Consultant Engineer) will assess the gas network drawings and result of the detailed site investigation in order to determine the approximate location of the existing gas pipelines within the works area. Should it be anticipated that the excavation for the proposed works will impact on this pipework, this will be taken into consideration at detailed design stage and any necessary or unavoidable diversions will be designed,

planned and agreed with Bord Gáis in advance of the construction phase. Planned diversions will be included in the works requirements or carried out in advance as appropriate. The Contractor will be supplied with the site investigation report and record drawings of the gas distribution network. Site Investigation carried out by the Contractor will further reduce the risk of striking the gas network and causing interruption to the system during the construction phase.

Residual Impact - Neutral Impact

Taking into account the abovementioned mitigation measures, there will be no residual impact to the gas mains following the construction phase.

11.2.4 Potential Impact to Electricity Network

Potential Temporary Moderate Impact

Electricity cable laid in close proximity to the location of the proposed flood defence walls and pumping stations has the potential to be damaged during excavation works. This would result in a loss of power in the area. The striking of an underground electricity cable during construction operations could potentially result in serious injury or death of site staff.

The potential impact to the electricity infrastructure as a result of the construction of the proposed works is predicted to be temporary and significant. There are major high voltage ESB lines running through Fr Matthew Quay and extending across Trinity Bridge. There will be an issue during the proposed works and will require careful coordination between contractors and the ESB to avoid impacts. These lines cannot be decommissioned or temporarily shut down.

Mitigation Measures

The locations of the electricity network relative to the proposed works will be confirmed as part of the Design Phase. The Employer's Representative (Consultant Engineer) will assess the service drawings and results of the detailed site investigation in order to determine the approximate location of the existing electricity cables within the works area. Should it be anticipated that the excavation for the proposed works will impact on the electricity network, this will be taken into consideration at detailed design stage and any necessary or unavoidable diversions will be designed, planned and agreed with the ESB in advance of the construction phase. Planned diversions will be included in the works requirements or carried out in advance as appropriate.

The Contractor will be supplied with the site investigation report and record drawings of the electricity network. Prior to excavation the Contractor will carry out additional site investigation, including slit trenches, in order to determine the exact location of the electricity network in close proximity to the works area. This will further reduce the risk of striking the cables and causing damage during the construction phase.

It is considered that any likely impacts to or from the overhead cables will be mitigated by applying standard construction practices. The Contractor must adhere to the ESB Code of Practice for Avoiding Danger from Overhead Electricity Lines, 2008 and the HSA Code of Practice for Avoiding Danger from Underground Services, 2010.

Residual Impact - Neutral Impact

Taking into account the abovementioned mitigation measures there will be no residual impact to the electrical infrastructure following the construction phase.

Potential Impact to Broadband Network

Potential Temporary Slight Impact

Broadband cables laid in close proximity to the location of the proposed flood defence walls and pumping stations has the potential to be damaged during excavation works. This would result in the loss of service in the area. The potential impacts are considered to be slight and temporary.

Mitigation Measures

Prior to tendering Contract, the Employer's Representative (Consultant Engineer) will assess the broadband network drawings and the detailed site investigation reports in order to determine the approximate location of the broadband network within the works area. Site Investigations carried out by the Contractor will further reduce the risk of striking the cables and causing damage during the construction phase. The locations of the broadband network relative to the proposed works will be confirmed as part of the Design Phase. Should it be anticipated that the excavation for the proposed works will impact on this pipework, this will be taken into consideration at detailed design stage and any necessary or unavoidable diversions will be designed, planned and agreed with the service provider in advance of the construction phase. Planned diversions will be included in the works requirements or carried out in advance as appropriate.

Residual Impact - Neutral Impact

Taking into account the abovementioned mitigation measures there will be no residual impact to the broadband infrastructure following the construction phase.

11.2.5 Potential Impact to Telecommunications Network

Potential Temporary Slight Impact

Works are proposed at the locations where telecommunication cables are present both above and below ground. Should these cables clash with the works they could become damaged during construction phase.

The potential impacts are considered to be temporary and moderate.

Mitigation Measures

Prior to tendering Contract, the Employer's Representative (Consultant Engineer) will assess the telecommunications network drawings and the detailed site investigation reports in order to determine the approximate location of the existing network within the works area. The locations of the telecommunications cable locations relative to the proposed works will be confirmed as part of the Design Phase. Prior to excavation the Contractor will carry out additional site investigation in order to determine the exact location of any underground telecommunications cables. This will further reduce the risk of striking the cables and causing damage during the construction phase. Should it be anticipated that the excavation for the proposed works will impact on this cabling, this will be taken into consideration at detailed design stage and any necessary or unavoidable diversions will be made, planned and agreed with the service provider in advance of the construction phase. In the case of the proposed flood defence walls where the cables potentially run along the proposed wall route, these cables will have to be taken into consideration at detailed design stage. Planned diversions will be included in the works requirements or carried out in advance as appropriate.

It is considered that any likely impacts to the overhead cables will be mitigated by applying standard construction practices.

Residual Impact - Neutral Impact

Taking into account the abovementioned mitigation measures there will be no residual impact to the telecommunications infrastructure following the construction phase.

11.3 WASTE MANAGEMENT DURING CONSTRUCTION

It is anticipated that the Morrison's Island Public Realm project will produce a significant volume of waste material during the construction phase. Through an extensive document review combined with information received from the scheme designers this section will examine the potential impacts associated with this waste and any mitigation measures required.

11.3.1 Background Information

'Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects (2006)' were published by the DoEHLG. These Guidelines outline the issues that need to be addressed at the pre-planning stage of a development all the way through to its completion.

Best Practice Guidelines sets thresholds to ascertain which projects require the preparation of C&D plans. The proposed development, exceeds the following threshold and therefore requires a C&D Waste Management Plan;

- Civil Engineering projects producing in excess of 500m^3 of waste, excluding waste materials used for development works on the site.

As outlined in Chapter 6, excavated material will be reused on site as much as practicable. Where this is not possible, the recycling rates for the C&D waste produced throughout the construction of the Morrison's Island Public Realm project should be maintained at or above 85%, if possible, as outlined in the Waste Management (Planning) Regulations 1997.

11.3.2 Classification Of Waste

Excavation for flood defence foundations and pumping stations will give rise to a volume of material during the construction phase of the proposed scheme. The excavated material will be reused where possible, however as much as 8,150 m^3 will have to be exported from the site.

The European Waste Codes (EWC) for typical waste materials that may possibly be generated during the construction phase are outlined in Table 11.3.

Table 11.3 Applicable European Waste Codes

Waste Material	EWC
Soil, stones and dredged spoil	17 05
Bituminous mixtures, coal tar and tarred products	17 03
Concrete, Bricks, Tiles and Ceramics	17 01
Metals (including their alloys)	17 04
Waste Hydraulic Oils*	13 01
Wastes of Liquid Fuels*	13 07

*Denotes Hazardous Materials

11.3.3 Potential Impact during Construction Phase

Potential Temporary Moderate Impact

Poor management of excavated waste could lead to the disposal of waste deemed unsuitable for reuse or recycling in facilities that do not carry the appropriate licenses.

In addition, if waste is not managed and stored correctly on site, it has the potential to cause nuisance and environmental impact. Litter may be generated from packaging taken from materials, mixed waste produced by the construction workers (lunches, cigarette waste etc.), or from debris from leftover/damaged construction materials. Poor management of waste may also result in water and ground pollution on the site or adjacent to the site.

Fuels and hydraulic oils/lubricants that will be used during the construction phase are classed as hazardous. There will be fuels stored on site for machinery and construction vehicles along with oils and lubricants. Should any spillages, waste or surplus liquids be disposed of incorrectly it could cause serious harm to the surrounding environment.

The potential impacts of construction and demolition waste on the environment are predicted to be short term and moderate.

Mitigation Measures

All current and applicable waste management legislation will be applied and adhered to. Contractors that are engaged in the transport of waste off-site will comply with the provisions of the Waste Management Act (1996) (as amended), associated Regulations and the Waste Management Plan prepared in accordance with 'Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects (2006)'. As such, the Contractor must handle, transport and dispose of waste in a manner that ensures that no adverse environmental impacts occur as a result of any of these activities. A collection permit to transport waste must be held by the relevant contractor which has been issued by the Local Authority where the waste has been generated i.e Cork City Council.

Waste receiving facilities must also be appropriately licensed or permitted for the waste being received. Operators of such facilities cannot receive any waste, unless in possession of a waste permit granted by the Local Authority under the 'Waste Management (Facility Permit & Registration) Regulations 2007' (as amended) or a waste license granted by the EPA. The permit/license held will specify the type and quantity of waste able to be received, stored, sorted, recycled and/or disposed of at the specific site. It has been confirmed that there are appropriate facilities in the area available to receive and process waste material.

The construction compound for the proposed scheme should have a dedicated Waste Storage Area (WSA) for any construction waste generated. Receptacles/skips or bays will be provided for each recyclable material. Dedicated waste bins should also be provided on any water going vessel/platform to prevent litter from contaminating the River.

Bedrock, Block and Concrete

It is reasonable to assume that gravels and bedrock may be encountered during the excavation of foundations and pumping stations. Any material which is not reused will be separated out and sent to the appropriate recycling facility or waste facility if deemed unsuitable for recycling.

During construction of flood defence walls and pumping stations it is reasonable to assume that there will be some waste concrete and blocks generated. This waste will be adequately contained and stored within the WSA of the construction compound. It will then be disposed of to a permitted or licensed facility.

Soil/Subsoil

Soils generated from excavations carried out will be stored separately from the gravels and bedrock and will be transported to an appropriately licensed facility by permitted contractors. It not considered likely that these materials will be hazardous, but should a portion of it be deemed to be contaminated they will be stored separately to the inert material. Samples will be taken and tested in order to appropriately classify the material as non-hazardous or hazardous to establish the criteria for the acceptance of waste at landfills. They will then be transported to an appropriately licensed facility by permitted contractors.

Scrap Metal

Reinforced concrete is likely to be used as part of the construction of the flood defence walls and pumping stations. As such it is reasonable to assume that a small amount of scrap metal be generated. Scrap metal is highly recyclable and as such it will be segregated from other waste and recycled accordingly.

Timber

A small amount of timber waste may also be generated as a result of hoarding around works areas, or from shuttering for in-situ concrete pours. It is likely that this timber can be reused for a number of different functions throughout the construction phase however a small amount of waste will be generated, and the timber as a whole could be disposed of as the construction phase comes to a close. Timber that is uncontaminated, i.e. free from paints, preservatives, glues etc, will all be recycled. Should any timber be deemed to be contaminated it will collected by an appropriately permitted specialist contractor and disposed of in an appropriately licensed facility.

Hazardous Materials

If hazardous materials are used/encountered on site, i.e. timber with paint, asbestos concrete pipes, a specialist contractor will be employed to carry out an environmental clean-up to remove all traces of contaminated material from the site. The specialist contractor will be licensed under the 'Waste Management (Collection Permit) Regulations, 2007' (as amended). This will be disposed of at an appropriately licensed facility.

In order to avoid any hazardous materials infiltrating the ground water during construction and operation phase there will be a bunded area constructed within the site compound with sufficient volume to contain any spills. All plant refuelling, maintenance or washing will be carried out within the bunded area. Spill kits will also be available at this area to facilitate the quick and effective cleaning of any substances.

Documentation

Waste will be weighed, either by weighing mechanism on the truck or at the receiving facility, and these records will be kept by the contractor (both hard and soft copies). A copy of all waste collection permits, for all waste contractors will be kept by the Waste Manager, working on behalf of the Contractor, on site.

If the waste is being transported to another site, a copy of the waste permit or EPA Waste License for that site must be provided and kept by the Waste Manager. If the waste is being shipped abroad, a copy of the Transfrontier Shipping (TFS) document must be obtained from Dublin City Council (as the relevant authority on behalf of all local authorities in Ireland) and kept on site along with details of the final destination (permits, licenses etc). A receipt from the final destination of the material will be kept as part of the on-site waste management records. All information will be entered into the waste management system to be maintained on site.

Residual Impacts – Neutral Impact

Taking into account the abovementioned mitigation measures the residual impact of the construction phase will be imperceptible.

11.3.4 Potential impact during the Operational Phase

Potential Temporary Slight Impact

The operational phase of the proposed scheme is unlikely to produce any waste of significant volume. Periodic maintenance of flood defences and pumping stations will be carried out which could generate very small volumes of litter, packaging, concrete, scrap metal, bitumen products or soils that if not disposed of correctly could adversely affect the local environment.

Mitigation Measures

For maintenance and repair work, all maintenance teams involved will take all waste generated on site back to their compounds to be placed in appropriate waste streams designated for recycling, reuse or disposal. No waste will be left at the site of the repair or maintenance.

Residual Impacts – Neutral Impact

Taking into account the abovementioned mitigation measures the residual impact of the operational phase will be imperceptible.

11.4 ACCESS TO LAND/RIVER

Potential Neutral Impact

The land in the Study Area is publicly owned and is adjacent to the River Lee. There is no land/river access severance proposed as part of the Morrison's Island Public Realm project.

11.5 LAND USE

11.5.1 Residential and Commercial Land Use

Potential Temporary Impacts

As the proposed works are adjacent to the river and on largely on public land (with the exception to some works at the entrances to buildings required) there is minimum impact on land owners occurring as a result of Morrison's Island Public Realm and Flood Defence Project.

There will be a predicted impact on material assets due to construction activities. The majority of this will consist of construction of reinforced flood walls/pumping stations. The businesses and residents will experience some disturbance during construction phase but this is anticipated to be a temporary impact and as the contractor is obliged to work within a stringent set of construction limits and guidelines it is predicted that the overall impact will not be significant. The proposed drainage scheme will result in a reduced risk of flooding which will have a positive impact on protected residential and commercial properties.

Mitigation Measures

Good communication between the Contractor and the adjacent property / landowners in advance of and during the construction phase will prevent undue disturbance due to noise, dust and to minimise difficulties caused by the restriction of access to properties.

Residual Impact – Significant Positive Impact

Taking into account the abovementioned mitigation measures and the benefit of the scheme to the commercial heart of the Cork City, the residual impact will be significant permanent positive.

12. TRAFFIC AND TRANSPORTATION

12.1 INTRODUCTION

This Chapter discusses the impact on Traffic and Transportation as the result of the construction and operation of the proposed Morrison's Island Public Realm project. These works comprise of a combination of flood walls, regrading of road and pavement sections, creation of civic amenity space and other minor works.

As set out in Chapter 3, the project has been divided into a number of distinct phases for implementation. It is proposed to undertake the work in three phases as follows:

- Phase 1 – 2.5 months (Father Matthews Quay)
- Phase 2 – 4.0 months (Morrison's Quay adjacent to Cork College of Commerce)
- Phase 3 – 5.5 months (Morrison's Quay)

This Chapter describes the existing environment and assesses the impact of the proposed enhancement and one-way network will have on the local road network.

The proposed streetscape enhancement, in conjunction with proposed flood defence infrastructure is located in the area bounded by the River Lee, South Mall and Parliament Street. It is located in the centre island of Cork City and within the Cork City Council jurisdictional area. The proposed scheme will upgrade approximately 530m of Father Matthew Quay and Morrison's Quay. The scheme will be constructed on an existing street which currently provides approximately 148 on-street parking spaces and will include the re-arrangement of parking quantum and configuration in the area. The proposed scheme will result in a net loss of approximately 115 car-parking spaces along both Quays.

This development will result in the Morrison's Island area becoming more attractive to pedestrian and cyclist usage and it is anticipated that the scheme will aid to induce additional city centre trips by sustainable modes. The footpath will be widened and made a shared surface for pedestrians and contra-flow cyclists. Cyclists travelling in the same direction of vehicular traffic will use the carriageway and will benefit from the reduced speed of the traffic resulting in a more comfortable environment for cycling.

12.2 METHODOLOGY AND LIMITATIONS

In completing this Chapter, the environmental team have reviewed the Transport Assessment prepared by the Consulting Design Engineers: Arup for the proposed flood defence infrastructure and streetscape enhancement of Morrison's Island, Cork City. This comprised a desk study and traffic counts. The report provides a description of the following:

- location of the proposed development and local road and street network.
- nature of the proposed scheme, in terms of the proposed alterations to the existing roads, streets, junctions, footways and cycling facilities.
- expected background traffic during the opening year of the development, taking into account the approved future year growth rates in accordance with the TII's 'Project Appraisal Guidelines' Unit 5.5 (Link-Based Traffic Growth)'.

For the purpose of the Traffic Assessment it was assumed that the new streetscape enhancement will be fully constructed and operational by mid-2019. Model outputs show that there will be 90 fewer two-way vehicle trips in the Midday peak traffic period (12:00 – 13:00) and 102 fewer two-way vehicle trips in the PM peak traffic period (17:00 – 18:00) to and from the proposed streetscape enhancement.

12.3 THE EXISTING ENVIRONMENT

12.3.1 Site Location

The site of the proposed Street Scape Enhancement is located on Morrison's Island in the Cork City Centre. The area is currently used for vehicular parking and pedestrian access to the City Centre from Union Quay. It contains business, churches and educational centres. It is accessed by car from Parliament Street and South Mall and as well as these routes pedestrians can access it from Union Quay via Trinity Bridge. Works for Union Quay boardwalk will have no impact on vehicular traffic.

12.3.2 Access and Egress to Morrison's Island

Vehicular access to the Morrison's Island area is provided from Parliament Street at the end of Parliament Bridge on to Father Matthew Quay and from the South Mall on to Father Matthew Street, Morrison's Street and Morrison's Quay. Vehicular egress from Morrison's Island is provided from Father Matthew Quay on to Parliament Street at the end of Parliament Bridge and from Morrison's Street and Morrison's Quay on to the South Mall. Pedestrians can access the area via the same access points as vehicles in addition to a pedestrian access via Trinity Bridge.

12.3.3 Public Transport

The area is well served by public transport. There are 16 bus routes on South Mall adjacent to the development. The Coke Zero Bike-Share Scheme has a hub on Father Matthew Quay and on South Mall.

12.3.4 Traffic Count

The traffic count data indicates that the busiest roadways in terms of traffic are Parliament Street and South Mall. The majority of the traffic coming over Parliament Bridge continues on to South Mall (east and west).

12.3.5 Existing Parking Provision

The site in question currently provides approximately 148 on-street parking spaces, including 6 disabled spaces, as well as 20 no. bicycle parking spaces and a Coke Zero Bike-Share Station which provides spaces for 15 no. bicycles. There are also 4 private car parks in the wider area. The on-street parking in this area in heavily utilised with the majority of traffic in the area seeking a parking space.

12.4 PROPOSED DEVELOPMENT

The proposed development is a Streetscape Enhancement of the Morrison's Island Area and Flood Defence Scheme along Father Matthew Quay and Morrison's Quay. At present there are approximately 148 parking spaces and the vast majority of these are perpendicular on the quay side of the street. These perpendicular parking space will be replaced with 33 parallel space recessed into the footpaths on the quay side.

Cyclists will benefit from the reduced speed on the carriageway as well as a shared footway area on the footpath for pedestrians and cyclists traveling against the one-way system. Cyclists travelling in the same direction as the one-way system are expected to use the carriageway.

The widening of the entrance to Trinity Bridge on both sides will allow easier access for both cycles and pedestrian to Morrison's Island. A clockwise one-way system will be introduced to the island to avoid traffic conflict and allow easy access the different areas on the island.

Pedestrian Access and Safety

It is proposed to make the area more pedestrian friendly by widening the footpath on the building side and adding a wide footpath on the quay side. Currently there is only a narrow footpath along the majority of the whole scheme on the building side and none on the quay side. As part of the Proposed Public Realm Project an extensive public lighting scheme is planned for the area. This will ensure a safe environment for all users of the area after dark.

On-Street Parking

As discussed, there are approximately 148 Parking spaces along the quay side of the street. The majority of these are perpendicular and result in a very narrow carriageway with, in places, space for only one vehicle on the carriageway that is designated as two-way. These parking spaces are being replaced by 33 parallel space that will be recessed into the proposed footpath and not encroach on the carriageway. The additional space gained from redesigning the road layout will provide for additional cyclist and pedestrian space.

Electric Car Parking Provision

The Cork City Development Plan stipulates that developments providing ten or more parking spaces will provide at least one parking space equipped with a functioning EV charging point and at least 10% of space shall incorporate ducting to allow for future fit out of a charge point.

There are 4 electric vehicle charge points proposed as part of the streetscape enhancement, fulfilling the Cork City Development Plan's requirements.

Disabled Parking Provision

The Cork City Development Plan stipulates that 5% of car parking spaces provided should be set aside for disabled car parking.

At present 4% of existing parking provision is designated as disabled parking (6 spaces) and it is proposed to replace this with 12% of future parking provision being designated as disabled parking (4 spaces).

Cycle Parking

It is proposed to install parking facilities of 16 stands (32 bicycles) by the public plaza at the termination of Morrison's Quay, South Mall and outside the College of Comm. This will replace the 20 bicycle spaces being removed from Morrison's Quay.

As part of the proposed scheme, the Public Bike-Share Scheme Station is being relocated to the southern end of Morrison's Quay. It is proposed that it be split into two blocks, each with a capacity of 16 bicycles.

Motorcycle Parking Provision

It is proposed to install parking three motorbike spaces on South Mall. The extension of the existing public plaza area at the corner of South Mall and Parnell Bridge will remove the existing motorcycle parking area. There are currently 20 motorcycle parking spaces located on South Mall, in the vicinity of the Public Plaza at the eastern end of the street.

12.5 POTENTIAL IMPACTS

12.5.1 Transport Infrastructure

Road Infrastructure

The primary access route to the Study Area is the R610 Regional Road which crosses the South Channel of the River Lee at Parliament Bridge and runs to Merchants Quay (N8). All roads in the Study Area are maintained by Cork City Council.

Bridges

Within the Study Area there are three bridges including one pedestrian bridge. Table 12.1 shows bridges crossing the River Lee within the study area, proposed impacts and regional routes impacted.

Table 12.1 Bridges, proposed impacts and impacted road infrastructure – South Channel

Bridge	Chainage	Impact	Road Impacted
Parnell Bridge	C02 375	None	R610
Trinity Bridge - Pedestrian	C02 700	Ground levels to be raised at north and sound banks (demountable flood gates to be deployed during flood events).	
Parliament Bridge	C02 950	None	R610

Potential Temporary Significant Impact

The majority of the proposed works for the Morrison's Island Public Realm project are contained within Fr Matthew Quay and Morrison's Quay adjacent to the River Lee and comprise the following as detailed in Chapter 3 and Appendix 3A. Detailed site investigation will be required at the location of the proposed works to confirm the design.

The potential impacts of the Morrison's Island Public Realm project on the road network are as follows:

- Temporary impact during construction due to the regrading of road and pedestrian pavements to achieve crest at flood defence level at Father Mathew Quay and Morrison's Quay.
- Temporary impact during construction due the proposed removal of existing right-angle parking and its replacement with parallel parking along the quays and works changing traffic flow to one-way only.

Mitigation Measures

All works 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*' and Cork City Council (2010) *Directions for Management of Roadworks in Cork City*. These works will be designed and supervised by a suitably qualified and experience professional to ensure they are carried out correctly.

Residual Impacts - Imperceptible Impact

Taking into account the abovementioned mitigation measures, the residual impact of the proposed scheme on the transport infrastructure will be imperceptible.

12.5.2 Traffic

Morrison's Island Public Realm project will impact traffic in Morrison's Island during the construction and operation phase.

Construction Impacts

Works at Morrison's Island is unlikely to significantly affect the flow of traffic in the city centre, as the route is primarily used for access to parking spaces as opposed to a major traffic route. The proposed direct defence works will not impact on the functionality of the route as the existing parking areas along the quays will provide sufficient space to carry out the works. Phasing of the works along the quays will be designed to ensure that, traffic flow can be maintained to access parking areas that remain available. Father Matthew Street provides an alternative access to the quays at this location when Father Matthew Quay is unavailable for traffic flow.

Pedestrian access can be maintained along the route during the direct defence works.

A pumping station is proposed at Trinity Bridge, which will likely require a temporary closure of the carriageway at this location, or potentially a reduction in carriageway width at this location to single-lane only. However, there will be no impact on the pedestrian bridge associated with this and pedestrian access will be maintained.

At the road re-grading stage, the route will need to be fully closed to allow for this element of the works. This will again likely be done in phases, and will facilitate traffic flow along the quays if necessary, although parking spaces will again be required to be removed temporarily.

The Public Bike hire site, will be decommissioned and removed temporarily during the works. The potential impacts of the Morrison's Island Public Realm project on the road network are as follows:

- Temporary impact during construction due to the regrading of road and pedestrian pavements to achieve crest at flood defence level at Father Mathew Quay and Morrison's Quay.
- Permanent impact during construction due the proposed removal of existing right-angle parking and its replacement with parallel parking along the quays and works changing traffic flow to one-way only.

Mitigation Measures

All works 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' and Cork City Council (2010) *Directions for Management of Roadworks in Cork City*. These works will be designed and supervised by a suitably qualified and experience professional to ensure they are carried out correctly.

The appointed contractor for the scheme will prepare a detailed construction traffic management plan to ensure safe access to Morrison's Island is maintained and the local road operates efficiently and safely during the course of the development. Due to the work on public roads, there will be disturbance to traffic in and around Morrison's Island. Diversions will need to be put in place as many of the roads will need to be closed when works are being carried out on them.

The traffic generated by the proposed construction of the streetscape enhancement will be on a temporary basis only.

It will be necessary for the Contractor to agree any traffic management plan with Cork City Council in advance of the project and that this plan is reviewed throughout the course of construction. Careful consideration must be given to the construction phase of the works to ensure minimal disruption to the traffic occurs during the construction stage.

Residual Impacts – Moderate Negative Impact

Taking into account the abovementioned mitigation measures, the impact of the proposed scheme on the traffic during the construction phase will be **Temporary Moderate Negative Impact**

Operational Impacts

The proposed streetscape enhancement and flood defence scheme at Morrison's Island will result in the loss of approximately 115 no. on-street public parking spaces along Morrison's Quay and Father Matthew Quay. Public parking at Morrison's Island is a key generator of vehicular trips to and from the area. Due to the reduction in on-street parking provision, it is anticipated that the proposed scheme will result in fewer vehicular trip to and from the area.

Due to the implementation of a clockwise one-way system, it is expected that there will be a small increase in traffic on Parliament Street and the South Mall in advance of the junction with Morrison's Street. Vehicles were previously able turn off Parliament Street onto Father Matthew Quay and turn off South Mall on to Father Matthew Street. These turning movement are now prohibited and all traffic now wishing to access Morrison's Island will do so by turning right on to Morrison's Street. Through traffic will now exit the island out on to Parliament Street from Father Matthew Quay and on to South Mall by Father Matthew Street.

The existing parking along Father Matthew Quay and Morrison's Quay is City Council Disc Parking, with a maximum stay duration of 2hrs. This is considered to be short stay, high turnover parking. Given its city centre location, it is anticipated that some vehicles which currently utilise this parking, will continue to utilise city centre parking including the number of multi-story carparks and surface carparks. It is further anticipated that the removal of parking spaces will aid modal shift to towards more sustainable terms of transport including walking, cycling and public transport. Morrison's Island will adequately serve all these modes.

The impacts of the proposed one-way system within the study area has been analysed and it has been determined that the revised road network will have sufficient capacity to accommodate the predicted number of vehicular trips to and from Morrison's Island.

The results of the modelling completed as part of the Traffic Assessment indicate that in the 2024 design year of the proposed development, all of the junctions within the study area will continue to operate satisfactorily below capacity and that the alterations to the street network will have an insignificant impact on the junctions in both the opening year and design year. It is expected that the junctions will all function well within capacity. Due to the removal of existing parking the majority of the traffic volumes at each of the junctions is reduced. The modelling demonstrates that the proposed streetscape enhancement and associated one-way system will not have a negative impact on the surrounding road network.

Mitigation Measures

Project design has been carried out by the Consultant Engineers in consultation with Cork City Council, and these works will be designed and supervised by a suitably qualified and experience professional to ensure they are carried out correctly.

The existing traffic movements in Morrison's Island will be altered following the completion of the streetscape enhancement. New signage will be required to be erected to guide motorists around the new one-way system and the appropriate way to various destinations.

Residual Impacts – Positive Impact

Taking into account the abovementioned mitigation measures, the impact of the proposed scheme on the traffic during the construction phase will be **Permanent Positive Impact**