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Dublin City Council and Irish Water

Applicant:

Dublin City Council

Project:

Grand Canal Storm Water Outfall Extension

Report:

Volume 2 Environmental Impact Assessment: Main Report

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Glossary and Abbreviations

Acronym	Description
AA	Appropriate Assessment
AADT	Annual Average Daily Traffic
ABP	An Bord Pleanála
ACSU	Archaeological Consultancy Services Unit
ADCO	The Archaeological Diving Company Ltd
AM	Before midday
bec	Botanical, Environmental & Conservation Consultants Ltd.
BGL	Below Ground Level
BH	Borehole
BOD	Biological Oxygen Demand
BS	British Standards
c.	Circa (approximately)
C&D	Construction and Demolition
CA	Competent Authority
CD	Chart Datum
COD	Chemical Oxygen Demand
CEMP	Construction Environmental Management Plan
CESSM	Civil Engineering Standard Method of Measurement
CFA	Continuous Flight Auger
CIEEM	Chartered Institute of Ecology and Environmental Management
CIRIA	Construction Industry Research and Information Association
Ch.	Chainage
CSO	Combined Sewer Overflow
DART	Dublin Area Rapid Transport
dB	Decibels
DCC	Dublin City Council
DCIHR	Dublin City Industrial Heritage Record

Acronym	Description
DDDA	Dublin Dockland Development Authority
DMRB	Design Manual for Roads and Bridges
DEHLG	Department of the Environment, Heritage & Local Government. The Department is now the Department of Housing, Planning and Local Government.
DIN	Dissolved Inorganic Nitrogen
DoELG	Department of the Environment and Local Government
EC	European Commission
E. *coli*	Escherichia Coliforms
e.g.	For example
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EPA	Environmental Protection Agency
EQS	Environmental Quality Standard
ESB	Electricity Supply Board
etc.	Et cetera (and the rest)
EU	European Union
GCSWOE	Grand Canal Storm Water Outfall Extension
GCT	Grand Canal Tunnel
GCTS	Grand Canal Tunnel Sewer
GDA	Greater Dublin Area
GDSDS	Greater Dublin Strategic Drainage Study
GHG	Greenhouse Gases
GSI	Geological Survey Ireland
GSL	Geotechnical Specialists Ltd.
GWB	Groundwater Bodies
HDPE	High Density Polyethylene
HGVs	Heavy Goods Vehicle
Hz	Hertz

Acronym	Description
IAQM	Institute of Air Quality Management
IGI	Institute of Geologists of Ireland
ISO	International Organization for Standardization
ITM	Irish Transverse Mercator
IW	Irish Water
JNCC	Joint Nature Conservation Committee
L_{Aeq}	Equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period
L_{AeqT}	Equivalent continuous sound level over the time period T (in seconds)
L_{Amax}	Instantaneous maximum sound level measured during the sample period
L_{Amin}	Instantaneous minimum sound level measured during the sample period
L_{A10}	Sound level that is exceeded for 10% of the sample period. It is typically used as a descriptor for traffic noise
L_{A90}	Sound level that is exceeded for 90% of the sample period. It is typically used as a descriptor for background noise
L_{AX}	"A-weighted" Sound Exposure Level of the event considered (dB)
Li	Locally important aquifer unproductive except for local zones
LoW	List of Waste
LV	Light Vehicles
KDA	Key Developing Area
km	Kilometres
m	Metres
mg	Milligrams
MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
MRP	Molybdate Reactive Phosphate
MSFD	Marine Strategy Framework Directive
Mt CO_2eq	Million Tonnes Carbon Dioxide Equivalent
N	Nitrogen (unless otherwise defined within a Section)

Acronym	Description
NBDC	National Biodiversity Data Centre
NHA	Natural Heritage Areas
NIS	Natura Impact Statement
NIAH	National Inventory of Architectural Heritage
no.	Number
NPF	National Planning Framework
NPWS	National Parks and Wildlife Service
NRA	National Roads Authority
NSL	Noise Sensitive Locations
NSO	National Strategic Outcomes
NTA	National Transport Authority
NVMP	Noise and Vibration Management Plan
OD	Ordnance Datum
OS	Ordnance Survey
OSCADY	Optimised Signal CApacity and DelaY
OSI	Ordnance Survey Ireland
PM	After midday
PM_{10}	Particulate Matter <10µm
$PM_{2.5}$	Particulate Matter <2.5µm
pNHA	Proposed Natural Heritage Areas
PAH	Polycyclic Aromatic Hydrocarbon
r_1	Distance at which L_{AX} is expressed
r_2	Distance to the assessment location
RBMP	River Basin Management Plan
RFC	Ratio of Flow to Capacity
RMP	Record of Monuments and Places
RPO	Regional Policy Objective
RPS	Record of Monuments and Places

Acronym	Description
RSES	Regional Spatial and Economic Strategy
RWMP	Resource and Waste Management Plan
SAC	Special Areas of Conservation
SDRA	Strategic Development Regeneration Area
SDZ	Strategic Development Zone
SEA	Strategic Environmental Assessment
SJRQ	Sir John Rogerson's Quay
SI	Statutory Instrument
SIL	Site Investigations Ltd.
SMR	Sites and Monuments Records
SPA	Special Protected Areas
Spp.	Refers to all the species belonging to that family or genus
TII	Transport Infrastructure Ireland
TPH	Total Petroleum Hydrocarbon
TSAS	Trophic Status Assessment Scheme
UAIA	Underwater Archaeological Impact Assessment
UK	United Kingdom
UNESCO	United Nations Educational, Scientific and Cultural Organisation
WI	Waterways Ireland
WIID	Wreck Inventory of Ireland Database
WEEE	Waste Electrical and Electronic Equipment
WFD	Water Framework Directive
WQM	Water Quality Modelling
WWDA	Waste Water Discharge Authorisation
WWDL	Waste Water Discharge License
WWTP	Waste Water Treatment Plant
yr	Year
ZoI	Zone of Influence

Acronym	Description
ZTV	Zone of Theoretical Visibility
μg	Microgram

SECTION 1: Introduction

1.1 Overview

This Environmental Impact Assessment Report (EIAR) for the Grand Canal Storm Water Outfall Extension (GCSWOE) has been prepared on behalf of Dublin City Council (DCC) (the Applicant). This EIAR accompanies a planning application made directly to An Bord Pleanála (ABP) under Section 226 of the Planning and Development Act 2000 (as amended). An EIAR is an assessment and analysis of potential impacts on the receiving environment caused by a proposed project. As part of the screening and scoping stage for the project, *Environmental Impact Assessment Screening Report* and *Environmental Impact Assessment Scoping Report* were prepared by J.B. Barry and Partners Ltd (2020), refer to Volume 3, Appendix 1A and Appendix 1B respectively.

1.2 Project Background

The Grand Canal Tunnel in Dublin City Centre was constructed in the early 1970's (Figure 1.1) in order to:

- Convey foul sewerage from the newly expanding suburbs in the west of the city to Ringsend Wastewater Treatment Plant;
- Provide a conduit for the overflows from the existing combined foul and storm sewers; and
- To convey storm relief flows from the Poddle and Swan Rivers thereby reducing the risk of flooding in those areas.

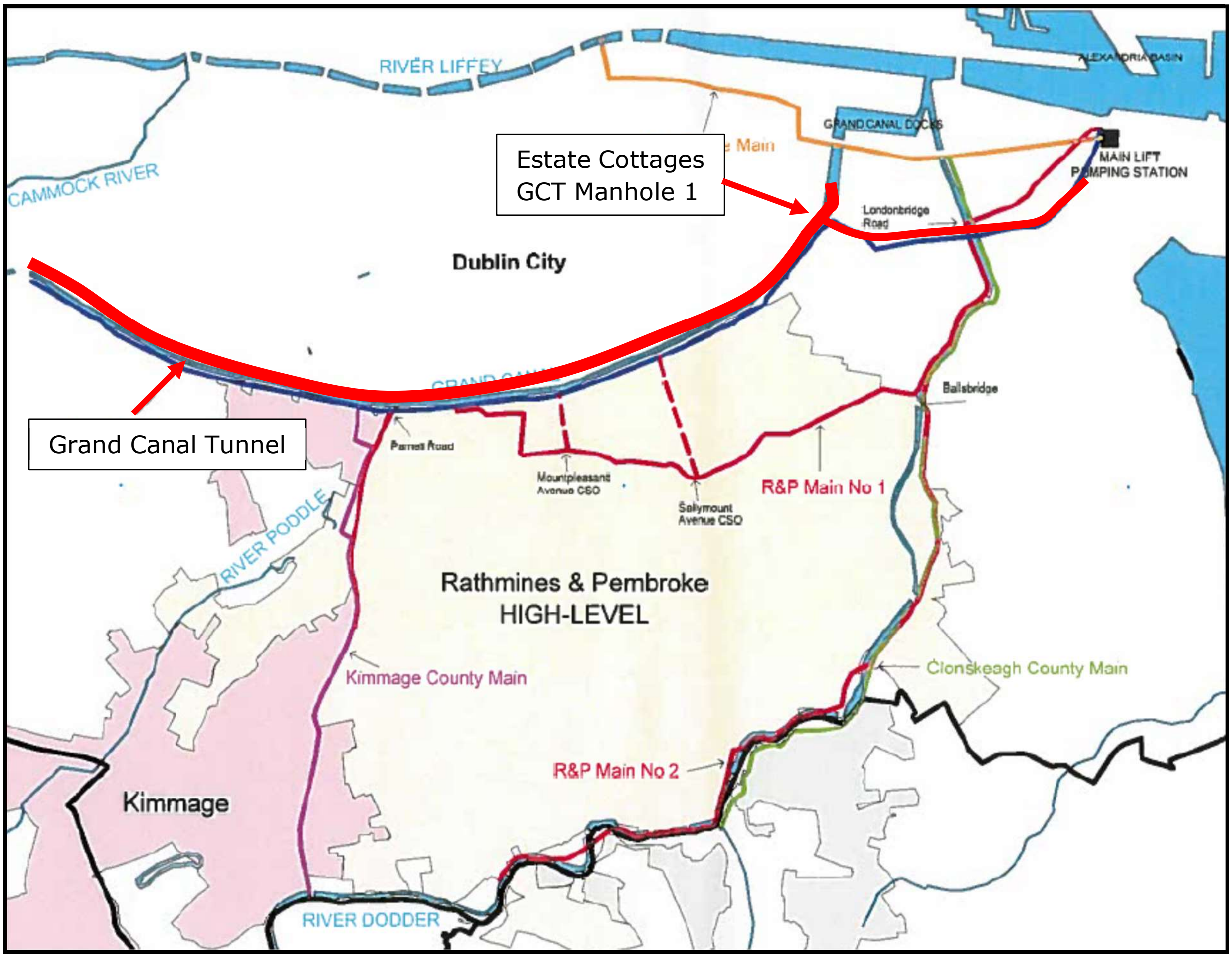


Figure 1.1 Grand Canal Tunnel

The existing tunnel is 4.8km in length and has a diameter of 3.6m. The tunnel is partitioned into two separate sections. The smaller compartment caters for foul wastewater and the larger compartment caters for stormwater. At Estate Cottages, north of canal bridge at Northumberland Road (Manhole 1) the tunnel splits with the foul component being conveyed to Ringsend Wastewater Treatment Plant and the stormwater component being conveyed to the Grand Canal Basin via a 3.2m diameter pipe.

The Basin, in this report refers to the waterbody within Grand Canal Docks. The Docks, in this report refers to the overall area encompassing the Basin, quayside, and surrounding area.

The Grand Canal Basin consists of an enclosed harbour where the Grand Canal terminates before it meets the River Liffey in Dublin, Ireland. This area is a hub of modern apartment buildings and office spaces and is also known as a Key Developing Area (KDA) within the Dublin City Council Development Plan, 2016 – 2022, and also a Strategic Development Zone (SDZ) within the North Lotts and Grand Canal Planning Scheme, 2013. The area is also important for entertainment, cultural, and recreational activities with a number of restaurants and bars, as well as the Bord Gáis Energy Theatre. The development of water-based recreational activity within the Basin is part of the rejuvenation programme in the area. After heavy rainfall, combined sewer overflows (CSO) in the catchment spill into the stormwater component of the Tunnel and discharges sewage contaminated flows into the Grand Canal Basin. Periodic bacteriological contamination of the water in the Basin (in excess of the bathing water standards) after heavy rainfall events has been identified by Waterways Ireland from water quality testing and they have urged Irish Water and DCC to extend the outfall to the River Liffey as proposed.

Irish Water, DCC, and Waterways Ireland agreed in 2017 to establish a Joint Working Group to examine the issue of periodic bacteriological contamination in the Basin. Extensive water quality analysis and monitoring of the impact of the surface water overflows into the Basin from the Irish Water combined sewer network for a period of one year has been undertaken. It has been demonstrated that the primary source of pollution of the waters in the Basin is the discharge from the storm water section of the Grand Canal Tunnel.

Since the discharge cannot be closed off, the preferred solution is to relocate the discharge point to a location outside the Basin. The preferred location for the discharge point is the River Liffey.

1.3 Planning History

In the early 1990's, arising from development and upgrading of the Grand Canal Docks and its environs, the Office of Public Works (who had responsibility for dock maintenance/operation) requested that the storm water discharge from the Grand Canal Tunnel be removed from the Grand Canal Basin. A study carried out by J. B. Barry and Partners in 1992 identified possible alternative options for re-routing the storm water discharge away from the Docks into the River Liffey. A preferred option was identified, cost estimates were prepared, and a report was submitted recommending implementation of the proposed project outlined herein.

In October 2000 Dublin Corporation instructed J. B. Barry and Partners to carry out a review of the extension of the Grand Canal Surface Water Outfall through the Grand Canal Docks to a new outfall at the River Liffey.

The first phase of this project was completed in 2002 where Phase 1 saw the construction of a 170m long 4.0x2.7m box culvert underneath Asgard Road, between Hanover Quay and Sir John Rogerson's Quay (SJRQ). The proposed Phase 2 of this project involves the connection of the Grand Canal Storm Water Tunnel to the box culvert completed as part of Phase 1, and the construction of the outlet structure into the River Liffey at SJRQ. In 2008/ 2009 the design prepared for Phase 2 proceeded to tender and a Section 25 certificate (planning consent) was granted by the Dublin Docklands Development Authority (DDDA). However, the project was put on hold in 2012 and was not progressed primarily due to the economic downturn. In 2015 the DDDA dissolved, and the Section 25 certificate became void. In 2017 a feasibility study was completed to consider three more alternative pipeline routes through the basin and assess the most appropriate option. It was concluded that the original option was the optimal solution.

1.4 Scope of EIAR

The EIAR being submitted with the planning application considers the impact of the overall proposed GCSWOE project. The scope of the EIAR comprises the works and activities associated with the proposed GCSWOE for which permission is being sought. For details of proposed works refer to Volume 2, Section 2.

The proposed GCSWOE project consists of two components as follows:

- Terrestrial component- This involves construction works along Hanover Quay and SJRQ; and
- Aquatic component- This involves construction works within the Grand Canal Basin.

1.5 Applicant

DCC and Irish Water have agreed to jointly complete the Planning and Statutory Approvals and co-fund the extension of the Grand Canal Tunnel outfall pipe. DCC is making the application. J. B. Barry and Partners have been appointed as the project consultant.

DCC is the authority responsible for local government in Dublin City and is governed by the Local Government Act 2001. Irish Water is a subsidiary of the Ervia Group (formerly Bord Gáis Éireann), which was incorporated as a company under the Water Services Act 2013. At present, Ervia's responsibility lies in the delivery of gas, water infrastructure and services throughout Ireland.

The application along with the Environmental Impact Assessment Report (EIAR) for the proposed development has been prepared by the design team led by J. B. Barry and Partners in conjunction with the Applicant. An AA Screening, Natura Impact Statement and Flood Risk Assessment have also been submitted as part of the planning application documents.

SECTION 2: Description of Proposed Development

2.1 Site Location

The project will begin at its most southern point in the Grand Canal Basin at the Grand Canal Tunnel Outfall. The works will involve constructing a pipeline from the Grand Canal Tunnel Outfall, near the Grand Canal Dock Dart Station, north through the Basin where it will pass through a section of Hanover Quay. It will then link up with an existing culvert on Asgard Road, built in 2002 as part of the Phase 1 works for this project. At the northern end of this existing culvert, a pipeline will be constructed underneath SJRQ together with an outfall to the River Liffey. The stormwater discharge will therefore have bypassed its previous outfall within the Basin and will discharge into the River Liffey/Lower Liffey Estuary. Refer to Figure 2.1.

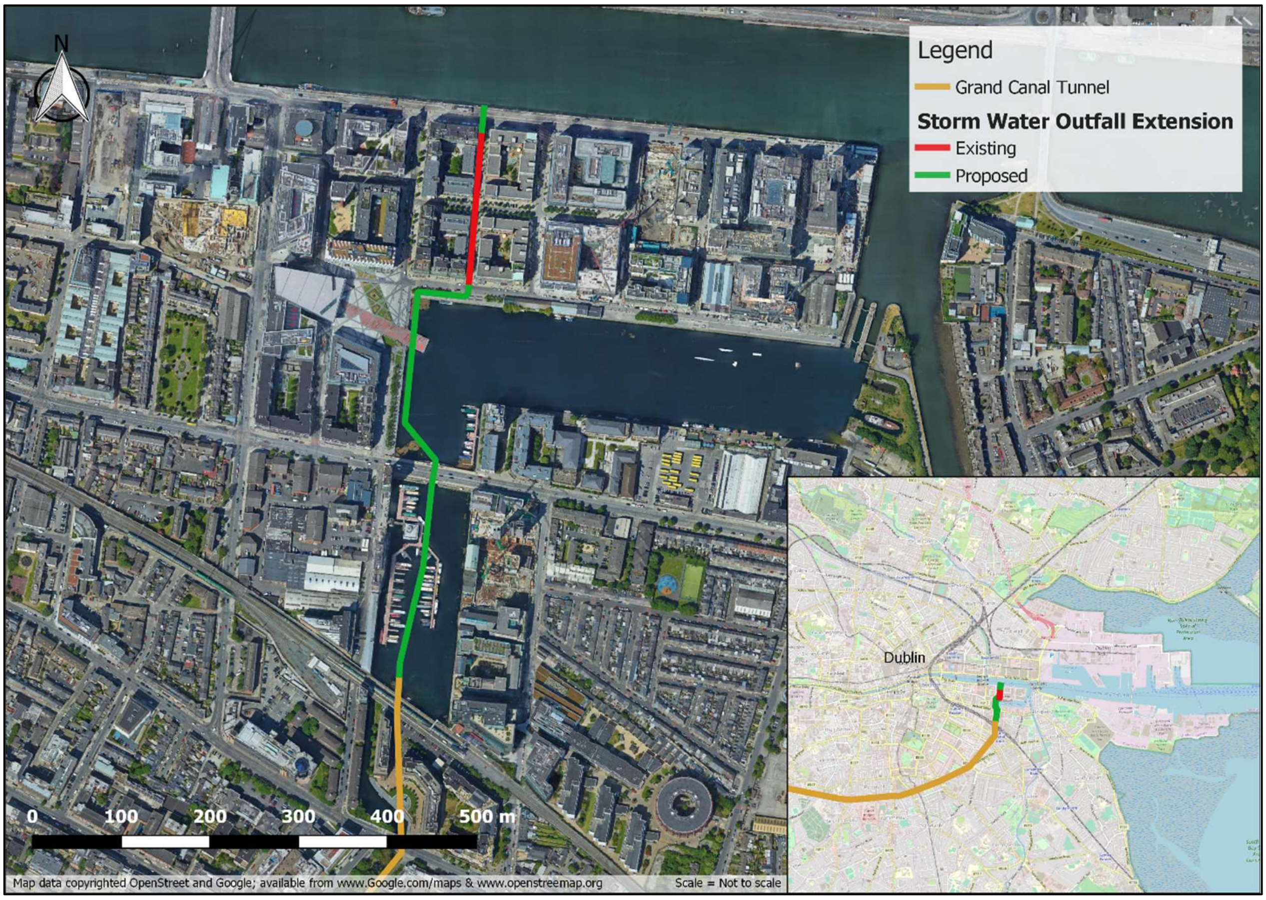


Figure 2.1 Overview of Grand Canal Storm Water Outfall Pipeline

As discussed, the development is located in the area zoned as a Strategic Development Regeneration Area (SDRA) in the Dublin City Council Development Plan, 2016 – 2022, see Figure 2.2. The Grand Canal Docks are set in an urban environment and the proposed development interacts with properties zoned as:

- SDRA 6;
- Conservation Areas;
- Zone 6 "to provide for the creation and protection of enterprise and facilitate opportunities for employment creation"; and
- Zone 14 "to seek the social, economic and physical development and/or rejuvenation of an area with mixed use of which residential and "Z6" would be the predominant uses".

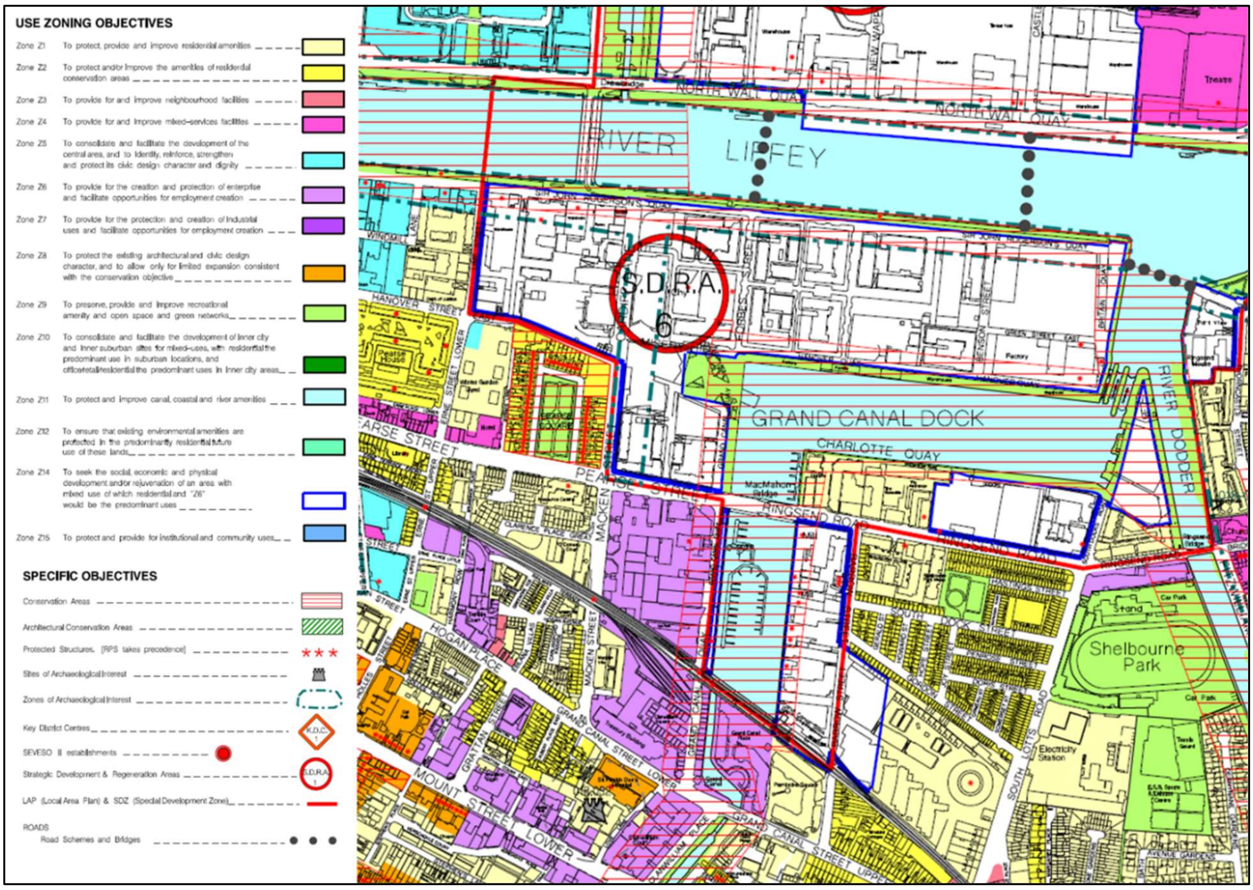


Figure 2.2 Map extract from Dublin City Development Plan 2016 - 2022 Map E Use Zoning Objectives (DCC, 2016)

2.2 Description of the Proposed Works

The proposed development will result in the re-routing of the stormwater section of the Grand Canal Tunnel to the River Liffey. This currently discharged into the Basin. The discharge periodically contains elevated concentrations of Faecal Coliform, BOD, Nutrients and Suspended Solids from Combined Sewer Overflows (CSOs). The proposed works for the scheme consists of the following:

- Construction of Transition Chamber 1 at chainage Ch.+0m (Starting at southernmost point of development at the existing storm water outfall);
- Construction of 5 no. 1.5m diameter pipes from chainage Ch.+7.26 – Ch.+310.00m;
- Construction of Transition Chamber 2 at chainage Ch.+310.00 – Ch.+320.00m;
- Construction of Twin 2.4m diameter pipes from chainage Ch.+320.00 – Ch.+490.00m;
- Construction of Transition Chamber 3 at chainage Ch.+490.00m;
- Construction of 4m wide 2.7m high (internal diameter) culvert on Hanover Quay;
- Construction of new outfall structure at SJRQ into the River Liffey; and
- Construction of permanent floating platform along Grand Canal Quay.

The total length of the pipeline to be constructed is 550m. The proposed works involve 450m of development on the silt bed of the Grand Canal Basin, and 100m along existing road and pedestrian infrastructure, see Figure 2.3. The bed of the Basin is mostly flat with some gentle undulations; a maximum depth of 3.9m was observed by the Archaeological Diving Company (ADCO) during a dive survey completed in 2008.

Three temporary cofferdams will be built at each of the transition chambers including:

- Transition Chamber 1 at the existing Grand Canal Tunnel Outfall;

- Transition Chamber 2 at the transition point from the 5 no. 1.5m diameter pipeline to the 2 no. 2.4m diameter pipeline; and
- Transition Chamber 3 at Hanover Quay.

The route is proposed to traverse underwater through the centre of the southern portion of the Basin, pass underneath the MacMahon Bridge, then bear close to the western wall of the Basin. The pipeline will enter Transition Chamber 3 at Hanover Quay and will run underground along the quay before connecting to the existing Phase 1 culvert on Asgard Road, see Volume 4, Project Drawings.

Particular constraints considered for the project include:

- Meeting canal draught requirements in terms of navigation; 1.9m minimum clearance;
- Avoiding the existing 8 foot (2.4m) diameter sewer, which is more than 100 years old, and runs west to east underneath the Basin at MacMahon Bridge;
- Minimising discharge velocities into the River Liffey; and
- Minimising risk of damage to the proposed extension pipe which could cause rapid drawdown of the Grand Canal Basin.

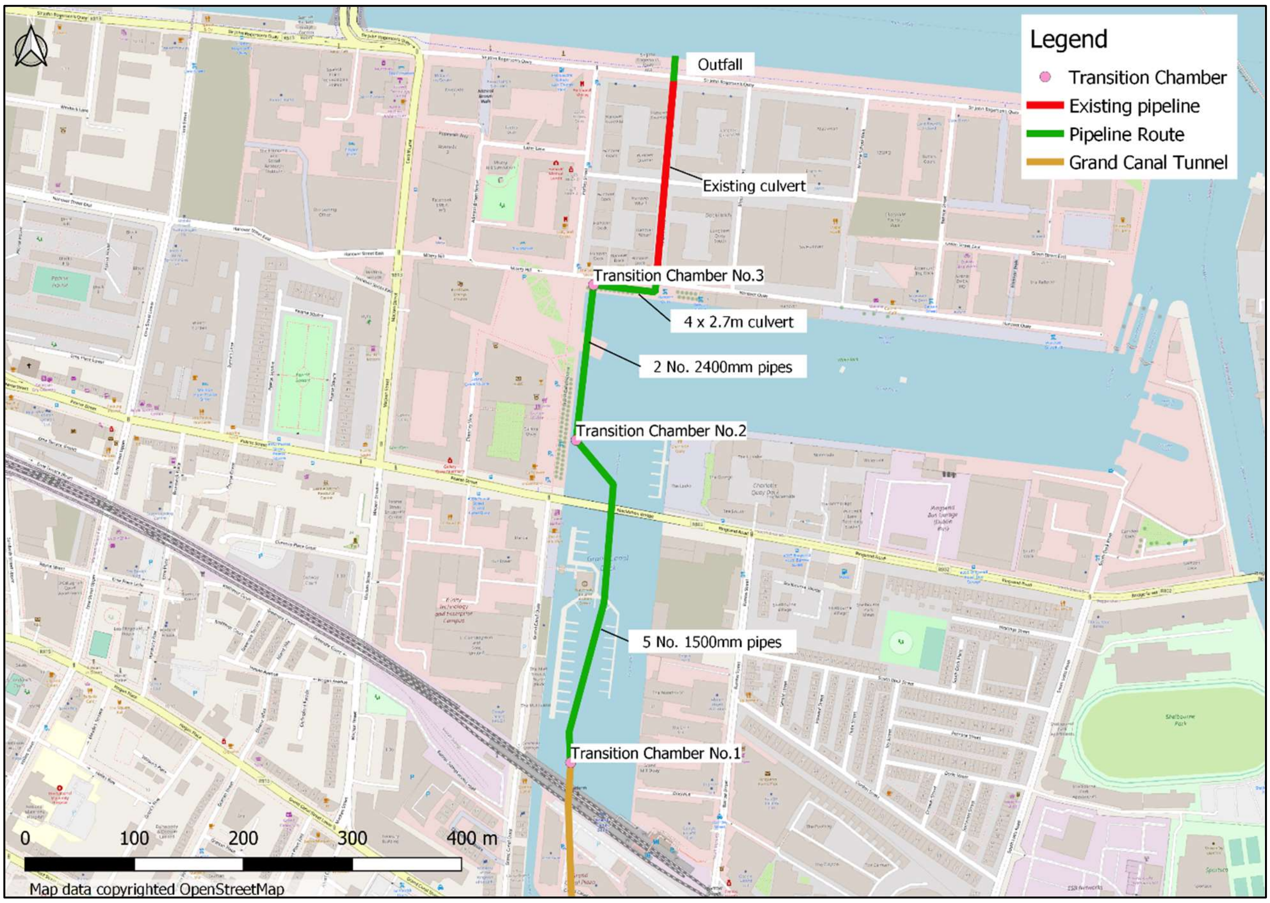


Figure 2.3 Grand Canal Storm Water Outfall pipeline within the Grand Canal Docks

The capacity of the proposed culverts were checked using the outputs from the Greater Dublin Strategic Drainage Study (GDSDS) and modelled using InfoWorks. The InfoWorks model was run for the following two joint probability scenarios:

- 1 in 1year storm (9.7m^3/s flow) with the modified 100-year tide (i.e. estimated future 100year tide (3.4mOD Malin Head); and
- 1 in 20-year storm (18.6m^3/s flow) and a Mean High Water Springs (MHWS) tide (2.25mOD Malin Head).

2.3 Proposed Methodology

2.3.1 Transition Chamber 1

The connection to the existing Tunnel will be made at Transition Chamber 1. It is proposed that a temporary cofferdam will be constructed at this location to enable the construction of the works. Steel sheet piles were used to construct the Tunnel outfall. These were cut off at bed level and are still present.

Flows through the Tunnel will be diverted for a period of up to 4 months. However, in emergency situations, flows may be returned to the Tunnel at short notice. Provision will be made for such a condition.

Once the cofferdam is in place, the bed will be prepared, and the in-situ transition chamber will be shuttered and poured. The transition chamber will include two penstocks capable of stopping flows entering the pipeline distribution chamber and onward into the pipelines. Communication ducts will be required for control of the penstocks.

Permanent access points (accessible only by boat) will also be constructed in the chamber. Davits will be provided to enable removal and installation of equipment. The exposed sections of the chamber will be clad in stone facing.

As part of the works, the existing access chamber in the storm water outfall chamber is to be fitted with a pressure sealed cover suitable for 5.0m unseating pressure. This chamber is below the normal dock water level.

2.3.2 Pipeline Section 1

From Transition Chamber 1 flows will be split between 5 no. 1.5m HDPE pipelines. Existing moorings will be temporarily dismounted and removed.

The bed will be recontoured to provide a level base. Where pockets of soft ground are identified though analysis of the site investigation or during the dredging, these will be excavated and filled with suitable material. The quantity of dredged material to be removed from the basin will be kept to a minimum. To prevent migration of silt, silt curtains will be required. Any material that is to be removed from the basin is to be dewatered and disposed of in line with an approved waste management strategy.

Precast U-channels will be lowered onto the bed and set in position. Pipe strings in suitable lengths will be welded or bolted together in the site compound and floated out, connected to adjoining strings and sunk into position in the U-channel. Communication ducts will also be laid within the U-channel. The U-channel will then be infilled with lean mix concrete.

Due to width restrictions, where the pipelines pass between the piers of MacMahon Bridge, no precast U-channel will be installed but rather the pipelines will be laid on concrete supports. The pipes will again be surrounded with lean mix concrete.

Submerged, blank flanged emergency manhole accesses will be provided to each pipe at Ch. +260.00m.

2.3.3 Transition Chamber 2

Transition Chamber 2 will serve to switch flows from the low profile 5 no. 1.5m diameter pipelines to the low footprint 2 no. 2.4m diameter pipes. Methodology for construction of Transition Chamber 2 will be similar to that of Transition Chamber 1: temporary cofferdam to enable in-situ construction of the concrete structure.

Similar to Transition Chamber 1, automated penstocks will be incorporated in the design of Transition Chamber 2. Man access into the chamber will be provided from surface level via an access gangway to be provided from Grand Canal Quay.

2.3.4 Pipeline Section No. 2

The 2 no. 2.4m diameter pipes running parallel to Grand Canal Quay will be installed using similar methodology, with allowances for differences in pipeline characteristics, to that used in Pipeline Section 1. To minimise impact on the existing Grand Canal Dock walls, the structure will be offset by a minimum of 4.0m from the dockside. Dredged material may be placed in this 4.0m clearance.

The pipeline route passes beneath the existing platform structure which extends from Grand Canal Dock into the basin.

It is proposed that 2 no. permanent floating moorings will be attached to the pipeline structure as part of the works. The moorings will be separate from the existing platform structure. These moorings are to be installed to prevent inadvertent striking of the submerged structure. Access to the southern and northern moorings will be from the Transition Chamber 2 gangway and an access ramp from Hanover Quay respectively. Short-term installation of hoardings will be put up on the top of the quay wall for health and safety reasons and the access to the Bord Gáis Energy Theatre platform overhanging the basin might be temporarily restricted while works are being undertaken in the close proximity to the platform.

2.3.5 Transition Chamber 3

Transition Chamber 3 is to be located in the Hanover Quay Campshire. It will provide for the transition between the twin pipe section and a 4.0m (w) x 2.7m (h) (internal dimensions) reinforced concrete box culvert section. Automated penstocks will be incorporated in the design of Transition Chamber 3. It will also allow for maintenance access to the pipeline and culvert.

Sheet piling will not be permitted or the construction of Transition Chamber 3; it is anticipated that Transition Chamber 3 and the Hanover Quay culvert will be constructed within a secant piled wall.

2.3.6 Pipeline Section 3

As described above, Pipeline Section No. 3 consists of a 4.0m (w) x 2.7m (h) (internal dimensions) reinforced concrete box culvert running between Transition Chamber 3 and Phase 1 culvert. A two stage turn through 90° is required to transition from the Hanover Quayside towards Asgard Road.

To allow for the construction of the pipeline, a section of the Hanover Quay will need to be taken down, stored, and the wall reinstated around the new structure. The extent of the demolition of the wall will be minimised. All demolition will be required to be undertaken under the supervision of an archaeologist. Stones from the dock wall, the cap stones and the stone steps are to be numbered during removal, stored and reinstated in the same order as demolition.

A designed temporary support system will be required to secure the wall where it is breached.

Significant ingress of water was encountered during previous excavation works along Hanover Quay. It is therefore concluded that the existing dock walls are not watertight. The stability of the existing dock walls must be considered in any proposed methodology to be provided by the Contractor.

The ground in Hanover Quay is considered to be contaminated. The Contractor will be required to update and finalise the Resource and Waste Management Plan (RWMP) addressing inter alia the treatment, storage, and disposal of contaminated material.

An existing ESB power line runs perpendicular to the proposed box culvert route on Hanover Quay Road. The box culvert will be required to pass beneath the pipe bridge.

2.3.7 Sir John Rogerson's Quay (SJRQ)

A new outfall structure is required between the northern end of the Phase 1 Culvert and SJRQ. As with the works through Hanover Quay, the construction of the outfall will require the demolition of a section of the quay wall. This work is subject to the same conditions to that at Hanover Quay. As with Hanover Quay, it is expected that there is contaminated ground at SJRQ and that the existing quay wall is not watertight.

A 4.0m x 2.7m reinforced concrete box culvert will connect the Phase 1 Culvert with the outfall proper. There is a significant number of services known to be located in the area including a high-pressure gas main. A pipe bridge for ESB cables is required over the box culvert. A new ESB cabinet is also required.

Penstocks and communication links are to be installed within the structure.

To facilitate the construction of the outfall structure, a cofferdam is to be constructed within the River Liffey. A permanent scour mattress is to be installed within the River Liffey as part of the works.

2.4 Construction and Commissioning Phase

2.4.1 Procurement

The applicant have procured J.B. Barry and Partners Ltd. as consultants to design the extension and manage the planning application for the extension. Subject to planning approval a consultant will be appointed to prepare contract documents and a Contractor will be procured to construct the works.

Any design flexibility provided for in the contracts will be limited by regulatory, technical and operational constraints, including mitigation measures relating to this EIAR and conditions of the planning consent.

The Contract scope generally will include but is not limited to the following works:

- Site preparation and finishing works;
- Trial pits/slit trenches to identify the precise location and level of all services that could be affected by the proposed works;
- Protection/supports to the existing services including gas transmission mains and high voltage ESB cables during construction and diversion/protection of all other existing services;
- Excavation, treatment and disposal of contaminated material and water from Hanover Quay, SJRQ and from the Grand Canal Dock;
- Dredging, dewatering and disposal of dredged material from the Grand Canal Basin;
- Construction of outfall structure at the Phase 1 Culvert at the north end of Asgard Road across SJRQ and construction of the outfall structure into the River Liffey including piled foundations and two channel penstocks;
- Construction of three transition/access chambers including installation of penstocks, actuators, access platforms and stoplogs;
- Tie-in to existing Grand Canal Tunnel outfall structure in the Inner Grand Canal Dock; and
- Installation of a pressure sealed manhole on the existing manhole of the existing storm water outfall chamber into the Grand Canal Dock.

2.4.2 Construction Programme

Licences were obtained during the development of the 2010 tender documents. It is anticipated that the restrictions imposed at that time will still stand under this iteration. These identify a number of constraints that will affect the phasing of the works. Phasing of the works is also required to minimise the negative impact of the construction phase on a number of adjacent developments. The requirements are outlined in the sections below.

Sir John Rogerson's Quay (SJRQ)

The construction of the outfall structure at SJRQ is to be carried out at the start of the contract.

The breaking through the secant piled wall to the Phase 1 Culvert is to be carried out towards the end of the contract. No breaking through of the secant wall can be undertaken until the new penstocks have been commissioned.

The works in SJRQ will be completed in approximately 3-4 months and will involve outfall construction and works on the Liffey Quay wall.

Hanover Quay

All works in Hanover Quay Campshire are to be completed in a period of approximately 4 months (including all reinstatement works).

The works in Hanover Quay will involve outfall construction works, Transition Chamber 3, reinstatement and all associated works.

The breaking through the secant piled wall to the Phase 1 Culvert is to be carried out towards the end of the contract. No breaking through of the secant wall can be undertaken until the new penstocks have been commissioned.

Outer Dock

No access to the works is to be provided from Grand Canal Quay Campshire. No machinery or materials are to be located on this Campshire.

The works in outer basin will be completed in approximately 5-6 months and will involve construction of Transition Chamber 2, installation of sewer pipe and culvert and associated works.

Inner Dock

The closure of the penstock at Transition Chamber 1 by DCC personnel shall be limited to 4 months duration. Potential emergency opening of this penstock must be facilitated at short notice.

The works in the inner basin will be completed in approximately 10-11 months and will involve construction of Transition Chamber 1, installation of pipe and culvert and associated works.

Diversion of moorings and services at Waterways Ireland Visitors Centre in the Inner Dock will be carried out as agreed and consented by Waterways Ireland.

Wayleaves and Consents

Letter of Consents and wayleave drawings are attached in Volume 3, Appendix 2A.

The letter of consent has been received from Waterways Ireland for the construction compound in the inner basin and to navigate through the basin. DCC have provided letter of consents for the construction compound on SJRQ and in the Campshire area. Dublin Port have also provided a letter of consent.

2.4.3 Works Compound Areas

To facilitate the works areas, 3 no. construction compound will be made available for the Contractor. The location of these construction compound is shown below in Figure 2.4 and in Volume 4, Project Drawings.

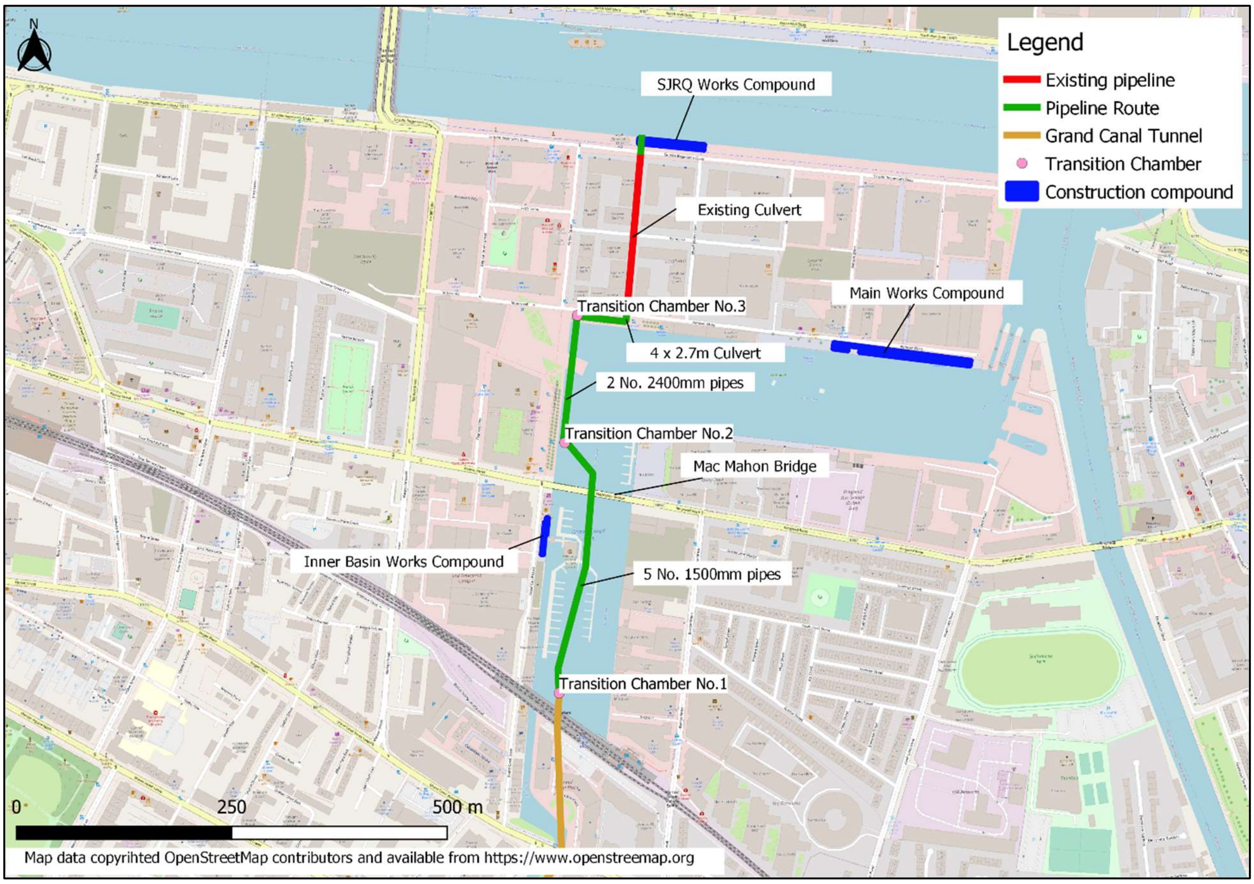


Figure 2.4 Works compound locations

Sir John Rogerson's Quay (SJRQ) Works Compound

A temporary works compound will be located at the SJRQ at the end of Asgard Road towards the River Liffey. This compound will assist in works involving the provision of a new outfall structure between the northern end of the Phase 1 Culvert and SJRQ. The construction of the outfall will require the demolition of a section of the quay wall. To facilitate the construction of the outfall structure, a cofferdam is to be constructed within the River Liffey.

Main Works Compound

The main works compound is located to the north of the Grand Canal Dock in the eastern Campshire area of Hanover Quay. The Campshires are typically landscaped with decorative paving installed. The section between the dock locks and Benson Street, does not have any established planting at present but existing paving would need to be removed, stored, and reinstated. A section of the quayside would be temporarily acquired to serve as the construction compound.

Consultation with DCC and Waterways Ireland has been undertaken to obtain the use of the Campshires for temporary occupation as a site compound.

Inner Basin Compound

The inner basin compound is located on the quay to the immediate west of the Waterways Ireland Visitor Centre. This quay measures approximately 50m x 10m. The quayside, with the exception of a small section at the southern end, is in the ownership of Waterways Ireland. A temporary wayleave has been consented to allow for the works.

The area is currently paved with stone pavers, kerbs, and cobble lock. Other landscape features include semi-mature trees, ornate tree guards, and stone benches. Sensitive and appropriate removal, storage and reinstatement of the existing urban finishes of the area will be required as part of a wayleave agreement.

As part of the engagement with Waterways Ireland carried out to date, the requirement to remove, store, and reinstate the eastern section of the existing moorings (and any berthed boats/house boats) within the basin has been agreed. As part of the constructability review, due to the size and number of watercraft required to carry out the works, and due to the complexity of the work activities that will occur in the inner basin, it is deemed necessary to relocate the moorings from the inner to the outer basin while construction works are taking place in the inner basin.

2.4.4 Access

Access to the works areas of this contract are outlined as follows:

- Hanover Quay- Access to Hanover Quay is via Forbes Street and SJRQ. Both of these streets are currently two-way streets;
- SJRQ - Access to SJRQ is from City Quay or Pearse Street (via Macken Street and Cardiff Lane) all of which are two-way streets. Boat access to the agreed working area in the River Liffey shall be in accordance with the navigation rules and as agreed with the Dublin Port Company; and
- Grand Canal Docks- Boat access to the agreed wayleaves in the Grand Canal Basin shall be in accordance with the navigation rules and as agreed with Waterways Ireland.

2.4.5 Construction Environmental Management Plan

A Construction Environmental Management Plan (CEMP) has been prepared and is included in Volume 3, Appendix 17A to the EIAR. The CEMP includes all of the construction mitigation measures, which are set out in the EIAR, and will be updated with any additional measures which may be required by the conditions attached to An Bord Pleanála's decision subject to approval. Implementation of the CEMP will ensure disruption and nuisance are kept to a minimum. The plan will have regard to the guidance contained in the handbook published by Construction Industry Research and Information Association (CIRIA) in the UK, Environmental Good Practice on Site Guide, 4th Edition (CIRIA 2015).

The CEMP will be a working document and will be finalised by the Contractor following appointment and prior to commencing works on site. However, all of the content provided in the CEMP will be implemented in full by the Contractor and its finalisation by the Contractor will not affect the robustness and adequacy of the information presented and relied upon in the EIAR.

The CEMP is a dynamic document, and the Contractor will ensure that it remains up to date for the duration of the construction period. The CEMP may need to be altered during the lifecycle of the construction period to take account of monitoring results, legislative changes, outcomes of third-party consultations etc. Additional appendices may be added to the CEMP to accommodate monitoring results, permits etc.

2.4.6 Commissioning

The structures will be tested for watertightness in stages prior to removal of temporary cofferdams or backfilling as appropriate.

All mechanical and communication equipment will be tested before introduction of flows.

2.4.7 Reinstatement

Areas affected by the works will be reinstated in full. The reinstatement will match the existing situation and will require consultation with various stakeholders.

The quay walls at Hanover Quay and SJRQ will be reinstated using the stone removed to enable the works and to match the surrounding walls.

2.5 Need for the Scheme

Water quality in the Grand Canal Basin has been adversely affected over recent years by the existing stormwater outfall discharging combined/foul sewerage into the southern end of the Basin (also known as the Inner Docks) during periods of high rainfall. The long retention time and low throughput of water through the Basin make it vulnerable to pollution after these events. In 2016, the impact on water quality in the Grand Canal Docks resulted in complaints being made to the EPA by Waterways Ireland. The most severe instances of microbiological contamination occurred in the Inner Basin in close proximity to the existing surface water outfall.

In 2017 Irish Water, DCC and Waterways Ireland agreed to establish a Joint Working Group to examine the issue. Extensive water quality analysis and monitoring of the impact of the surface water overflows into the Basin from the Irish Water combined sewer network for a period of one year has demonstrated, that the primary source of the periodic pollution of the waters in the Basin is the discharge from the surface water section of the Grand Canal Tunnel.

It was concluded that if the Grand Canal Basin is to be usefully developed as an amenity in accordance with current policy, the existing discharge point of the Grand Canal Tunnel surface water outfall must be removed from the Basin (as proposed in the Dublin City Development Plan 2016-2022).

The solution involves the extension of the existing storm water outfall pipe to SJRQ where an outfall structure will be constructed into the River Liffey.

Primary objective:

- Extension of the Grand Canal Surface Water Outfall through the Grand Canal Docks to a new outfall at the River Liffey.

Primary drivers:

- To reduce pollution and improve water quality in the Grand Canal Basin; and
- To enhance the amenity value of the Grand Canal Docks.

SECTION 3: Legislative Context

3.1 Introduction

This section sets out the legislative context governing the planning and development of the proposed project. This includes a strategic review of the planning policy context at a national, regional and local level and other relevant statutory and non-statutory planning documents. This section also provides a summary of public consultation, EIA process and EIAR structure. An overview of the planning history of the project has been provided in Volume 2, Section 1.

National and regional plans and policies inform the policies and objectives of local authority Development Plans, and also in this case, the Strategic Development Zone Planning Scheme, which set the local statutory planning context. This section should be read alongside the individual discipline sections in this EIAR, which also include appropriate reference to governing policies and objectives, where relevant.

As outlined in the preceding sections, Dublin City Council are seeking planning permission for a storm water outfall extension at Grand Canal Dock which will discharge to the River Liffey. This application is being made in accordance with Section 226 of the Planning and Development Act 2000 on the basis that it relates to a Local Authority proposed development which is intended to be carried out wholly or partly on the foreshore and which requires environmental impact assessment.

This section has been prepared by Conor Frehill, (BA HONS, Master of Regional and Urban Planning, MRTPI), Director at HW Planning. Conor has 13 years' experience in the planning profession comprising local authority roles and private practice. Conor has acted as planning lead on a wide variety of projects, including those with Environmental Impact Assessment Reports and Strategic Environmental Assessment exercises. His experience extends to planning policy development, local authority plan-making processes, the preparation of evidenced based strategies, leading on community-led planning initiatives, and the coordination of planning applications for mixed use developments, strategic infrastructure and renewable energy projects. Conor is a chartered member of the Royal Town Planning Institute.

3.2 European Context

3.2.1 Environmental Impact Assessment Directive (Consolidated 2011/92/EU and 2014/52/EU)

Environmental Impact Assessment (EIA) is a procedure under the terms of European Directives on the assessment of the effects of certain public and private projects on the environment. The EIA Directive (2014/52/EU) became applicable in Ireland from May 16th, 2017, and amends Directive 2011/92/EU. The EIA Directive(s) have been transposed into Irish legislation by the Planning and Development Acts 2000 to 2019 (the "Planning Acts") and the Planning and Development Regulations, 2001 (as amended). The most recent 2014 EIA Directive has been transposed into Irish Legislation, through the European Union (Planning and Development) (Environmental Impact Assessment) Regulations (S.I. 296 of 2018*)* which came into effect on 1 September 2018 and the EIAR will be prepared in accordance with these Regulations. Projects for which an EIA is mandatory under Annex I of the Directive have been listed under Part 1 of Schedule 5 of the Planning and Development Regulations 2001 - 2018. Similarly, Part 2 of Schedule 5 outlines thresholds for other projects which also require EIA, as per Annex II of the Directive.

In addition, a 'sub-threshold' EIA may be required, if the Planning Authority determines that the development would be likely to have significant effects on the environment. Schedule 7 of the Regulations details the criteria for determining whether a development would or would not be likely to have significant effects on the environment considering the characteristics of the proposed development, its location and characteristics of potential impacts.

In the case of the subject proposal, an EIA Screening Report was carried out in June 2020 by J. B. Barry and Partners (Volume 3, Appendix 1A). This concluded that although the project is sub threshold under Part 2, Class 10 (b) (iv) of Schedule 5 of the Planning and Development Regulations 2000 (as amended), there is a possibility of significant effects on the environment associated with the project. Consequently, adopting the precautionary principle, it was concluded that in the interest of providing a quantified statement of any impacts to the competent authority the project shall be subject to a full EIA, and that an EIAR shall accompany the planning application. An EIA Scoping Report was carried out in November 2020 by J. B. Barry and Partners (Volume 3, Appendix 1B) which outlined the various potential impacts and aspects of the environment to be considered.

3.2.2 Birds and Natural Habitats Directives

Adopted in 1992, the Council Habitats Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora aims to promote the maintenance of biodiversity, taking account of economic, social, cultural and regional requirements. It forms the cornerstone of Europe's nature conservation policy with the Birds Directive 2009/147/EC and establishes the EU wide Natura 2000 ecological network of protected areas, safeguarded against potentially damaging developments.

An Appropriate Assessment (AA) Screening Report was also carried out in June 2020 by J. B. Barry and Partners. This concluded that there was a possibility of significant effects to Natura 2000 sites and that a Natura Impact Statement (NIS) should be prepared. The NIS was carried out in March 2021 by JBA Consulting. The AA NIS has been provided as standalone documents as part of the submitted planning application made directly to An Bord Pleanála by Dublin City Council.

3.2.3 EU Water Framework Directive (2000/60/EC)

The Water Framework Directive (WFD) established a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater with the objective to protect and improve water quality in all waters to achieve good ecological status by 2015 or, at the latest, by December 2027.

Specifically, the WFD aims to:

- Prevent further deterioration and protects and enhances the status of aquatic ecosystems and, with regard to their water needs, terrestrial ecosystems and wetlands directly depending on the aquatic ecosystems;
- Promotes sustainable water use based on a long-term protection of available water resources;
- Aims at enhanced protection and improvement of the aquatic environment, inter alia, through specific measures for the progressive reduction of discharges, emissions and losses of priority substances and the cessation or phasing-out of discharges, emissions and losses of the priority hazardous substances;
- Ensures the progressive reduction of pollution of groundwater and prevents its further pollution; and
- Contributes to mitigating the effects of floods and droughts.

The Water Framework Directive is linked to a number of other EU directives in several ways. These include Directives relating to the protection of biodiversity (Birds and Habitats Directives), directives related to specific uses of waters (drinking water, bathing waters and urban wastewater directives) and to directives concerned with the regulation of activities undertaken in the environment (Industrial Emissions and Environmental Impact Assessment directives). More recent directives on topics such as Floods and the Marine Strategy Framework have significant linkages with the WFD which is also supplemented by the Priority Substances Directive and the Groundwater Directive.

3.2.4 Marine Strategy Framework Directive (2008/56/EC)

The aim of the European Union's ambitious Marine Strategy Framework Directive (MSFD), adopted on 17 June 2008 is to protect more effectively the marine environment across Europe.

The Commission also produced a set of detailed criteria and methodological standards to help Member States implement the Marine Strategy Framework Directive. These were revised in 2017 leading to the new Commission Decision on Good Environmental Status.

Annex III of the Directive was also amended in 2017 to better link ecosystem components, anthropogenic pressures and impacts on the marine environment with the MSFD's 11 descriptors and with the new Decision on Good Environmental Status.

The Commission adopted a report on the first implementation cycle of the Marine Strategy Framework Directive in June 2020. This report, required by Article 20 of the Directive, shows that while the EU's framework for marine environmental protection is one of the most comprehensive and ambitious worldwide, it needs to be supplemented to be able to tackle predominant pressures such as overfishing and unsustainable fishing practices, plastic litter, excess nutrients, underwater noise and other types of pollution.

3.2.5 Public Participation Directive (2003/35/EC)

The public participation part of the Aarhus Convention has been implemented by Directive 2003/35/EC. Under this, the general public has a right to participate effectively in decision-making in environmental matters. Public authorities should enable the public to comment on, for example proposals for projects affecting the environment, or plans and programmes relating to the environment. The outcome of the public participation process should be taken into consideration in the decision-making process. To facilitate this, information should be made available to help members of the public participate in the decision-making process and understand the reasons for it. The requirements under the directive have been transposed into Irish planning law and legislation governing other environmental licenses and consents.

3.3 National Context

3.3.1 Water Services Act 2007

The 2007 Water Services Act sought to legislate for the provision of water services; to give effect to certain acts adopted by institutions of the European communities in respect of those services and, in addition, to make provision for miscellaneous amendments to the local government (water pollution) acts 1977 and 1990 and the fisheries (consolidation) act 1959 and the environmental protection agency act 1992 and certain other enactments relating generally to the provision of water services and to provide for related matters.

3.3.2 Water Services Policy Statement 2018-2025

The purpose of the Policy Statement, the first to be prepared under the Water Services Act 2017 is to clarify - for Irish Water and for others – the government's expectations for the delivery and development of water and wastewater services.

The statement outlines plans for investment of €8.5 billion in public water services between 2018 and 2027. Among the policy objectives outlined in the plan include:

'Bringing and maintaining public water and wastewater services to acceptable international benchmarks, verified by independent monitoring and reporting.

Achieving improved outcomes in quality in respect of drinking water and in wastewater in relation to rural and private water services.

Adopting forward planning and risk management approaches to minimise the impact of non-compliances with all relevant EU Directives and to safeguard against future compliance risks'.

The document refers to the River Basin Management Plan for Ireland which aims, inter alia, to prioritise investment in urban wastewater management to support the protection of high-status waters and to achieve water quality improvements in other water bodies to support the achievement of objectives for designated shellfish-growing and bathing waters.

3.3.3 River Basin Management Plan for Ireland 2018-2021

The River Basin Management Plan outlines the approach that Ireland will take for the protection of waters over the period to 2021. The Plan builds on the work of its predecessor and the development of an enhanced evidence-base to guide policy and the targeting of local measures. The Plan contains an extensive list of key actions, which include the following:

- Investment in wastewater treatment by Irish Water to help improve water quality and prevent deterioration of quality in targeted water bodies;
- Scientific assessments of water bodies and implementation of focused local implementation measures to address water quality issues; and
- The development of water and planning guidance for local authorities to help consider the risks to water quality during planning and development decision-making.

3.3.4 Project Ireland 2040 – National Planning Framework

The National Planning Framework (NPF) is the principal national planning policy document for the country. The purpose of the document is to create the conditions to successfully accommodate growth and positive change. The NPF includes a list of 'shared goals' across the country framed as 10 National Strategic Outcomes (NSO) which are set out in Figure 3.1. This includes NSO 9 related to 'Sustainable Management of Water, Waste and Other Environmental Resources'. Water Infrastructure is listed as a strategic investment priority in the NPF.

Figure 3.1 National Strategic Outcomes (Extract from National Planning Framework)

A key focus of the NPF is the achievement of 'compact, smart, sustainable growth'. In the case of Dublin, the framework identifies some key future growth enablers to achieve same, inclusive of the following:

- *'Identifying a number of ambitious largescale regeneration areas for the provision of new housing and employment throughout the city and metropolitan area and the measures required to facilitate them as integrated, sustainable development projects;*
- *Improving sustainability in terms of energy, waste and water, to include district heating and water conservation;*
- *Public realm and urban amenity projects, focused on streets and public spaces, especially in the area between the canals and where linked to social regeneration projects; and*

- *Delivery of the metropolitan cycle network set out in the Greater Dublin Area Cycle Network Plan inclusive of key commuter routes and urban greenways on the canal, river and coastal corridors'.*

The protection and enhancement of water resource and development of green ecosystems are key focuses in the NPF, as reflected in a number of dedicated objectives.

National Policy Objective 57:

- *'Ensuring that River Basin Management Plan objectives are fully considered throughout the physical planning process'.*

National Policy Objective 60:

'Conserve and enhance the rich qualities of natural and cultural heritage of Ireland in a manner appropriate to their significance'.

National Policy Objective 63:

'Ensure the efficient and sustainable use and development of water resources and water services infrastructure in order to manage and conserve water resources in a manner that supports a healthy society, economic development requirements and a cleaner environment'.

3.3.5 Maritime Area Planning Act

The Maritime Area Planning Act was signed into law on the 23rd December 2021. The planning system will now operate within a newly defined 'maritime area' which is defined as everything from the high-water mark to the outer limit of Ireland's continental shelf (a maximum of 350 nautical miles from shore). The Act provides for the establishment of the Maritime Area Regulatory Authority ("MARA"), which will be responsible for the granting of Maritime Area Consents, licences and the enforcement of this newly established regulatory regime. It is anticipated that the MARA will come into existence in 2023. The Act allows the Minister to issue accompanying regulations, as well as marine planning guidelines and policy directives, similar to existing provisions for land-based planning.

3.4 Regional Strategy and Guidelines

The Regional Spatial and Economic Strategy for the Eastern and Midland Region (RSES) is a 12-year strategic regional development framework to guide development in the region. It establishes a broad framework for the way in which society, environment, economy and the use of land should evolve. The primary aim of the RSES is to implement Project Ireland 2040 at the regional tier.

The Strategy indicates that collaboration between national, regional and local public bodies is crucial to ensuring our water and environmental resources are managed properly for the future, including incorporating a circular economic approach.

The RSES seeks the provision of infrastructure and services in a sustainable, planned and infrastructure led manner to ensure the sustainable management of water, waste and other environmental resources. The key Regional Policy Objectives (RPOs) relating to the sustainable management of water and the achievement of water quality include:

3.4.1 Water Quality

RPO 7.10: '*Support the implementation of the Water Framework Directive in achieving and maintaining at least good environmental status for all water bodies in the Region and to ensure alignment between the core objectives of the Water Framework Directive and other relevant Directives, River Basin Management plans and local authority land use plans'.*

3.4.2 Greenways / Blueways

RPO 7.25*: 'Support local authorities and state agencies in the delivery of sustainable strategic greenways, blueways, and peatways projects in the Region under the Strategy for the Future Development of National and Regional Greenways'.*

Chapter 7 underlines the importance of developing a clean and well-protected environment to support human health and wellbeing, whilst providing a natural resource for tourism. Within this, the strategy identifies the potential *"to position Dublin Docklands as a significant water-focussed amenity and develop the Grand Canal and Spencer Docks as the urban gateways to the Grand and Royal Canals".*

3.4.3 Wastewater Treatment

RPO 10.10*: 'Support Irish Water and the relevant local authorities in the Region to eliminate untreated discharges from settlements in the short term, while planning strategically for long term growth in tandem with Project Ireland 2040 and in increasing compliance with the requirements of the Urban Waste Water Treatment Directive from 39% today to 90% by the end of 2021, to 99% by 2027 and to 100% by 2040'.*

3.4.4 Surface Water

RPO 10.15: *'Support the relevant local authorities (and Irish Water where relevant) in the Region to improve storm water infrastructure to improve sustainable drainage and reduce the risk of flooding in the urban environment and in the development and provision at a local level of Sustainable Urban Drainage solutions'.*

RPO 10.16: *'Implement policies contained in the Greater Dublin Strategic Drainage Study (GDSDS), including SuDS'.*

3.5 Local Policy

3.5.1 Dublin City Development Plan 2016-2022

The Dublin City Development Plan (2016-2022) sets out policies and objectives to guide how and where development will take place in the city over the lifetime of the Plan.

Chapter 4 of the Plan establishes the shape and structure for Dublin City in planning terms. In relation to the continued development of Dublin Docklands, it states that the key challenge is ensuring that that character is retained and enhanced and that the Docklands is seen as being an integral part of the city centre. It notes, inter alia, that *'the active use of the public realm in the Docklands to host events and the use of the waterbodies, such as the Grand Canal Dock, for active leisure or recreational uses significantly enhances the vitality of this evolving urban environment'.*

Chapter 8 of the Plan relates to Movement and Transport and the achievement of key sustainability objectives for city. This includes a suite of road and bridge improvements, including those required as part of the North Lotts and Grand Canal Dock SDZ. Ongoing traffic management, including during the construction phase of projects, is identified as a key policy objective:

MT21: *'To improve the management and control of traffic in the city, to increase internal and external sustainable accessibility, to improve road safety, to safeguard commercial servicing requirements, to mitigate the impact of construction works and to minimise the adverse environmental impacts of the transport system'.*

The Plan identifies the North Lotts and Grand Canal Dock SDZ as the principal scheme for the focused development of the Docklands, where the development of recreation and leisure amenities, and public realm are identified as key supporting infrastructure to be delivered commensurate with employment and housing development. The Plan includes a general committed that *'the Council will continue to work with all stakeholders in the Docklands area to ensure the successful delivery of the SDZ in relation to both public and private investment'.*

Chapter 9 of the Plan relates to 'Sustainable Environmental Infrastructure'. It identifies that pollution of water sources, including from surface water, poses a significant risk. It sets out a strategic approach to tackling key infrastructure issues, which includes the following:

- 'Ensuring the implementation of the recommendations and actions of Irish Water's 'Water Services Strategic Plan 2015 – A Plan for the Future of Water Services'; and
- Ensuring the implementation of the measures and actions set out in the River Basin Management Plan and Programme of Measures to achieve the objectives and targets set out therein, and thereby implement the Water Framework Directive'.

This is formalised under a number of key policies and objectives:

SI14: *'To promote and maintain the achievement of at least good status in all water bodies in the city'.*

SI16: *'To promote the protection and improvement of the aquatic environment, including through specific measures for the progressive reduction or cessation of discharges and emissions'.*

SI06: *'To implement the European Union Water Framework Directive through the implementation of the appropriate River Basin Management Plan and Programme of Measures'.*

SI013: *'To provide additional and improved surface water networks to both reduce pollution and allow for sustainable development'.*

Dublin City Council has adopted a number of policies to help manage environmental air quality and noise exposure throughout the city.

SI24:*'To monitor and improve air quality in accordance with national and EU policy directives on air quality and, where appropriate, promote compliance with established targets'.*

SI25: *'To seek to preserve and maintain air and noise quality in the city in accordance with good practice and relevant legislation'.*

Chapter 10 of the Plan 'Green Infrastructure, Open Space & Recreation' recognises that landscape and key open spaces in Dublin City provide for critical amenity, sense of identity and place. It is Council policy to promote and develop these as key resources.

GI07: *'To promote the city landscapes, including rivers, canals and bay, as a major resource for the city and forming core areas of green infrastructure network'.*

Figure 15 of the Plan identifies existing and proposed green routes in the city, which includes a network within and around Grand Canal Dock. Refer to Figure 3.2.

Figure 3.2 Extract from Figure 15 City Centre Green Routes, Dublin City Development Plan 2016-2022

The theme of safeguarding and sustainably developing water-side and water-based amenities if further supported by the following:

GI17: *'To develop sustainable coastal, estuarine, canal and riverine recreational amenities to enhance appreciation of coastal natural assets in a manner that ensures that any adverse environmental effects are avoided, remedied or mitigated'.*

GI017: *'To seek the continued improvement of water quality, bathing facilities and other recreational opportunities in the coastal, estuarine and surface waters in the city and to protect the ecology and wildlife of Dublin Bay'.*

GIO32: 'To endeavour to provide play spaces in every neighbourhood in the city, which are open to public use'.

Grand Canal Dock is part of historic quays along the River Liffey and is within a zone of Archaeological Potential. There are a number of recorded monuments and sites within the study area, the protection of which is provided for under the Plan.

CHC1: *'To seek the preservation of the built heritage of the city that makes a positive contribution to the character, appearance and quality of local streetscapes and the sustainable development of the city'.*

3.5.2 Draft Dublin City Development Plan 2022-2028

Dublin City Council is presently reviewing the current Dublin City Development Plan 2016-2022 and preparing a new City Development Plan for the period 2022-2028. The pre-draft consultation ended on the 22nd February 2021. Stage 2 of the process commenced on the 25th November 2021 when the Draft Plan was put on public display.

Section 10.5.5 of the Draft Plan emphasises the importance of the city's rivers and canals as an integral part of the green infrastructure network. It highlights that the city's river are not achieving 'good ecological status' as per the Water Framework Directive. This is due to a number of factors including upstream pollution, sewer overflows / misconnections and urban runoff. In response, the Draft Plan promotes the protection, creation and/or enhancement of riparian buffer zones to benefit rivers as well as opportunities for river restoration. It is noted that this will increase the potential to filter out pollutants and sediments from over-land surface run-off, provide significant amenity and recreational value, and enhance food management. This is formalised under Draft Policy Objective GI29 Protect Character of River Corridors.

GI29: 'To protect, maintain, and enhance the watercourses and their river corridors in the city and to ensure that development does not cover or encroach upon rivers and their banks. To maintain natural river banks and restore them as part of any new development. The creation and/or enhancement of river corridors will be required and river restoration opportunities where possible will be supported to help improve water quality, and ecology, provide natural flood relief as well as providing amenity and leisure benefits'.

The Draft Plan includes a focused objective to deliver on the Water Animation Strategy for the Docklands.

GI034: '*To support the implementation of the North Lotts and Grand Canal Dock SDZ Docklands Water Animation Strategy 2018 to promote the Dublin Docklands as a significant water focussed amenity and the sustainable use of the waterways as an integral part of the vitality and experience of Dublin Dock - lands, that enhances the area as a world class destination for living, doing business, tourism, leisure and cultural activities'*.

The new Dublin City Development Plan 2022-2028 is expected to be adopted in December 2022.

3.5.3 North Lotts and Grand Canal Dock Strategic Development Zone (SDZ)

On the 18th December 2012 the government designated part of the Dublin Docklands' area at North Lotts and Grand Canal Dock as a strategic development zone (SDZ), refer to Figure 3.3. The planning scheme for the area was approved by An Bord Pleanála on the 16th May 2014 and has directly shaped the planning and development of the 66 hectare area over the intervening years.

Chapter 3 of the scheme establishes a vision and high-level themes for the area, which includes:

- **Sustainability**, including flood management, energy conservation and sustainable movement, but also as a contribution to reducing urban sprawl, enhancing the green economy, creating a more healthy, socially inclusive, and ultimately a more resilient city;
- **Quality of Life**, including the achievement of a safe, supportive, external environment, incorporating recreational facilities, public spaces, life-affirming social infrastructure, including any necessary educational facilities. The scheme identifies that it *'is a key principle to promote a green/ blue network providing public access recreational and bio-diversity opportunities, particularly along all the water bodies';*
- **Identity**, to create a distinctive Dublin maritime quarter. It is this unique character which will distinguish Dublin Docklands on the global stage. This can be achieved on a number of fronts, including reimagining the existing heritage to providing for new active uses and providing a context for a rich urban landscape;
- **Infrastructure**, both physical and social, including drainage, water supply, electricity, gas, telecommunications and flood management, all of which are necessary to promote quality neighbourhoods, employment and a good ecological environment; and
- **Movement & Connectivity**, by making a safe and efficient public realm which caters for walking, cycling, public transport and the car. Increased connectivity across and along the water bodies is also a component of this key theme.

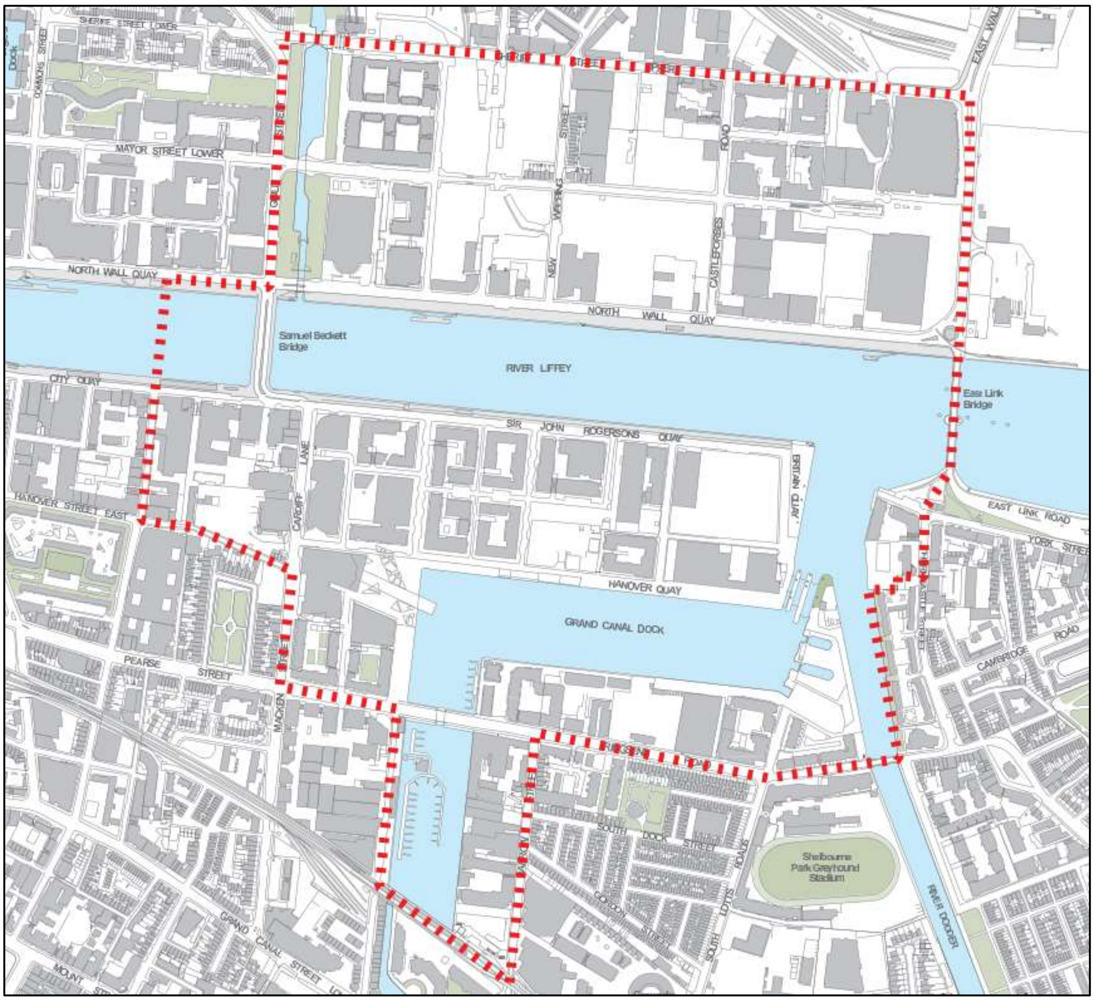


Figure 3.3 Extract from Figure 1 of North Lotts and Grand Canal Dock SDZ, showing extent of study area

Chapter 4 of the Scheme identifies that there are proposals to relocate the Grand Canal Surface Water Outfall from the Grand Canal Dock to the River Liffey. Figure 16 of Scheme includes an outline of existing and proposed drainage infrastructure in the SDZ area, which includes outline of the subject planned infrastructure works. Refer to Figure 3.4 below.

The delivery of this infrastructure is supported by a specific policy objective:

SI3: *'To complete, as a priority, the relocation of the Grand Canal Surface Water Outfall from the Grand Canal Dock Basin to the River Liffey'.*

Independent of this, the scheme emphasises that all future development will be required to be drained on a completely separate system, i.e. both foul and rainwater flows should be directed to separate pipes, noting that this reduces the possibility of flooding of the foul pipelines during times of extreme rainfall events.

The following policy objectives also apply to the general development of the area:

SI7: *'To promote the achievement of good ecological status, good ecological potential and good chemical status for the length of the Liffey WMU by 2027 and to implement the programme of measures set out in the River Basin Management Plan 2009 – 2015, in accordance with the Water Framework Directive (WFD) 2000/60/EC'.*

SI8: *'That all new developments shall be required to comply with the standards set out in the Greater Dublin Strategic Drainage Study (GDSDS)'.*

SI9: *'To achieve best practise and innovations in SUDS design as part of the planning scheme, including the successful co- ordination of surface water management with ecology and amenity functions of open space and landscaped areas. All planning applications shall be accompanied by a surface water drainage plan which will include proposals for the management of surface water within sites, protecting the water quality of the existing water bodies and ground water sources, and retrofitting best practice SUDS techniques on existing sites, where possible'.*

SI18: *'To ensure that surface water quality is protected in the construction of enhanced drainage works to meet requirements of the Water Framework Directive'.*

SI19: *'To ensure the protection of surface and ground water quality in the plan area and surrounding areas, and the protection of protected habitats and species including designated national and international conservation sites in implementing the plan'.*

SI21: *'To require that each planning application be accompanied by a Construction Management Plan, which shall include information on construction traffic routes, hours of operation, control of noise, and environmental effects'.*

Section 4.6.5.4 'Built Heritage' of the scheme includes focused commentary on the heritage value of Grand Canal Dock, emphasising that proposals should seek to conserve the character and physical integrity of distinguishing features and minimise interference in original maritime, river and transport heritage including quay walls. It also recognises the importance of the protection of the visual amenity of known heritage sites and features, as well as historic views and vistas. New development is required to consider the landscape quality of the Docklands and the protection of same is formalised through an analysis of key views and prospects.

The approach to heritage and landscape conservation and heritage is formalised through a suite of key policy objectives, which include:

BH1: *'To ensure that the architectural and historic significance of the Docklands Area is protected, conserved and enhanced, to include areas of significant streetscape and urban landscape'.*

BH3: *'To ensure that new development respects the significance of the site and is appropriate to its historic, spatial context'.*

BH4: *'To conserve the character and physical integrity of the Grand Canal Dock and its sea locks, the graving docks, historic marine artefacts, street furniture, views and vistas to preserve its identity'.*

BH8: *'To minimise interference in original maritime and river and transport heritage, thereby protecting quays, canal walls, docks, graving docks' industrial fabric and allowing space around these features for amenity purposes'.*

BH9: *'To retain historic paving and street furniture, in addition to maritime features such as mooring rings and the mid-18th century street grid pattern of North Lotts'.*

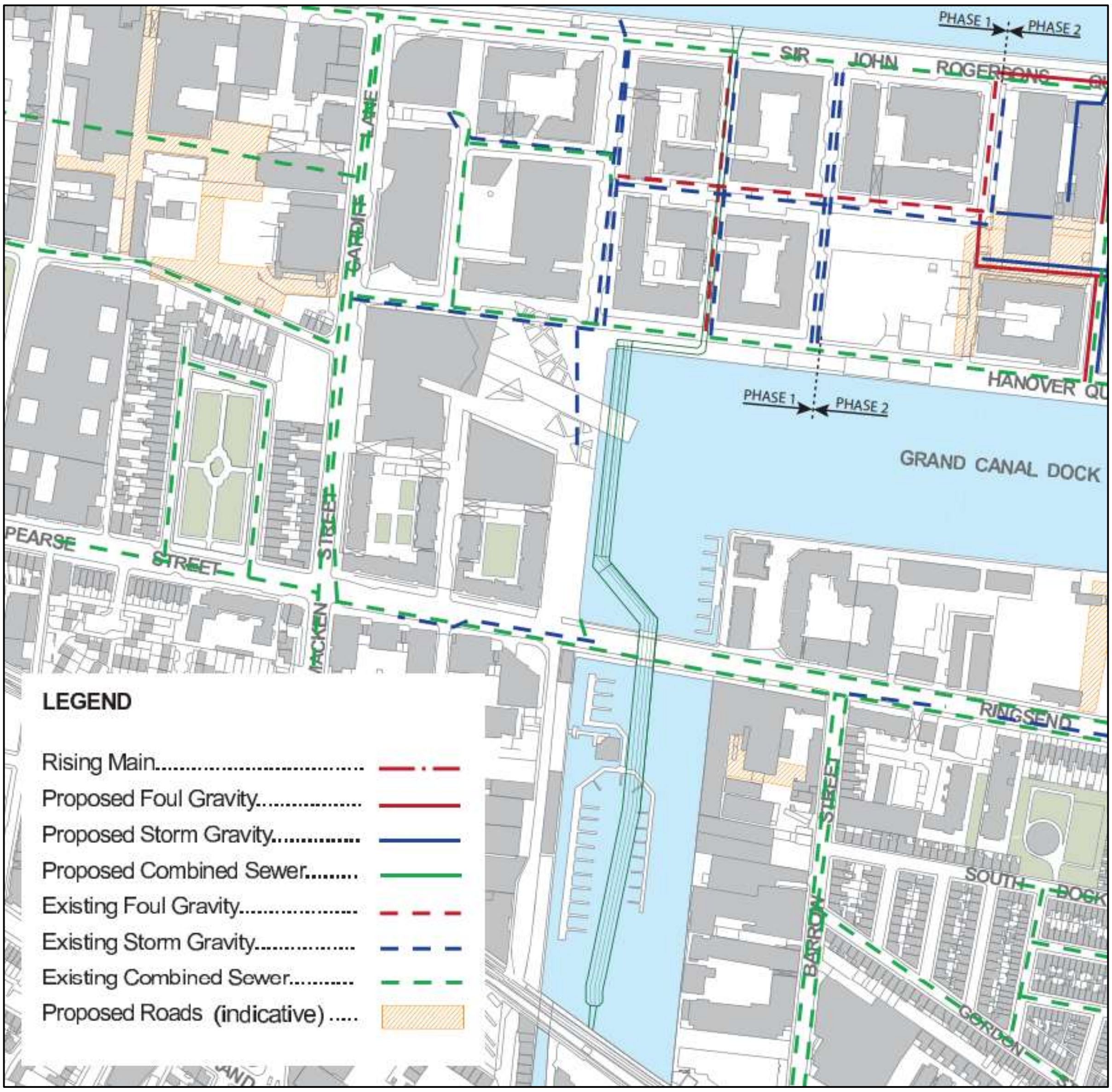


Figure 3.4 Extract from Figure 16 of North Lotts and Grand Canal Dock SDZ, showing existing and proposed drainage infrastructure

It is key policy focus of the Scheme to leverage the unique maritime qualities and city centre location of the Docklands to further develop the areas' tourism and leisure offer. Within this, it is noted that the historic character of the Docklands is '*embodied in its vital relationship with the water bodies',* but that maximising the recreational, tourism and cultural use of these in the area remains a challenge due to heritage and environmental sensitivities. The Planning Scheme encourages the use of the waterfront and water bodies for family attractions, outdoor activities, sports events and the development of waterside facilities.

TL1: *'To promote the water bodies as part of Docklands' identity and ensure water-based leisure, business, tourist and sporting activities are encouraged and supported in a sustainable manner'.*

TL2: *'To promote the SDZ area as a destination for cultural tourism and encourage the use of Grand and Royal Canals for leisure and recreational purposes'.*

TL6: *'To support retention of existing leisure and sports activities in the area and encourage new facilities for the Docklands community and visitors to the area, and that they meet the needs of all members of the existing and future communities'.*

TL9: *'To promote the recreational use of the water including the rowing, paddling and boating club activities in the area and to seek to ensure that any new infrastructure is provided in a manner which safeguards and protects these recreational resources'.*

Under the 'Environment, Open Space & Green Infrastructure' section, the Scheme again seeks to ensure that waterside development facilitates recreational activities in a planned and safe manner for the new communities. As part of this, it is also an objective to protect and enhance biodiversity value.

GI12: *'To enhance the bio-diversity value of the local area by protecting habitats, in particular along water bodies, and to create opportunities for new habitats through appropriate native species landscaping schemes, to integrate the natural environment with high-quality urban development'.*

The theme of promoting water-based recreation and events is continued again in Chapter 4.12 of the Scheme related to 'Public Realm', which includes the following focused objectives:

PR2: *'To promote water-based recreation and events'.*

PR10: *'To support the development of flexible and moveable publicly accessible leisure facilities on the water space and the campshires to facilitate changes in demand'.*

3.6 Other Reports/ Support Studies

3.6.1 Dublin Docklands Social Infrastructure Audit 2015

A supporting evidence base document for the North Lotts and Grand Canal Dock SDZ, this report was commissioned to examine the current context with respect to social infrastructure provision in the Dublin Docklands, to determine future requirements and make recommendations on priority areas for investment.

The report highlights that more could be done to utilise the valuable water-based amenities of the area, particularly during summer months. This would engender important quayside vibrancy and help expand the recreational sports offer in the Docklands. It identifies the need for the formal development of an improved programme of water-based activities. It states that a concentrated effort should also be made to safeguard the presence of existing clubs with a focus on water-based activities.

3.6.2 North Lotts and Grand Canal Dock SDZ Water Animation Strategy 2018

In 2018, Dublin City Council prepared this strategy in consultation in Waterways Ireland and Dublin Port Company.

The strategy positions Grand Canal Dock as a vibrant area which has emerged as one of the busiest in the city and that this has been complemented *"on-water by a range of tourist and leisure craft and water sports activities"*. It notes that due to water quality issues, immersive water sports are not currently permitted, with the following opportunity identified:

'Improved water quality to improve user experience and enhance biodiversity. Creation of a 'Blue Playground' within the Grand Canal Dock that allows for the delivery of an all year around local, national and international immersive water based events and animation program'.

The Implementation section of the strategy includes 6 planned actions to be advanced by the Council in partnership with Waterways Ireland, Dublin Port Company and Irish Water, with listed action 3 stating the following:

'Proceed with planning application and detailed engineering design for the extension of the surface water outfall from into Grand Canal Dock to the Liffey to improve water quality in Grand Canal Dock'.

The Water Animation Strategy Map identifies areas within the Grand Canal Dock for uses which include short stay/visit ships, docking and mooring zones (including licensed berths), active sport zones, and passive zones. Refer to Figure 3.5 below.

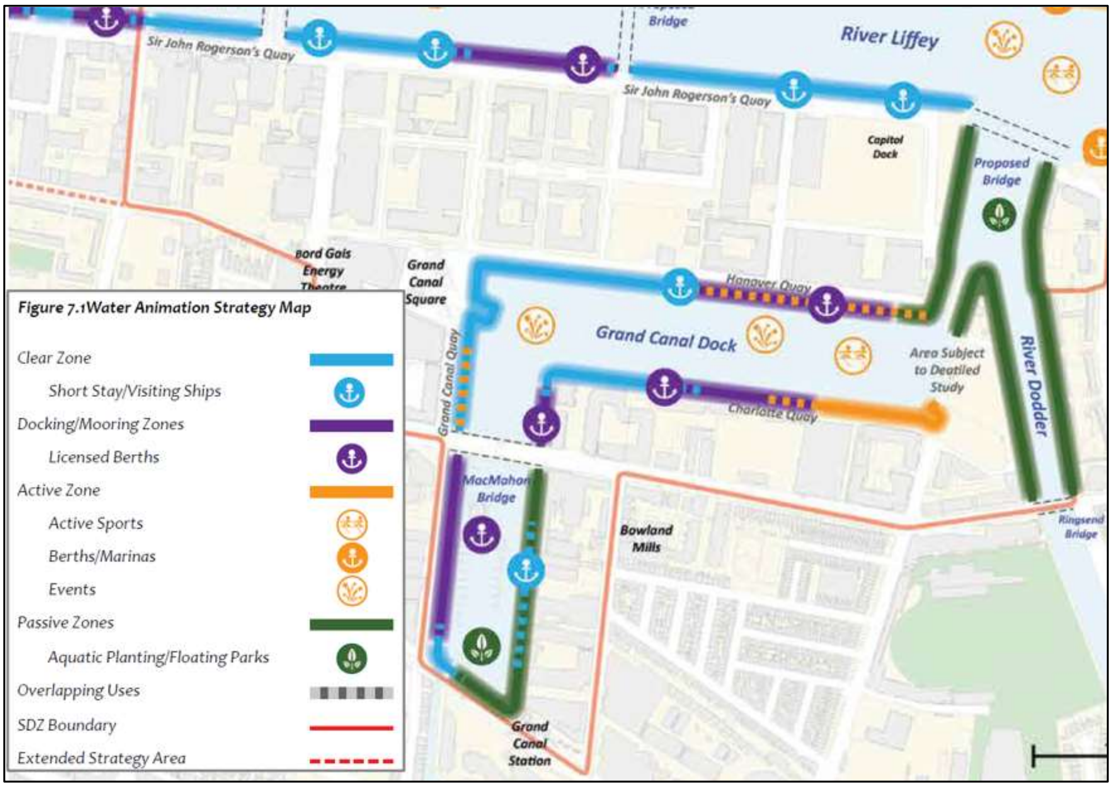


Figure 3.5 Extract from Water Animation Strategy Map

3.6.3 'Waters Edge' Tourism Framework for Docklands

Prepared as a joint initiative between CHQ/EPIC, Fáilte Ireland, Dublin City Council and Waterways Ireland with input from a range of existing businesses in the area, this document was prepared with a focus on developing a strong tourism plan for the Docklands. It includes three key clusters around which the appeal of the area is framed, one of which is Grand Canal Dock. The recommended actions of the report include the following:

- Capital investment to remedy the water quality issue to achieve all year bathing water quality to deliver Grand Canal Dock as The Blue Playground in Dublin;
- Creation of a water sports hub on Charlotte Quay; and
- Develop a year-round programming and animation strategy to provide an exciting and balanced range of heritage, cultural, sports, recreational and wellbeing activities.

3.6.4 Grand Canal Basin Amenity Project Joint Working Group Report

Building on the preceding work in relation to the Water Animation Strategy and Waters Edge Framework, this report assesses impact on policy objectives arising from water quality concerns in the Grand Canal Basin. Based on concentrated period of survey work between September 2017 and May 2018, it establishes that the major contributory factor leading to the reduced water quality in the basin is the Grand Canal Tunnel Surface Water Outfall which is inhibiting the use of the basin as a water amenity. It identifies that the solution to the problem is the removal of the outfall from the dock, and secondly, that analysis on the benefits accruing from the relocation of the Grand Canal Tunnel outfall to the River Liffey justify the estimated costs of such work, subject to a more detailed cost benefit analysis.

3.7 EIA Process

3.7.1 Introduction

The purpose of this Section of the EIAR is to demonstrate the process that has been undertaken in the preparation and submission of this EIAR. This EIAR has been prepared in accordance with Article 1(2)(g) of the EIA Directive 2014/52/EU (the EIA Directive), which describes an EIA as a process consisting of:

- "*the preparation of an environmental impact assessment report by the developer, as referred to in Article 5(1) and (2);*
- *the carrying out of consultations as referred to in Articles 6 and, where relevant, Article 7;*
- *the examination by the competent authority of the information presented in the environmental impact assessment report and any supplementary information provided, where necessary, by the developer in accordance with Article 5(3), and any relevant information received through the consultations under Articles 6 and 7;*
- *the reasoned conclusion by the competent authority on the significant effects of the projects on the environment, taking into account the results of the examination referred to in point (iii) and, where appropriate, its own supplementary examination; and*
- *the integration of the competent authority's reasoned conclusion into any of the decisions referred to in Article 8a".*

The EIA process is described in the EU guidelines (2017) as-

"*The process of carrying out an Environmental Impact Assessment as required by Directive 2011/92/EU, as amended by Directive 2014/52/EU on assessment of the effects of certain public and private Projects on the environment. The EIA process is composed of different steps: preparation of the EIA Report, publicity and consultation and decision-making*."

The structure and general sequence of this EIAR follows the EPA Guidelines (May 2022), as illustrated in Figure 3.6 below. The process consists of the following steps or stages:

- **Screening -** Determining whether an EIA is required or not;
- **Scoping -** If an EIA is required, then the scope of the EIAR is established;
- **EIAR -** An Environmental Impact Assessment Report (EIAR) is prepared by the Applicant as part of the consent application. The EIAR sets out among other things a statement of the likely significant effects, if any, which the proposed project, if carried out, would have on the environment;
- **EIA -** Once the application is lodged, the competent authority (CA) (in this case, ABP) examines the EIAR, circulating it to statutory consultees while also making it available to the public. In addition to its own consideration of the information presented in the EIAR the CA takes account of other information submitted by the applicant, certain authorities and the public during the consent process; and
- **Consent Decision -** The consent decision is a key milestone which marks the end of the formal EIA process. The implementation of mitigation measures and any monitoring measures contained in the EIAR and consent decision continues after the formal EIA process is complete.

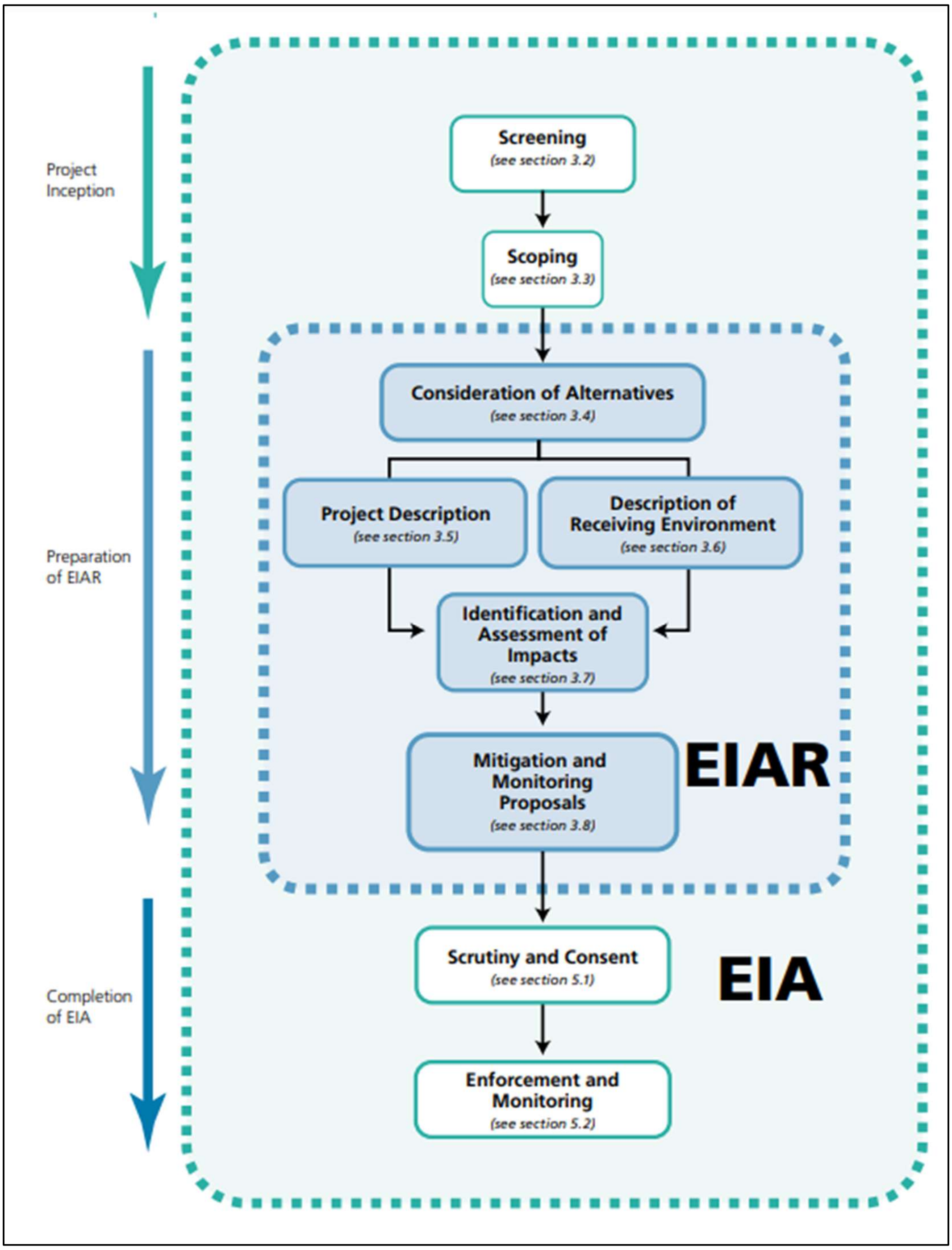


Figure 3.6 EIA Process*

(*Source: Guidelines on the Information to be Contained in Environmental Impact Assessment Report (May 2022))

3.7.2 Screening

The proposed GCSWOE was screened early in the design phase to establish the requirement for an EIA. In accordance with the EIA Directive, EU Guidelines (2017), EPA Guidelines (2022) and applicable legislation, the project was examined in the context of 'type of development' and 'thresholds'.

Article 4(1) and Annex I of the EIA Directive (2014/52/EU) lists projects for which an EIA is mandatory, whereas Article 4(2) and Annex II lists project types for which an EIA may be required. The EIA Screening Report is contained in Volume 3, Appendix 1A.

3.7.3 Scoping

The scoping stage of the EIAR is a process of determining the content and extent of the matters which should be covered in the environmental information to be submitted in the EIAR.

The scoping exercise considered such matters as:

- Content, structure, and format of the EIAR;
- Methods and criteria to be used in predicting and evaluating impacts;
- Likely significant impacts of the project, during its construction and operational phase;
- Scope of the study required for each of the EIAR environmental topics;
- Available data and information and determination of where additional surveys and investigations are required;
- Alternatives and mitigation measures to be considered as part of the project;
- Legislative requirements; and
- Any additional consultation requirements.

As part of the scoping stage, the *Environmental Impact Assessment Scoping Report* (Volume 3, Appendix 1B) was prepared by J.B. Barry and Partners Ltd. and issued to the relevant prescribed bodies and local authorities.

3.7.4 EIAR Structure

This EIAR has been completed in accordance with the requirements as set out in the EIA Directive, (2014/52/EU) and relevant guidelines and documentation, including:

- Guidelines on the Information to be contained in Environmental Impact Assessment Report (EPA, 2022);
- Draft Guidelines on the Information to be contained in Environmental Impact Statements (EPA, 2017);
- Advice Notes for Preparing Environmental Impact Statements Draft (EPA, 2015); and
- Guidance on the preparation of Environmental Impact Assessment Report (Directive 2011/92/EU as amended by 2014/52EU) (EU, 2017).

The composition of this EIAR is in accordance with EPA Guidelines (2022) which requires that information contained within an EIAR should be in accordance with Article 3(1), Article 5(1) and any additional information specified under Annex IV under the Directive 2014/52/EU.

The structure of this EIAR is as follows:

- Volume 1 Non-Technical Summary;
- Volume 2 Environmental Impact Assessment: Main Report;
  - Section 1 Introduction;
  - Section 2 Description of the Proposed Development;
  - Section 3 Legislative Context;
  - Section 4 Assessment of Alternatives;
  - Section 5 Population and Human Health;
  - Section 6 Biodiversity;
  - Section 7 Water Quality and Hydrology;
  - Section 8 Land, Soils, Geology and Hydrogeology;
  - Section 9 Air Quality and Climate;
  - Section 10 Noise and Vibration;
  - Section 11 Traffic and Transport;
  - Section 12 Archaeology and Cultural Heritage;
  - Section 13 Waste Management;
  - Section 14 Material Assets;
  - Section 15 Landscape and Visual Impact;
  - Section 16 Interactions;
  - Section 17 Summary of Mitigation;
  - Section 18 Summary of Residual Impacts; and

– Section 19 Cumulative Impacts.

- Volume 3 Environmental Impact Assessment Report: Appendices; and
- Volume 4 Project Drawings.

Article 5(1) and Annex IV of the EIA Directive provides detail on the information to be included in an EIAR. Table 3.1 provides a checklist of the information referred to in Article 5(1) with a confirmation of where the relevant information is contained within the EIAR.

Table 3.1 Article 5(1) Checklist

Information Referred to in Article 5(1)	EIAR Section
1. Description of the project, including in particular:	
(a) a description of the location of the project;	Volume 2, Section 2
(b) a description of the physical characteristics of the whole project, including, where relevant, requisite demolition works, and the land-use requirements during the construction and operational phases;	Volume 2, Section 2
(c) a description of the main characteristics of the operational phase of the project (in particular any production process), for instance, energy demand and energy used, nature and quantity of the materials and natural resources (including water, land, soil and biodiversity) used;	Volume 2, Section 2
(d) an estimate, by type and quantity, of expected residues and emissions (such as water, air, soil and subsoil pollution, noise, vibration, light, heat, radiation) and quantities and types of waste produced during the construction and operation phases.	Volume 2, Section 2 Volume 2, Section 5 to Section 19
2. A description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects.	Volume 2, Section 4
3. A description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution thereof without implementation of the project as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge.	Volume 2, Section 1 to Section 3
4. A description of the factors specified in Article 3(1) likely to be significantly affected by the project: population, human health, biodiversity (for example fauna and flora), land (for example land take), soil (for example organic matter, erosion, compaction, sealing), water (for example hydromorphological changes, quantity and quality), air, climate (for example greenhouse gas emissions, impacts relevant to adaptation), material assets, cultural heritage, including architectural and archaeological aspects, and landscape.	Volume 2, Section 5 to Section 19
5. A description of the likely significant effects of the project on the environment resulting from, inter alia:	
(a) the construction and existence of the project, including, where relevant, demolition works;	Volume 2, Section 3 Volume 2, Section 13
(b) the use of natural resources, in particular land, soil, water and biodiversity, considering as far as possible the sustainable availability of these resources;	Volume 2, Section 5 to Section 19

Information Referred to in Article 5(1)	EIAR Section
(c) the emission of pollutants, noise, vibration, light, heat and radiation, the creation of nuisances, and the disposal and recovery of waste;	Volume 2, Section 5 to Section 19
(d) the risks to human health, cultural heritage or the environment (for example due to accidents or disasters)	Volume 2, Section 5 Volume 2, Section 12 Volume 2, Section 6
(e) the cumulation of effects with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources;	Volume 2, Section 19
(f) the impact of the project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change;	Volume 2, Section 5 to Section 19
(g) the technologies and the substances used.	Volume 2, Section 2 to Section 15 Volume 4, Project Drawings
The description of the likely significant effects on the factors specified in Article 3(1) should cover the direct effects and any indirect, secondary, cumulative, transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the project. This description should take into account the environmental protection objectives established at Union or Member State level which are relevant to the project.	Volume 2, Section 5 to Section 19
6. A description of the forecasting methods or evidence, used to identify and assess the significant effects on the environment, including details of difficulties (for example technical deficiencies or lack of knowledge) encountered compiling the required information and the main uncertainties involved.	Volume 2, Section 5 to Section 19
7. A description of the measures envisaged to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects on the environment and, where appropriate, of any proposed monitoring arrangements (for example the preparation of a post-project analysis). That description should explain the extent, to which significant adverse effects on the environment are avoided, prevented, reduced or offset, and should cover both the construction and operational phases.	Volume 2, Section 5 to Section 19
8. A description of the expected significant adverse effects of the project on the environment deriving from the vulnerability of the project to risks of major accidents and/or disasters which are relevant to the project concerned. Relevant information available and obtained through risk assessments pursuant to Union legislation such as Directive 2012/18/EU of the European Parliament and of the Council (*) or Council Directive 2009/71/Euratom (**) or relevant assessments carried out pursuant to national legislation may be used for this purpose provided that the requirements of this Directive are met. Where appropriate, this description should include measures envisaged to prevent or mitigate the significant adverse effects of such events on the environment and details of the preparedness for and proposed response to such emergencies.	Volume 2, Section 5 to Section 19
9. A non-technical summary of the information provided under points 1 to 8.	Volume 1
10. A reference list detailing the sources used for the descriptions and assessments included in the report.	Volume 2, Section 5 to Section 19

Section Layout

Each environmental topic contained within the Volume 2 of the EIAR, has been structured according to EPA Guidelines (2022) and will generally be presented under the following headings:

Introduction

Each Section will be introduced by the specialist, providing an overview of the relevant matters to the individual assessment.

Methodology

Provides detail on the guidelines and methodologies relevant to the assessment.

Receiving Environment

In individual Sections, the receiving environment contains a summary of the existing environment, focusing on aspects of the project relevant to the individual assessment.

Characteristics of the Development

The characteristics of the project included in each section is a summary description of the proposed GCSWOE project elements and activities that are relevant to the individual assessment. A detailed description of the proposed project is provided in Volume 2, Section 2 Description of Proposed Development.

Potential Impacts

In accordance with the EPA Guidelines (2022), potential effects may include direct effects and any indirect, secondary, cumulative, transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the project.

The assessment of impacts will also consider a "Do-Nothing" impact where appropriate. In other words, a description of the environment as it would be in the future if the proposed GCSWOE was not carried out.

The assessment of any potential impacts in each environmental topic is described in terms of 'Quality', 'Significance', 'Magnitude', 'Probability', 'Duration', and 'Type'. The description and criteria for describing and rating impacts and effects are outlined in greater detail under Section 3.7.5 below.

Mitigation Measures

A description of any specific mitigation measures envisaged to avoid, permit, reduce or, if possible, eliminate any significant adverse effects on the environment identified under the assessment of potential impacts described above.

Cumulative Impacts

The cumulative impact assessments have been undertaken by each specialist and outlined in each relevant Section of this EIAR. This includes the potential cumulative impacts and the resulting effects arising from the proposed GCSWOE development, when considered in combination with other existing and/ or approved projects.

Residual Impacts

This section describes the assessment of the specific direct and indirect impacts of the proposed GCSWOE project. Residual Impacts are predicted impacts remaining after mitigation measures have been applied.

The predicted impacts are discussed having regard to their character, magnitude, duration, consequences and significance and also their cumulative impact.

Where there is uncertainty in the EIA, then a 'worst case' impact is also considered for both the construction and operational phases of the development, which takes each respective environmental topic into consideration.

Monitoring

A description of any proposed project monitoring of effects on the environment which might be necessary, covering the monitoring methods and the agencies responsible for their implementation.

References

Provides details of the documents and information used to inform the assessment.

Assessment of Alternatives

According to the Environmental Impact Assessment Guidelines (May 2022), and Annex IV (2) of the EIA Directive, the EIAR must contain:

"A description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects."

In accordance with those requirements, details contained within this EIAR relating to the consideration of reasonable alternatives, are outlined under Volume 2, Section 4.

Environmental Interactions

This section of the EIAR identifies the interactions between the various environmental aspects covered in Sections 5 - 15 of the Volume 2 of the EIAR. This Section is directed by Article 3(1)(g) of the EIA Directive 2014/52/EU, which requires "*the interaction between the factors referred to in points (a) to (d)*".

The details contained within this EIAR relating to Interactions are outlined in each individual section and also compiled under Volume 2, Section 16 Summary of Interactions.

Summary of Mitigation

This section of the EIAR collates and summarises the mitigation measures that have been identified in the individual sections. These include mitigation measures that are embedded into the design of the plant, appropriate management practices and the provision of commitments relating to construction activities.

The details contained within this EIAR relating to the summary of mitigation are outlined under Volume 2, Section 17 Summary of Mitigation.

Summary of Residual Impacts

This section of the EIAR collates and summarises the residual impacts which remain following the implementation and incorporation of the mitigation measures and environmental commitments summarised under Volume 2, Section 17 Summary of Mitigation.

The details contained within this EIAR relating to the summary of residual impacts are outlined under Volume 2, Section 18 Summary of Residual Impacts.

Cumulative Impacts

The cumulative impact assessments have been undertaken by each specialist and outlined in each relevant Section of this EIAR. This section of the EIAR presents a summary of the potential cumulative impacts and resulting effects arising from the components of the proposed GCSWOE project when combined with other existing and/or approved projects.

The details contained within this EIAR relating to cumulative impacts are outlined under Volume 2, Section 19 Cumulative Impacts.

3.7.5 Assessment of Impacts - Methodology

The main purpose of an EIAR is to identify, describe and present an assessment of the likely significant impacts of a project on the environment. This informs the assessment process on whether to grant consent for a project and, if granting consent, identify conditions that may be attached to the permission. The type and characteristics of the impacts are clearly set out in Annex III (3) and Annex IV (5) of the EIA Directive.

The following section outlines the approach to describing environmental impacts and effects in this EIAR. The methodology adopted closely follows that set out in the EPA Guidelines (2022) and as outlined in Table 3.2 below.

This methodology has been applied across all sections to assist in the clarity of assessment and to provide consistency in the description of effects. The criteria provided in are used where applicable - all categories of terms do not need to be used for every effect.

Table 3.2 Description of Effects (EPA, 2022)

Assessment Criteria	Description of Effects
Quality of Effects It is important to inform the non-specialist reader whether an effect is positive, negative or neutral	**Positive Effects** A change which improves the quality of the environment (for example, by increasing species diversity; or the improving reproductive capacity of an ecosystem, or by removing nuisances or improving amenities).
	Neutral Effects No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error.
	Negative/ Adverse Effects A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing nuisance).
Describing the Significance of Effects ''Significance' is a concept that can have different meanings for different topics – in the absence of specific definitions for different topics the following definitions may be useful (also see Determining Significance below.).	**Imperceptible** An effect capable of measurement but without significant consequences.
	Not significant An effect which causes noticeable[2] changes in the character of the environment but without significant consequences.
	Slight Effects An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
	Moderate Effects

Assessment Criteria	Description of Effects
	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
	Significant Effects An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
	Very Significant An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
	Profound Effects An effect which obliterates sensitive characteristics
Describing the Extent and Context of Effects Context can affect the perception of significance. It is important to establish if the effect is unique or, perhaps, commonly or increasingly experienced.	**Extent** Describe the size of the area, the number of sites, and the proportion of a population affected by an effect.
	Context Describe whether the extent, duration, or frequency will conform or contrast with established (baseline) conditions.
Describing the Probability of Effects Descriptions of effects should establish how likely it is that the predicted effects will occur.	**Likely Effects** The effects that can reasonably be expected to occur because of the planned project if all mitigation measures are properly implemented.
	Unlikely Effects The effects that can reasonably be expected not to occur because of the planned project if all mitigation measures are properly implemented.
Describing the Duration and Frequency of Effects 'Duration' is a concept that can have different meanings for different topics – in the absence of specific definitions for different topics the following definitions may be useful.	**Momentary Effects** Effects lasting from seconds to minutes
	Brief Effects Effects lasting less than a day
	Temporary Effects Effects lasting less than a year
	Short-term Effects Effects lasting one to seven years.
	Medium-term Effects Effects lasting seven to fifteen years.
	Long-term Effects Effects lasting fifteen to sixty years.
	Permanent Effects Effects lasting over sixty years
	Reversible Effects Effects that can be undone, for example through remediation or restoration
	Frequency of Effects

Assessment Criteria	Description of Effects
	Describe how often the effect will occur. (once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, monthly, annually)
Describing the Types of Effects	**Indirect Effects or Secondary Effects** Impacts on the environment, which are not a direct result of the project, often produced away from the project site or because of a complex pathway.
	Cumulative Effects The addition of many minor or significant effects, including effects of other projects, to create larger, more significant effects.
	'Do-Nothing Effects' The environment as it would be in the future should the subject project not be carried out.
	`Worst case' Effects The effects arising from a project in the case where mitigation measures substantially fail. It can also be a worst case assumption where there is uncertainty in the assessment or in the effectiveness of mitigation measures.
	Indeterminable Effects When the full consequences of a change in the environment cannot be described.
	Irreversible Effects When the character, distinctiveness, diversity or reproductive capacity of an environment is permanently lost.
	Residual Effects The degree of environmental change that will occur after the proposed mitigation measures have taken effect.
	Synergistic Effects Where the resultant effect is of greater significance than the sum of its constituents, (e.g. combination of SOx and NOx to produce smog).

Determining Significance

Table 3.2 above provides seven categories by which to determine the significance of an impact. Figure 3.7 below is an illustration provided in the EPA Guidelines (2022) of how the *character of a predicted impact to the sensitivity of the receiving environment* can determine the significance of the impact.

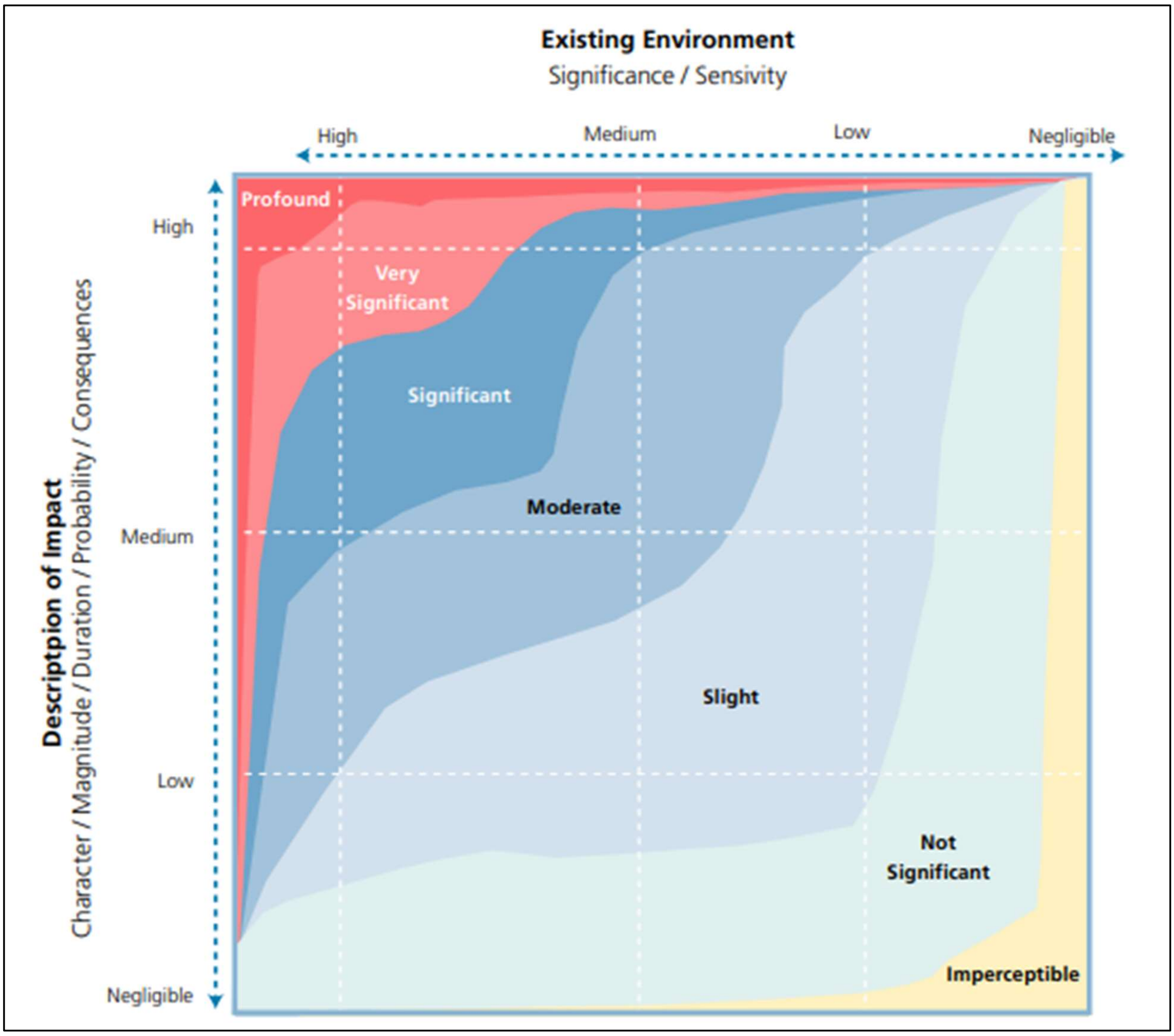


Figure 3.7 Chart showing typical classifications of the significance of impacts*

(*Source: EPA Guidelines on the Information to be Contained in Environmental Impact Assessment Report (2022))

3.7.6 EIA Team

Article 5(3)(a) of amended EIA Directive (2014/52/EU) (EIA Directive) states that "*the developer shall ensure that the environmental impact assessment report is prepared by competent experts*". The *Guidelines on the Information to be contained in Environmental Impact Assessment Reports* issued by the EPA in May 2022 highlights the need for competent experts to be involved in the EIA process and in the preparation of the EIAR.

The EIAR for this project has been prepared by J. B. Barry & Partners with additional specialist input provided by competent experts in a variety of disciplines. Responsibility for individual sections of the EIAR is as listed in the Table 3.3 below. A description of experts who have contributed to this EIAR, their qualifications, experience and any other relevant credentials is provided in each individual section.

Table 3.3 EIAR Sections and Competent Experts

EIAR Section	Consultant
Non-Technical Summary	J.B. Barry and Partners Ltd.
Introduction	J.B. Barry and Partners Ltd.
Description of Proposed Development	J.B. Barry and Partners Ltd.

EIAR Section	Consultant
Legislative Context	HW Planning
Assessment of Alternatives	J.B. Barry and Partners Ltd.
Population and Human Health	HW Planning
Biodiversity	JBA Consulting
Water Quality and Hydrology	J.B. Barry and Partners Ltd., DHI Water Environments (UK) Ltd.
Land, Soils, Geology and Hydrogeology	J.B. Barry and Partners Ltd.
Air Quality and Climate	AWN Consulting (A Trinity Consultants Company)
Noise and Vibration	AWN Consulting (A Trinity Consultants Company)
Traffic and Transport	J.B. Barry and Partners Ltd.
Archaeology and Cultural Heritage	Archaeological Consultancy Services Unit (ACSU), The Archaeological and Commercial Diving Company (ADCO)
Waste Management	J.B. Barry and Partners Ltd.
Material Assets	J.B. Barry and Partners Ltd.
Landscape and Visual Impact	JBA Consulting
Summary of Interactions	J.B. Barry and Partners Ltd.
Summary of Mitigation	J.B. Barry and Partners Ltd.
Summary of Residual Impacts	J.B. Barry and Partners Ltd.
Cumulative Impacts	J.B. Barry and Partners Ltd.
Overall Co-ordination and Management of EIAR	J.B. Barry and Partners Ltd.

3.8 Consultation

As part of the preparation of this EIAR, Irish Water and Dublin City Council undertook consultation with the public, interested parties, and prescribed bodies in respect of the proposed development. Prescribed bodies/stakeholders were identified as part of a Stakeholder Audit, as listed in Table 3.4 below. This audit was maintained and updated throughout the project.

A number of statutory bodies were contacted throughout the different stages of the EIAR process. A summary of submissions received as part of this process is enclosed in Volume 3, Appendix 3A. The submissions received were communicated to each section specialist and where applicable have been addressed in each section.

Table 3.4 Key Stakeholder List

Prescribed bodies and key stakeholders	
An Taisce	Irish Rail
An Bord Pleanála	Irish Environmental Network
Birdwatch Ireland (BWI)	Irish Landscape Institute
Bord Iasca Mhara	Irish Water (IW) (inc. internal departments)
Commission for Railway Regulation	Irish Whale and Dolphin Group
Córas Iompar Éireann	Irish Wildlife trust
Dublin Airport	Irish Underwater Council
Dublin City Council (inc. internal departments)-	Marine Institute Ireland

Prescribed bodies and key stakeholders	
DCC Archaeology Department, DCC Environmental Health Officer, DCC Biodiversity Officer, DCC Central Area Committee, DCC Flood Projects and Water Framework Directive Division, DCC Heritage Officer, DCC Planning Department, DCC South East Area Committee, DCC Transport Department, DCC/ Elected Representatives	
Dublin Chambers of Commerce	Marine Ecology Group
Dublin Cycling Campaign	Minister for Agriculture, Food and the Marine
Dublin Port Company and Harbour Master	Minister for Communications, Climate Action and Environment
Dublin Regional Authority	Minister for Culture, Heritage and the Gaeltacht
Dun Laoghaire Rathdown County Council	Minister for Environment, Climate, and Communications
Eastern Regional Fisheries Board	Minister for Housing, Planning and Local Government
Eastern and Midlands Regional Assembly	Minister for Justice
Eastern and Midlands Regional Waste Office	Minister for Law Reform
Eirgrid	Minister for Transport
Electricity Supply Board (ESB)	National Asset Management Agency
Enterprise Ireland	National Monument Service
Environmental Protection Agency (EPA)	National Parks and Wildlife Service (NPWS)
Fáilte Ireland	National Transport Authority (NTA)
Fingal County Council	Office of Public Works (OPW)
Gas Networks Ireland (GNI)	Sea Fisheries Protection Authority
Geological Survey of Ireland (GSI)	South Dublin County Council
Health and Safety Authority (HSA)	The Arts Council
Health Service Executive (HSE)	The Heritage Council
Inland Fisheries Ireland (IFI)	Transport Infrastructure Ireland (TII)
Irish Aviation Authority	Udáras na Gaeltachta
Irish Coast Guard	Waterways Ireland (WI)

Alongside this, a pre-application meeting was held with the Foreshore Licensing Unit, a consultation meeting was held with DCC Transport Department regarding traffic management in the area during construction phase and regular meetings have been undertaken with Waterways Ireland regarding works within the basin. The Development Application Unit of the Department of Housing, Local Government and Heritage were approached by the project biodiversity consultants (JBA) in relation to a pre-planning consultation, they responded- '*The Department is not in a position to make specific comment on this particular referral at this time. No inference should be drawn from this that the Department is satisfied or otherwise with the proposed activity. The Department may submit observations/recommendations at a later stage in the process.*'

Consultations were carried out with Dublin Port Company. They indicated that the proposed development may restrict berthing for large ships along SJRQ in the immediate vicinity of the outfall. However, they acknowledge the need for the project and have issued a letter of no objection.

In addition to the above, each section specialist has consulted relevant Departments and Bodies in order to acquire additional information where needed to undertake the assessment.

A number of communications tools and channels were utilised including:

- A Frequently Asked Questions (FAQ) document;
- Project information pages on Irish Water and Dublin City Council website;
- Press release to regional newspapers; and
- Public Information Day Webinar. List of invitees included local organisations and businesses. A full list of invitees to the webinar is attached in the Volume 3, Appendix 3B.

3.9 Separate Consent Processes

In addition to the planning permission, the consents and considerations described in the following subsections are also required for construction/ operation of the proposed GCSWOE project.

3.9.1 The Waste Water Discharge (Authorisation) (WWDA) Regulations 2007 (as amended)

The project will be constructed in the area licenced (WWDA) for the Ringsend Agglomeration. The Ringsend agglomeration had a licence issued in 2010 (Licence D0034-01). The CSOs spilling to the GCTS (Grand Canal Tunnel Sewer) were listed in the original WWDA application documents. Irish Water are in process of submitting a license review for the Ringsend agglomeration to account for the numerous overflows and the upgrade project at the treatment plant. The GCSWOE project will be included in the license review.

3.9.2 Foreshore License

The location of the proposed outfall structure at SJRQ is between the high and low water marks and hence a foreshore license under the Foreshore Act 1933 (as amended) will be obtained for the works to be undertaken at SJRQ.

A Foreshore Licence dated 18/04/2002 and extended to 17/04/2008 had been obtained for the proposed development. The status and validity of this licence was reviewed, and it was concluded that a new application for a licence will need to be made. The application process for the foreshore license will be initiated following the planning application and will take account of the planning conditions attached to the permission if approved.

3.10 Conclusion

EU and national policy are unequivocal on the need to protect and enhance all water bodies and improve their quality to achieve 'good status' by 2027 at the latest. Based on a review of the governing legislative and planning policy context, it is evident that the proposed development will deliver on a number of key objectives relating to the sustainable management of water, waste, and environmental resources. The policies of the current Dublin City Development Plan 2016-2022 are prescriptive on the need to promote the protection and improvement of the aquatic environment and provide for the sustainable development of water-side and water-based amenities as part of network of green and blue infrastructure and this is reinforced as part of the emerging Dublin City Development Plan 2022-2028. The proposed development is supported specifically by means of a dedicated policy in the current North Lotts and Grand Canal Dock Strategic Development Zone planning scheme "to complete as a priority, the relocation of the Grand Canal Surface Water Outfall from the Grand Canal Dock Basin to the River Liffey" and the key benefits in policy terms will be environmental, ecological, economic and social. These positive benefits will extend to existing and future developments and communities in the area.

3.11 References

Dublin City Council, (2016). *Dublin City Development Plan 2016-2022.*

Dublin City Council, (2021). Draft *Dublin City Development Plan 2022-2028.*

Dublin City Council, (2014). *The North Lotts and Grand Canal Dock Strategic Development Zone Planning Scheme.*

Dublin City Council, (2015). *Dublin Docklands Social Infrastructure Audit 2015.*

Dublin City Council, (2018). *North Lotts and Grand Canal Dock SDZ Water Animation Strategy 2018.*

Dublin City Council, Failte Ireland, Waterways Ireland, CHQ/EPIC, (2018). '*Waters Edge' Tourism Framework for Docklands.*

Dublin City Council, Waterways Ireland, Irish Water, (2018). *Grand Canal Basin Amenity Project Joint Working Group Final Report.*

Eastern and Midland Regional Assembly, (2019). *Regional Spatial and Economic Strategy for the Eastern and Midland Region 2019-2031.*

European Union (EU), (2000). *The EU Water Framework Directive (2000/60/EC).*

European Union (EU), (2008). *The EU Marine Strategy Framework Directive (2008/56/EC).*

European Union (EU), (2011). *The EU Environmental Impact Assessment Directive (2011/92/EU).*

European Union (EU), (2014). *The EU Environmental Impact Assessment Directive (2014/52/EU).*

European Union (EU), (1992). *The EU Habitats Directive (92/43/EEC).*

European Union (EU), (2003). *The EU Public Participation Directive (2003/35/EC).*

Government of Ireland, (2007). *Water Services Act 2007.*

Government of Ireland, (2020). *Water Services Policy Statement 2018-2025.*

Government of Ireland, (2018). *River Basin Management Plan for Ireland 2018-2021.*

Government of Ireland, (2018). *Project Ireland 2040 – National Planning Framework.*

SECTION 4: Assessment of Alternatives

4.1 Introduction

This section was completed by Anne Marie Conibear who is Director of J. B. Barry and Partners and has over 30 years' experience in water and wastewater engineering. Anne Marie holds a Masters in Business Practice from University College Cork and a Bachelor of Engineering degree (BE) from University College Dublin. She is a Chartered Engineer with the Institution of Civil Engineers in the UK (CEng, MICE), a Fellow of Engineers Ireland (FIEI) and a Registered Consultant of the Association of Consulting Engineers in Ireland (RConsEI). Anne Marie was the Project Manager and Senior Engineer on the original design of the scheme in 2007-2009 and is fully familiar with the alternatives considered and reasons for the option chosen. She has been involved in the development or peer reviewing of many EIARs including Moville and Greencastle Sewerage Scheme, Ringsend Wastewater Treatment Plant Upgrade Project and the River Fergus Ennis Certified Drainage Scheme.

This section of the EIAR examines the main alternatives considered for the proposed development and provides an indication of the main reasons for the final scheme choice, taking into accounts the effects on the environment. Annex IV, Article 2 of Directive 2014/52/EU requires:

"A description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects."

This scheme has a long history – the Grand Canal Tunnel was constructed in 1976 and it was originally proposed to discharge to the River Liffey but instead the outfall was located in the inner Grand Canal Basin which eventually discharges to the River Liffey.

The Greater Dublin Strategic Drainage Study (GDSDS), which was adopted in 2005, included the analysis of the existing foul and stormwater systems in the Greater Dublin Area (GDA). It resulted in policies, strategies and projects for the development of sustainable drainage systems having regard to the major economic development of the GDA, the need to provide for the future socio-economic development in the region, and to comply with the latest environmental legislation. The study recognised the need for the continued use of the GCT to transfer foul to Ringsend WWTP and stormwater with occasional combined water (foul and storm) to the River Liffey. The GDSDS Report also noted *'The outfall for the Grand Canal storm sewer is located at the Grand Canal Dock but proposed works, some of which have been completed, will transfer these storm flows directly to the River Liffey'.* The SEA for the GDSDS was completed in 2008.

In 2001, an EIS was prepared to extend the GCT to the River Liffey, and Section 25 consent was obtained from the Dublin Dockland Development Authority (DDDA). Phase 1 of the project was constructed in 2002 as part of the DDDA's development of commercial and residential properties in the Dockland area. Tender documents were prepared for Phase 2 in 2010 but given the financial situation in Ireland at that time the project didn't proceed. In the interim the DDDA was disbanded, and it is therefore necessary to prepare a new planning application along with an updated EIAR.

Therefore, whilst many options were considered as part of the historical overall studies, the starting point for the consideration of alternatives in this EIAR is the extension of the existing discharge location, the tie into the Phase 1 Culvert and the discharge to the River Liffey. This is consistent with the requirements of the EPA Guidelines, the GDSDS and the North Lotts and Grand Canal Dock Strategic Development Zone (SDZ) as explained below.

In the Rathmines and Pembroke catchment, CSOs are required I to limit foul flows to the Grand Canal Tunnel foul cell from the existing combined sewer system. By discharging excess combined flows to the storm cell which outfalls to the Liffey transitional waters, a Formula A approach was considered acceptable (spilling to the storm side during periods of high rainfall); The surface water side of the tunnel *currently discharges into the Grand Canal Dock and receives direct flows from Crumlin, excess flow from the River Poddle and spilled flow from combined sewer overflows in the Rathmines and Pembroke area*.

4.1.1 Legislative Context and Guidelines

The EPA Guidelines (2022) state that neither the applicant or competent authority can realistically be expected to examine options that have been previously determined by a higher authority or which has been subject to SEA. For example, Section 3.4.1 states:

"Higher level alternatives may already have been addressed during the strategic environmental assessment of relevant strategies or plans. Assessment at that tier is likely to have taken account of environmental considerations…"

"Note also that plan-level/higher-level assessments may have set out project-level objectives or other mitigation that the project and its EIAR should be cognisant of. Thus, these prior assessments of strategic alternatives may be taken into account and referred to in the EIAR".

The GDSDS, and associated SEA, is the fundamental strategy for the sustainable development of drainage systems and treatment of foul sewage in the GDA. The strategy includes the assumption that the GCT would be extended to the River Liffey.

The North Lotts and Grand Canal Dock SDZ, which has been subject to a SEA, has the following objective:

"SI3: To complete, as a priority, the relocation of the Grand Canal Surface Water Outfall from the Grand Canal Dock Basin to the River Liffey".

The Docklands Master Plan (2008) has the following policy statement.

Policy IF3: The Authority will support the elimination of the discharges from the outfall of the Greater Dublin drainage sewer (Grand Canal Tunnel) from its present location in the inner basin of the Grand Canal Dock.

The elimination of the discharges of the Storm Water Outfall in the basin is referred to under Dublin Docklands Master Plan Objective (IF3) with the purpose under the SEA of enhancement of water quality and biodiversity.

The legislation governing the assessment of alternatives as part of the EIA process is set out in the (EIA) Directive 2014/52/EU (as amended). Article 5 (1) (d) of the Directive states that an EIAR must contain inter alia:

"*a description of the reasonable alternatives studied by the developer, which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment*".

This is further supported in Annex IV of the revised Directive. Information referred to in Article 5 (1), whereby a description of reasonable alternatives should be presented, "*for example in terms of project design, technology, location, size and scale*".

The Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (DoHPLG, 2018) states that for reasonable alternatives,

"4.12. The Directive requires that information provided by the developer in an EIAR shall include a description of the reasonable alternatives studied by the developer. These are reasonable alternatives which are relevant to the project and its specific characteristics. The developer must also indicate the main reasons for the option chosen taking into account the effects of the project on the environment.

4.13 Reasonable alternatives may relate to matters such as project design, technology, location, size and scale. The type of alternatives will depend on the nature of the project proposed and the characteristics of the receiving environment. For example. Some projects may be site specific so the *consideration of alternative sites may not be relevant. It is generally sufficient for the developer to provide a broad description of each main alternative studied and the key environmental issues associated with each, A "mini-EIA" is not required for each alternative studied."*

A number of alternatives have been assessed under the Rathmines and Pembroke Drainage Area Plan, completed as part of the GDSDS:

- Storm Water Separation;
- Storm Water Storage; and
- Pipeline Upsizing.

It should be noted that while multiple options were considered under the Rathmines and Pembroke Drainage Area Plan these solutions don't eliminate overflows and therefore the intermittent pollution events are not resolved.

The Rathmines and Pembroke Drainage Study (2015) does not identify what level of impact or proportion of impact that these discharges have on the water quality and how does this impact compare to that imposed on the Grand Canal Basin by the storm water discharges. This is because it assumed that the GCSWOE project (commenced in 2002) would be completed and the outfall extended to River Liffey (the GDSDS, North Lotts and Grand Canal Dock SDZ and the Docklands Master Plan (2008)).

The EPA Guidelines also notes that reasonable alternatives relate to matters such as project design, technology, location, size and scale. It is also noted that *"the objective is for the developer to present a representative range of the practicable alternatives considered"*.

4.2 Existing Infrastructure

The existing Grand Canal Tunnel, which was constructed in 1976, discharges underwater into the inner Grand Canal Basin. The outfall structure is located adjacent to the Barrow Street station and railway line and only the gantry and access manhole are visible.

The Phase 1 Culvert, which is 170m long 4m wide and 2.7m high, was completed in 2002 as part of the development of the Docklands Area. It is located under Asgard Road between Hanover Quay and SJRQ. Provision was made for the future connection of Phase 2 on either side, one between the existing Grand Canal Tunnel in the Inner Basin, and the other towards the proposed outfall location on SJRQ. Figure 4.1 and Figure 4.2 below shows the location of the current outfall structure and the Phase 1 Culvert and the Figure 4.3and Figure 4.4below are during the construction of Phase 1.

Figure 4.1 Existing Frand Canal Tunnel Discharge Location

The aim of the project is to connect the Grand Canal Tunnel discharge location to the Phase 1 Culvert and to a new Outfall structure that discharges into the River Liffey.

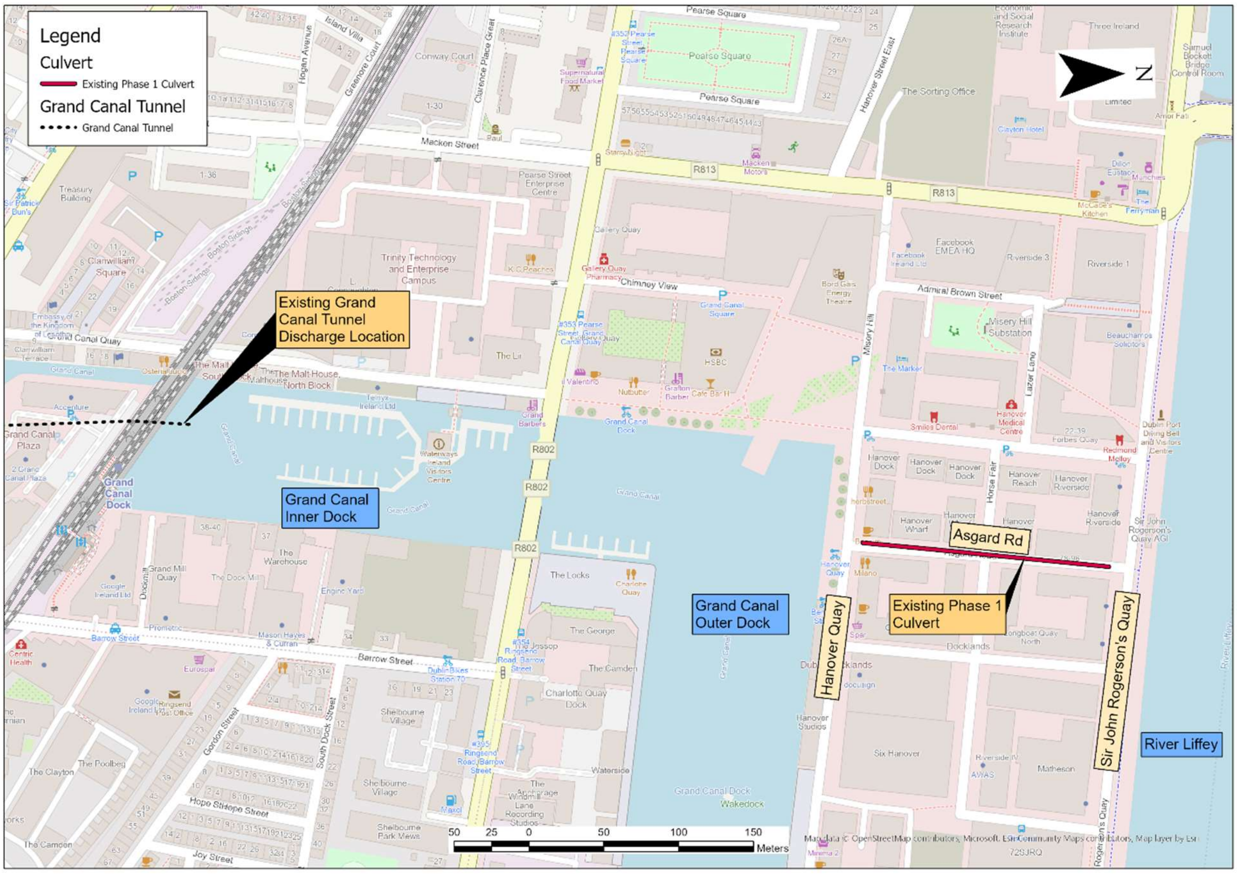


Figure 4.2: Existing Stormwater Infrastructure at Grand Canal

Figure 4.4 Phase 1 Culvert during construction under Asgard Road

Figure 4.3 Tie-in of culvert to secant piled wall for future connection to Phase 2 culvert

4.3 Assessment of Alternatives

Significant Stakeholder consultation was undertaken over the development of the project including Waterways Ireland, Dublin City Council, Dublin Port Authority and the Harbour Master. The following physical constraints informed the design and include:

- A minimum draught clearance of 1.9m to ensure that canal boats can access the basin;
- A minimum of 0.5m clearance over the "8-foot" Ringsend sewer at MacMahon Bridge – to protect the structure;
- Need to minimise boat draught restrictions in the Grand Canal Basin and for example, Waterway Ireland require the pipeline/culvert to be in the Hanover Quay Camphire rather than taking up berthing space along the quays; and
- The wall stability assessments identified that pipelines/structures should be offset a minimum of 8m from the Inner Basin quay wall and 4m from Outer Dock quay wall.

A number of alternatives have been assessed, these include:

- Do Nothing;
- Remove Pollution at Source; and
- Pipeline Options, layouts and construction methodologies.
  - Option 1
  - Option 2
  - Option 3
  - Option 4

4.3.1 Do Nothing Option

Under a “Do Nothing” option where Phase 2 of the Grand Canal Stormwater Outfall Extension project is not carried out, the effects would be as follows:

- In times of heavy rainfall CSO (combined sewer overflows) from the south city catchment and the overflow from the River Poddle will enter the stormwater cell of the Grand Canal Tunnel and discharge to the Basin through the existing outfall. These flows contain a combination of storm water and sewage. It should be noted that CSOs are an integral part of any wastewater and stormwater collection network. They are installed to prevent sewer pipes backing up when their capacity is exceeded during rainfall events. Otherwise the sewers and manholes would surcharge and cause flooding.
- The water quality in the basin will continue to be adversely impacted. The basin has very little other inflows and there is limited dilution or throughflow of water.
- This is a significant amenity area with a large number of canal boats – particularly in the inner basin. Deterioration in water quality within the basin will limit the opportunity to develop water-based activities.
- The Grand Canal Tunnel is an integral component of the Greater Dublin Strategic Drainage Strategy. Flows in the tunnel will continue to increase due to on-going urbanisation of the catchment and also due to increased/more severe rainfall events due to climate change. As its capacity is maximised the flows to the basin will increase and the risk of overtopping the lock gates and causing localised flooding will increase.
- The elimination of the discharges of the Storm Water Outfall in the basin is referred to under Dublin Docklands Master Plan policy (IF3) with the purpose under the SEA of enhancement of water quality and biodiversity. The same objective is repeated in the North Lotts & Grand Canal Dock STZ (S13) and associated SEA prepared by Dublin City Council Planning and Economic Development Department. Should Phase 2 not proceed then these objectives will not be achieved.
- Should the project not proceed the Phase 1 Culvert constructed in 2002 will become redundant and serve no useful purpose.

4.3.2 Remove Pollution at Source

Whilst current best practice is to construct separate storm and sewer pipe networks, many of the older pipe networks in Dublin City are combined and it is not feasible or practicable to locate all of these and to install new separate pipelines. Currently the potential sources of flows in the GCT are as follows:

- **River Poddle Flood Relief Flows** – This is located in the upstream end of the tunnel at Greenmount and diverts high flows (i.e. during a storm event) from the River Poddle to the GCTS storm cell.

- **Stormwater sewers** – approximately 2/3 of the GCTS capacity is reserved for flows from stormwater sewers. These sewers are from hardstanding areas including roads, footpaths, driveways and car parks and take away surface water from rainfall events.

- **Combined sewers and stormwater overflows** – some parts of Dublin city include combined sewers i.e. the sewer is for both foul and stormwater. CSO's protect the Wastewater Treatment Plants (WWTPs) from being overloaded. They also ensure that the collection network does not surcharge and back up during times of extreme rainfall when the flow in the collection network exceeds Formula A. Normally the excess flow spills from CSOs are directed into nearby water courses. There are a number of CSOs based in the High Level Rathmines and Pembroke (R&P) catchment that overspill to the storm side of the GCTS. Irish Water commissioned a study into the R&P catchment and sewer upgrades and improvements are currently underway. However, the study also concluded it will not be possible to eliminate CSOs. It should also be noted that these spills occur during extreme rainfall events and hence there is significant dilution of the water.

- **Foul service/sewer misconnections** – given the age and complexity of the foul and storm sewer network in Dublin city misconnections can occur. Whilst efforts have and are being made to identify them, they are extremely difficult to locate, and the associated remediation works in busy urban areas is disruptive to traffic, commercial operations and domestic properties.

There are a number of different sources of pollutants to the stormwater cell of the GCT and it is not feasible to locate and remediate these at source. In addition, CSOs are an integral part of combined sewer networks. Instead, the discharge of the polluted water needs to be controlled and discharged to a location where there is adequate dilution and dispersion.

4.3.3 Pipeline Options

Figure 4.5 below shows the locations of the different pipeline routes, including the tunnelling option, considered as part of the development of the scheme. As all options are within the Grand Canal Basin and Hanover Quay the environmental impacts are similar and generally positive as it will bring the combined flow away from the dock and into the River Liffey where there is appropriate dilution and dispersion. The following text therefore looks at other ways to assess the options (technical and economic) and the requirements of the Stakeholders in the Dock.

All options have been hydraulically designed to convey the stormwater discharge to the proposed outfall to the River Liffey on SJRQ. It should be noted that where canal boats need to cross over the pipelines then the 5 no. 1.5m diameter pipeline configuration is required to provide adequate draught. Where this is not necessary (along the quay wall in the outer basin) then the 2 no. 2.4m diameter pipelines provide the necessary hydraulic capacity. In addition, transition chambers are required where there is a change in pipe configuration.

The SJRQ outfall structure, which connects into the existing Phase 1 Culvert, is common to all options.

Three separate construction compound locations have been identified as being necessary of the works and these are Hanover Quay (for works in the Outer Basin), Grand Canal Quay alongside the Waterways Ireland visitor centre (for works in the Inner Basin) and at SJRQ (for works on the outfall structure).

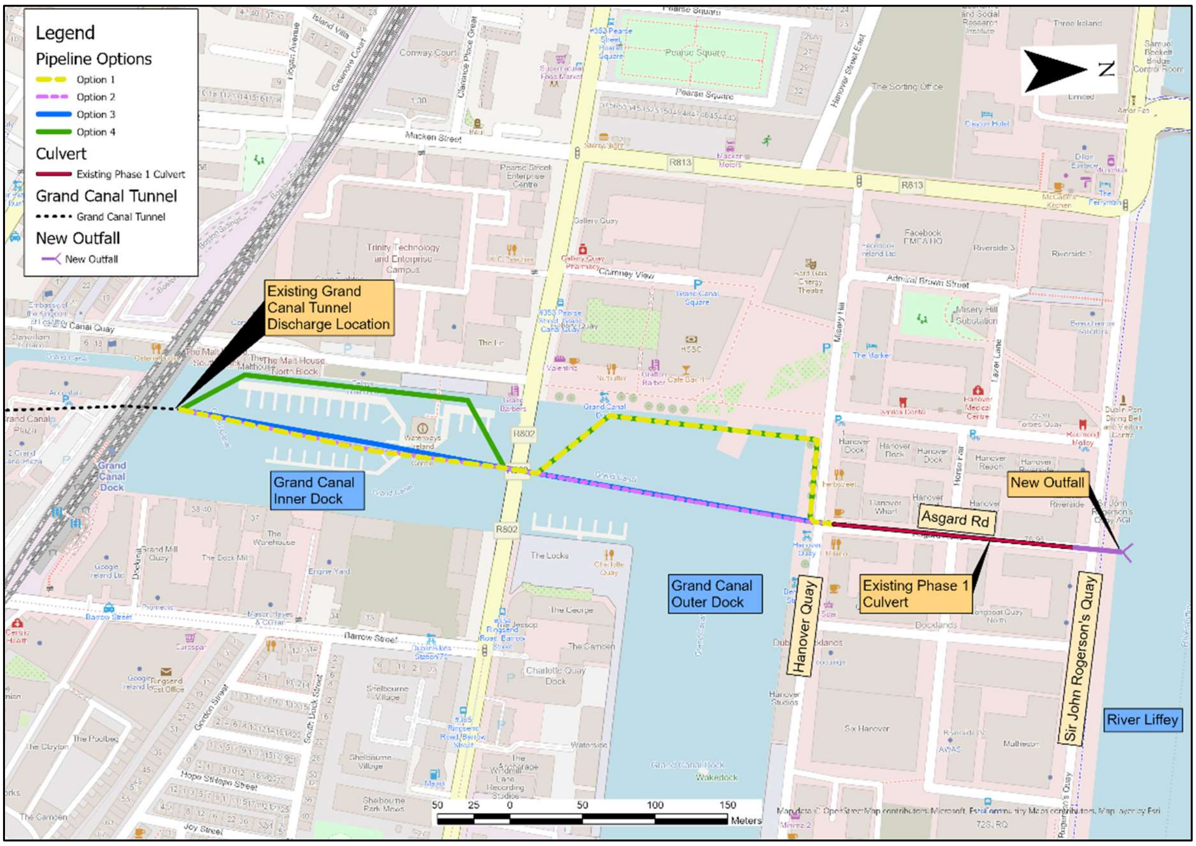


Figure 4.5: Pipeline Options

4.3.4 Option 1 – Centre of Inner dock, alongside GC Square and in Hanover Quay

Option 1 was the preferred design and had been granted planning approval by the DDDA, refer to Figure 4.6. This option was based on negotiations and the requirements stakeholders. This option consists of:

1. Transition Chamber 1 at the existing surface water outfall in the Inner Basin;
2. 5 no. 1.5m diameter pipelines – 308m long;
3. Transition Chamber 2 in the Outer Basin;
4. 2.4m diameter pipelines, 136m parallel to Grand Canal Square and under the platform;
5. Transition Chamber 3 located in Hanover Quay;
6. 4m by 2.7m box culvert, 67m in Hanover Quay to connect into the existing Phase 1 Culvert in Asgard Road; and
7. Outfall structure at SJRQ will connect back to the Phase 1 Culvert on Asgard Road.

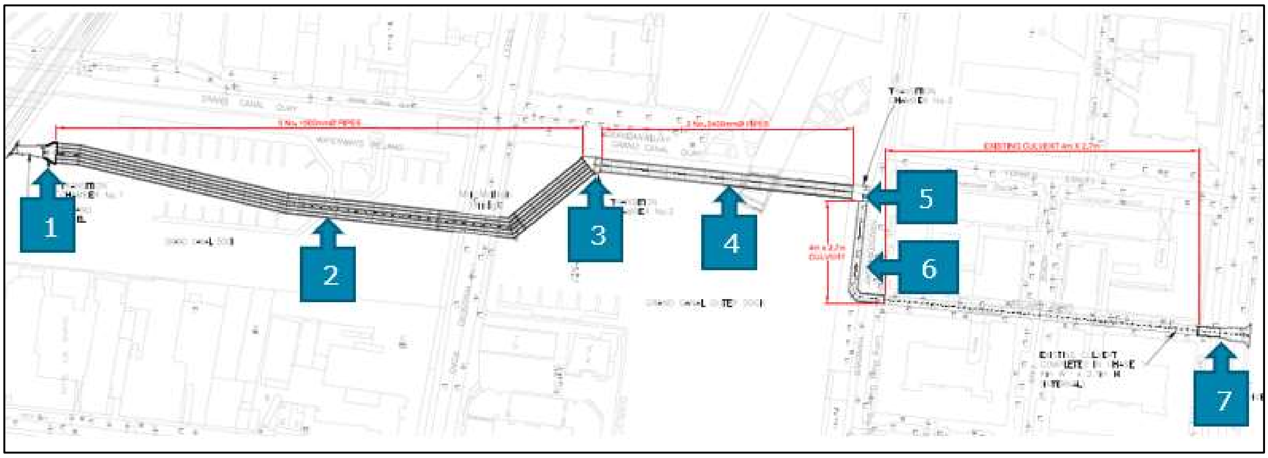


Figure 4.6 Pipeline Option 1

4.3.5 Option 2 – Direct pipeline in the dock

Option 2 is a direct pipeline from the tunnel outfall to the existing Phase 1 Culvert, refer to Figure 4.7. This option consists of:

1. Transition Chamber 1 at the existing surface water outfall in the Inner Basin;
2. 5 no. 1.5m diameter pipelines, 436m long;
3. Transition Chamber 2 located in Hanover Quay;
4. 4m by 2.7m box culvert, 13m long at the Transition Chamber 2 to connect to the existing Phase 1 Culvert in Asgard Road; and
5. Outfall structure at SJRQ will connect back to the Phase 1 Culvert on Asgard Road.

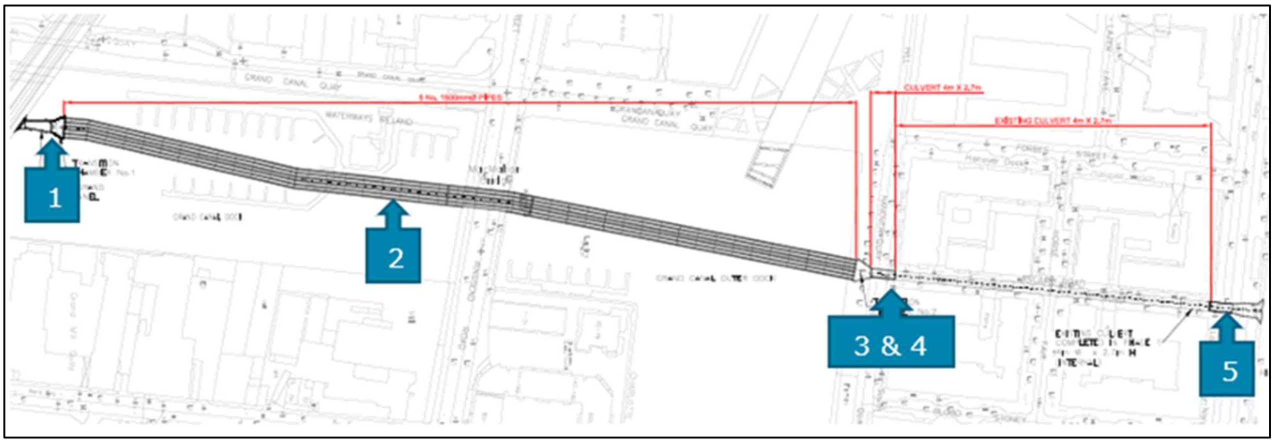


Figure 4.7 Pipeline Option 2

4.3.6 Option 3 – Tunnelled Option & Syphon

Option 3 presents an alternative construction methodology, using tunnelling in place of traditional construction for a direct connection from Grand Canal Tunnel to Hanover Quay, refer to Figure 4.8. The depth of this tunnel is determined based on the need to go under the existing 8ft city sewer below MacMahon Bridge and thus this option would be a syphon. This option includes:

1. 15m diameter launch shaft in the Outer Dock;
2. Access causeway and working platform;
3. 2 no. 2.5m diameter pipes - with a gap of 1.5m between the pipes;
4. 12m diameter reception shaft in the Inner Dock to connect to the Phase 1 Culvert; and
5. Outfall structure at SJRQ will connect back to the Phase 1 Culvert on Asgard Road. Note: this outfall structure is common to all options considered.

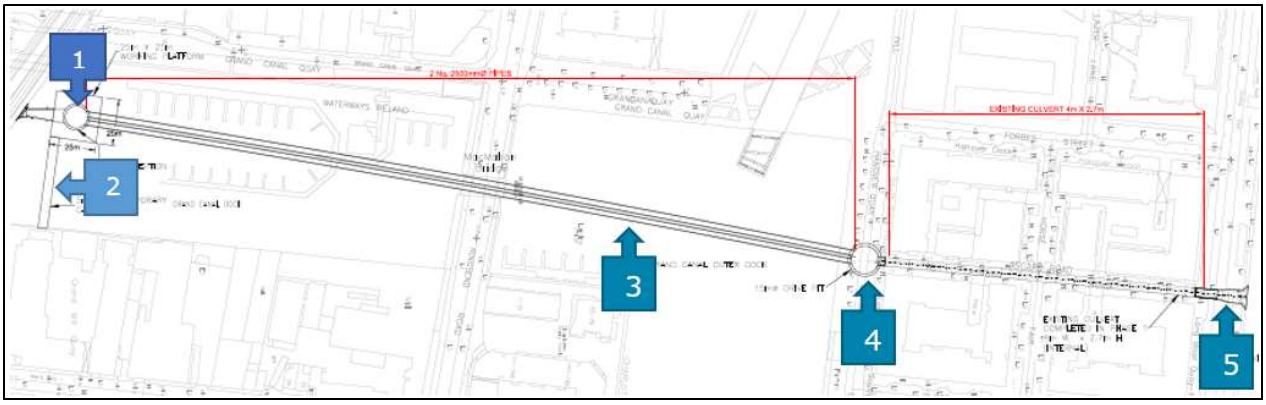


Figure 4.8 Pipeline Option 3

4.3.7 Option 4 – keeping close to both the existing quay walls

Option 4 is a variation of Option 1 where the pipework arrangement and route within the inner dock area have been altered, refer to Figure 4.9. The route of the pipeline has been diverted to run along the Inner Dock Quay Wall. This option would consist of:

1. Transition Chamber 1;
2. 5 no. 1.5m diameter pipelines directed a short distance to the Inner Dock Quay Wall;
3. Transition Chamber 2;
4. 2 number 2.4m diameter pipelines will run parallel to the Inner Dock Quay Wall, offset a distance of 8m;
5. Transition Chamber 3 located in Grand Canal Quay Wall (Inner Dock);
6. 5 no. 1.5m diameter pipelines;
7. Transition Chamber 4 located near the Quay Wall (Outer Dock);
8. 2 no. 2.4m diameter pipelines;
9. Transition Chamber 5 located in Hanover Quay;
10. 4m by 2.7 box culvert will be constructed as far as the existing culvert in Asgard Road; and
11. Outfall structure at SJRQ will connect back to the Phase 1 Culvert on Asgard Road. Note: this outfall structure is common to all options considered.

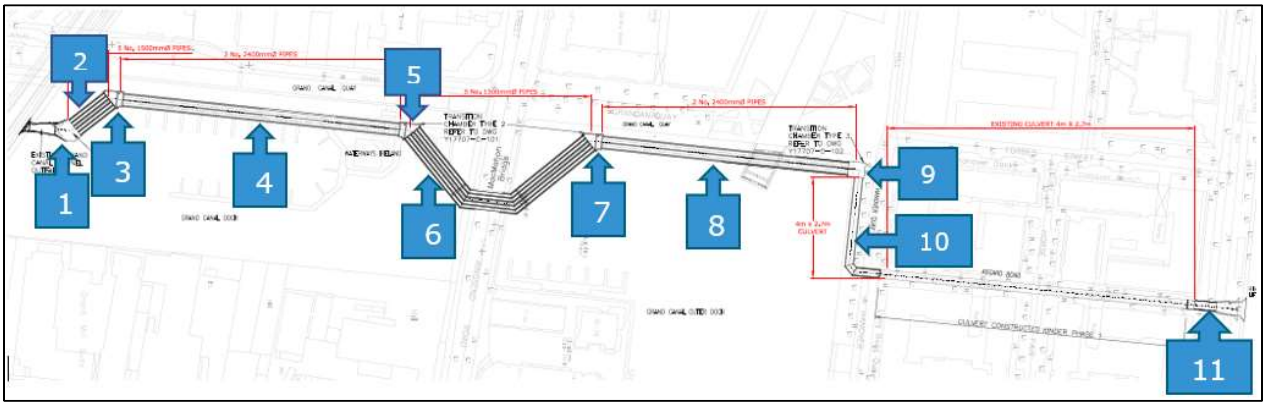


Figure 4.9 Pipeline Option 4

4.4 Comparison/Assessment of Options

As the "Do Nothing" option was not acceptable and the removal of pollution at source was neither feasible nor practical, the extension of the outfall to the River Liffey bypassing the Basin is the preferred solution. The various pipeline route options were then considered. The following Table 4.1, based on the 2017 FSR, details the advantages and disadvantages of each option. This has been updated as part of the EIAR process to cater for recent developments in the catchment.

Table 4.1 Comparison of Pipeline Options

Option	Advantages	Disadvantages
Option 1	▪ Minimal dredging in Outer Dock (average depth approx. 400mm) ▪ Berth space retained along Hanover Quay ▪ Less disruption to mooring system in the Inner Dock than Option 4 ▪ Second lowest cost option ▪ Reduced risk compared with tunnelling ▪ Stakeholders, and specifically Waterways Ireland, prefer this option (and this was the one that had planning from the DDDA) ▪ Studies/investigations completed for this route (may need some updating)	▪ Significant disruption to landscaped area of Hanover Quay, including removal of trees, metal guards to trees, stone seating and planters. Reinstatement costs included in the cost estimate ▪ Construction work in Hanover Quay would be very visible to the public and potentially disruptive to the businesses in this area. ▪ Challenging work element threading pipe under the architectural platform in the outer dock ▪ Limited wayleave and more extensive traffic management constraints in Hanover Quay

Option	Advantages	Disadvantages
Option 2	▪ Reduced disruptions to the traffic and the public in a busy area of Hanover Quay comparing with Option 1 and Option 4 ▪ Reduced risk compared with tunnelling ▪ Less disruption to mooring system in the Inner Dock than Option 4 ▪ Challenging work element threading pipe under the architectural platform in the outer dock excluded ▪ Simple design, with 5 pipe system in all GC Basin ▪ Lowest cost option	▪ Route not acceptable to WI due the mooring area for large ships that would be sterilized ▪ Less area available for boats circulation than Option 1 and Option 4
Option 3	▪ Simple design, with 2 pipe system in all GC Basin ▪ Less disruption to mooring system in the Inner Dock than the other options ▪ Avoids the architectural platform in the outer dock ▪ Reduction of groundwater pumping due tunnelling shafts can be sunk underwater	▪ Highest construction risk option due the tunnelling method, particular concern would be the potential to damage the existing 8ft city sewer, the nearby railway line and other structures could be damaged by vibration ▪ Given the need to go under the 8ft city sewer the pipeline would be a syphon with attendant potential maintenance issues ▪ Additional Site Investigations required due to the depth of the pipeline ▪ Access would be required from the quays in the inner dock via private property which may not be permitted (very built-up area). ▪ Access causeway and working platform would need to be constructed in the Inner Dock ▪ Significant disruption in Hanover Quay ▪ Highest cost option
Option 4	▪ More area available for boats circulation ▪ Significant section of pipeline offset from quay wall, reducing the amount of work to be completed from pontoons/barges. ▪ Berth space retained along HQ ▪ Reduced risk compared with tunnelling ▪ Minimal dredging in Outer Dock (average depth approx. 400mm)	▪ Additional Archaeological studies required ▪ Significant disruption to landscaped area of Hanover Quay, including removal of trees, metal guards to trees, stone seating and planters. Significant reinstatement costs ▪ Challenging work element threading pipe under the architectural platform in the outer dock ▪ Complicated design, 5 pipe system and 2 pipe system ▪ Most number of transition chambers ▪ Significant disruptions to mooring system in the Inner Dock ▪ Limited wayleave and more extensive traffic management constraints in Hanover Quay ▪ Significant impact on the structure of existing Waterways Ireland Visitor Centre due the pipeline proximity ▪ Third highest cost option

Environmental

As all options remove the discharge from within the Grand Canal Basin and into the River Liffey where there is adequate dilution and dispersion, the overall operational environmental impacts are similar and positive. The impact on the River Liffey is the same for all route options. Route preferences were generally based on construction impacts and design considerations to meet constraints within the basin.

Each of the options was considered in terms of the various environmental categories.

In considering effects on Population and Human Health, Option 1 is the most favourable as this will enhance the amenity value of the basin during operational phase and will have least effect on boats circulation within the basin. This option is also preferred by the key stakeholder (Waterways Ireland). Option 2 is less favourable as less area will be available for boats circulation than Option 1 and Option 4. This will impact on the amenity value of the basin during operational phase. Option 4 has the potential to impact on the structure of existing Waterways Ireland Visitor Centre due the pipeline proximity and the required 8m buffer distance from the quay wall (to prevent damage) will impact the moorings.

In considering effects on Biodiversity, Option 3 is more preferable than other options as there will be no disturbance to the bed of the basin.

In considering effects on Water Quality and Hydrology, all the options are neutral since the outfall is common in all options and they will have same impacts on water quality during the operational phase.

In considering effects on Air Quality and Climate, all options are neutral. The impacts will arise only during construction phase and are deemed to be similar and insignificant for all options.

In considering the effects of Noise and Vibration Option 3 is the least favoured as it has the highest construction risk due the tunnelling method. The nearby railway line and the 8ft sewer beneath MacMahon Bridge as well as other structures would be at risk of damage due to vibration.

In considering the effects on Traffic, Option 2 is the most favourable as it will cause less disruption to the traffic and public on Hanover Quay during construction phase. During operational phase all options will be neutral in this regard. Option 3 is the least favoured as it involves significant spoil generation, resulting in increased traffic in the area during the construction phase in order to transport the spoil away from the site.

In considering the effects on Archaeology and Cultural Heritage, Option 4 is the least favoured. A significant part of this option runs along the quay walls and there is potential to damage these protected structures.

In considering the effects on Land, Soils, Geology, Hydrogeology and Waste Management, Option 3 is the least favourable as significant amounts of spoil will be generated due to tunnelling. This will require significant testing works to check for contaminated soil and disposal off-site accordingly. Option 1 is favoured as this will involve minimal disturbance due to shallower required dredging in the outer dock.

In considering effects on Material Assets, Option 2 is least favourable as less area will be available for large boat circulation than Option 1 and Option 4. This will impact on the amenity value of the basin during operational phase. Option 3 is also less favourable as it has highest construction risk due to the tunnelling method, particular concern would be the potential to damage the existing 8ft city sewer.

In considering the effects on the Landscape and Visual environment, Option 1 and Option 4 are less favourable as they will cause temporary disruption to landscaped area of Hanover Quay, including removal of trees, metal guards to trees, stone seating and planters.

Hence in terms of Environmental criteria, Option 1 emerges as the marginally preferred option as it has the least negatives.

Technical and Design Considerations

Option 3, the tunnelling option has the highest cost and is also associated with the highest construction risk particularly in relation to damage to the existing 8ft city sewer, the railway line and nearby properties. This is the least favourable pipeline option.

The next option that was disregarded was Option 4, due to the complexity of the pipeline configurations and the need for 5 transition chambers. There would also be significant disruption & redesign required to the docking system for the canal boats in the inner dock.

Option 1 is preferrable to Option 2 as it retains access to more of the berthing spaces on Hanover Quay and maximises the navigable area of the Outer Basin. It is the second least costly option. Extensive consultations with Stakeholders, and in particular Waterways Ireland, confirmed Option 1 as their preferred option. Option 2 route is also not acceptable to Waterways Ireland due to the extent of the mooring area for large ships that would be sterilized.

Cost

The estimated total Contract Capital Costs (excluding VAT) for the three pipeline options 1, 2 and 4 are similar (within 6%.). The tunnelling option 3 is considerably more expensive (approximately 30% more).

Table 4.2 below provides a summary of comparison between the four options in terms of environmental and technical criteria.

Table 4.2 Summary of Comparison of Alternatives

Criteria	**Outfall Options**			
Environmental	**Option 1**	**Option 2**	**Option 3**	**Option 4**
Population and Human health	▲	▼	●	▼
Biodiversity	●	●	▲	●
Water Quality and Hydrology	●	●	●	●
Land, Soils, Geology and Hydrogeology (Including Waste Management)	▲	●	▼	●
Air Quality and Climate	●	●	●	●
Noise and Vibration	●	●	▼	●
Traffic and Transport	●	▲	▼	●
Archaeology and Cultural Heritage	●	●	●	▼
Material Assets	●	▼	▼	●
Landscape and Visual Impact	▼	●	●	▼
Technical	**Option 1**	**Option 2**	**Option 3**	**Option 4**
Constructability	●	●	▼	●
Risk	●	●	▼	●
Design	●	●	▼	▼
Cost	**Option 1**	**Option 2**	**Option 3**	**Option 4**
Cost	●	●	▼	●

▲ **More Favourable**

● **Neutral**

▼ **Less Favourable**

4.4.1 Preferred Pipeline Option

Option 1 emerges as the preferred option in terms of Environmental and Technical criteria. Option 1 will enhance the amenity value of the basin, retains access to more of the berthing spaces on Hanover Quay, reduces the risk of damage to quay walls in the inner basin, and maximises the navigable area of the Outer Basin. It is the second least costly option (5%). Extensive consultations with Stakeholders, and in particular Waterways Ireland, has also confirmed Option 1 as their preferred option.

4.5 Summary

The Grand Canal Tunnel was constructed in 1976 and it was always intended that it would be extended into the River Liffey. Planning permission was granted by the DDDA and the Phase 1 Culvert was completed in 2002. Phase 2 is about extending the existing Grand Canal Tunnel outfall into the southern end of the Phase 1 Culvert and at its northern end constructing and connecting the SJRQ outfall structure.

Options considered included Do Nothing, Remove Pollution at Source and four pipeline route options (including a tunnelling option).

The 'Do Nothing' Option is not considered sustainable as the Grand Canal Basin becomes polluted when there are CSO spills within the catchment during rainfall events. There are many canal boats in the inner basin and the basins have significant amenity value (actual and potential). The basins do not have the throughflow or dilution capacity to deal with these periodic pollution discharges. In addition, the need to discharge the stormwater outfall to the River Liffey is included in both the Docklands Master Plan Policy Objective (IF3) and the North Lotts & Grand Canal Dock STZ (S13).

The 'Remove Pollution at Source' is not considered practicable given the difficulties identifying the multiple sources of the pollution but also the fact that sewer networks are designed during heavy rainfall to overflow into the stormwater network (via CSO). The CSO prevent sewage flooding in local areas and protect the WWTPs. This option is not considered feasible due to costs, disruption and engineering feasibility.

The tunnelling option (Option 3) was disregarded due to the significant construction risk and high costs. Options 1, 2 and 4 are similar but Option 1, which was developed in conjunction with the Stakeholders, is the preferred option as it maximises the berthing areas along Hanover Quay, maximises the navigable area of the outer dock.

The Applicant is satisfied that the project proposed is the optimum to deliver the desired outcome.

SECTION 5: Population and Human Health

5.1 Introduction

This section has been prepared by Conor Frehill, (BA Honours, Master of Regional and Urban Planning, MRTPI), Director at HW Planning. Conor has 13 years' experience in the planning profession comprising local authority roles and private practice. Conor has acted as planning lead on a wide variety of projects, including those with Environmental Impact Assessment Reports and Strategic Environmental Assessment exercises. His experience extends to planning policy development, local authority plan-making processes, the preparation of evidenced based strategies, leading on community-led planning initiatives, and the coordination of planning applications for mixed use developments, strategic infrastructure and renewable energy projects. Conor is a chartered member of the Royal Town Planning Institute.

The 2014 Environmental Impact Assessment (EIA) Directive (2014/52/EU) has updated the list of topics to be addressed in an Environmental Impact Assessment Report (EIAR) and has replaced 'Human Beings' with 'Population and Human Health'. This section also meets the requirement for assessment of 'population, human health' as per Schedule 6 of the Planning and Development Regulations 2001-2020.

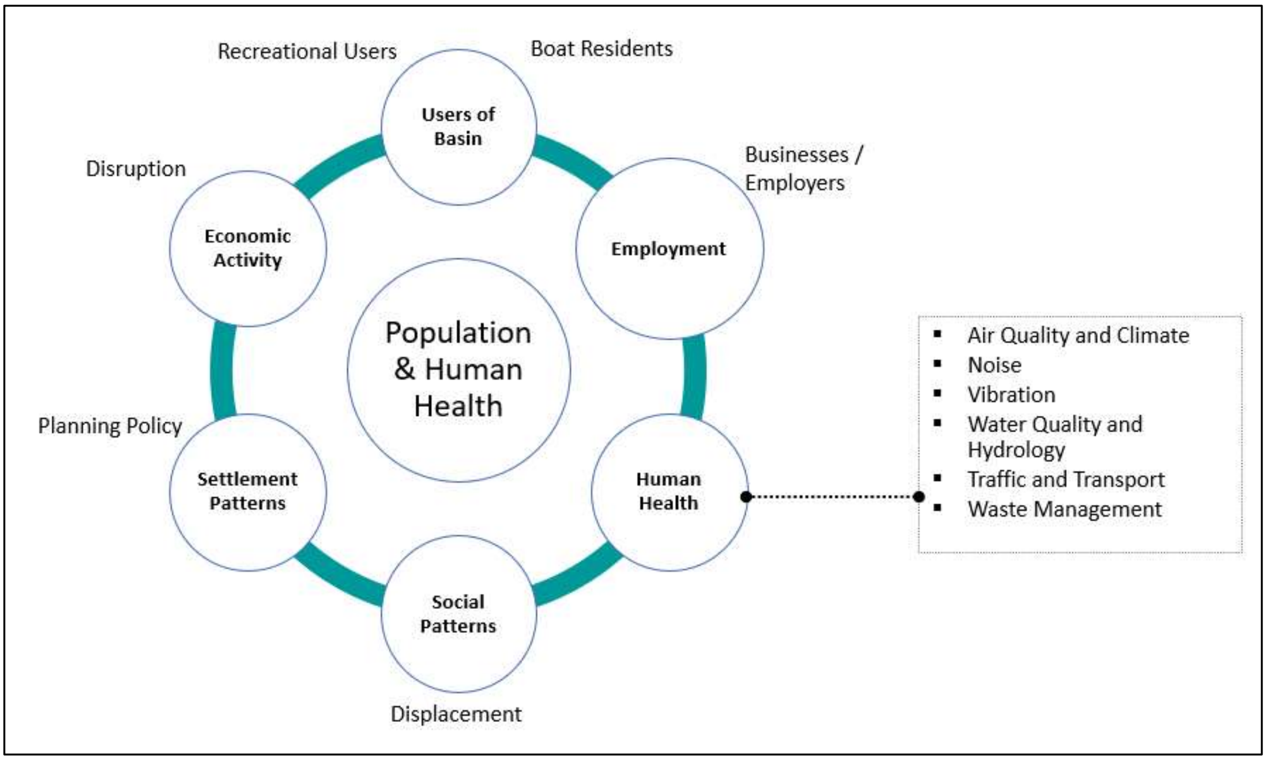


Figure 5.1 Potential Impacts identified in Scoping Document

As noted in Figure 5.1 there are several inter-related environmental topics such as the potential impacts of the proposed development on Water Quality and Hydrology, Air Quality and Climate, Noise and Vibration, Traffic and Transportation, and Waste Management which are of intrinsic direct and indirect consequence to human health. These are addressed in detail in this Volume 2 of the EIAR in Sections 7, 9, 10, 11 and 13 respectively. While the baseline scenario for these environmental topics is not duplicated in this section, the assessment of impacts on population and human health refers to those environmental topics under which human health effects might occur in line with the EPA *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports.*

It should be noted that an EIAR was completed in respect of the proposed development in 2001. This section takes into account the conclusions of the 'Human Beings' section of the previous EIAR and updates the findings in the context of subsequent census data and changes to the legislative requirements for EIAR, which now include an appraisal of the impact of the proposed development on the receiving environment in terms of population and human health.

5.2 Methodology

The European Commission guidance *'Environmental Impact Assessment of Projects, Guidance on the preparation of the Environmental Impact Assessment Report'* (European Union, 2017) state the following in respect of "human health":

"*Human health is a very broad factor that would be highly Project dependent. The notion of human health should be considered in the context of other factors in Article 3(1) of the EIA Directive and thus environmentally related health issues (such as health effects caused by the release of toxic substances to the environment, health risks arising from major hazards associated with the Project, effects caused by changes in disease vectors caused by the Project, changes in living conditions, effects on vulnerable groups, exposure to traffic noise or air pollutants) are obvious aspects to study* ".

This section of the EIAR document has been prepared with reference to the *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports*, published by the EPA in May 2022. A desktop study of the following published policy documents and data was undertaken to appraise the location. The likely and significant potential impact upon population and human health receptors and population trends in the subject site and in the wider hinterland were assessed.

- Central Statistics Office (CSO) Census 2011 & 2016 data;
- Quarterly Economic Commentary Summer 2021, ESRI;
- AIRO Census mapping;
- Eastern and Midland Regional Assembly Regional Spatial and Economic Strategy;
- Dublin City Development Plan 2016-2022;
- The North Lotts and Grand Canal Dock Planning Scheme 2014;
- The Public Realm Masterplan for the North Lotts and Grand Canal Dock Planning Scheme 2014;
- A Water Animation Strategy for the Docklands 2018; and
- Failte Ireland Docklands Visitor Experience Development Plan 2020 (DVEDP).

This assessment is a study of the potential indirect and direct socio-economic and public health impacts of the construction phase and the operational phases of the development. Effects on receptors were assessed in terms of magnitude, quality, significance and duration.

5.2.1 Assessment Criteria

All impacts or effects are described in following terms as in accordance with the "*Description of Effects"* outlined in Table 3.3 of the EPA *Guidelines on Information to be Contained in Environmental Impact Assessment Reports 2022*.

Quality: Positive, Neutral, Negative

Significance: Imperceptible, Not Significant, Slight, Moderate, Significant, Very Significant, Profound

Extent and Context: Size of area, population etc.

Probability: Likely, unlikely

Duration: Momentary (seconds to minutes), Brief (less than a day), Temporary <1 yr, Short-term 1-7 yrs, Medium Term 7-15yrs, Long Term 15-60 yrs, Permanent >60 yrs, Reversible (can be undone), Frequency (once, rarely, occasionally, frequently, constantly or hourly, daily, weekly, monthly, annually).

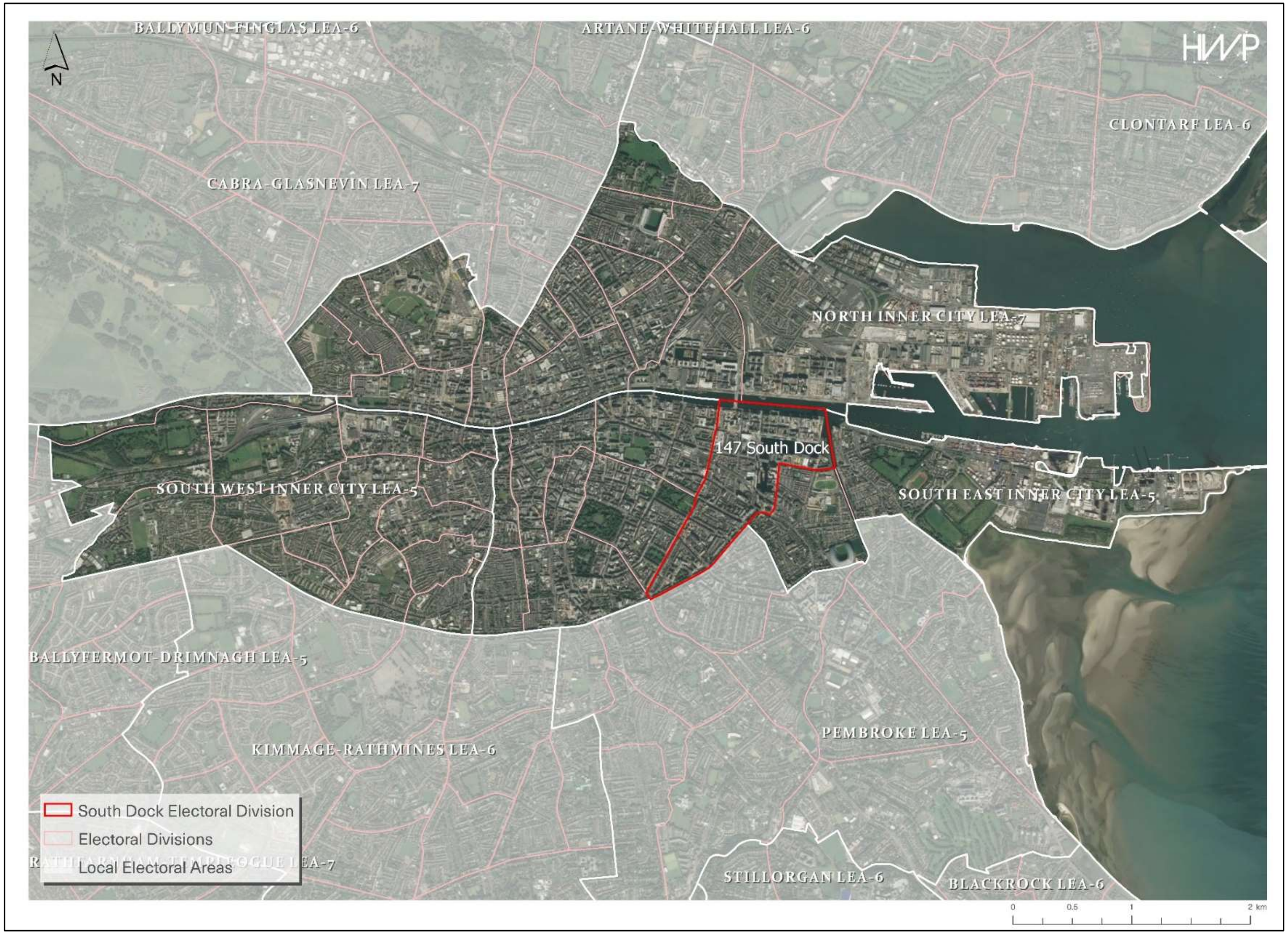


Figure 5.2 Study Area Wider Hinterland

5.3 Receiving Environment

The following section contains a description of the current state of the environment (baseline scenario) in relation to population and human health and the possible impacts on these arising from the proposed development, which are not already covered by other disciplines in this EIAR and include:

- Users of the Basin – Residential and Recreational Population;
- Employment & Economic Activity;
- Social and Settlement Patterns; and
- Human Health, including Health & Safety.

5.3.1 Population

There are two principal resident groups in the Grand Canal Basin. These are:

- The land-based-resident population; and
- The boat-based resident population.

In addition to the land-based resident population in the vicinity of the subject site, the waters of Grand Canal Dock include boat residences and recreational users. Waterways Ireland has 59 mooring locations in Grand Canal Dock, of which 20 are houseboat serviced mooring locations where residential extended mooring permits allow the holder to moor for up to one year. These are all currently full. Visitor Permits allows boats to enter the canal system and stay for up to 31 days. The census figures in Table 5.1 incorporate both the land and boat-based residents of the area.

Located in the South Dock Electoral Division (as defined by the Central Statistics Office), the subject site is situated within one of the busiest parts of Dublin City Centre. The area comprises sizable working and residential populations, as well as visiting populations having regard to established recreational, tourism and cultural uses in Dublin Docklands. The South Dock Electoral Division falls within the larger South-East Inner City Local Electoral Areas (LEA). South Dock Electoral Division has been identified as the detailed study area of the subject site, with the combined areas of the North Inner City LEA and the South East and South West Inner City LEAs delineated as its wider hinterland. The South Dock Electoral Division and the larger LEAs are indicated in the map in Figure 5.2.

Table 5.1 Population Change Figures 1991-2016

Area	1991*	1996	2002	2006	2011	2016**	%Change 1991-2016
South Dock ED 147	2,589	3,307	3,764	5,123	7,129	7,004	171%
South Inner City (LEA)	37,815	43,424	64,211	71,281	77,950	82,947	119%
North Inner City (LEA)	24,862	44,518	46,497	51,726	58,435	63,612	156%
Inner City (N & S combined)	62,677	87,942	110,708	123,007	136,385	146,559	134%
Dublin City	478,389	481,854	495,781	506,211	527,612	554,554	16%
State	3,525,719	3,626,087	3,917,203	4,239,848	4,588,252	4,761,865	35%

**Based on information from Table 4.1 of 2001 Project EIAR*

*** Notwithstanding the LEA boundary changes between 2002 and 2019 the figures in Table 5.1 and the boundaries in Figure 5.2 reflect the current LEA boundaries*

The South Dock Electoral Division was historically the focus of heavy industry which gave way to dereliction and contamination issues when these industries declined. The area has experienced considerable redevelopment since 1998, as part of the Dublin Docklands area redevelopment project under the auspices of the Dublin Docklands Development Authority.

The resident population within the South Docks Electoral District has increased from 2,589 persons in 1991 to 7,004 persons in the 2016 census. This growth rate of 171% is significantly higher than that experienced by the Dublin City Council area as a whole and the state during the same period. But it is in line with the quantum of growth experienced in the wider inner city LEAs, which also grew strongly. The inclusion of the area within the North Lotts and Grand Canal Dock Strategic Development Zone (SDZ) planning scheme (2014), supports this growth, with over 400,000 square metres of office space and over 2,000 homes to be developed across 22 hectares (Figures derived from Dublin City Development Plan 2016-2022 Progress Report, date 26th October 2019).

It should be noted that while the South Dock Electoral Division experienced an extended period of higher than average population growth between 1991 and 2011, the 2016 Census data indicates that this trend had reversed in the last intercensal period, when a population decline of -1.8% was experienced, atypical of the wider dockland area, Dublin City or national population growth trends. Figure 5.3 highlights the lack of uniformity in the population trends within the inner-city area between 2011 and 2016, with some areas such as the Mansion House B electoral division, which adjoins the South Dock electoral division, experiencing strong growth.

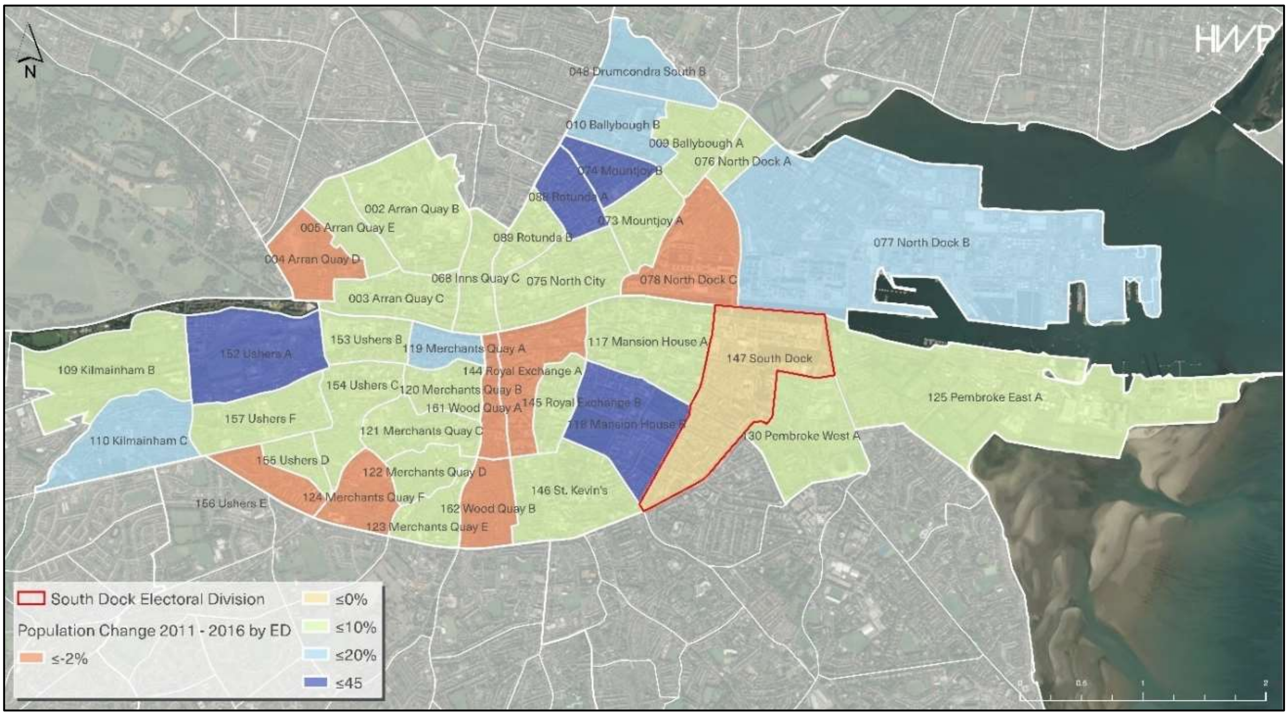


Figure 5.3 Population Change 2011 – 2016 (CSO Data)

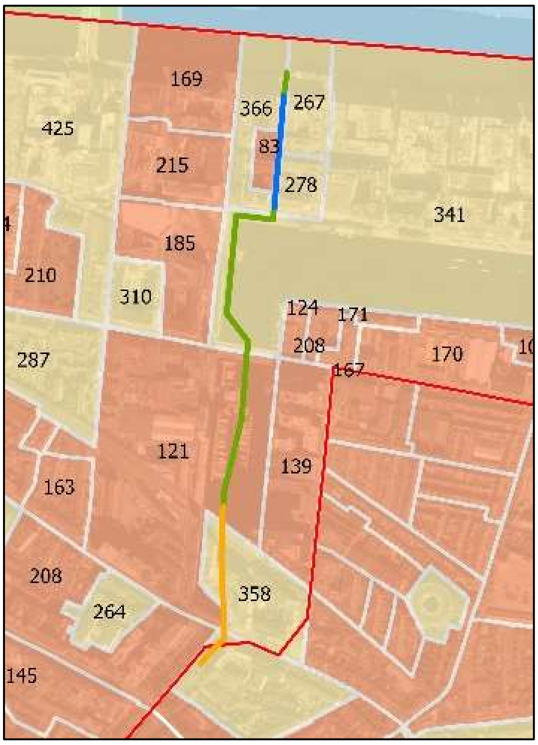


Figure 5.4 Small Area Population 2016 (based on CSO Data)

CSO Small Area Census figures have been used to provide a more detailed breakdown of the population within the South Dock Electoral Division (Figure 5.4). In 2016 a population of 3,164 persons resided in the 14 CSO Small Areas which had boundaries within 100m of the proposed works (CSO Small Areas identified in Volume 3, Appendix 5A), these are the population that are most likely to be directly impacted by the proposed development.

Table 5.2 Birthplace of Residents in 2016 (CSO 2016 Census)

Birthplace	% in Dublin City Council Area	% in South Dock ED	% in Adjoining Small Areas
Ireland	78.03%	64.19%	59.48%
UK	4.15%	5.31%	6.10%
Poland	1.88%	1.21%	1.56%
Lithuania	0.44%	0.14%	0.17%
Other EU 28	6.34%	14.19%	16.11%
Rest of World	9.15%	14.96%	16.55%
Not stated	0.00%	0.00%	0.00%
Total Born Outside of Ireland	21.96%	35.81%	40.49%

As Table 5.2 indicates there is a very diverse population base within the South Dock Electoral Division, with 36% of the population born outside of Ireland, in comparison with 22% of the population in the Dublin City Council area. This figure is even more pronounced if we look at the 14 CSO Small Areas adjoining the subject site where the figure rises to 40.5%.

Another characteristic of the area is the youth of the resident population, with the majority of the population within the 20 – 39 years old age cohort. In Small Areas immediately adjacent to the proposed development 67.4% of the population are in this age group, almost twice as many as in the overall Dublin City Council area where the proportion is 38.6%. Refer to Table 5.3. Conversely, there are significantly fewer children and elderly residents, the former is reflected in the relatively low occupancy rate. Refer to Table 5.4.

Table 5.3 Age of Residents in 2016 (CSO 2016 Census)

Age Cohort	% in Dublin City Council Area	% in South Dock ED	% in Adjoining Small Areas
0-19	19.0%	11.4%	10.0%
20 - 39	38.6%	62.5%	67.4%
40-59	23.9%	17.9%	17.8%
60-79	13.7%	7.6%	4.6%
80 plus	3.6%	0.7%	0.2%

Table 5.4 Household Size in 2016 (CSO 2016 Census)

Area	Persons	Households	Occupancy Rate
South Dock ED 147	6,258.00	3,035.00	2.06
Dublin City	525,229	211,747	2.48

5.3.2 Employment & Economic Activity

While Dublin City has experienced an upward trend in economic performance in recent years, the docklands area in particular has evolved into a prime office location, with a strong presence of multi-national organisations and indigenous corporate headquarters. This is reflected in its nickname 'Silicon Docks', highlighting it as a major global tech employment cluster, based on the presence of the European headquarters for Google and Facebook. However, there are also financial, legal and digital-media employment clusters in the immediate vicinity with Business Parks and Innovation Parks fostering start-ups and entrepreneurship. The high-profile move of the Central Bank to North Lotts further endorses the area as an attractive employment hub. Alongside this Trinity College Dublin is progressing plans to develop a second campus based at Grand Canal Quay, with a vision that the campus could act as a catalyst for a globally competitive innovation district in the areas of research, enterprise, programming, while also performing as a public space and a cultural connector.

The dramatic success of the redevelopment of the docklands is evident in the jobs ratio (total number of jobs divided by the labour force) which is used as an indicator to measure an area's economic vibrance and sustainability. In the 2016 census, there were c. 4.93 jobs to resident worker in the South Dock Electoral District area, compared to 1.22 jobs to resident worker in the Dublin City Council area as a whole and 0.978 jobs to resident worker in Dublin City and Suburbs. Refer to Table 5.5. These should all be viewed in the context of the state average for settlements which is 0.86 (Source NPF, Appendix 2).

Table 5.5 Jobs Ratio in 2016 (CSO 2016 Census)

	Dublin City and Suburbs	Dublin City Council	South Dock ED 147
Labour Force (A)	524,019	304,870	5,087
Number of Jobs (B)	512,449	372,810	25,088
Jobs Ratio (B/A)	0.978	1.223	4.932

Alongside this, the 2016 Labour Force Participation Rate in the South Dock Electoral District is high at 79.5% compared to 64.7% for the Dublin City Council area, which in itself is relatively high compared to the state average of 61.4%. The high participation rate in the study area appears to correlate with the fact that the majority of the population is in the 20 – 39 years old age cohort (Table 5.3). When viewed in conjunction with the fact that a significant element of this population was born outside of Ireland (Table 5.2), and that the percentage of the population with degree or higher-level education is substantially above the state and Dublin City average (Table 5.6), a picture emerges of a young, highly-skilled, mobile workforce attracted to live and work in the dockland for its many career opportunities.

While the ESRI Quarterly Economic Commentary – Summer 2021 indicates that the impact of the Covid- 19 pandemic has not been evenly distributed with younger workers disproportionately impacted, it also notes that only 2.1% of the Pandemic Unemployment Payment recipients were employed in the Information and Communication Activity Sector, and that foreign-dominated, export orientated sectors are highly influential in the economy's growth rate for the year to date. It is considered that the employment rate in the study area which is a hub for international technology companies will have remained stable. Nonetheless, ESRI anticipate that the national unemployment rate, that reached 18.9% in 2020, will revert to 7.1% by 2022.

Table 5.6 % Degree Level Education or Higher in 2016 (CSO 2016 Census)

Highest Level of Educational Attainment	State	Dublin City Council	South Dock ED 147
Degree Level or Above	34.9%	35.9%	60.4%

The sustainability of the study area, an emerging urban village, as a place to live and work is evident from the CSO 2016 Census commuter figures where the percentage of the population who walk to work or college is 51%, over twice the average rate for the Dublin City Council areas and three times the national average (Table 5.7).

Similarly, the importance of the study area as an employment hub is demonstrated by the commuter flow data summarised in Figure 5.5.

Table 5.7 Commuting Patterns (CSO 2016 Census)

Commuting	State	Dublin City Council	South Dock ED 147
Walking	14%	25%	51%

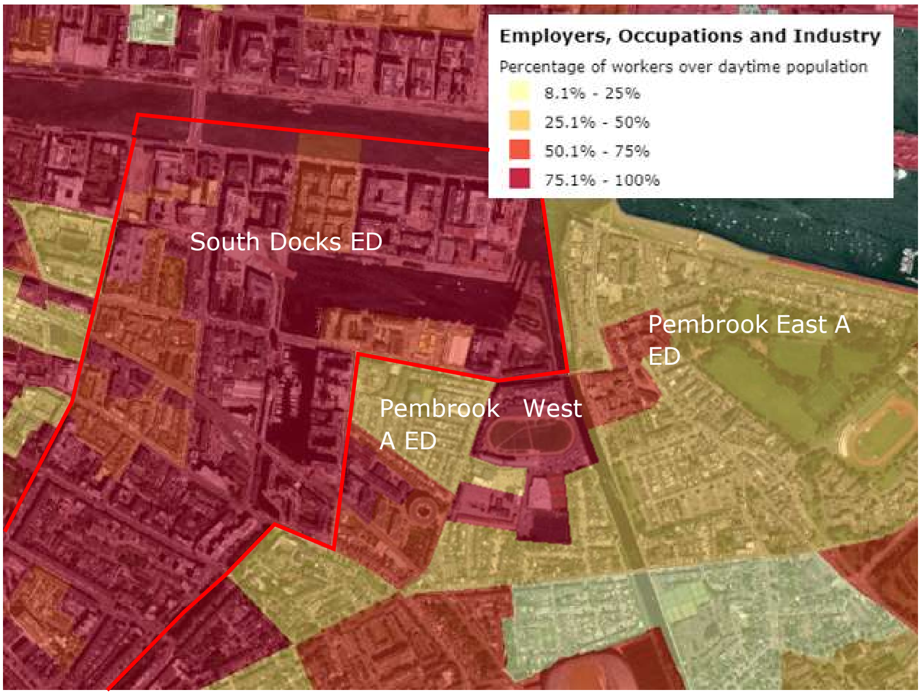


Figure 5.5 Commuter Flow Data (based on AIRO Census 2016 Maps)

This shows a net inflow of 20,727 commuters into South Dock ED in 2016; this pattern is less pronounced in adjoining EDs with net inflow of 1,554 commuter in Pembroke West A, and a net outflow of 1,022 commuters in Pembroke East.

It should be noted that the Grand Canal Dock Station, located on Barrow Street is adjacent to the Google EMEA HQ. This station services main line commuter rail routes to Dundalk, Maynooth and Longford in addition to the Dublin Area Rapid Transit (DART) system.

5.3.3 Social and Settlement Patterns

Recreational Users

The South Dock Electoral Division, historically the focus of heavy industry, has more recently become synonymous with some major city centre visitor attractions. Adventure and water-based recreation activities have come to the fore; with the Grand Canal Docks becoming the focus for wakeboarding, wind surfing, kayaking and paddle boarding activities. Alongside this, a slipway on the eastern edge of the dock has until recently allowed for use by the semi-aquatic vehicle of Viking Splash Tours. Due to water quality issues, immersive watersports are not currently permitted.

The area’s rich maritime heritage can be explored in the Waterways Ireland Visitor Centre on Grand Canal Quay, the Diving Bell on SJRQ, Irelands smallest museum and a range of walking tours. There are also a number of parks and public spaces in the form of:

- Grand Canal Square;
- Pearse Square Park;
- Chimney Park, a children’s play park; and
- The nearby South Dock Street Park.

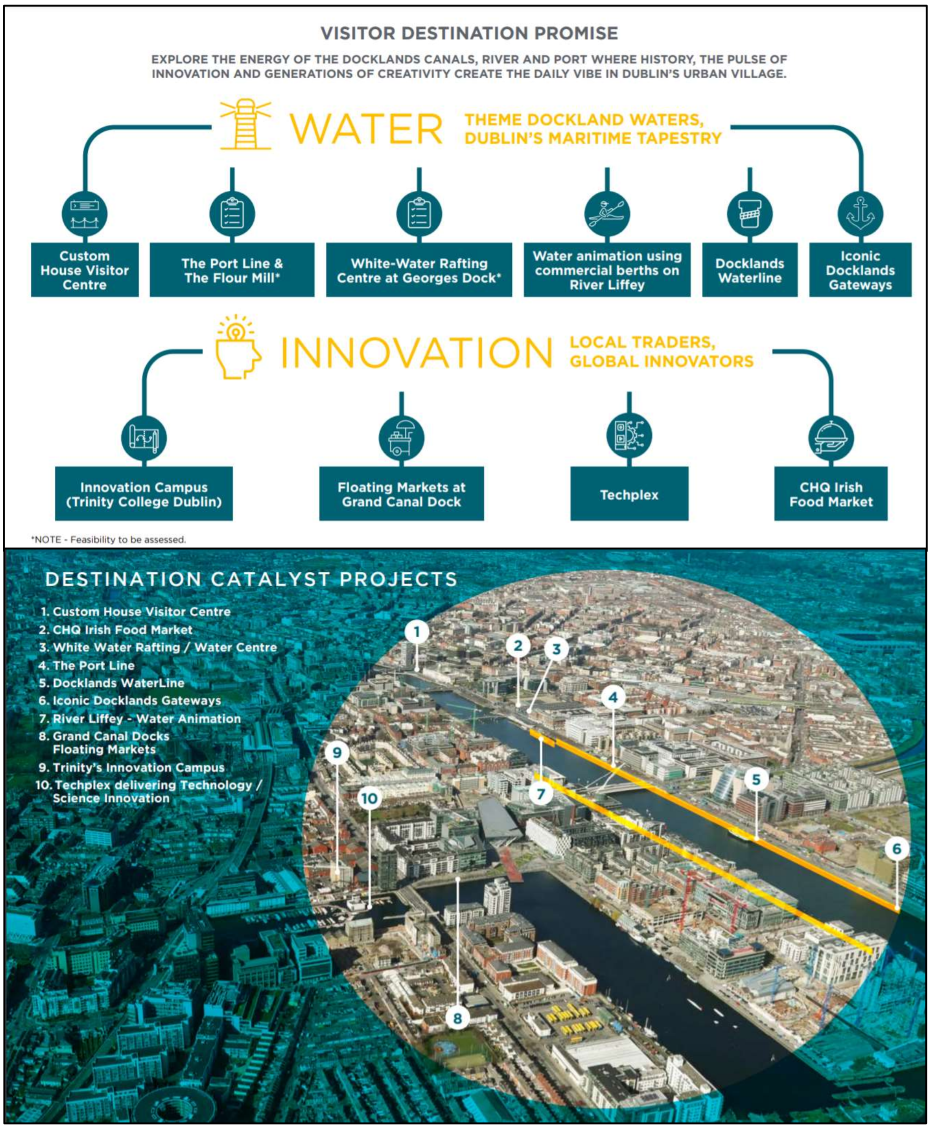


Figure 5.6 Extracts from Failte Ireland's DVEDP

Failte Ireland recognises the overall Docklands area as an area with much potential to develop as a visitor destination, refer to Figure 5.6. In 2020 they produced the Docklands Visitor Experience Development Plan (DVEDP). In it is notes that a significant amount of development is already underway in the Docklands with-

'*some exciting and truly transformational projects already in the pipeline. The DVEDP seeks to capture these projects within one plan and to help harness their potential over the next five years*'.

Within the South Dock Electoral Division there are specific proposals for:

- Grand Canal Floating Markets;
- Trinity Innovation Campus; and
- Techplex.

In addition, there are wider-scoping proposals to increase water animation on the Liffey and enhance WaterLine and PortLine activity. The Docklands Visitor Experience Development Plan envisages the timeframe for the Floating Markets, which is at feasibility assessment stage, to be 2024 with projected visitor numbers in excess of 250,000. The cultural space as part of the Trinity Innovation Campus is anticipated to be in operation in 2024 with a projection of 20,000 – 100,000 visitors. The Techplex, a visitor experience to leverage the culture of technology advancement within the area is still at early concept stage.

Land Use

The land use pattern in the South Docks Electoral Division area is changing rapidly. The traditional form was functionally segregated, with predominantly large industrial buildings along the quays and small terraced housing to the south. As Figure 5.7 indicates this form is giving way to predominantly high rise commercial or mixed commercial and residential buildings, with pockets of residential terraced housing remaining. This change is typified by the development of Bolands Mills. The site which included 6 storey warehouses dating from the 1830s, stopped production in 2001 and was subsequently derelict. In 2015 a €150 million redevelopment project commenced on-site known as 'Bolands Quay', accommodating new residences, commercial, retail, and civic space. Google bought the site from the National Asset Management Agency in 2018.

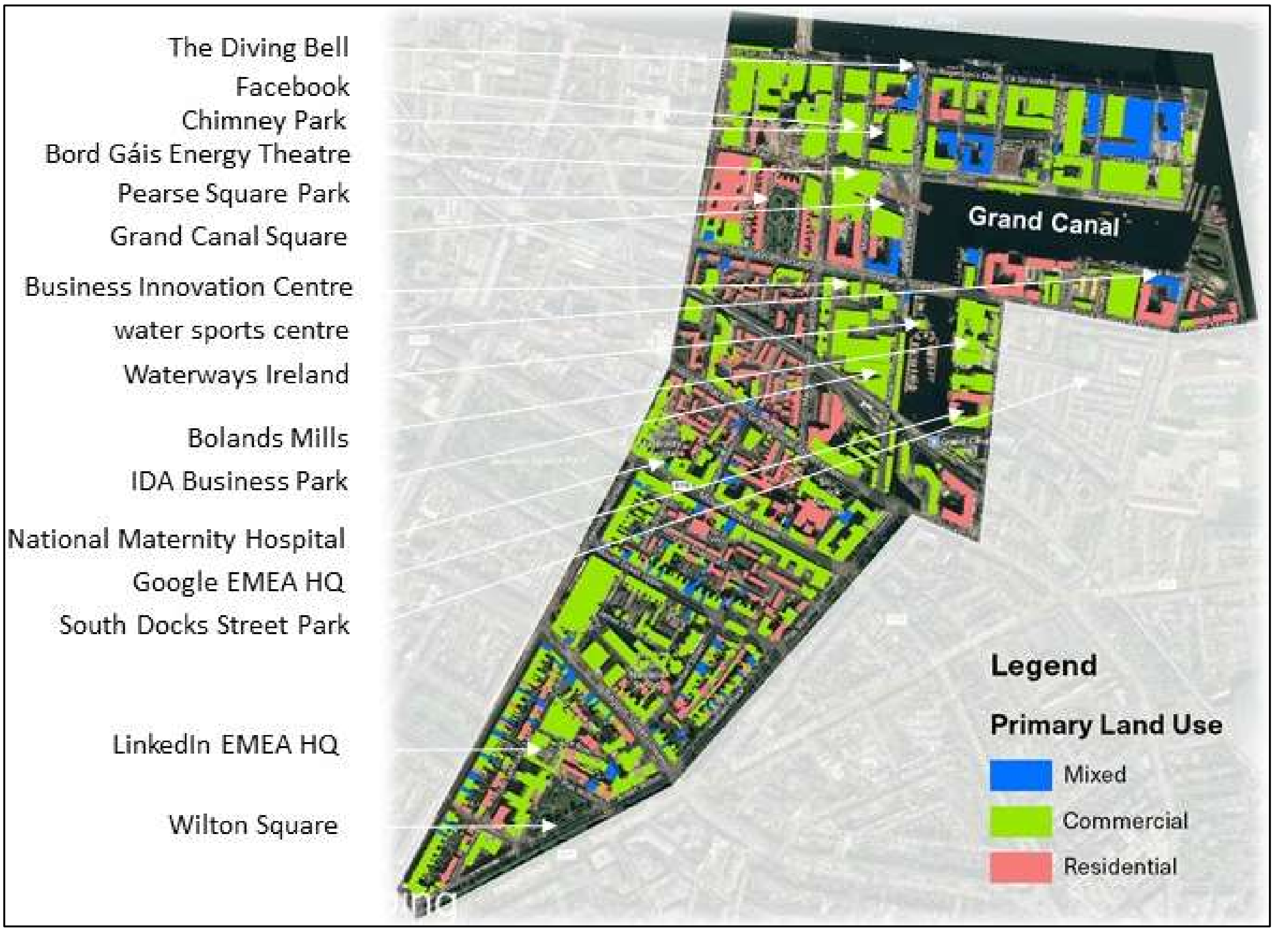


Figure 5.7 Indicative Land Use in the South Dock ED

Settlement Pattern

The Figure 5.8 below uses CSO Small Area Census figures to indicate the pattern of population distribution within the South Dock Electoral Division. The population density is significantly lower in the established residential area to the south where traditional building heights range from 1 to 4 storeys. The dockland redevelopment area to the north, typified by Barrow Street, Hanover Quay, SJRQ are characterised by increased building height and density.

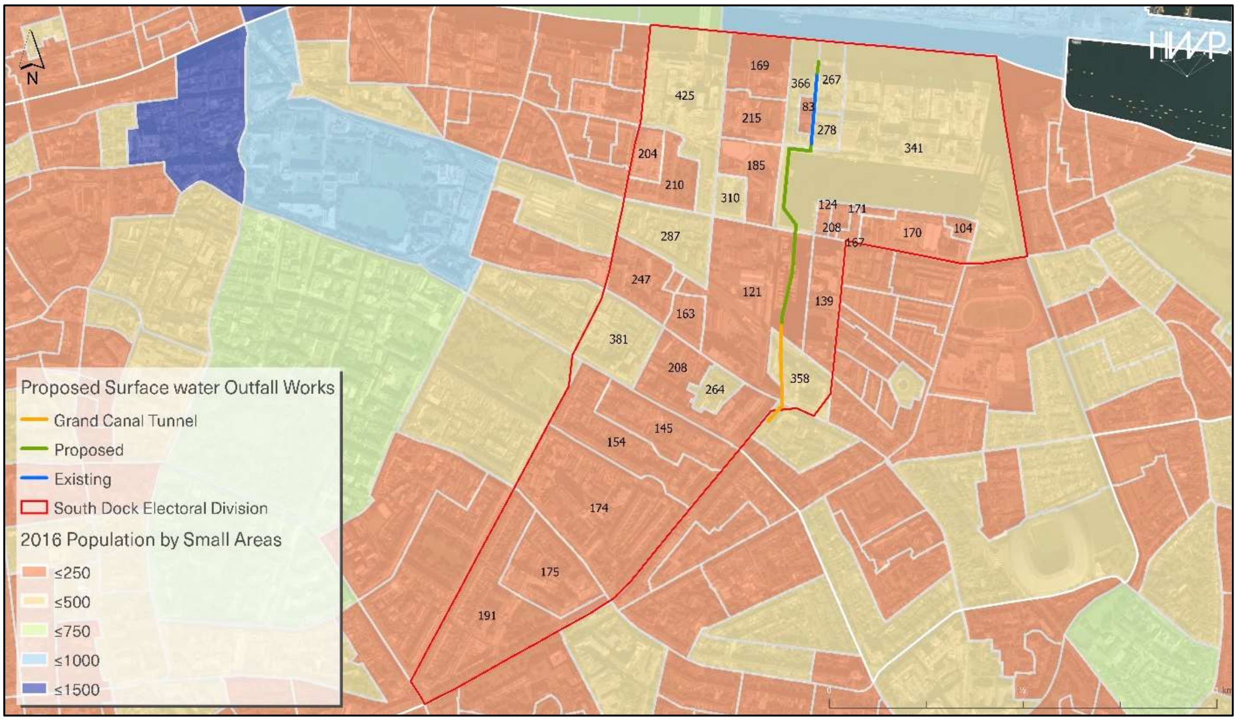


Figure 5.8 CSO 2016 Census Data showing Population Density

The 2016 Census figures indicate a housing stock of 4,000 for the South Dock Electoral Division, with a vacancy rate of 12.9%. Figure 5.9Figure 5.9 indicates the remaining undeveloped sites in the area in 2014, as identified in The North Lotts and Grand Canal Dock Strategic Development Zone(SDZ).

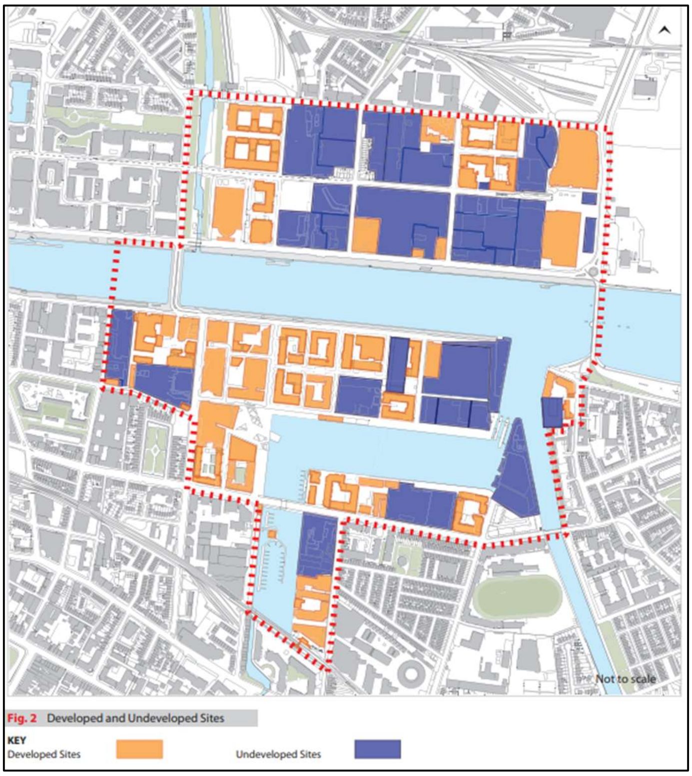


Figure 5.9 North Lotts and Grand Canal Dock Strategic Development Zone(SDZ)

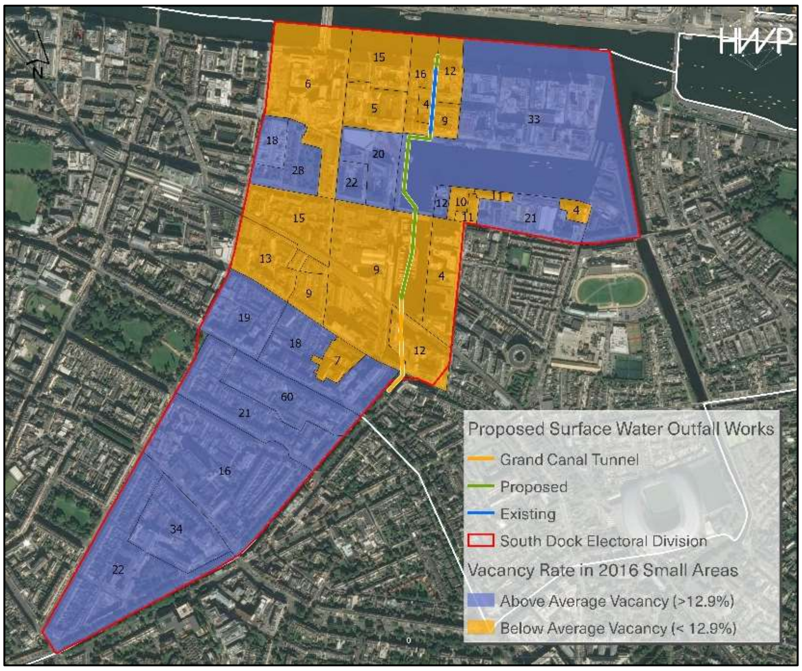


Figure 5.10 2016 Census Rates by Small Areas

Figure 5.10 indicates that the pattern of vacancy had not changed significantly by 2016, with vacant undeveloped sites remaining in the Hanover Quay and SJRQ areas and South of Mount Street to a lesser extent off Pearse Street, Ringsend Road and Pembroke Row. In the 2016 Census the vacancy rate in the vicinity of the proposed works was below average in the sections to south of Grand Canal Bridge and to the north of Hanover Quay. The Grand Canal Square Area and Charlotte Quay area, both adjacent to the subject site, were indicated with higher than average vacancy rates in the 2016 Census, but have both subsequently been redeveloped.

5.3.4 Human Health

Health, as defined by the World Health Organization (WHO), is '*a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity*'. The Healthy Ireland Framework 2013-2025 defines health as 'everyone achieving his or her potential to enjoy complete physical, mental and social wellbeing. Healthy people contribute to the health and quality of the society in which they live, work and play'. This Framework also states that health is much more than an absence of disease or disability, and that individual health, and the health of a country, affects the quality of everyone's living experience. Human health has the potential to be impacted upon by environmental factors such as air, water or soil through which contaminants could accumulate and have potential to cause harm through contact with human beings. This section of the EIAR focuses primarily on the potential likely and significant impact on Population and Human Health in relation to health effects/issues and environmental hazards from the other environmental factors and interactions that potentially may occur.

5.4 Characteristics of the Development

The proposed development aims to address water quality concerns in the Grand Canal Dock by intercepting the storm water discharge where it enters the Dock and relocating the discharge point to the River Liffey. The proposed development will involve construction of a 550m length of pipeline which will pass from the Grand Canal Tunnel Outfall, near the Grand Canal Dock Dart Station, north through the Basin where it will pass through a section of Hanover Quay. It will then link up with an existing culvert on Asgard Road, built in 2002 as part of the Phase 1 works for this project. At the northern end of this existing culvert, an outfall will be constructed underneath SJRQ. A full description of the proposed development can be found in Volume 2, Section 2.

5.5 Potential Impacts

This section provides a description of the specific, direct and indirect, impacts that the proposed development may have during both the construction and operational phases of the proposed development focusing on health issues and environmental hazards arising from the other environmental factors.

5.5.1 Do Nothing Scenario Impacts

If the proposed project does not proceed, water quality in the Basin of the Grand Canal Dock will continue to be adversely impacted due to the existing stormwater outfall discharging foul sewage into the inner docks during periods of high rainfall. There are health and commercial impacts arising from the 'do-nothing' scenario. The Grand Canal Docks is a principal focus for water-based activities in Dublin Docklands which includes water sports, tourist and leisure craft. Due to water quality issues, immersive watersports are not currently permitted. The improvement of basin water quality by means of the proposed project will have significant positive benefits, including the promotion of the use of the waterways as an integral part of quality of life for the community.

As noted in Volume 2, Section 7 Water Quality and Hydrology, the Water Framework Directive status for the Grand Canal Basin was downgraded from 'Good' in the period between 2010-2015 to 'Moderate' for the period between 2013-2018. If the proposed project does not proceed the waterbody is 'At risk' of not meeting the WFD objectives (EPA, 2020). This has significant implication for the existing water-based activities and would curtail plans for their expansion as outlined in the Failte Ireland Docklands Visitor Experience Development Plan.

5.5.2 Construction Phase Impacts

Population

The construction phase of the proposed development should not have a significant direct impact on the population numbers within the South Dock Electoral Division or the wider hinterland. It is expected that the construction workforce will travel from existing places of residence to the construction site rather than reside in the immediate environs of the site. There will be temporary impact on the boat-based residents in the 20 mooring locations in Grand Canal Dock who will need to be relocated to facilitate construction activities in the inner basin. *The magnitude of this change is considered locally high and the effect would be significant, short-term and negative*.

Increased road traffic and the potential for disruption to all modes of travel and access in the vicinity of the works due to closures and diversions could cause disturbance to the residential, working and recreational population of the area. Similarly, noise and dust emission during construction could also potentially impact on all sectors of the population. *In the absence of mitigation there is the potential for a slight, short-term negative effect.*

Employment and Economic Activity

The construction phase of the proposed development will take approximately 24 months and will generate construction employment directly on-site, amounting to some 60 persons at any one period during the phased development. It will also benefit support industries such as building supply services, professional and technical professions etc. There will also be some potential for positive indirect benefits for local businesses catering for the needs of the construction workforce. These beneficial impacts on economic activity will be largely temporary and confined to the construction period. *This is considered to be a moderate, short-term positive effect.*

Conversely there is potential for temporary disruptions to the operation of WakeDock and Surfdock Watersports School in the Grand Canal. However, without mitigation there is potential for a *moderate, short-term negative effect* on those in employment in these areas during certain phases of the construction period.

In the absence of mitigation, the proposed development could have an impact more generally on the economic activity of the surrounding area during the construction phase due to the associated nuisance of increased traffic and the potential for disruption to all modes of travel and access in the vicinity of the works due to temporary road, footpath, cycle lane station closures and diversions. Alongside this there is potential for impacts from construction dust and noise. These issues are examined with associated mitigations outlined in detail in Volume 2, Sections 9, 10, 7, 11 and 13 of the EIAR. *In the absence of mitigation there is the potential for a moderate, short-term negative effect.*

Social and Settlement Patterns

The social and recreational uses are fundamental to the character of the area. There is potential for short-term adverse effects on the amenity of the recreational users of the area arising from temporary closure/restrictions on access to the water-based facilities during construction. Potential impairment of water quality in the Grand Canal Basin due to surface water run-off or through resuspension of particles or accidental spill of pollutants may also result in further temporary restrictions on access. Recreational water-based activities are primarily seasonal and there is scope for undertaking the works outside the main activity seasons to minimise any impact. However, in the absence of mitigation there is the potential for *a significant, short-term, negative effect.*

The construction phase has the potential to adversely impact the townscape by the temporary degradation of the public realm. This will take the form of temporary hoarding around land-based works along Hanover Quay and SJRQ and around the construction compounds. Also, temporary hoarding may be put in place to the edge of the construction zones on Grand Canal Quay and Grand Canal Square for works in the outer basin. There will also be three construction compounds located at the eastern end of Hanover Quay, at Grand Canal Quay adjacent to the Irish Waterways Visitors Centre, and at SJRQ. Volume 2, Section 15 Landscape and Visual Assessment notes that the docklands have been in nearly constant development over the past two decades. While it acknowledges that the proposals will represent an increase in construction activity it considers that this is arguably characteristic of the area. It concludes that 'although there would be *adverse significant* landscape effects experienced during the construction phase these will all be *temporary or short-term and reversible'.*

Settlement patterns are unlikely to be impacted by the relatively short-term duration of the construction phase. *This is considered to be a negligible, short-term neutral effect.*

Human Health

The potential risks or nuisances that may be caused to human beings during the construction phase have been assessed in other sections of this report along with corresponding mitigation measures considering air quality, water quality, traffic, noise, and vibration. These are summarised below and also in Table 5.8:

- Potential negative impacts on human health could primarily occur as a result of construction dust through the release of PM10 and PM2.5 emissions. Section 9 – Air Quality and Climate concludes that there is a low risk of dust related human health impacts. Therefore, in the absence of mitigation there is the potential for *imperceptible, negative, short-term impacts* to human health as a result of the proposed development;
- There is also the potential for traffic emissions, primarily in the form of NO2, to impact air quality in the short-term over the construction phase, particularly due to the increase in HGVs accessing the site. However, Section 9 concludes that the proposed development will not significantly impact NO2 concentrations in the vicinity of the site and concentrations will remain similar to background levels. The construction stage traffic has the potential for a *neutral, imperceptible and short-term impact* on both air quality and climate;
- Section 10 – Noise and Vibration notes that the construction phase will include a wide range of activities and noise sources from which, due to the proximity of noise sensitive areas, there is potential for significant noise impacts to occur. The results of the baseline survey confirm that construction noise levels will need to be limited to 65 dB LAeq,16hour at the nearest noise sensitive locations to prevent significant impacts occurring. Vibration levels associated with construction activity at the nearest dwellings should not exceed those outlined in Section 10.2.2;
- In terms of peak construction haulage Section 10 concludes that the worst-case predicted noise level at the nearest receptor the impacts of construction related traffic on public roads can be regarded as *slight;*

- In terms of vibration, as a non-percussive piling technique is being employed it will inherently reduce the level of piling vibration generated. The impact of vibration arising from construction traffic is expected to be *insignificant;*
- Section 11 Traffic and Transport considers that overall the traffic generated by the development will not significantly impact the operation of the SJRQ / Macken St junction in the AM or PM peak scenarios or the Pearse St (R802) /Grand Canal Quay/ Ringsend St junction in the PM peak scenario. However, the proposed development may result in significant impacts to the Pearse St (R802) /Grand Canal Quay/ Ringsend St junction in the AM peak scenario, however, this is based on a worst case estimate of traffic generation and will be *short-term* in duration;
- Alongside this increased traffic and the potential for disruption to access in the vicinity of the works due to closures and diversions must also be considered. Road safety issues may arise. In the absence of mitigation there is the potential for a *slight, short-term negative effect*;
- During the construction phase there is potential for impacts on the water quality within the Grand Canal Basin through resuspension of particles or accidental spill of pollutants. This will impact to varying degrees on the recreational users and water-based residents in the Dock. Silt curtains will be utilised to limit the impacts of potential resuspension in the immediate vicinity of the working area. In the absence of mitigation there is the potential for *short-term impact which is moderate adverse in magnitude and moderate negative in significance;* and
- As noted previously, in the absence of mitigation there is the potential for moderate, short-term negative effects. There may be some temporary employment disruption in the water activity employment sector, however, overall, it is envisaged that there will be net employment and local economic benefits resulting from the construction phase. These both positively correlate with health and wellbeing. This is considered to be a *moderate, short-term positive effect*.

Table 5.8 Summary of Construction Impacts

Human Health	Impacts Without Mitigation
Air Quality –dust emissions	negative, imperceptible, short-term
Air Quality –traffic emissions	neutral, imperceptible, short-term
Climate	neutral, imperceptible, short-term
Noise - construction	negative, significant, localised, short-term
Noise – construction traffic	negative, slight, short-term
Vibration	not significant, localised, short-term
Traffic	negative, significant, localised short-term
Road Safety	negative, slight, localised, short-term
Water Quality	negative, short-term, moderate adverse
Employment	positive, moderate, short-term

5.5.3 Operational Phase Impacts

Population

It is noted that Section 15 considers there will be a *slight negative permanent effect* experienced by some residents and staff in buildings overlooking the Grand Canal Basin due to a slight increase in cluttering of their views. The proposed floating moorings platform are essential to the protection of the pipeline from damage by boats. This will extend along the edge of Grand Canal Quay/Square between the bridge and Hanover Quay. The proposed moorings will reduce slightly the visual prominence of the jetty due to reduction in the amount of open water surrounding it, and this will have a minor effect on the visual appeal of the jetty.

The Dublin Port Company have indicated that berthing at the SJRQ may be restricted in the vicinity of the outfall. This will result in *slight negative long-term effect*. However, it is envisaged that this will be counterbalanced by the water quality improvement resulting from proposed development which will enhance the attractiveness of the area as a place to work, live and visit. It will enable the wider water-activation and Docklands Visitor Experience Development Plan proposals for the area to progress, with resulting indirect positive impacts on employment. The existing community is highly sustainable with the majority of residents walking to work. If this pattern persists increased local employment will result in increased population in the area. It could potentially therefore result in a *moderate, long-term positive effect*.

Employment and Economic Activity

Enhancement of the existing water-based recreational facilities is proposed as part of the proposed development. Both the proposed water quality and recreational facilities improvements will contribute directly towards the attractiveness of the area resulting in general improvements to the economic activity of the surrounding area during the operational phase. This would result in an overall *moderate, long-term positive effect*.

This is in line with wider-scoping proposals to increase water animation on the Liffey and enhance WaterLine and PortLine activity and the Docklands Visitor Experience Development Plan which has ambitious plans for the area. It is envisaged that the proposed Floating Markets, could be realised by 2024 with projected visitor numbers in excess of 250,000. The Trinity Innovation Campus anticipated to be in operation by 2024 is projected to attract 20,000 – 100,000 visitors.

Social and Settlement Patterns

Social patterns are likely to be positively impacted by the project and as current water quality issues curtail the recreational development of the area. Their removal will permit the introduction of immersive watersports, which are currently prohibited and will facilitate water activation plans and other proposed recreation uses as outlined in the Failte Ireland Docklands Visitor Experience Development Plan. It is likely that increased local employment may result in a greater demand for housing and visitor accommodation in the area, which is in line with national, regional and local policies in relation to compact and consolidated growth in central urban locations and the co-location of housing with employment hubs. It is envisaged that the proposed development would potentially result in a *moderate, long-term positive effect*.

Human Health

The potential risks or nuisances that may be caused to human beings during the operation phase have been assessed in other sections of this report considering air quality, water quality, traffic, noise, and vibration. These are summarised below and also in Table 5.9:

- Section 9 – Air Quality and Climate determines that there will be no emissions to the atmosphere from the proposed development during the operational phase. Therefore, there is no potential for impacts to air quality or climate as a result of the proposed development. The operational phase is considered to have a neutral effect in terms of air quality and climate. In addition, the proposed development has been designed to cater for increased flows associated with climate change, heavy rainfall events and will reduce potential flooding upstream. It is considered that the indirect impact of the proposed development on climate will be *imperceptible.* However, we consider the *slight, long-term positive effect* of the flood mitigation on the human health of the upstream residents should also be considered;
- Section 10 – Noise and Vibration notes that the potential noise impact from operational plant associated with the development will be *negligible*. In terms of vibration, it is noted that the proposed development will not give rise to any significant levels of vibration and therefore the associated impact is *not significant;*
- Section 11- Traffic and Transport considers that there will be *no impacts* during the operational phase;
- During the operational phase it is envisaged there will be significant water quality improvements within the Grand Canal Basin through the proposed enhancement of main drainage infrastructure in the area. It is concluded that there will be *moderate, permanent, positive effect*. The impact on the water quality within the Liffey Estuary and Dublin Bay will be *slight/imperceptible, long-term, adverse;* and
- As noted previously, the enhanced water quality arising from the proposed development will facilitate growth in the local water activity employment sector. In addition, it will support the delivery of the

planned Fáilte Ireland plans for the area. There is a positive correlate between employment and health and wellbeing. This is considered to be a *moderate, long-term positive effect.*

Table 5.9 Summary of Operational Impacts

Human Health	Impacts Without Mitigation
Air Quality	neutral, long-term
Climate	imperceptible, long-term
Flood mitigation	positive, slight, long-term
Noise	negligible, long-term
Vibration	not significant, long-term
Traffic	neutral, long-term
Water Quality	positive, moderate, permanent on Basin and imperceptible, long term on Liffey and Dublin Bay
Employment	positive, moderate, long-term

5.6 Mitigation Measures

It has been determined that there are likely to be potential impacts on population and human health principally during the construction phase of the scheme. Therefore, these aspects are considered further in the EIAR, and any subsequent mitigation measures will be identified.

5.6.1 Construction Phase

- In terms of control of fugitive dust Section 9 outlines a suite of mitigation measures that will ensure the prevention of significant emissions. The key identified aspects for controlling dust are incorporated into the CEMP prepared in respect of the proposed development;
- Early consultation has been established between Waterways Ireland and the residents of the 20 houseboats located in serviced moorings in Grand Canal Dock who hold permits allowing them to moor there for up to one year. The timeframe of the proposed works in general and specific works impacting directly on these moorings has been communicated to Waterway Ireland who will ensure that these long-term residents and any persons proposing to use the short-term visitor moorings during the construction phase will be provided with alternative mooring arrangement for the duration as required;
- A Detailed Traffic Management Plan will be prepared in consultation with stakeholders. This will co-ordinate the management of vehicular and pedestrian traffic adjacent to the site including road closures and diversions, to mitigate any traffic congestion or road safety impacts which may arise for road and pavement users. The plan will set out agreed procedures to control the movement of construction traffic and materials entering and leaving the site;
- Similarly, good engagement will be continued with the water-based recreation businesses operating in the Grand Canal Dock and their clients. This will be required to minimise any impacts on the proposed development on these stakeholders;
- The Contractor will be required to develop a comprehensive construction Noise and Vibration Management Plan with best practice being adopted to monitor and limit the hours when high noise levels are permitted; establish channels of communication with stakeholders; select and locate plant to minimise noise levels;
- Temporary hoardings will be put in place around land-based works along Hanover Quay and Sir John Rogerson's Quay and around the construction compounds. Also, temporary hoarding may be put in place to the edge of the construction zones on Grand Canal Quay and Grand Canal Square for works in the outer basin. Refer to Section 15.6.1; and
- Water quality - For the construction activities within the Basin best practice will be adopted. The use of silt curtains around the works within the basin will contain any resuspended silt particles.

5.6.2 Operational Phase

Overall, it has been determined that it is unlikely that there will be many potential negative impacts on population and human health during the operation phase of the scheme, conversely it is considered it will have significant positive impact on the area and the community. Therefore, mitigation measures have not generally been deemed necessary during the operational phase of the proposed development. However, Volume 2, Section 10 does note in relation to plant noise that the maintenance Contractor shall ensure that any works are within the noise limits as set out in Section 10.2.4. Furthermore Volume 2, Section 15 notes that while the vast majority of the changes to the landscape fabric of the site will take place underwater or underground, the design and materials of any new surface features should be sympathetic to the historic setting.

5.7 Cumulative Impacts

The projects in the area which have been considered in terms of potential cumulative effects are outlined in Section 19 of this EIAR. These include:

- Alexandra Basin Redevelopment;
- Barrow Street Improvements;
- Inner Basin Boardwalk;
- Boland's Mill;
- Bus Connects;
- Canal Loop Greenway;
- Campshires Public Realm;
- Dart Underground;
- Dodder Greenway;
- Dodder Public Transportation Opening Bridge;
- Dublin District Heating System;
- Dublin Eastern Bypass project;
- Extension of Luas Red Line across the River Liffey;
- Grand Canal Greenway- Grand Canal Dock Section;
- Grand Canal Quay East;
- Liffey Cycle Route;
- Liffey-Tolka Project;
- Maintenance dredging in Dublin Port;
- Malthouse;
- Metrolink;
- MP2 Project, Dublin Port Company;
- North Lotts and Grand Canal Dock SDZ Water Animation Strategy 2018;
- Point Pedestrian Bridge;
- Refurbishment of Camden Lock Gates;
- Ringsend Wastewater Treatment Plant Upgrade;
- South Campshire Flood Defence Wall project;
- Southern Port Access Route;
- Treasury Building; and
- Trinity East Innovation Hub.

The status of these projects was reviewed on the basis of available information, with the following considered to have some potential cumulative impacts with population and human health:

- Alexandra Basin Redevelopment (ABR);
- Bus Connects;
- Dodder Public Transportation Opening Bridge;
- Dublin District Heating System;
- Grand Canal Greenway- Grand Canal Dock Section;
- Grand Canal Quay East development works;
- MP2 Project, Dublin Port Company;

- Ringsend Waste Water Treatment Plant Upgrade;
- South Campshire Flood Defence Wall Project; and
- Treasury Building.

5.7.1 Construction Phase

The residual impact from the proposed development following appropriate mitigation will be negligible. For the purposes of this assessment of impacts a 'worst case' scenario has been assessed based on known information. If construction phases with the subject project and the above referenced projects overlap, there may be potential for construction phase cumulative impacts which will be limited to the duration of construction activities and be short-term in nature. It is envisaged that subject to the implementation of mitigation measures proposed, that the proposed development will result in no significant impacts concerning air quality, water quality, noise, vibration, traffic or landscape impacts related to population and human health.

5.7.2 Operational Phase

Once constructed, the proposed development will be permanent and non-reversible. It is considered that cumulative impacts relating to population and human health factors including traffic, air quality, water quality, landscape, noise and vibration will be not significant.

In the context of identified benefits related to the delivery of the proposed infrastructure which will improve water quality within Grand Canal Basin, enable water-activation and Docklands visitor experiences, supporting employment and economic activity as well as social and settlement patterns, it is considered that the development will result in significant benefits in terms of wider population and human health considerations.

5.8 Residual Impacts

5.8.1 Construction Phase

Once the mitigation measures as proposed are implemented no residual significant impacts are expected to arise as a result of the construction and operation of the proposed development. However, the overall proposed development will result in a *slight, negative and short-term* impact during construction phase.

5.8.2 Operational Phase

The Dublin Port Company have indicated that berthing at the SJRQ may be restricted in the vicinity of the outfall. This will result in *slight negative long-term effect* during the operational phase. However, the proposed development will result in *slight to moderate, long-term and positive* impacts on population and human health during the operation phase.

5.9 Interactions

5.9.1 Water quality and hydrology

Construction impacts on water quality have been assessed in Section 7.

5.9.2 Air Quality and Climate

Construction impacts due to emissions from construction dust and vehicular traffic have been assessed in Section 9.

5.9.3 Noise and Vibration

Construction impacts due to noise and vibration from vehicular traffic, most notably HGVs (e.g. transporting earthworks material) have been assessed in Section 10.

5.9.4 Traffic and Transport

The construction traffic arising from haulage of plant and materials to and from the construction site and increases in traffic volumes on the surrounding road network have been assessed in Section 11.

5.9.5 Waste Management

Construction impacts due to waste arising from the construction phase have been assessed in Section 13.

5.9.6 Landscape and Visual Impact

Construction impacts on views and changes to the landscape during the construction phase have been assessed in Section 15.

5.10 Monitoring

5.10.1 Construction Phase

The monitoring measures outlined in Sections 7, 9, 10, 11 and 13 will be undertaken during the construction phase and will identify any issues arising during this phase of the proposed development. Specific Health and Safety monitoring will be carried out in line with the Site Management Plan and Building Certification Regulations.

5.10.2 Operational Phase

On-going noise and vibration monitoring during the operational phase of the development is not required.

5.11 References

All-Island Research Observatory (AIRO), (2021). *AIRO Census Mapping*: www. airo.maynoothuniversity.ie/mapping-resources

Central Statistics Office (CSO), (2021). *Census 2011 & 2016 data:* www.cso.ie

Dublin City Council, (2014). *The North Lotts and Grand Canal Dock Planning Scheme*

Dublin City Council, (2016). *Dublin City Development Plan 2016-2022*

Dublin City Council, (2014). *Public Realm Masterplan for the North Lotts & Grand Canal Dock SDZ Planning Scheme 2014*

Dublin City Council, (2018). *North Lotts and Grand Canal Dock SDZ Water Animation Strategy 2018*

Dublin City Council, (2021). *Dublin City Councils Planning Enquiry System:* www.planning.agileapplications.ie/dublincity

Environmental Protection Agency (Ireland) (EPA), (2022). *Guidelines on the information to be contained in Environmental Impact Assessment Reports.*

Environmental Protection Agency (Ireland) (EPA), (2017). *Guidelines on the information to be contained in Environmental Impact Assessment Reports, Draft*

Economic & Social Research Institute (ESRI), (2021). *Quarterly Economic Commentary, Summer 2021*

Eastern and Midland Regional Assembly, (2019). *Regional Spatial and Economic Strategy for the Eastern and Midland Region 2019-2031*

Failte Ireland (2020). *Docklands Visitor Experience Development Plan 2020*

Pobal, (2021). *Pobal Maps:* www.pobal.ie

SECTION 6: Biodiversity

6.1 Introduction

JBA Consulting Ireland Ltd. has been commissioned by DCC and IW to provide the Biodiversity Section of the EIAR in relation to the proposed Grand Canal Storm Water Outfall Extension (GCSWOE) project.

6.1.1 Aims

The aims of this assessment are to:

- Establish baseline ecological conditions to enable identification of potentially important ecological features within the zone of influence of the project;
- Determine the ecological value of identified ecological features, including terrestrial, aquatic/marine and avian features;
- Assess the significance of impacts of the proposed project on ecological features of value;
- Identify avoidance, mitigation or compensatory measures;
- Identify residual impacts after mitigation and the significance of their effects; and
- Identify opportunities for ecological enhancement and net gain of biodiversity.

6.2 Methodology

6.2.1 The Team

The section was completed by Malin Lundberg (BSc, MSc), an experienced field ecologist with JBA. Malin has five years' experience of which three are within consultancy. She has extensive experience of preparing Ecological Impact Assessments (EcIA) and biodiversity chapters for EIAR for private developers and local authorities, including residential developments, quarry rehabilitation and a proposed greenway route.

The assessment has been reviewed by Patricia Byrne (BSc (Hons), PhD, MCIEEM). Patricia is a Senior Ecologist with 20 years' experience of environmental and ecological work, with the last five years as an ecologist with JBA. She has authored and reviewed numerous ecological assessments under the Habitats Directive; and prepared numerous EcIAs for residential developments, biodiversity chapters for EIARs including King's Island Flood Relief Scheme for Limerick County Council.

6.2.2 Policy, Legislation and Guidance

This assessment was prepared with regard to the following policy documents, legislation and guidance:

National and International Legislation

- The Planning & Development Act 2000 & the Planning and Development (Amendment) Act, 2010 (as amended) hereafter referred to as the Planning Acts;
- The Wildlife Act 1976 as amended by the Wildlife (Amendment) Act, 2000 (as amended) hereafter referred to as the Wildlife Acts;
- European Communities (Environmental Impact Assessment) Regulations 1989 to 2001;
- European Commission (EC) Habitats Directive 92/43/EEC (as amended);
- EC Birds Directive 2009/147/EC;
- European Communities (Birds and Natural Habitats) Regulations 2011 (as amended) hereafter referred to as the Birds and Habitats Regulations;
- Flora (Protection) Order, 2015;
- Environment (Miscellaneous Provisions) Act 2011;
- The Fisheries (Consolidation) Act 1959;
- The Local Government (Water Pollution) Act, 1977 (as amended by Sections 3 and 24 of the 1990 Act);
- EU Water Framework Directive (2000/60/EC) and European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003); and
- EU Marine Strategy Framework Directive (2008/56/EC).

Relevant Policies and Plans

- National Biodiversity Action Plan 2017-2021;
- Ireland's National Strategy for Plant Conservation; and
- Dublin City Biodiversity Action Plan 2015-2020.

Guidance

- Guidelines for Ecological Impact Assessment in the United Kingdom and Ireland: Terrestrial, Freshwater, Coastal and Marine. Chartered Institute of Ecology and Environmental Management (CIEEM, 2018);
- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports by the Environmental Protection Agency, EPA 2022;
- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (Draft) Environmental Protection Agency (EPA, 2017);
- Guidelines for Assessment of Ecological Impacts of National Road Schemes (NRA, 2009a);
- Environmental Impact Assessment of National Road Schemes – A Practical Guide (NRA, 2008b); and
- Best Practise Guidance for Habitat Survey and Mapping. The Heritage Council (Smith et al., 2011).

6.2.3 Designated Nature Conservation Sites

Sites of international importance including Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) are collectively known as Natura 2000 sites. These sites contain examples of some of the most important natural and semi-natural ecosystems in Europe. Designated sites, which also include Natural Heritage Areas (NHAs) and proposed Natural Heritage Areas (pNHAs), which are national designations, were also identified within the proposed development's area of influence. The designated search area was 15 km from the development for Natura 2000 sites, and 10km for NHA and pNHA sites. This distance defines the 'Zone of Influence' (ZoI) of the proposed development for protected sites.

6.2.4 Screening of Ecological Features

The ecological features identified during the aquatic surveys and from desk-based assessments were reviewed.

An EIA Screening Report has been completed for the project (J. B. Barry & Partners, 2020). The EIA Screening Report has identified ecological features which occur within the proposed project site or within the wider ZoI of the project (habitats within the site or directly downstream include rivers and coastal and marine habitats). A further, seven European designated sites have been identified to have surface water connection with the proposed project as they are located downstream of the site, and the proposed Natural Heritage Area (pNHA), Grand Canal pNHA (Site Code 002103) occurs within the proposed project site.

Consultation was carried out with Central Fisheries Board in 2007 and Inland Fisheries Ireland in January 2020. It has been noted that the River Liffey is an important salmonid system, and monitoring carried out by Inland Fisheries Ireland under the Water Framework Directive in 2010 has recorded a total of 17 fish species including Atlantic Salmon (listed under Annex II and V of the EU Habitats Directive), European Eel, Lamprey, Sea trout, and Brown trout.

The assessment in the Biodiversity Section will focus on the ecological features identified in the EIA Screening Report:

- Permanent loss of substrate habitat under the footprint of the proposed pipeline. The survey carried out in 2001 identified this impact to be minimal since there were no sensitive ecological receptors found during the survey. However, impacts on local ecological receptors should be based on a new freshwater and estuarine survey;
- Potential impacts on salmonids by transferring potentially polluting stormwater loads to River Liffey; and
- Potential impacts on nearby European sites (Natura 2000 sites).

An Appropriate Assessment (AA) Screening Report has been completed to assess the potential for effects on Designated European Sites (Natura 2000 sites) (J. B. Barry & Partners, 2020). The AA Screening Report concluded that there is potential for significant effects on European sites arising from the proposed development. An AA Stage 2 Natura Impact Statement (NIS) has therefore been produced separate to this EIAR. The NIS assesses the likely significant effects and proposes mitigation measures to avoid any significant effect on any of the Natura 2000 sites identified within the ZoI. Natura 2000 sites are therefore not considered in this report.

6.2.5 Assessment of the Effects on Features

Ecological features include nature conservation sites, habitats, species assemblages/ communities, populations or groups of species. The assessment of the significance of predicted impacts on ecological features is based on both the 'value' of a feature, and the nature and magnitude of the impact that the project will have on it. The impact is based on the project, including construction best practice measures that will be implemented.

Valuation of Receptors

The value of designated sites, habitats, and species populations is assessed with reference to:

- Their importance in terms of 'biodiversity conservation' value (which relates to the need to conserve representative areas of different habitats and the genetic diversity of species populations);
- Any social benefits that habitats and species deliver (e.g. relating to enjoyment of flora and fauna by the public); and
- Any economic benefits that they provide.

The valuation of designated sites takes into account whether a site has statutory or non-statutory protection. Assessment of habitat depends on several factors, including the size of the habitat, its conservation status and quality. The assessment also takes account of connected off-site habitat that may increase the value of the on-site habitat through association. Valuation of species depends on a number of factors including distribution, status, rarity, vulnerability, and the population size present.

Designated sites, habitats and species populations have been valued using the scale in Table 6.1.

Table 6.1: Examples of criteria used to define the value of ecological features

Level of Value	Examples of Criteria
International	- An internationally important site e.g. Special Protection Area (SPA), Special Area of Conservation (SAC), Ramsar (or a site considered worthy of such designation). - A regularly occurring substantial population of an internationally important species (listed on Annex IV of the Habitats Directive). - Designated shellfish waters. - Major fisheries area.
National	- A nationally designated site e.g. Natural Heritage Area (NHA), a proposed Natural Heritage Area (pNHA), statutory Nature Reserve, or a site considered worthy of such designation. - A viable area of a habitat type listed in Annex I of the Habitats Directive or of smaller areas of such habitat which are essential to maintain the viability of a larger whole. - A regularly occurring substantial population (e.g. 1% national population) of a nationally important species, e.g. listed on The Wildlife Act 1976 or The Wildlife (Amendment) Act 2000. - A species included in the Irish Red Data Lists/Books.
Regional/County (Co. Dublin)	- Species and habitats of special conservation significance within County Dublin. - An area subject to a project/initiative under the County's Biodiversity Action Plan. - A regularly occurring substantial population of a nationally scarce species.
Local (works site and its vicinity)	- Areas of internationally or nationally important habitats which are degraded and have little or no potential for restoration. - A good example of a common or widespread habitat in the local area. - Species of national or local importance, but which are only present very infrequently or in very low numbers within site area.
Less than local	- Areas of heavily modified or managed vegetation of low species diversity or low

Level of Value	Examples of Criteria
	value as habitat to species of nature conservation interest. - Common and widespread species.

Magnitude of Impacts

Ecological effects or impacts can be described and categorised in a number of ways. Examples of relevant terms are listed in the Table 6.2 below.

Table 6.2: Categories of Effects (derived EPA, 2022)

Quality of Effects	**Positive Effects** A change which improves the quality of the environment (for example, by increasing species diversity; or the improving reproductive capacity of an ecosystem, or by removing nuisances or improving amenities).
	Neutral Effects No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error
	Negative/adverse Effects A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing nuisance).
Probability of Effects	**Likely Effects** The effects that can reasonably be expected to occur because of the planned project if all mitigation measures are properly implemented.
	Unlikely Effects The effects that can reasonably be expected not to occur because of the planned project if all mitigation measures are properly implemented.
Duration and Frequency of Effects	**Temporary Effects** Effects lasting less than a year
	Short-term Effects Effects lasting one to seven years
	Medium-term Effects Effects lasting seven to fifteen years
	Long-term Effects Effects lasting fifteen to sixty years.
Types of Effects	**Indirect Effects** (a.k.a. Secondary Effects) Impacts on the environment, which are not a direct result of the project, often produced away from the project site or because of a complex pathway.
	Cumulative Effects The addition of many minor or significant effects, including effects of other projects, to create larger, more significant effects.
	'Do-Nothing Effects' The environment as it would be in the future should the subject project not be carried out.
	'Worst case' Effects The effects arising from a project in the case where mitigation measures substantially fail.
	Residual Effects The degree of environmental change that will occur after the proposed mitigation measures have taken effect.
	Synergistic Effects Where the resultant effect is of greater significance than the sum of its constituents,

These factors are assessed together to determine the magnitude of the impact on the status of a habitat or species population, and on the integrity of the site that supports them. Professional judgement is then used to assign the impacts on the receptors to one of four classes of magnitude, detailed in Table 6.3

Table 6.3: Definition of magnitude

Magnitude	Definition
High	An irreversible or long-term impact on the integrity of a site or conservation status of a habitat, species assemblage/community, population or group. If adverse, this is likely to threaten its sustainability; if beneficial, this is likely to enhance its conservation status.
Medium	A medium to long-term impact on the integrity of a site or conservation status of a habitat, species assemblage/community, population or group, which if adverse, is unlikely to threaten its sustainability (or if beneficial, is likely to be sustainable but is unlikely to enhance its conservation status.
Low	A short-term but temporary impact on the integrity of a site or conservation status of a habitat, species assemblage/community, population or group that is within the range of variation normally experienced between years.
Negligible	A short-term but temporary impact on the integrity of a site or conservation status of a habitat, species assemblage/community, population or group that is within the normal range of annual variation.

Significance of Impacts

The significance of an impact is a product of the value of the ecological feature and the magnitude of the impact on it, moderated by professional judgement. Table 6.4 shows a matrix which is used for guidance in the assessment of significance, with impacts being considered to be of major, moderate or minor significance, or negligible. Impacts can also either be assessed as positive or negative using the same matrix.

Table 6.4: Significance of impacts matrix

Value of feature	Impact			
	High	**Medium**	**Low**	**Negligible**
International	Major	Major	Moderate	Neutral
National	Major	Moderate	Minor	Neutral
Regional / County	Moderate	Minor	Minor	Neutral
Local	Minor	Minor	Negligible	Neutral
Less than local	Negligible	Negligible	Negligible	Neutral

Residual Impacts

Where significant residual impacts are identified, further mitigation measures will be proposed as part of the Ecological Impact Assessment process to avoid, reduce or minimise them. Each impact assessment section assigns a final significance level to the impact described, which considers and includes the implementation of any stated mitigation measures; these are the residual impacts.

6.2.6 Baseline

To determine the baseline conditions at the site a review of all available information was made. When determining the pre-work conditions on-site, including the presence or absence of protected habitats and/ or species, the precautionary principle was used where limited information was available. A desk-based assessment was carried out to collate information regarding protected/ notable species and statutorily designated nature conservation sites in, or within close proximity to, the study area. A data search for protected and notable species was conducted using the National Biodiversity Data Centre Mapping System (NBDC, 2020). A 10km grid square was used to encompass the study area and species records were extracted from the map at a 10km² resolution. Information for statutory designated sites including Special Protection Areas (SPAs), Special Areas of Conservation (SACs), Ramsar Sites, Natural Heritage Areas (NHAs) and proposed Natural Heritage Areas (pNHAs) was collected from the online resources provided by the National Parks and Wildlife Service (NPWS).

The following reports were consulted during this process:

- NPWS (2019a). The Status of EU Protected Habitats and Species in Ireland. National Parks and Wildlife Service, Department of the Culture, Heritage and the Gaeltacht, Dublin, Ireland (NPWS, 2019a);
- NPWS (2019b). The Status of EU Protected Habitats and Species in Ireland. Habitats Assessment Volume 2. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland;
- NPWS (2019c). The Status of EU Protected Habitats and Species in Ireland. Species Assessment Volume 3. Habitats Assessment Volume 2. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland;
- Environmental Protection Agency online databases on water quality (Available online at https://gis.epa.ie/EPAMaps/);
- Aerial photography available from www.osi.ie and Google Maps http://maps.google.com/;
- Online data available on Natura 2000 sites as held by the National Parks and Wildlife Service (NPWS) from www.npws.ie;
- National Biodiversity Data Centre – Species Distribution Maps; Available online at www.biodiversityireland.ie;
- All Ireland Red Data lists for vascular flora, mammals, butterflies, non-marine molluscs, dragonflies & damselflies, amphibians and fish;
- Water Framework Directive water maps (available online at http://www.wfdireland.ie/maps.html and https://www.catchments.ie/); and
- International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species (available online at http://www.iucnredlist.org).

Zone of Influence

The ZoI for the project is based on a judgement of the likely extent of the ecological impacts. This will vary for different ecological features, depending on their sensitivities to environmental change. For the majority of the project, impacts will be limited to those within the site boundary. However, for impacts relating to airborne emissions, ground water and disturbance, the ZoI is extended to 10km and for surface water pathways it is extended 15km for statutory designated sites (Natura 2000 sites).

Field Surveys

An aquatic benthic ecological survey of the Grand Canal Dock and River Liffey Estuary was carried out by BEC Consultants Ltd. on the 28-29th July 2020 (BEC Consultants Ltd, 2020). The benthic habitat was investigated by means of a grab sample survey with six samples undertaken within Grand Canal Docks and four samples within the Liffey Estuary.

Macroinvertebrates were identified using stereoscopic and compound microscopes and standard freshwater keys.

Additional data collected include water depth, salinity and temperature.

The intertidal zone of the study area comprised the quay walls of the River Liffey along SJRQ. Species present were recorded.

Habitat classification followed the Marine Habitat Classification for Britain and Ireland (JNCC, 2015).

A terrestrial alien invasive species survey was carried out along the pipe route. The focus of this survey was species listed under the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations (S.I. 477/ 2011) (as amended). These are species for which there is a legal imperative to prevent their spread. No listed species were found to be present.

The results have been compiled into a report (Grand Canal Dock Storm Water Outfall Project: Aquatic Ecology and Alien Invasive Species Survey) which accompanies this application (BEC Consultants Ltd, 2020) and is contained in the Volume 3, Appendix 6A to this EIAR.

Cumulative Impacts

Potential sources of cumulative impacts were identified based on the ecology of valued ecological features. Potential sources of cumulative impacts were sought within ranges, territories or catchments where there is the potential for a significant impact on a site or species. The plans and projects identified as potential sources of cumulative impacts are described in Section 6.7.4.

Limitations and Constraints

This assessment is based on site visits and existing data from the above-mentioned sources. The report necessarily relies on some assumptions and is inevitably subject to some limitations. These do not affect the conclusion, but the following points are recorded in order to ensure the basis of the assessment is clear:

- Surveyor bias may lead to differences of opinion with regards to the ecological value of the affected area; however, best professional judgement has been used at all times and surveyors were sufficiently experienced to be able to assess with confidence likely impacts that have occurred.
- Information on the works and conditions on site are based on current knowledge at the time of writing. Changes to the site since surveys were undertaken cannot be accounted for. Any changes to the proposed works will require an assessment by a suitably qualified ecologist to determine if re-assessment is required.
- Adverse weather can cause delays to the schedule and alter the timing of works. This has been accounted for using a worst-case scenario where possible.
- The site visits were carried out in June and September, and the data does not reflect the whole ecology of the site throughout the year. The precautionary principle is used at all times when determining potential ecological sensitivity of the site.

6.3 Receiving Environment

This receiving environment section presents information gathered from existing reports and desk-based sources as detailed in Section 6.2.6 and aquatic surveys carried out by BEC Consultants Ltd. on 28-29th July 2020.

6.3.1 Desk-based Assessment

Statutory Designated Natura 2000 Sites

The proposed development has been identified to have surface water connectivity with 7no. Natura 2000 sites (Table 6.5 and Figure 6.1).

An NIS report (JBA, 2021) has been produced which examines the likely pathways and impacts of the proposed works on these Natura 2000 sites and recommends mitigation measures.

Table 6.5: Statutory designated Natura 2000 sites with surface water pathway with the proposed development

Designation	Name	Site Code	Distance via hydrological pathway
SPA	South Dublin Bay and River Tolka	004024	3.5km
SAC	North Dublin Bay	000206	5.1km
SPA	North Bull Island	004006	5.9km

Designation	Name	Site Code	Distance via hydrological pathway
SAC	South Dublin Bay	000210	7km
SAC	Rockabill to Dalkey Island	003000	9.7km
SAC	Howth Head	000202	10km
SPA	Howth Head Coast	004113	13km

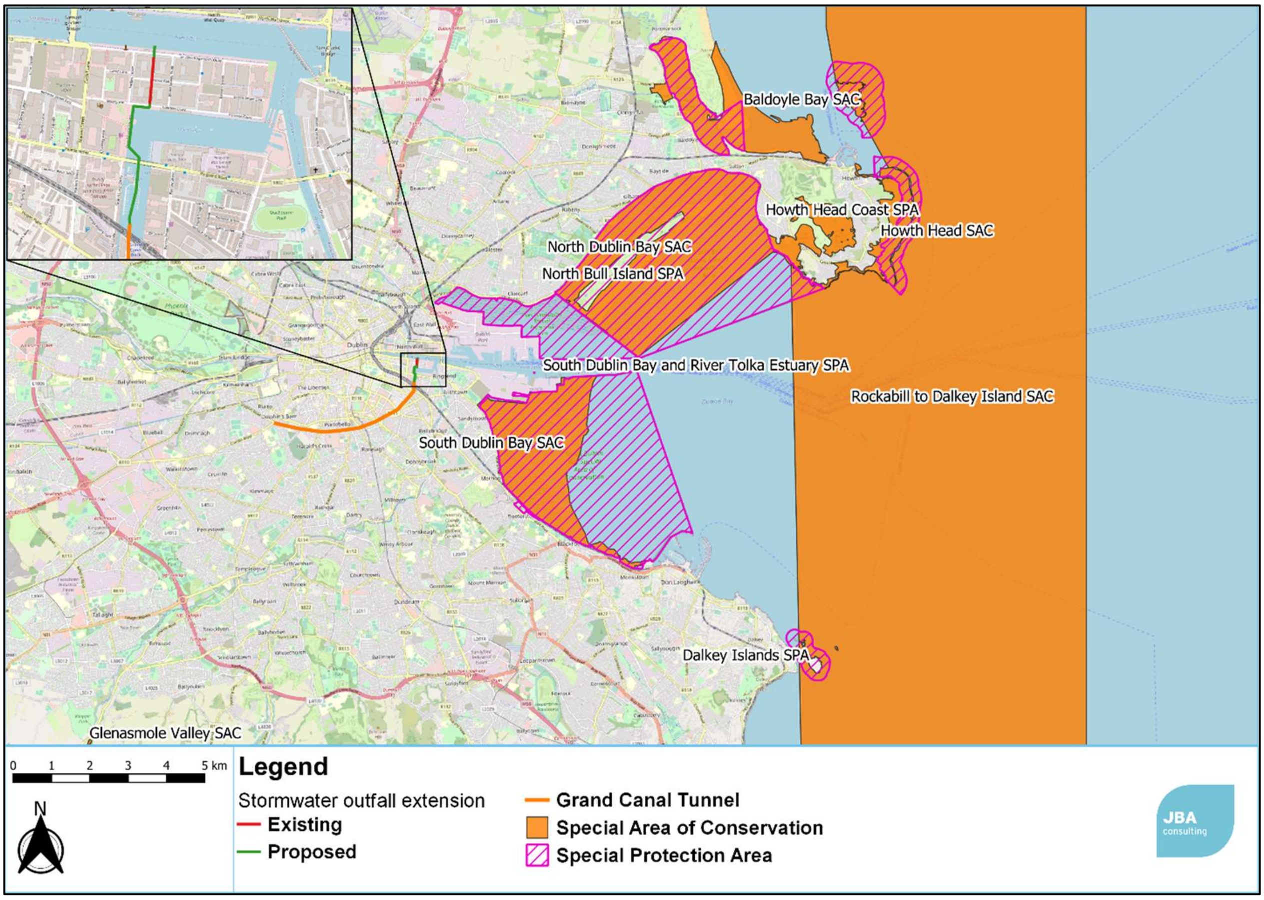


Figure 6.1: Location of statutory designated sites in relation to the proposed development

Non-statutory Designated Natural Heritage Areas

The proposed development is located within the Grand Canal pNHA (002104). A further three pNHAs are located within the vicinity of the proposed development including North Dublin Bay pNHA (000206), South Dublin Bay pNHA (000210), and the Dolphins Dublin Docks pNHA (000201), see Table 6.6 and Figure 6.2. North Dublin Bay pNHA and South Dublin Bay pNHA are located within North Dublin Bay SAC and South Dublin Bay SAC respectively. The assessment for these Natura 2000 sites is included in the AA Screening/NIS. The site briefs and ecological features of the other two pNHAs are described in Table 6.7 and assessed below.

Table 6.6: Proximity and importance of non-statutory designated sites in the vicinity of the proposed development

Designation	Name	Site Code	Distance via hydrological pathway
pNHA	Grand Canal	002104	0.0km
pNHA	Dolphins Dublin Docks	000201	2.7km
pNHA	North Dublin Bay	000206	3.9km
pNHA	South Dublin Bay	000210	7.0km

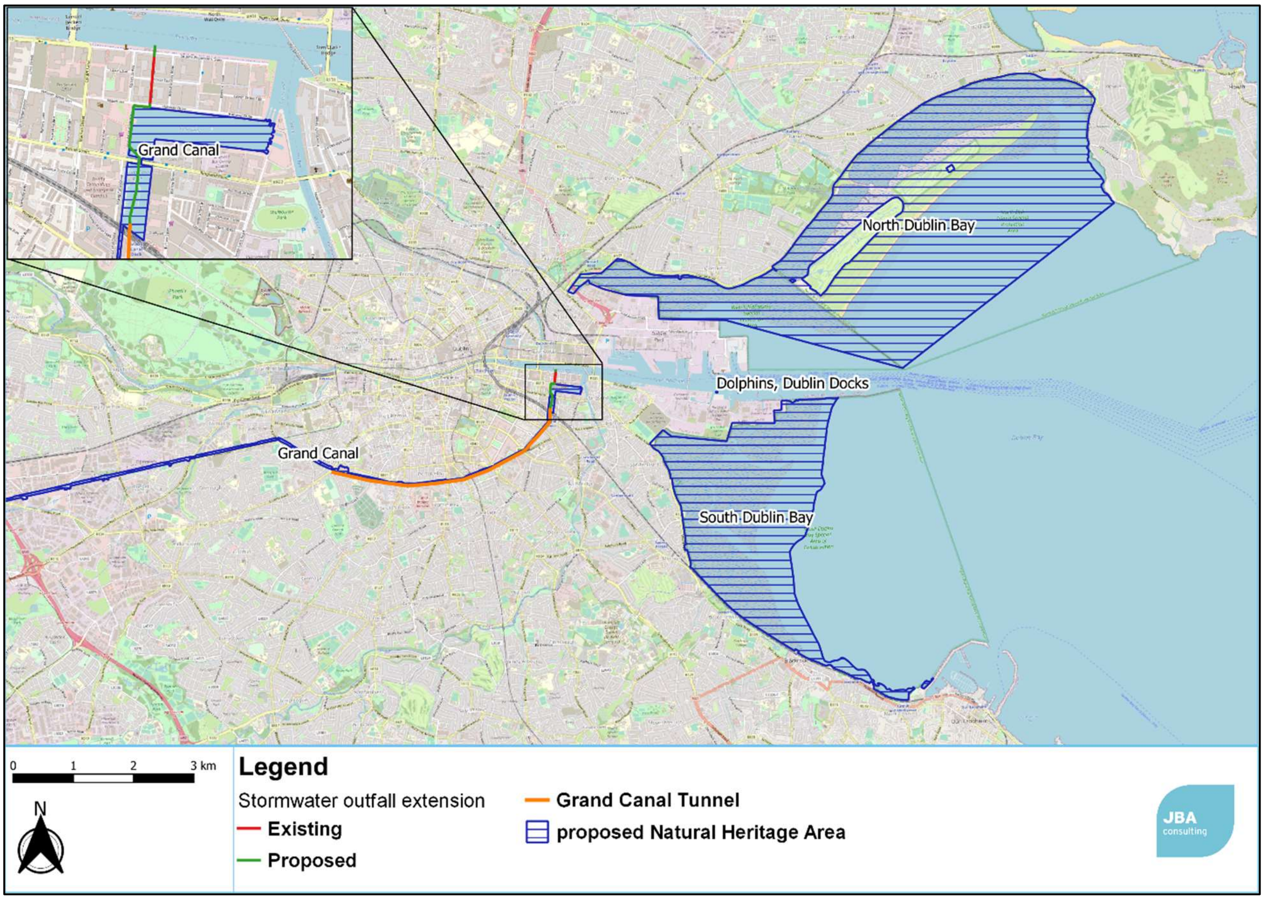


Figure 6.2: Location of non-statutory sites in relation to the proposed development

Table 6.7: pNHA site briefs and ecological features

Site name	Brief	Ecological features
Grand Canal	The site comprises a canal channel and the banks on either side of it of the man-made canal between the River Liffey at Dublin and the River Shannon at Shannon Harbour, and the Barrow at Athy (NPWS, 2009).	Canal, hedgerow, tall herbs, calcareous grassland, reed fringe, open water, scrub and woodland. Arrowhead *Sagittaria sagittifolia*, Water-cress *Nasturtium officinale*, Hemlock Water-dropwort *Oenanthe*

Site name	Brief	Ecological features
		crocata, Opposite-leaved Pondweed *Groenlandia densa* (Flora Protection Order), Otter *Lutra lutra*, and Smooth Newt *Lissotriton vulgaris*
Dolphins, Dublin Docks	The site is small and includes two mooring 'dolphins' near Pigeon House Harbour. The site is used by nesting terns; approximately 350 pair of Common Terns *Sterna hirundo* were recorded in 2006 (DCC, 2008).	Common Tern

The proposed development is within the eastern most end of the Grand Canal pNHA. The proposed construction stage works could impair the water quality within the Grand Canal Basin by the resuspension of fine particles or accidental spill of pollutants used for the construction (e.g. concrete, hydrocarbons). The Grand Canal pNHA is therefore considered further in the assessment.

The Dolphins, Dublin Docks pNHA is located downstream of the proposed development, where River Liffey meets the Irish Sea at Dublin Bay. Potential pollutants could impact on the Common Tern colony through contact with feathers, and by ingestion through grooming of the affected feathers or feeding. The birds may also be indirectly impacted by impacts on the food sources available (i.e. fish). The Dolphins, Dublin Docks pNHA is therefore considered further in the assessment.

Other Designated Sites

The proposed development is located within the Transition Zone of the Dublin Bay Biosphere UNESCO site and approximately 3.2km west from its Core Zone. In 2015 the Dublin Bay Biosphere was designated for its rich biological diversity and comprises Dublin Bay, North Bull Island, and adjacent lands, including parts of Dublin. The biosphere supports well developed salt marshes and dune systems and is also important for nesting and wintering waterfowl. The Core Zone comprises a number of Natura 2000 sites as mentioned previously and as such is considered in the AA Screening and NIS assessment.

Protected Species

Records of protected and notable species including birds, amphibians, fish and mammals present within the 10km grid square O13 during the past 10 years were collated from the National Biodiversity Data Centre (NBDC, 2020) database.

Protected species recorded include Common Frog *Rana temporaria*, Smooth Newt *Lissotriton vulgaris*, Harbour Porpoise *Phocoena phocoena*, Grey Seal *Halichoerus grypus*, Eurasian Badger *Meles meles*, Eurasian Pygmy Shrew *Sorex minutus*, Eurasian Red Squirrel *Sciurus vulgaris*, European Otter *Lutra lutra* and West European Hedgehog *Erinaceus europaeus*, and a number of bat species.

The records also include a range of protected bird species, many of which are waterbirds including Arctic Tern *Sterna paradisaea*, Barnacle Goose *Branta leucopsis,* Bar-tailed Godwit *Limosa lapponica,* Black Guillemot *Cepphus grille,* Black-headed Gull *Larus ridibundus,* Black-legged Kittiwake *Rissa tridactyla,* Black-tailed Godwit *Limosa limosa,* Brent Goose *Branta bernicla,* Common Coot *Fulica atra*, Common Goldeneye *Bucephala clangula,* Common Greenshank *Tringa nebularia,* Common Pochard *Aythya farina,* Common Redshank *Tringa tetanus,* Common Shelduck *Tadorna tadorna,* Common Tern *Sterna hirundo,* Dunlin *Calidris alpine,* Eurasian Curlew *Numenius arquata,* Eurasian Oystercatcher *Haematopus ostralegus,* Eurasian Teal *Anas crecca,* Eurasian Wigeon *Anas Penelope,* European Golden Plover *Pluvialis apricaria,* Gadwall *Anas Strepera,* Great Black-backed Gull *Larus marinus,* Great Cormorant *Phalacrocorax carbo,* Great Crested Grebe *Podiceps cristatus,* Great Northern Diver *Gavia immer,* Greater Scaup *Aythya marila,* Grey Plover *Pluvialis squatarola,* Herring Gull *Larus argentatus,* Lesser Black-backed Gull *Larus fuscus,* Little Egret *Egretta garzetta,* Little Grebe *Tachybaptus ruficollis,* Mallard *Anas platyrhynchos,* Mediterranean Gull *Larus* *melanocephalus,* Mew Gull *Larus canus,* Mute Swan *Cygnus olor,* Northern Lapwing *Vanellus vanellus,* Northern Shoveler *Anas clypeata,* Red Knot *Calidris canutus*, Red-breasted Merganser *Mergus serrator,* Red-throated Diver *Gavia stellate,* Ringed Plover *Charadrius hiaticula,* Tufted Duck *Aythya fuligula* and Water Rail *Rallus aquaticus*.

These freely available desk study results should not be considered definitive data sets for the desk study area. An absence of desk study data does not necessarily indicate that a site is absent of notable flora or fauna.

<u>*Common Tern*</u>

There is a known nesting location for Common Tern on the Camden Lock structure at the outer end of the Grand Canal Basin (Figure 6.3). This nest site is known to regularly support a single pair of Common Tern during the breeding season. Common Tern is listed on Annex I of the EU Birds Directive, and breeding populations are confined to a small number of suitable locations on the Irish coast. Common Tern is a Qualifying Interest of South Dublin Bay and River Tolka Estuary SPA and the Dolphins, Dublin Docks pNHA. It is considered that birds using this nest site may be associated with the population within the designated area of the SPA and pNHA.

Therefore, disturbance as potential impact to Common Tern will be assessed further when assessing potential impacts on the Dolphins, Dublin Docks pNHA. It is also considered in the separate NIS as part of the South Dublin Bay and River Tolka Estuary SPA.

Figure 6.3: Location of Common Tern nest on Camden Lock structure.

Aquatic Fauna

The Dublin coast and River Liffey provide habitat for a range of protected aquatic species. The Biodiversity Action Plan (DCC, 2016) identify Grey Seal, Common Seal Seal *Phoca vitulina*, River Lamprey *Lampetra fluviatilis*, Sea Lamprey *Petromyzon marinus*, Atlantic Salmon *Salmo salar* and Otter *Lutra lutra,* all of which are protected under the EU Habitats Directive and the Wildlife Acts. Single sightings of cetaceans Short-beaked Common Dolphin *Delphinus delphis, Harbour porpoise* and Fin Whale *Balaenoptera physalus* have been recorded in the lower Liffey Estuary (NBDC, accessed 2022). All cetaceans are protected under Annex IV of the EU Habitats Directive.

Otter

A study on Otter in Dublin City found that River Liffey, along with other rivers, accounted for the highest densities of Otter records (Macklin *et al.,* 2019). This is despite the high level of human disturbance along the river and increasing levels of pollution on the downstream sections of River Liffey. The study highlights the importance of preserving remaining areas of good to high quality Otter habitat within DCC boundaries. It also identifies water quality as an important ecosystem marker and that Otter status improves with cleaner water and a more diverse prey resource. Otters are known to use the Grand Canal Basin and adjacent area of the River Dodder. An Otter holt has been identified in the general vicinity, and its location is known to be outside of the zone of influence. An Otter management plan for Grand Canal Basis has been commissioned by NPWS but is not yet available.

Fish

Fish stock surveys were conducted on the River Liffey Estuary for the Eastern River Basin District (ERBD) as part of the programme of fish monitoring for the Water Framework Directive (WFD) in 2008 and 2010 by Inland Fisheries Ireland (IFI). The 2008 survey resulted in a return of 14 fish species including the protected Salmon and European Eel *Anguilla Anguilla* as well as Thick-lipped grey mullet *Chelon labrosus*, Sand goby *Pomatoschistus minutus*, Flounder *Platichthys flesus*, Long-spined sea scorpion *Taurulus bubalis*, Cod *Gadus morhua*, Pollack *Pollachius pollachius*, Sand smelt *Atherina presbyter*, Plaice *Pleuronectes platessa*, Sprat *Sprattus sprattus.* Dab *Limanda limanda*, *Three-spined stickleback Gasterosteus aculeatus* and Whiting *Merlangius merlangus.*

The 2010 survey (Kelly et al, 2010) returned 17 fish species including: Thick-lipped grey mullet, Sand goby, Flounder, Long-spined sea scorpion, Lesser sandeel *Ammodytes tobianus*, Five-bearded rockling *Ciliata Mustela*, Cod, Pollack, Fifteen-spined Sticklback *Spinachia spinachia*, Sand smelt, Plaice, Greater pipefish *Syngnathus acus*, Red gurnard Aspitrigla cuculus, Corkwing wrasse *Crenilabrus melops*, Ballan wrasse, *Labrus bergylta*, Gunnel (Butterfish) *Pholis gunnellus* and Sprat.

The fish survey carried out for the WFD across Ireland in 2014 (Kelly *et al.,* 2015) sampled fish in River Liffey at Lucan Bridge, Lucan, Co. Dublin. The abundance of Salmon fry (year 0+) and older Salmon (1+ and older) was 0-0.025 no./m^2 respectively. Juvenile Lamprey spp. were recorded at a density of 0-0.0005 no./m^2. The ecological classification for fish status in rivers in combination with expert opinion, identified the status as ‘Good’ in 2014. The same status was given the river in 2009.

Of the protected fish recorded in the River Liffey and Estuary, European Eel currently has a Critically Endangered IUCN status and is protected under the OSPAR Convention, while Atlantic Salmon and Lamprey species are protected under the Annex II and V of the EU Habitats Directive. European Eel are regarded as being of international ecological importance given the level international protections afforded to them under the OSPAR Convention.

The Grand Canal is known for its course fishery and common fish species include Pike *Esox Lucius*, Roach *Rutilis rutilis*, Perch *Perca fluvialitilis*, Bream *Abramis brama*, Carp *Cyprinus carpio*, Tench *Tinca tinca*, as well as Three-spined stickleback and Nine-spined stickleback. European Eel has also been recorded within the Grand Canal. Coarse fish are not protected species and are not regarded as sensitive receptors. The Grand Canal is located upstream of the Grand Canal Basin, and therefore fish within it are outside of the zone of influence and are therefore not considered further in this assessment.

As the protected aquatic species; Salmon, Lamprey spp., European Eel, Harbour and Common Seal, cetacean species and Otter, have been recorded both downstream and upstream of the Grand Canal Basin exit into the River Liffey, they are considered as ecological receptors of the proposed development and are of regional value. They are therefore carried forward in the assessment.

Invasive Non-native Species

The Records of Invasive Non-native Species listed on the third schedule of the EC (Birds and Natural Habitats) Regulations 2011 S.I. No. 477/2011 collated from the NBDC (2020) database, present within the surrounding 10 km (O13) within the past 10 years are listed in Table 6.8

Table 6.8: Invasive Non-native Species within the 10km square of the proposed project (NBDC, 2020).

Species name
Greylag Goose (*Anser anser*)
Canadian Waterweed (*Elodea canadensis*)
Cherry Laurel (*Prunus laurocerasus*)
Fallopia japonica x *sachalinensis* = F. x *bohemica*
Giant Hogweed (*Heracleum mantegazzianum*)
Giant Knotweed (*Fallopia sachalinensis*)
Giant-rhubarb (*Gunnera tinctoria*)
Indian Balsam (*Impatiens glandulifera*)
Japanese Knotweed (*Reynoutria japonica*)
Nuttall's Waterweed (*Elodea nuttallii*)
Harlequin Ladybird (*Harmonia axyridis*)
American Mink (*Mustela vison*)
Brown Rat (*Rattus norvegicus*)
Eastern Grey Squirrel (*Sciurus carolinensis*)

6.3.2 Water Framework Directive

In response to the increasing threat of pollution and the increasing demand from the public for cleaner rivers, lakes and beaches, the EU developed the Water Framework Directive (WFD). This Directive is unique in that, for the first time, it establishes a framework for the protection of all waters including rivers, lakes, estuaries, coastal waters and groundwater, and their dependent wildlife/habitats under one piece of environmental legislation for all European member states.

The WFD (Directive 2000/60/EC) is a substantial piece of EU water legislation that came into force in 2000. The overarching objective of the WFD is for the water bodies in Europe to attain Good or High Ecological Status. The Environment Protection Agency (EPA) is the competent authority in Ireland responsible for delivering the WFD. River Basin Management Plans (RBMP) have been created which set out measures to ensure that water bodies in the country achieve 'Good Ecological Status'.

Good Ecological Quality will depend on the quality of the individual quality elements on which the Ecological status is scored; namely the biological, chemical and morphological condition in a particular water body. Any reduction in any of these elements will result in a reduction of the overall ecological status.

Water Framework Status and Objectives

It is understood that the River Basin Management Plan (2018-2021) has been adopted by all local authorities in order to achieve the aims of the WFD. The Plan sets out the new approach that Ireland will take to enhance protection, prevention, and monitoring of Irish waterbodies. The main actions include:

- Improve waste water treatment;
- Conservation and leakage reduction;
- Scientific assessment of water bodies and implementation of local measures;
- A new collaborative Sustainability and Advisory Support Programme;
- Dairy Sustainability Initiative;
- Development of water and planning guidance for local authorities;
- Extension of Domestic Waste Water Treatment Systems grant Schemes; and
- A new Community Water Development Fund.

Regardless of their current quality, surface waters should be treated the same in terms of the level of protection and mitigation measures employed, i.e. there should be no negative change in status (refer below).

Surface Water Status

The Grand Canal Basin has the WFD status 'Moderate' (2013-2018) which is a downgrade from previous period ('Good' (2010-2015)). The waterbody is 'At risk' of not meeting the WFD objectives (EPA, 2020).

Liffey Estuary Lower has the WFD status 'Good' (2013-2018) which is an upgrade from previous period ('Moderate' (2010-2015)). The waterbody is 'At risk' of not meeting the WFD objectives with the main pressure being urban wastewater (EPA Catchments Unit, 2018).

Groundwater Status

The groundwater body which underlies the proposed works site is the groundwater body IE_EA_G_008. The Groundwater Vulnerability around the site is low to moderate, the WFD status for this groundwater body is currently under 'review' (EPA, 2020).

A summary of the ground water system is given Table 6.9. Data is extracted from Geological Survey Ireland (GSI) website.

Table 6.9: Groundwater Description (GSI 2021)

Layer	Source	Description	Classification Range
Bedrock Geology 100k	GSI	Dark limestone & shale	N/A
Subsoils (Quaternary Sediment)	GSI	Man made / Urban	N/A
Teagasc Soils	GSI	Made ground	N/A
Bedrock Aquifer	GSI/ EPA	Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones	N/A
Gravel Aquifer	GSI / EPA	-	N/A
Sub Soil	GSI	Low	High, Moderate, Low

Layer	Source	Description	Classification Range
Permeability			
Groundwater Recharge	GSI	59mm/year	Mm/year
Groundwater Vulnerability	GSI	Low - moderate	Rock at or near Surface or Karst Extreme High Moderate Low Water
WFD Groundwater Body	EPA	IE_EA_G_008	N/A

6.3.3 Aquatic Survey

An aquatic benthic ecological survey of the Grand Canal Dock Basin and River Liffey Estuary was carried out by BEC Consultants Ltd on 28-29th July 2020. Habitats and species recorded are presented in the following sections.

Site Overview

The Grand Canal Dock is a freshwater body of water located at the eastern end of the Grand Canal, where the canal can be accessed from the River Liffey. The main water source for the Grand Canal is the Milltown Feeder, which flows from Pollardstown Fen, Co. Kildare, supplying the canal with high quality water. The water level of the Grand Canal Basin is maintained at 3.4mOD, and it is regulated through a set of weirs located in the north-eastern part of the basin, that discharge any excess water from the basin into the mouth of the River Dodder and onwards into the River Liffey.

Habitats

The benthic grab survey of the Grand Canal Dock Basin benthic habitat returned a total of 22 species or higher taxa, comprising 361 individuals. All these species were freshwater species with the dominant species being the water slater *Asellus aquaticus* and the snail *Bithynia tentaculate*. Submerged aquatic plants recorded within the basin include Nuttall's Waterweed *Elodea nuttallii*, Rigid Hornwort *Ceratophyllum demersum* and Spiked Water-milfoil *Myriophyllum spicatum*, with filamentous algae and the stonewort *Nitella flexilis* agg. also present. The leech *Erpobdella octoculata* and oligochaete worms of the family Naididae were most common in the upper Grand Canal Dock Basin, where the existing outfall is located. These species are tolerant to organic pollution and give an indication that the water from the stormwater outfall is high in organic pollution. This indication is further supported by the presence of filamentous algae. The water slater *Asellus aquaticus* is also tolerant to organic pollution.

The estuarine habitat of Lower River Liffey in the area of SJRQ is defined as SS.SMu.SMuVS Sublittoral mud in variable salinity (estuaries). This habitat is defined by the fine, anoxic mud with some leaf detritus recovered by the benthic grab samples, and the varying salinity of the water. No fauna were recorded in the grab samples taken in this location. The lack of fauna in this area is likely to be the result of the challenging estuarine habitat, with its varying salinity, along with historic pollution of the fine sediment, resulting in anoxic conditions.

The intertidal habitat on the quay wall in the same area is defined as LR.LLR.FVS.Fcer *Fucus ceranoides* on reduced salinity eulittoral rock. This habitat is defined by the dominating species found on the wall, Horned Wrack *Fucus ceranoides* together with Green Algae *Ulva* spp. Fauna found on the wall include the barnacle *Austrominius modestus* and the Sea Slater *Ligia oceanica*. The species richness on the quay wall is low, which is expected from the estuarine location. This type of habitat is common within the River Liffey Estuary and other estuaries around Ireland with similar conditions.

The survey did not identify any protected species or habitats within the site. The survey did not identify any protected species or habitats within the site. However, European Eel are known to be present within the Basin and Grand Canal. Due to the barrier provided by the lock gates it is less likely that protected fish species such as Salmon, Lamprey spp. and will enter Grand Canal Basin, as these species tend to look for water flow to swim against or with. However, on the infrequent occasions that the lock gates are opened it is possible that these species can enter the basin.

Value of Receptors

The Grand Canal Dock Basin is part of the Grand Canal pNHA, though the aquatic benthic habitat within the Basin is of local value. Many of the species present in the Basin have preference for eutrophic waters and are tolerant to organic pollution. The basin also supports the nationally rare macrophyte Rigid Hornwort, however it can be locally abundant in the Grand Canal and has a strong preference to eutrophic waters.

While the grab samples did not record any fauna in the estuarine habitat of Lower River Liffey, the habitat is still of regional value as it is identified in the Biodiversity Action Plan (DCC, 2016) as a part of the green infrastructure network in the city. River Liffey also supports the legally protected species Grey Seal, Common Seal, Brook Lamprey, River Lamprey, Sea Lamprey, European Eel and Atlantic Salmon.

The intertidal habitat on the quay wall is identified to be of local value.

Invasive Non-native Species

No terrestrial invasive species listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations (S.I. 477/2011) (as amended) were recorded along the pipeline route (including upper Grand Canal Dock down to the proposed outfall location at the River Liffey on SJRQ). However, the invasive non-native species Butterfly-bush *Buddleja davidii* was recorded along the quay wall at SJRQ. This is not a Third Schedule species, but it has the ability to outcompete native species, therefore its eradication is recommended.

Within the Grand Canal Basin, two aquatic invasive species listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations (S.I. 477/2011) (as amended) were recorded (BEC, 2020) namely the Zebra Mussel *Dreissena polymorpha* and Nuttall's Waterweed *Elodea nuttallii.*

The freshwater shrimp *Crangonyx pseudogracilis* is a non-native species recorded within the Grand Canal Dock, however it is considered low risk as an invasive species.

6.3.4 Summary of Ecological Features

A summary of the ecological features carried forward and considered in the assessment and their respective value are given in Table 6.10. The ecological features are assessed for potential impact during construction and operation in the following sections.

Table 6.10: Summary of ecological features and their value

Ecological Feature	Value
Grand Canal pNHA	National
Dolphins, Dublin Docks pNHA	National
Grand Canal Dock Basin (Aquatic benthic habitat)	Regional
Lower River Liffey (SS.SMu.SMuVS Sublittoral mud in variable salinity (estuaries))	Regional

Ecological Feature	Value
Quay wall (LR.LLR.FVS.Fcer *Fucus ceranoides* on reduced salinity eulittoral rock)	Local
Aquatic fauna	Regional

6.4 Characteristics of the Development

The development will entail works that has the potential to impact on ecological receptors in the vicinity of the site.

6.4.1 Culvert/Pipeline Within the Basin

During the construction phase bed material will be moved/displaced within the basin. This involves dredging and pushing aside silt from the bed of the basin. A 200mm gravel bed will be laid down on the footprint of the pipeline, with deeper areas on soft spots where required. As much of the material as possible will be left within the basin and placed around the pipeline. Material that will be removed will be treated as contaminated material and transported to a suitably licensed facility.

The pipeline will be lowered into place within the basin. Lengths of the precast U-shaped housing and pipeline sections will be lowered directly onto the silt bed. Concrete will be poured below the water level to fill up the U-shaped housing between the individual pipelines.

6.4.2 Transition Chamber 1 (3m), Transition Chamber 2 (3m)

The cofferdams for these chambers 1 and 2 within the basin will be constructed using conventional sheet piling.

6.4.3 Transition Chamber 3 (7.4m) and Culvert beneath Hanover Quay

Excavations along Hanover Quay to allow for the new pipeline will be at a depth of 6.55m.

Sheet piles will not be permitted along the back of Hanover Quay wall i.e. in the Campshire itself. It is anticipated that Transition Chamber 3 and the Hanover Quay culvert will be constructed within a secant piled wall. This secant piled wall will be required to minimise working width, to contain the existing contaminated material and to limit any water ingress from the dock and surrounding ground. This will tie into the cofferdam or other temporary works provided by the Contractor in the dock to ensure a watertight seal.

6.4.4 Outfall Works and Tie-in at SJRQ

The Contractor must provide a cofferdam or other temporary works to ensure a watertight seal around the excavation/works in SJRQ and the River Liffey.

For the works in SJRQ, low vibration, Continuous Flight Auger (CFA) piles are required, as a condition specified by the Bord Gáis Transmission Main Department.

During operation stormwater, with intermittent overflow from combined sewer (rainfall related), will be discharged into River Liffey from the storm water discharge point constructed at Sir Rogerson's Quay instead of into Grand Canal Basin.

6.5 Potential Impacts

The impacts on the valued ecological features are assessed here. The initial assessment considers the potential impact pathways and whether these apply to the ecological features. The impact assessment considers the project and the anticipated effects in the absence of any mitigation.

6.5.1 Do Nothing Impacts

If the proposed development would not go ahead the overflow of stormwater would continue to discharge into the Grand Canal Basin. The WFD status of the Grand Canal Basin has been downgraded from 'Good' to 'Moderate' and is classified as being 'at risk'. The continued discharge of polluted water with intermittent high concentrations of faecal coliforms, BOD, nutrients, and suspended solids will continue to deteriorate the water quality of the Basin and decrease the chances of the waterbody reaching WFD 'good' status.

There will be no direct discharge of stormwater overflow into River Liffey and thus no impact on the habitats in this area.

6.5.2 Construction Phase

Non-statutory Designated Sites

Grand Canal pNHA

The ecological value of the Grand Canal pNHA lies in the diversity of species it supports along its linear habitats. The ecological features are found in the canal section upstream of the Basin. While the Grand Canal Basin is part of the pNHA, it does not support any of these ecological features. Therefore, impacts from the proposed project are not anticipated.

- Characterisation of Unmitigated Impact on the Feature
  - The characterisation of unmitigated impacts uses the 'worst case' impact magnitude scenario in all cases. Impacts could be direct, indirect and/or cumulative. Given that the proposed works are undertaken downstream of the ecological features of Grand Canal pNHA, there will be no impact to these features.
- Rationale for prediction of effect
  - Any impacts from the proposed works would be retained within the Basin or transported downstream. The entire Grand Canal is part of the pNHA, however, no ecological features of the pNHA are found within the Basin itself, therefore no impacts are anticipated.
- Effect without mitigation
  - The unmitigated effect of this development would result in a *neutral impact* to a site of national importance.

Dolphins, Dublin Docks pNHA

Potential ecological impact to this site will occur via surface water pathway. Potential release of pollutants (e.g. hydrocarbon from machineries, concrete) and sediment within the Grand Canal Basin could impact on ecological receptors downstream, such as the Common Tern population.

- Characterisation of Unmitigated Impact on the Feature
  - Pollutants:

    Potential release of pollutants and sediment may have a negative impact on the Common Tern population at the Dolphins, Dublin Docks pNHA. Direct impact may occur through contact with pollutants and indirect impact may occur via impacts on prey species, such as fish, of the Common Tern.
- Rationale for prediction of effect
  - Pollutants:

    Direct impact may occur through contact of accidental pollution spills with feathers, which will ultimately degrade their physical condition or by being ingested through the grooming of feathers or while feeding in the aquatic environment. Indirect impact may occur via impact on prey species, such as fish, of the Common Tern.

- Effect without mitigation
  - The unmitigated effect to this development, in terms of potential pollutants, would result in a potential *moderate, short-term impact* to a site of national importance.

Habitats

Grand Canal Dock Basin – aquatic benthic habitat

Potential impact to the aquatic benthic habitat will occur via land and surface water pathways. Loss of benthic habitat and species will occur at the footprint of the new pipeline within the Basin and where dredging will occur. Potential short-term release of pollutants (e.g. hydrocarbon from machineries, concrete) and sediments within the Basin will impact on water quality and potentially degrade the aquatic habitat.

- Characterisation of Unmitigated Impact on the Feature
  - There will be a direct impact on the site due to the loss of benthic habitat and potential reduction in water quality. Pollutants may cause effects such as eutrophication, increased algal and macrophyte growth, increased turbidity and increased sedimentation. However, the works are short-term during the construction phase (<2 years). While the benthic habitat at the footprint of the pipeline within the Basin will be lost, the pipelines will provide substrate for species to recolonise.
- Rationale for prediction of effect
  - There will be a direct loss of aquatic benthic habitat due installation of a new pipeline at the silt bed of the Basin, however, this will be temporary as species will be able to colonise the new surface with time. There is potential for reduction in water quality due to accidental spill of hydrocarbons and possible release of pollutants such as concrete.
- Effect without mitigation
  - The unmitigated effect of this development would result in a *minor, short- term impact* to a site of local importance

Lower River Liffey – SS.SMu.SMuVS Sublittoral mud in variable salinity (estuaries)

During the construction phase, potential impact to this habitat will occur via surface water pathway. Potential short-term release of pollutants and sediment within the Grand Canal Basin could impact on ecological receptors downstream, such as the habitat of the Lower River Liffey.

- Characterisation of Unmitigated Impact on the Feature
  - There will be potential for a direct impact on the habitat due to reduction in water quality. Pollutants may cause effects such as increased eutrophication, increased algal and macrophyte growth, increased turbidity, and increased sedimentation.
- Rationale for prediction of effect
  - There is potential for reduction in water quality due to accidental spill of hydrocarbons and possible release of pollutants such as concrete. Further, dredging and lowering of the pipeline within the Grand Canal Basin could result in the resuspension of sediment which could settle in downstream areas.
- Effect without mitigation

- The unmitigated effect of this development would result in a *minor, short-term impact* to a site of regional importance.

Quay wall – LR.LLR.FVS.Fcer Fucus ceranoides on reduced salinity eulittoral rock

Potential impact to this habitat will occur via land pathways. Loss of habitats and species will occur at the footprint of the new stormwater outfall at SJRQ. As the habitat on the quay wall occurs upstream of the current outlet from the Grand Canal Basin to River Liffey, no impacts are anticipated via surface water pathway from works undertaken within the Basin.

- Characterisation of Unmitigated Impact on the Feature
  - There would be a direct impact on the habitat due to the loss of intertidal habitat on the quay wall at the footprint of the stormwater outfall.
- Rationale for prediction of effect
  - There will be a direct loss of intertidal habitat due to the construction of the new stormwater outfall. However, the loss of habitat will be partly temporary and with time, species will be able to recolonise the new surface, though there will be a small reduction in total habitat area as the new stormwater outfall will cover an area of 74.75 m^2.
- Effect without mitigation
  - The unmitigated effect of this development would result in a *negligible, short-term impact* to a habitat of local importance.

Species

Aquatic Fauna

Potential impact to aquatic fauna including Grey Seal, Common Seal, cetaceans, River Lamprey, Sea Lamprey, European Eel, Atlantic Salmon, and Otter may occur via surface water pathway. There are records of these species present along the coast, and within the River Liffey: Salmon and Lamprey spp. migrate further up the river to spawn. While these are mobile species, they are all present in the transitional reaches of River Liffey. Potential release of pollutants and sediment within the Grand Canal Basin can be transported downstream and could impact on these ecological receptors.

Common Tern

There is a known nesting location for Common Tern on the Camden Lock structure at the outer end of the Grand Canal Basin. This nest site is known to regularly support a single pair of Common Tern during the breeding season. It is considered that birds using this nest site may be associated with the population within the designated area of the SPA and pNHA. There is the potential for indirect impact via disturbance to the nesting Common Tern pair at Camden Lock structure due to construction works and increased human activity.

- Characterisation of Unmitigated Impact on the Features
  - During construction phase, potential accidental release of pollutants and mobilisation of sediment may have a negative impact on this group of species. Decreased water quality or direct contact with pollutants is considered to have a negative impact on the populations of these species. Potential reduction of available prey species may also result in a decrease in the populations of various prey of this group of species.
  - There will be an increase in noise and visual intrusion due to construction activity, including dredging, construction of pipeline and transition chambers. The main site compound will be located on Hanover Quay, near the Camden Lock and the presence of site personnel may also

cause disturbance to the nesting Common Tern pair during the breeding season. These activities will be short-term during the construction phase of the project.

- Rationale for prediction of effect

  - Direct impact may occur through accidental release of pollutants (during construction phase), coming in contact with the fur (mammals) or gills (fish) or by ingestion, impacting on the overall fitness of individuals. Reduced water quality and sedimentation could also impact on the food chain of the species, i.e. fish, macro-invertebrates and flora species, thus reducing the food resources available to these species. Further, as the River Liffey is the main river connecting several other rivers in the catchment with the Irish Sea, including the River Dodder and the River Camac, impacts on migrating fish such as Salmon, European Eel and Lamprey spp. can potentially impact on the populations in these rivers as well.
  - It is not anticipated the works will cause significant disturbance to the nesting tern pair at Camden Lock as there is already background disturbance from human presence and commercial activity in the area to which nesting birds are likely to be habituated, and therefore less prone to disturbance. However, should the Camden Lock structure be accessed by site personnel it is likely that nesting terns will be disturbed, potentially leading to less time spent on the nest and reduced fitness of chicks.

- Effect without mitigation

  - The unmitigated effect of this development would result in a *minor, short-term impact* on species of regional importance.
  - Regarding disturbance, given that there is only one pair nesting at the site, the unmitigated effect would result in a *short-term, minor impact.*

Invasive Non-native Species

The only invasive species identified in the areas of proposed works are Nuttall's Waterweed and Zebra Mussel (BEC,2020). Both these species are found in freshwater habitats and therefore, there will be no spread of these species downstream to estuarine and coastal habitats. There is the potential for an increased spread of the species within the Grand Canal Basin and they could outcompete native species in this habitat. This would be a natural occurrence as Zebra Mussel already occurs within the basin. It can spread by transport of larvae in flowing or carried water, or by adults attached to boats, equipment, etc. (Minchin et al., 2003).

There are no terrestrial invasive non-native species occurring along the pipeline route.

- Effect without mitigation

  - Silt contaminated with Nuttall's Waterweed or Zebra Mussel that is removed and transported from the Basin in the process of the works has the potential to contaminate other freshwater bodies. Barges or boats used during the works also have the potential to spread these species to other water bodies outside of the site after works are completed. The unmitigated effect would potentially result in *long-term, major* impacts on water bodies outside of the site.

6.5.3 Operational Phase

Non-statutory Designated Sites

Grand Canal pNHA

The removal of the stormwater outfall in the Grand Canal Basin will lead to a reduction in input of polluted water. This would have a positive effect on the Basin as it would improve the water quality within the Basin and has the potential to improve the overall WFD status of the waterbody.

Dolphins, Dublin Docks pNHA

Potential ecological impact to this site will occur via surface water pathway. Stormwater with an intermittent overflow from combined sewer will be discharged into River Liffey and transported downstream and could indirectly impact on ecological receptors downstream, such as the Common Tern population.

- Characterisation of Unmitigated Impact on the Feature

  - Discharge of polluted water may have a negative impact on the Common Tern population at the Dolphins, Dublin Docks pNHA. Direct impact may occur through contact with pollutants and indirect impact may occur via impacts on prey species, such as fish, of the Common Tern leading to reduction of available food resource. The Water Quality Modelling (WQM) report assessed the change in water quality in River Liffey based on four parameters: Molybdate Reactive Phosphate (MRP), Dissolved Inorganic Nitrogen (DIN), Biological Oxygen Demand (BOD) and E. coli. There was no discernible change in the achievement of the Environmental Quality Standard (EQS) compared to the baseline in regards to MRP and DIN with the % difference in concentration in much of the Lower Liffey being less than 1%. BOD showed no discernible change in the achievement of the EQS compared to the baseline. It was noted that this parameter showed the greatest increases compared to the baseline, however, the resultant values were still well below the EQS thresholds. For E. coli the increases due to the GCSWOE were seen to be less than 2% in the time varying scenario reducing rapidly away from the outfall and between 2 and 5% for the storm-based scenarios. Importantly, at the downstream boundary these both reduced to less than a 1% increase compared to the baseline. Therefore, any discharge from the new stormwater outfall will not significantly impact on the Common Tern population of Dolphins, Dublin Docks pNHA.

- Rationale for prediction of effect

  - Direct impact may occur through contact of pollution with feathers, which will ultimately degrade their physical condition or by being ingested through the grooming of feathers or while feeding in the aquatic environment. Indirect impact may occur via impact on prey species, such as fish, of the Common Tern. However, the discharge from the combined stormwater overflow outfall will cause a very slight change in water quality. The WQM report has shown that the hydrodynamic properties of the River Liffey will dilute and disperse contaminants over relatively short spatial scales with changes in pollution concentrations from the baseline being less than 1 % in much of the Lower Liffey. There will be no discernible change in the ability to meet the surface water environmental quality standards (EQS). The WFD status for the Lower Liffey Estuary and Dublin Bay will remain good.

- Effect without mitigation

  - The unmitigated effect to this development would result in a neutral impact to a site of national importance.

Habitats

Grand Canal Dock Basin – aquatic benthic habitat

The removal of the stormwater outfall in the Grand Canal Basin will lead to a reduction in input of polluted water. This would have a positive effect as it would improve the water quality within the basin and has the potential to improve the overall WFD status of the waterbody. This may allow for a more diverse fauna to colonise the benthic habitat.

Lower River Liffey – SS.SMu.SMuVS Sublittoral mud in variable salinity (estuaries)

Potential impact to this habitat will occur via surface water pathway. Stormwater with an intermittent overflow from combined sewer will be discharged into River Liffey and could impact on ecological receptors downstream, such as the estuarine habitat within River Liffey.

- Characterisation of Unmitigated Impact on the Feature

  - Direct impact on the habitat could be through potential reduction in water quality. Pollutants may cause effects such as increased eutrophication, increased algal and macrophyte growth, increased turbidity and increased sedimentation.
  - The Water Quality Modelling (WQM) report assessed the change in water quality in River Liffey based on four parameters: Molybdate Reactive Phosphate (MRP), Dissolved Inorganic Nitrogen (DIN), Biological Oxygen Demand (BOD) and *E. coli*. There was no discernible change in the achievement of the Environmental Quality Standard (EQS) compared to the baseline in regard to MRP and DIN with the % difference in concentration in much of the Lower Liffey being less than 1%. BOD showed no discernible change in the achievement of the EQS compared to the baseline. It was noted that this parameter showed the greatest increases compared to the baseline, however, the resultant values were still well below the EQS thresholds. For *E. coli* the increases due to the GCSWOE were seen to be less than 2% in the time varying scenario reducing rapidly away from the outfall and between 2 and 5% for the storm-based scenarios. Importantly, at the downstream boundary these both reduced to less than a 1% increase compared to the baseline.
  - Therefore, any discharge from the new stormwater outfall will not significantly impact on the sublittoral mud in variable salinity (estuaries) habitat.

- Rationale for prediction of effect

  - The discharge from the combined stormwater overflow outfall will cause a very slight change in water quality. The WQM report has shown that the hydrodynamic properties of the River Liffey will dilute and disperse contaminants over relatively short spatial scales with changes in pollution concentrations from the baseline being less than 1 % in much of the Lower Liffey. There will be no discernible change in the ability to meet the surface water environmental quality standards (EQS). The WFD status for the Lower Liffey Estuary and Dublin Bay will remain good.

- Effect without mitigation

The unmitigated effect of this development would result in a neutral impact to a site of regional importance.

Quay wall – LR.LLR.FVS.Fcer Fucus ceranoides on reduced salinity eulittoral rock

Potential impact to this habitat will occur via surface water pathway. Stormwater with an intermittent overflow from combined sewer will be discharged into River Liffey and could impact on the intertidal habitat on the quay wall.

- Characterisation of Unmitigated Impact on the Feature

  - There would be a direct impact on the habitat due to potential reduction in water quality. Pollutants may cause effects such as increased eutrophication, increased algal and macrophyte growth, increased turbidity and increased sedimentation.
  - The Water Quality Modelling (WQM) report assessed the change in water quality in River Liffey based on four parameters: Molybdate Reactive Phosphate (MRP), Dissolved Inorganic Nitrogen (DIN), Biological Oxygen Demand (BOD) and *E. coli*. There was no discernible change in the achievement of the Environmental Quality Standard (EQS) compared to the baseline in regard to MRP and DIN with the % difference in concentration in much of the Lower Liffey being less than 1%. BOD showed no discernible change in the achievement of the EQS compared to the baseline. It was noted that this parameter showed the greatest increases compared to the baseline, however, the resultant values were still well below the EQS thresholds. For *E. coli* the increases due to the GCSWOE were seen to be less than 2% in the time varying scenario reducing rapidly away from the outfall and between 2 and 5% for the storm-based scenarios. Importantly, at the downstream boundary these both reduced to less than a 1% increase compared to the baseline.
  - Therefore, any discharge from the new stormwater outfall will not significantly impact on the *Fucus ceranoides* on reduced salinity eulittoral rock habitat.

- Rationale for prediction of effect
  - The discharge from the combined stormwater overflow outfall will cause a very slight change in water quality. The WQM report has shown that the hydrodynamic properties of the River Liffey will dilute and disperse contaminants over relatively short spatial scales with changes in pollution concentrations from the baseline being less than 1 % in much of the Lower Liffey. There will be no discernible change in the ability to meet the surface water environmental quality standards (EQS). The WFD status for the Lower Liffey Estuary and Dublin Bay will remain good.

- Effect without mitigation
  - The unmitigated effect of this development would result in a neutral impact to a habitat of local importance.

Species

Aquatic Fauna

Potential impact to aquatic fauna including Grey Seal, Common Seal, River Lamprey, Sea Lamprey, Atlantic Salmon, European Eel, cetaceans and Otter may occur via surface water pathway. There are records of these species present along the coast and within the River Liffey. Salmon and Lamprey spp. migrate further up the river to spawn. While these are mobile species, they are all present in the transitional reaches of River Liffey. Stormwater with an intermittent overflow from combined sewer will be discharged into River Liffey and transported downstream and could impact on these ecological receptors.

- Characterisation of Unmitigated Impact on the Feature
  - Intermittent discharge of polluted water may have a negative impact on this species group. Decreased water quality or direct contact with pollutants is considered to have a negative impact on the populations of these species. Potential reduction of available prey species may also result in a decrease of population in this species group.
  - The Water Quality Modelling (WQM) report assessed the change in water quality in River Liffey based on four parameters: Molybdate Reactive Phosphate (MRP), Dissolved Inorganic Nitrogen (DIN), Biological Oxygen Demand (BOD) and *E. coli*. There was no discernible change in the achievement of the Environmental Quality Standard (EQS) compared to the baseline in regards to MRP and DIN with the % difference in concentration in much of the Lower Liffey being less than 1%. BOD showed no discernible change in the achievement of the EQS compared to the baseline. It was noted that this parameter showed the greatest increases compared to the baseline, however, the resultant values were still well below the EQS thresholds. For *E. coli* the increases due to the GCSWOE were seen to be less than 2% in the time varying scenario reducing rapidly away from the outfall and between 2 and 5% for the storm-based scenarios. Importantly, at the downstream boundary these both reduced to less than a 1% increase compared to the baseline.
  - Therefore, any discharge from the new stormwater outfall will not significantly impact on the aquatic fauna.

- Rationale for prediction of effect
  - The discharge from the combined stormwater overflow outfall will cause a very slight change in water quality. The WQM report has shown that the hydrodynamic properties of the River Liffey will dilute and disperse contaminants over relatively short spatial scales with changes in pollution concentrations from the baseline being less than 1 % in much of the Lower Liffey. There will be no discernible change in the ability to meet the surface water environmental quality standards (EQS). The WFD status for the Lower Liffey Estuary and Dublin Bay will remain good.

- Effect without mitigation

– The unmitigated effect of this development would result in a neutral impact on species of regional importance.

6.6 Mitigation Measures

The assessment of potential effects on ecological features has identified potential entry of pollutants and resuspension of silt in the surface water during construction as the main source of impact. The proposed mitigation measures therefore focus on pollution and sediment control measures. The CEMP is contained in the Volume 3, Appendix 17A to this EIAR.

6.6.1 Construction Phase

The following ecological features are impacted via surface water pathways during the construction phase: Dolphin's Dublin Docks pNHA, Grand Canal Dock Basin, Lower River Liffey (SS.SMu.SMuVS Sublittoral mud in variable salinity (estuaries)), and aquatic fauna.

Water Quality

Relevant legislation and best practice guidance that have been considered includes but not limited to the following:

- CIRIA C532 Control of water pollution from construction sites. Guidance for consultants and contractors (CIRIA, 2019 - www.ciria.org);
- CIRIA C515 Groundwater control – design and practice, 2nd ed. (CIRIA, 2019 - www.ciria.org);
- CIRIA Guidance C741: Environmental good practice on site guide (Charles & Edwards, 2015; CIRIA, 2019 - www.ciria.org); and
- Inland Fisheries Ireland 2016 Guidance on Protection of Fisheries During Construction Works In and Adjacent to Waters.

In particular, the following measures will be implemented:

- A CEMP has been prepared and is included in Volume 3, Appendix 17A to the EIAR which will be updated and finalised by the Contractor prior to construction commencing. This CEMP incorporates *inter alia* the mitigation measures listed in this section;
- Adoption of a surface water plan including appropriate barrier controls to prevent potentially polluted surface water from the site reaching Grand Canal Basin or the River Liffey (e.g. bunding);
- Oil booms and oil soakage pads will be maintained on-site to enable a rapid and effective response to any accidental spillage or discharge. These will be disposed of correctly and records will be maintained by the environmental manager of the used booms and pads taken off site for disposal; and
- Fail-safe site drainage and bunding through drip trays on plant and machinery will be provided to prevent discharge of chemical spillage from the sites to surface water.

Pollution Control and Spill Prevention

<u>Prevention measures:</u>

- Daily inspections and maintenance of plant and machinery checking for leaks, damage or vandalism will be made on all plant and equipment. The inspections will be recorded on a sign-off sheet on site;
- The site compound storage areas and cleaning areas will be rendered impervious and will be constructed to ensure no discharges will cause pollution to surface or ground waters;
- Designated locations for refuelling land-based plant and machinery off site, >100m from waterbody;
- Refuelling protocol to include:
    - Refuelling of barge/vessels to take place at designated area at/adjacent to site compound at Hanover Quay;
    - Vessels to be securely docked before attempting to refuel;
    - Clear and easy access for personnel to get from tank on quay to refuelling point on boat/barge;
    - Refuelling to be carried out under strict supervision of Environmental Officer;

- Refuelling by trained, authorised and named personnel only;
- Refuelling pipe to be supervised at all times;
- Refuelling from storage tank by pump only, with automatic cut-off, and automatic retraction of hose pipe. Adequate length of hose required, to enable full and easy access to fuelling point on vessel;
- No fuel to be stored at site compound; and
- Spill kits and booms to be available in case of accidental spillage.

- Potentially contaminated run off from plant and machinery maintenance areas will be managed within the site compound surface water collection system; and
- Damaged or leaking containers will be removed from use and replaced immediately.

<u>Control measures:</u>

In the event of a spill the Contractor will ensure that the following procedures are in place:

- Emergency response awareness training for all Project personnel on-site works;
- Appropriate and sufficient spill control materials will be installed at strategic locations within the site and at barge/boat refuelling area at Hanover Quay;
- Spills kits for immediate use will be kept in the cab of mobile equipment;
- Spill kits will be stored in the site compound with easy access for delivery to site in the case of an emergency. A minimum stock of spill kits will be maintained at all times and site vehicles will carry spill kits at all times. Spill kits must include suitable spill control materials to deal with the type of spillage that may occur and where it may occur. Typical contents of an on-site spill kit will include the following as a minimum:

  - Absorbent granules.
  - Absorbent mats/cushions.
  - Absorbent booms.
  - Spill kits will contain gloves to handle contaminated materials and sealable disposal sacks.

- Track-mats, geotextile material and drain covers;
- Absorbent material will be used with pumps and generators at all times;
- All potentially polluting substances such as oils and chemicals used during construction will be stored in containers clearly labelled and stored with suitable precautionary measures such as bunding within the site compound;
- All used spill materials e.g. absorbent pads will be placed in a bunded container in the Contractor's compound. The material will be disposed of by a licenced waste Contractor at a licenced facility. Records will be maintained by the environmental site manager; and
- All tank and drum storage areas on the site will, as a minimum, be bunded to a volume not less than the following:

  - 110% of the capacity of the largest tank or drum within the bunded area; or
  - 25% of the total volume of substances which could be stored within the bunded area.

  , whichever is greater.

Silt Control and Sediment Management

Silt control measures will incorporate the following:

- A silt curtain will be installed around the area of works within the Grand Canal Basin. The works within the basin will be carried out in two phases, the inner and outer basin. The silt curtain will be installed to screen the inner basin, i.e. south of MacMahon Bridge. Before works commence in the outer basin, i.e. north of MacMahon Bridge, a silt curtain will also be installed to screen the outer basin area off. The silt curtain is secured to an anchoring system and hangs within the waterbody. The curtain will be in place during the entire phase of the construction;

- The silt curtain will be inspected regularly and maintained to prevent failure during the work. Accumulated material upstream of the silt curtain will be carefully removed and properly disposed of. Any accumulated material will be removed before removing the silt curtain;
- Any silt to be removed will be inspected for protected species by ECoW and which will be returned to the Basin;
- The silt to be disposed of will be moved to a suitable licensed facility off-site;
- Bunding will be installed along Hanover Quay, between the area of works along the quay and the Grand Canal Basin prior to works commencing in this area. All surface water run-off from the construction site will be directed to a temporary facility, where the flow will be attenuated, and sediment allowed to settle. Before passing through a hydrocarbon interceptor prior to discharge. Bunding will only be removed when sediment movement is no longer a risk;
- Silt-traps will be maintained and cleaned regularly during the course of site works; and
- Lock gates will be kept closed while the construction works take place within the basin. Only necessary controls of water levels within the basin will be permitted.

Wet Concrete Leachate Control

The measures prescribed with regard to sedimentation and surface water run-off will also minimise the risk of input of cementitious material during construction. However, the following measures will also apply:

- In order to prevent input of cementitious materials into the Grand Canal Basin from the below water elements of the construction, concrete structural elements will be precast, wherever possible;
- Concrete to be used below water will be a concrete mix for aquatic/marine environment, e.g. fast curing with good anti-washout properties;
- Where concrete or other wet materials are to be used over/below water, appropriate bunded platforms will be in place to capture any spilled concrete, sealants or other materials;
- For construction works within the basin a geotextile screen (silt curtain) and boom with oil barrier will be employed around aquatic works to restrict, silt or oil from polluting the water ;
- Batching of concrete will be done off site and delivered to site as required by Readymix truck;
- Only designated and trained operators experienced in working with concrete will be employed during the concrete pouring phase;
- Raw, uncured or waste concrete will be collected and stored appropriately for disposal by a licensed Contractor in accordance with the Waste Management Plan;
- A designated concrete washout area will be contained and impermeable;
- Large volumes of water with dissolved concrete can be pumped into a skip to settle out; settled solids will need to be appropriately disposed of off site; and
- Waters from wash facility will be recycled to the greatest extent feasible and will not be discharged directly to surface water drains, watercourses or soakaways. Waters that cannot be recycled will discharge through silt and full retention oil/petrol interceptor prior to discharge. A regular maintenance programme shall be put in place to ensure that the silt and hydrocarbon interceptors remain effective.

Protected Species

An Ecological Clerk of Works (ECoW) will, in the appropriate season and prior to construction works commencing visually check the Camden Lock structure for the Common Tern nest. If deemed necessary, a barrier will be put in place to prevent access to the nest and ensure there is no risk of disturbance during the construction period.

Biosecurity

Measures will need to be put in place to ensure that there is no spread of invasive non-native species or diseases. There will be no disturbance of the Grand Canal Basin outside of the proposed project area. Sediment removed will be treated as contaminated and disposed of to a licensed facility off site.

The Check-Clean-Dry approach will be followed, ensuring that all barges/ boats, PPE and equipment is cleaned before entering and leaving site. For more information refer to: www.nonnativespecies.org/checkcleandry.

6.6.2 Operational phase

No significant impacts have been identified during the operation phase, therefore mitigation measures are not proposed.

6.7 Residual Impacts

Residual ecological impacts are those that remain once the development proposals have been implemented. The main aim of ecological mitigation, compensation, and enhancement is to minimise or eliminate residual impacts.

6.7.1 Construction Phase

The construction of the new stormwater outfall will cause a re-suspension of sediment within the Grand Canal Basin and potential pollution incidents caused by accidental spills or leaks, e.g. oil/ diesel from machinery and concrete. Silt and pollutants have the potential to be transported in water and thus impact on ecological features downstream, such as the Lower River Liffey, aquatic fauna, and the ecological features of Dolphin's Dublin Docks pNHA, i.e. the Common Tern population. There is also the potential for disturbance of the nesting Common Tern pair at the Camden Lock structure.

Mitigation measures are being implemented, including pollution control, silt management control, and concrete leachate control to prevent any adverse effects on receiving ecological features. An ECoW will inspect the nesting site of the Common Tern prior to construction and a barrier will be put in place if required to prevent disturbance.

There will be a temporary loss of benthic habitat at the footprint of the pipeline within the Grand Canal Basin and a small permanent loss of *Fucus ceranoides* on reduced salinity eulittoral rock habitat at the outfall at SJRQ. The benthic habitat is anticipated to naturally recolonise after construction and the *Fucus ceranoides* on reduced salinity eulittoral rock habitat will be partly recolonised. No mitigation measures are proposed.

With the implementation of proposed mitigation measures in place for the protection of surface water, the residual impact of the construction phase is assessed to be of *temporary slight negative impact* on account of the loss of habitat within the Grand Canal Basin and quay wall.

6.7.2 Operational Phase

There will be a permanent slight reduction of the quay wall habitat area (74.75m^2) due to the new outfall. However, in the context of the total area of quay wall habitat along the Lower River Liffey it is anticipated to have a negligible impact on this habitat of local value.

The removal of the stormwater outfall in the Grand Canal Basin will lead to a reduced input of polluted water. This will have a long-term positive effect as it will improve the water quality within the basin and has the potential to improve the overall WFD status of the waterbody. This will also have a positive effect on the benthic sedimentary habitat and its infauna.

The residual impact during operation is assessed to be *positive* due to the improvement of water quality within the Grand Canal Basin.

The discharge from the combined stormwater overflow outfall will cause a very slight change in water quality in the River Liffey. The WQM report has shown that the hydrodynamic properties of the River Liffey will dilute and disperse contaminants over relatively short spatial scales with changes in pollution concentrations from the baseline being less than 1% in much of the Lower Liffey. There will be no discernible change in the ability to meet the surface water environmental quality standards (EQS). The WFD status for the Lower Liffey Estuary and Dublin Bay will remain good.

6.7.3 Interactions

Interactions with other environmental factors of the EIAR have been identified with the following sections of Volume 2, Section 7 Water Quality and Hydrology and Section 8 Land, Soils, Geology and Hydrogeology.

As a result of the project, the water quality within the Grand Canal Basin will improve. This in turn will improve aquatic habitats in the basin and the environment for species inhabiting the basin. The impacts of the relocated stormwater discharge on the receiving waters will be insignificant during the operational phase.

Impacts on sediment include disturbance to the silt bed of the Grand Canal Basin from dredging the footprint of the pipeline, lowering pipeline sections and construction of Transition Chambers. This could impact on the quality and distribution of aquatic habitats and species. However, potential impact will be short-term and the pipeline will provide substrate for species to recolonise.

Contamination of benthic sediment due to accidental spillages and fugitive emissions could end up in the Grand Canal Basin or River Liffey due to surface water run-off.

Adequate mitigation measures for silt control and pollution control relating to the construction phase are addressed above in Section 6.6

There is the potential for interactions between air quality and biodiversity as works will take place within a section of the Grand Canal proposed Natural Heritage Area (pNHA) (site code 002104). There is the potential for increased NO_X and NO_2 emissions from traffic accessing the site to impact the pNHA. There is no potential for significant impacts to the designated site as a result of traffic emissions. It has been determined that there is an overall negligible risk of dust related emissions causing ecological impacts. Once the mitigation measures outlined within Section 9.6.1 are implemented dust related impacts are predicted to be short-term, neutral and imperceptible.

There will be an increase in noise due to construction activity. The results of the noise modelling and surveys were used to assess the impacts on birds (nesting terns). These activities will be short-term during the construction phase of the project. The noise specialist provided the biodiversity specialist with predicted noise levels resulting from the construction and operational phases. No significant impact on the sensitive receptors is predicted.

6.7.4 Cumulative Impacts

The following projects or plans were identified as potential sources of cumulative impacts:

- Dublin City Council Development Plan 2016 – 2022;
- Greater Dublin Drainage Strategy;
- River Basin Management Plan for Ireland 2018-2021;
- Dublin Port Masterplan 2040;
  - Alexandra Basin Redevelopment;
  - MP2 Project;

- Bus Connect Ringsend to City Centre;
- Dodder Public Transportation Opening Bridge;
- Pedestrian Bridge across River Liffey;
- Dart+ Underground;
- The Dublin Eastern Bypass;
- Dodder Greenway;
- Dublin District Heating;
- Grand Canal Greenway- Grand Canal Dock Section;
- Grand Canal Quay East development works;
- Maintenance dredging in Dublin Port;
- Luas Red Line Poolbeg Extension;
- Greater Dublin Area Cycle Network Plan;
- Metrolink;
- Ringsend Waste Water Treatment Plant Upgrade;
- South Campshire Flood Defence Wall Project;
- Treasury Building; and
- Planning Applications on Myplan.ie.

Plans

<u>*Dublin City Development Plan 2016-2022*</u>

Dublin City Development Plan 2016-2022 sets out aims policies and objectives for the proper planning and sustainable development in the city. The Plan seeks to develop and improve, in a sustainable manner, the social, economic, cultural and environmental assets of the city (DCC, 2016).

To achieve a green, connected city and more sustainable neighbourhoods in line with the core strategy of the Plan the strategic approach will aim at (DCC, 2016):

- Implementing a 'green infrastructure' strategy;
- Creating sustainable connectivity between green areas; and
- Providing for the recreational and amenity needs of the population.

It is the policy to develop the green infrastructure network through the city where linear parks and waterways play an important role in connecting existing open spaces.

The City Development Plan is designed to be taken in conjunction with other similar plans and programmes, to have the overall effect of strengthening the management of and enhancing the protection and conservation of Natura 2000 sites (SACs and SPAs). Specific statements, policies and objectives are formulated within the Plan to allow the Council to take appropriate steps to avoid the deterioration of Natura 2000 sites.

An Appropriate Assessment Stage 2 Natura Impact Statement was completed in 2016 and published as part of the Dublin City Development Plan (volume 6). The zone of influence for this Plan was identified as 15km. The concluding statement in this appropriate assessment stage 2 report ruled out the potential for significant effects on European sites as a result of the Plan. The potential likely significant impacts from core strategies, and their related mitigation measures are outlined as follows:

- The housing strategy will result in an increase of 29,500 housing units. This has the potential to cause a change of water quality due to developments, and the potential to disturb species and European sites. **Relevant mitigation measures** include:

  - Promoting the development of vacant or under-utilised sites in line with environmental surveys including flora and fauna;
  - Protecting flora, fauna, and habitats by conserving NHAs, SPAs, and SACs;
  - Promoting the progressive reduction of pollution of groundwater and preventing its further pollution;
  - Ensuring development is permitted in tandem with available water supply and wastewater treatment and to manage development; and
  - Promoting sustainable design and construction to help reduce emissions from the demolition and construction of buildings.

- The employment, enterprise, and retail strategies will support the consolidation of the city centre and development of the regeneration areas will encourage movement of people, which has the potential to impact European sites. **Relevant mitigation measures** include:

  - Promoting sustainable development by balancing complex sets of economic, environmental or social goals in planning decisions;
  - Developing a sustainable network of safe, clean, attractive pedestrian routes, lanes, and cycleways in order to make the city more coherent and navigable;
  - Improving pedestrian and cycle access routes to strategic level amenities while ensuring that ecosystem functions are not compromised, and biodiversity is conserved;
  - Ensuring development is permitted in tandem with available water supply and wastewater treatment services; and
  - Promoting sustainable design and construction to help reduce emissions from the demolition and construction of buildings.

- The sustainable infrastructure strategy has the potential to significantly impact European sites. **Relevant mitigation measures** include:

  - Protecting flora, fauna, and habitats which have been identified by Articles 10 and 12 of the Habitats Directive;
  - Promoting and maintaining the achievement of at least 'good' status in all waterbodies in the city;
  - Promoting the progressive reduction of pollution of groundwater and preventing further pollution;
  - Supporting initiatives to reduce marine pollution in Dublin Bay;

- The public transport strategy has the potential to significantly impact European sites by way of disturbance, change in water quality, and noise pollution. **Relevant mitigation measures** include:

  - Carrying out road capacity improvements subject to environmental and conservation considerations;
  - Maintaining air and noise quality in accordance with good practice and relevant legislation; and
  - Improving pedestrian and cycle access routes to strategic level amenities while ensuring that ecosystem functions are not compromised, and biodiversity is conserved.

A number of **mitigation measures** have been prepared and applied to the policies and objectives that have been screened in for Appropriate Assessment as follows:

- SI1: to support Irish Water in provision of high-quality drinking water, water conservation, and in the development of water and wastewater systems to meet public demands in the city and wider region, in accordance with the Greater Dublin Water Supply Strategic Study, and the Greater Dublin Strategic Drainage Study;
- SI2: to support Irish Water to ensure the upgrade of wastewater infrastructure, in particular Ringsend wastewater treatment plant, marine outfall, and orbital sewer;
- SI3: to ensure that development is permitted in tandem with available water and wastewater treatment. Also, to manage development whereby there is adequate capacity;
- SI4: to promote and maintain good status in all waterbodies in the city;
- SI5: to promote the enhancement of aquatic ecosystems and wetlands;
- SI6: to promote the protection and improvement of the aquatic environment through reduction of discharges and emissions;
- SI7: to promote the reduction of groundwater pollution;
- SI8: to mitigate the effects of floods and draughts;
- GI20: to seek the improvement of water quality, bathing facilities, and other recreational opportunities in the coastal, estuarine and surface water environments in the city. Also, to protect ecology and wildlife of Dublin Bay;
- GI21: to support initiatives to reduce marine pollution in Dublin Bay in with other organisations, to raise awareness, and to have regard to the Marine Strategy Framework Directive (2008/56/EC);
- GI23: to protect flora, fauna and habitats, which have been identified by Articles 10 and 12 of the Habitats Directive, Birds Directive, Wildlife Acts 1976-2012, the Flora (Protection) Order 2015 S.I. No. 356 of 2015, European Communities (Birds and Natural Habitats) Regulations 2011 to 2015;
- GI24: to conserve and manage all natural heritage areas, SACs and SPAs designated, or proposed to be designated, by the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs;
- GI25: to make provisions for habitat creation/ maintenance and facilitate biodiversity by encouraging the development of linear parks, nature trails, wildlife corridors, urban meadows and urban woodlands;
- GI26: to have regard to the conservation and enhancement of significant non-designated areas of ecological importance in accordance with development standards set out in this plan;
- The revised policies and objectives following relevant mitigation measures are outlined below;
- Policy SC3: to develop a sustainable network of safe, clean, attractive pedestrian routes, lanes and cycleways in order to make the city more coherent and navigable. The mitigation measures applied include GI23, GI24, GI25, and GI26;
- Policy GH8: to promote the sustainable development of vacant or under-utilised infill sites and to favourably consider higher-density proposals which respect the design of the surrounding development and the character of the area. The mitigation measures applied include GI23, GI24, GI25, and GI26;

- Policy RD2: to require that proposed retail developments for large-scale or sensitive sites in line with environmental requirements, are accompanied by a retail design brief guided by the key principles contained in the "Retail Design Manual – DECLG, 2012", www.environ.ie. The mitigation measures applied include GI23, GI24, GI25, and GI26;
- Policy MT7: to improve the city's environment for walking and cycling through the implementation of improvements to thoroughfares and junctions and also through the development of new and safe routes, including the provision of foot and cycle bridges. Routes within the network will be planned in conjunction with Green Infrastructure Objectives and on foot of (inter alia) the NTA's cycle network plan for the Greater Dublin Area and the National Cycle Manual having regard to policies GI5 and GI018. The mitigation measures applied include GI23, GI24, GI25, and GI26. A clause was inserted in the Transport and Movement chapter that stated, "all development proposals shall be subject to Article 6 EU Habitats Directive Appropriate Assessment";
- Policy MT12: to improve the pedestrian environment and promote the development of a network of pedestrian routes which link residential areas with recreational, educational and employment destinations to create a pedestrian environment that is safe and accessible to all. The mitigation measures applied include GI23, GI24, GI25, and GI26. A clause was inserted in the Transport and Movement chapter that stated, "all development proposals shall be subject to Article 6 EU Habitats Directive Appropriate Assessment";
- Policy SI8: to mitigate the effects of floods and droughts subject to environmental assessment. The mitigation measures applied include GI15, HI16, GI17, and GI016;
- Objective MT01: to encourage intensification and mixed-use development along public transport corridors and at transport nodes where sufficient public transport capacity and accessibility exists to meet the sustainable transport requirements of the development, having regard to conservation policies set out elsewhere in this plan and the need to make best use of urban land. DCC will seek to prepare SDZ's, LAP's, or other plans for areas surrounding key transport nodes where appropriate, in order to guide future sustainable development. The mitigation measures applied include GI23, GI24, GI25, and GI26. A clause was inserted in the Transport and Movement chapter that stated, "all development proposals shall be subject to Article 6 EU Habitats Directive Appropriate Assessment";
- Objective MT09: to develop, within the lifetime of this plan, the Strategic Cycle Network for Dublin city – connecting key city centre destinations to the wider city and the national cycle network, and to implement the NTA's Greater Dublin Area Cycle Network Plan, to bring forward planning and design of the Santry River Greenway, incorporating strongly integrative social and community development initiatives. The mitigation measures applied include GI23, GI24, GI25, and GI26. A clause was inserted in the Transport and Movement chapter that stated, "all development proposals shall be subject to Article 6 EU Habitats Directive Appropriate Assessment"; and
- Objective MT031: to initiate and/ or implement the following road improvement schemes and bridges within the six-year period of the development plan, subject to the availability of funding and environmental requirements and compliance with the "Principles of Road Development" set out in the NTA transport strategy:

    - River Road
    - Richmond Road
    - Malahide Road/ R107 (including North Fringe improvements)
    - Blackhorse Avenue
    - Clonshaugh Road Industrial Estate
    - Ballymun (improved town centre linkage)
    - Kilmainham/ South Circular Road
    - Link from Military Road to Conyngham Road
    - East Wall Road/ Sheriff Street to North Quays
    - Cappagh Road
    - Dodder Bridge
    - Liffey Valley Park pedestrian/ cycle bridge
    - Cycle/ pedestrian bridges that emerge as part of the evolving Strategic Cycle Network and Strategic Green Infrastructure Network
    - Newcomen Bridge (upgrading for pedestrian and cyclist use)
    - Three new bridges proposed as part of the North Lotts and Grand Canal Dock SDZ.

Greater Dublin Drainage Strategy

The Greater Dublin Drainage Strategy sets out the strategic planning for the development of waste water treatment in the Greater Dublin area in relation to the Ringsend WWTP Upgrade, Greater Dublin Drainage Project and associated wastewater network drainage projects (IW, 2018). The Ringsend WWTP Upgrade includes plans to expand the WWTP to its ultimate capacity, together with associated network upgrades required. The Greater Dublin Drainage Project is planned to relieve both the Ringsend WWTP and network loading by construction of a new WWTP at Clonshaugh, an orbital sewer and provision of an outfall pipe discharging 1km north east of Ireland's Eye.

The Ringsend WWTP upgrade is in progress and carried out in stages, with an increased capacity of 400,000 PE by the first half of 2021 and the ultimate capacity of 2.4 million PE to be in operation by 2025 (IW, 2021).

River Basin Management Plan for Ireland 2018-2021

The River Basin Management Plan (RBMP) for Ireland 2018-2021 sets out the actions that Ireland will take to improve water quality and achieve 'good' ecological status in water bodies (rivers, lakes, estuaries and coastal waters) by 2021 (DoHPLG, 2018a). Changes from previous River Basin Management Plans is that all River Basin Districts are merged as one national River Basin District. The Plan provides a more coordinated framework for improving the quality of our waters — to protect public health, the environment, water amenities and to sustain water-intensive industries, including agri-food and tourism, particularly in rural Ireland.

The first cycle of River Basin Management Plans included the Eastern River Basin District - River Basin Management Plan (ERBDMP) 2009 – 2015 (WFD (2010). The plans summarised the waterbodies that may not meet the environmental objectives of the WFD by 2015 and identified which pressures are contributing to the environmental objectives not being achieved. The plans described the classification results and identified measures that can be introduced in order to safeguard waters and meet the environmental objectives of the WFD:

- Prevent deterioration of water body status;
- Restore good status to water bodies;
- Achieve protected areas objectives; and
- Reduce chemical pollution of water bodies.

The ERBD Management Plan (2009-2015) and the River Basin Management Plan for Ireland (2018-2021) aim to improve the management and water quality of the Eastern RBD, and hence the River Liffey and Dublin Bay.

Dublin Port Masterplan 2040

The Masterplan sets out options for the infrastructural development of Dublin Port between 2012 and 2040 (Dublin Port Company, 2018). The presented options for development are depending on demand and capacity, and are subject to securing the planning and other necessary consent. The Port should provide a capacity based on an increased average annual growth rate of 3.3% which the handling of 77 million gross tonnes by 2040. The second objective of the Masterplan is to re-integrate Dublin Port with Dublin City and Dublin Bay. This will involve a range of projects and initiatives based on the Port's heritage and on the natural environment.

The review carried out of the Masterplan in 2018 includes assessment of the likely environmental impacts arising from the set out development path was undertaken including the potential impact on Natura 2000 sites. A specific set of measures have been identified to mitigate the environmental impacts of future development. These measures will be developed in detail at the study stage and at the detailed design stage of future projects.

Mitigation measures detailed in the NIS (RPS Group Ireland, 2018) are outlined as follows:

- Water Quality and Habitat Deterioration - individual projects will require Construction stage Environmental Management Plans (CEMPs); Erosion and Sediment Control Plans; Invasive Species Management Plans; Emergency Response Plans; Dust and Noise Minimisation Plans or Dredging

Mitigation Plans as applicable to ensure marine water quality is maintained and the favourable conservation condition of marine, coastal and wetland habitats does not deteriorate. Modelling to predict the extent, duration and concentration of plumes of suspended sediments associated with marine construction activities and modelling of waste water and storm water discharges. Drainage systems shall be designed to maintain a separation between the clean storm water and potentially contaminated runoff to ensure that water is treated onsite before discharge.
An Emergency Response Plan and an Accident Prevention Procedure are being implemented at Dublin Port to reduce the potential for accidental spillages and the severity of actual spillages.

- Underwater noise and disturbance - dredging will be confined to periods between September and March inclusive to avoid impacting on harbour porpoises during the breeding and calving season. Marine Mammal Observers shall be stationed on survey vessels prior to and during any activities producing significant underwater noise emissions. These will have the authority to stop activities when marine mammals are close enough to be at risk.
- Aerial Noise and Visual Disturbance - individual projects will include proposals for any activities producing significant aerial noise emissions (e.g. rock-breaking, demolition, piling) stimuli to be restricted to daylight hours and subject to ornithological monitoring of responses of waterbirds to noise. Construction phase and regular operational phase activities during the overwintering season adjacent to SPAs will be screened to prevent waders and waterbirds being disturbed by the presence of people in close proximity to intertidal areas.
- Habitat Loss - modelling will be undertaken to predict the magnitude and extent of changes to the sedimentation and scouring patterns in the South Dublin Bay and River Tolka Estuary SPA as a result of construction of a new jetty requiring land reclamation or creation of a 400m manoeuvring area at the eastern edge of the port.

The NIS also outlines compensation measures where mitigation measures are not possible. The development of Dublin Port will result in the loss of marine structures (dolphins) used by breeding terns. The compensation measures will provide a new, larger breeding area and monitoring of the tern colony.

Two of the projects outlined in the Dublin Port 2040 Masterplan, Alexandra Basin Redevelopment and MP2, have been granted permission and construction phase is underway. These projects have been considered in-combination with the proposed project

Irish Water's Biodiversity Action Plan

Irish Water are committed to ensure that they build and manage their infrastructure responsibly to protect ecosystems. The Biodiversity Action Plan (BAP) has been developed to help in the conservation and enhancement of the natural environment. The overall aim of the Biodiversity Policy is "*In association with the provision of water and wastewater services, biodiversity and the natural environment are conserved, protected and where practical enhanced, through our responsible stewardship, sustainable water services and strong partnerships.*"

The overarching objectives of the BAP are:

- Ensure no net loss of biodiversity as a result of Irish Water activities, projects or plans. Follow the mitigation hierarchy by avoiding impacts in the first instance, before seeking to reduce, improve or compensate. Actively seek opportunities for biodiversity net gain by identifying opportunities for biodiversity enhancement at both existing and proposed Irish Water sites;
- Develop a community of staff/personnel who are informed and can easily access the appropriate information in relation to biodiversity and the expertise they require to support them; and
- Collaborate with external stakeholders to deliver biodiversity benefits at local, regional and national scales. Work collaboratively with relevant public/private organisations and local communities to support healthy ecosystems that can deliver ecosystem services.

In addition to the overarching objectives, seven key objectives have been identified which align with Irish Water policy-level strategic objectives. These are:

- Issue all Irish Water sites with a clear set of measures that will enhance and protect biodiversity;
- Raise awareness and provide educational supports on biodiversity to Irish Water staff and its partners;

- Ensure 'no net loss' of biodiversity when carrying out activities, or delivering plans or projects;
- Implement actions arising from the All-Ireland Pollinator Plan across all Irish Water sites, to support and increase our pollinator population;
- Promote the use of nature-based solutions for water protection and wastewater treatment;
- Manage invasive alien species at Irish Water sites; and
- Collaborate and work with key internal and external stakeholders, and the wider community, to protect and enhance biodiversity.

The Irish Water's BAP has set out objectives to preserve and where possible enhance the natural environment and its ecosystems. The proposed GCSWOE project is not considered to interfere with the objectives of the BAP. It is however, anticipated that the stormwater outfall extension will have a long-term positive effect on the environment in the Grand Canal Basin as the reduction of pollutants entering the basin will improve the water quality and the benthic habitat. This is in line with two of the key objectives of the BAP, namely "issue all Irish Water sites with a clear set of measures that will enhance and protect biodiversity" and "ensure 'no net loss' of biodiversity when carrying out activities, or delivering plans or projects". The discharge from the combined stormwater overflow outfall into the River Liffey will cause a very slight change in water quality and there will be no discernible change in the ability to meet the surface water environmental quality standards (EQS). The WFD status for the Lower Liffey Estuary and Dublin Bay will remain good. The slight reduction in quay wall habitat is negligible in the context of the total area of quay wall habitat along the Lower River Liffey. Therefore, the operation of the new stormwater outfall is not anticipated to have a significant in-combination impact on the ecological features together with the Irish Water's BAP as the new stormwater outfall is in line with objective of the BAP and will not contravene the aims and objectives of the BAP.

Other Projects

Other larger development projects and schemes, some of which are under construction and others are still at early planning stage, are listed in Table 6.11.

Since September 2018, the projects listed in Table 6.11, which are not retention applications, home extensions and/or internal alterations, have applied for planning permission in the locality of the proposed site.

Table 6.11: Larger development projects and schemes in the vicinity of the proposed Grand Canal Stormwater Outfall Extension project.

Project	Description	Considered cumulatively (yes/no)	Reasoning
Alexandra Basin Redevelopment	The works involve: Works at Alexandra Basin West including construction of new quays and jetties, remediation of contamination on the bed of the basin, capital dredging to deepen the basin and to achieve the specified depths of -10m Chart Datum (CD) at the new berths. Infilling of the Basin at Berths 52 & 53 and construction of a new river berth with a double tiered Ro-Ro ramp. Deepening of the fairway and approach to Dublin Port to increase the ruling depth from -7.8m CD to -10.0m CD.	Yes	Works are being carried out and are likely to coincide with timing of construction phase of the Grand Canal Stormwater Outfall Extension.
MP2 Project	Works involve: ▪ Construction of a new Ro-Ro jetty (Berth 53) for ferries up to 240m in length. ▪ A reorientation of the already consented Berth 52 (ABP Ref. 29N.PA0034) and modification to Berth 49. ▪ A lengthening of an existing river berth (50A). ▪ The redevelopment of Oil Berth 3, and infill of Oil berth 4, as a future deep-water container berth for the Container Freight Terminal. ▪ The dredging of berthing pockets and channel widening. ▪ Consolidation of passenger terminal buildings, demolition of redundant structures and buildings, and removal of connecting roads to increase the area of land for the transit storage of Ro-Ro freight units as a Unified Ferry Terminal (UFT); a heritage zone adjacent to Berth 53 and the Unified Ferry Terminal set down area.	Yes	Planning permission has been granted and works are underway. They are likely to coincide with timing of construction phase of the Grand Canal Stormwater Outfall Extension.
Bus Connects Ringsend to City	The preferred route on the south side of River Liffey is along City Quay, SJRQ and crossing Grand Canal outlet to the river.	Yes	Due to timing and location, it may act in-combination with proposed project.

Project	Description	Considered cumulatively (yes/no)	Reasoning
Centre	Construction will take place during a 2-year period between 2022 and 2027.		
Dodder Public Transportation Opening Bridge	The scheme comprises a new public transportation opening bridge over the River Dodder at its confluence with the River Liffey along with the construction of approach roads associated with the bridge. The purpose of the proposed bridge is to improve the pedestrian, cyclist and public transportation accessibility between the Poolbeg Peninsula and the rest of the city and to allow the development of the proposed Poolbeg West Strategic Development Zone (SDZ).	Yes	The project is in early planning stage. It is possibly to coincide with timing of construction phase of the Grand Canal Stormwater Outfall Extension.
Pedestrian Bridge across River Liffey	Amendments are proposed to the North Lotts and Grand Canal Dock SDZ Planning Scheme in relation to pedestrian bridge relocation across the River Liffey. It is proposed for a new pedestrian/cycle bridge to the west of Tom Clarke (East Link) Bridge.	No	No details of timeline are provided. These projects can have potential cumulative impacts with the proposed GCSWOE during construction phase. However, as there is no evidence at the moment for the timeline of these projects to overlap with the proposed GCSWOE project, cumulative impacts have not been assessed as part of this submission. However, the EIA and AA undertaken for these developments will take into account any cumulative impacts with the proposed GCSWOE project.
Dart+ Underground	The current programme timeline for Dart+ (coastal south) is: 2022 Design Development and Public Consultation on Emerging Preferred route will be carried out. In 2023, public consultation on preferred route, railway order application and detailed design will be carried out.	No	As per the Draft Transport Strategy 2022-2044 by National Transport Authority (NTA), updated assessment work, taking account of current transport policies, has identified that the Dart Underground and Tunnel scheme is not being brought forward at this time due to funding constraints
Dublin Eastern Bypass	The Dublin Eastern Bypass is proposed to be located approx. 630m east of the proposed outfall at SJRQ. The bypass route proposes to travel across the Dublin Port area by underground tunnel or at-grade road and bridge. The route is proposed to travel along south of the East Wall Road, along the alignment of the Tom Clarke Bridge (East Link Toll Bridge) and the R131.	No	This project is not intended to progress as part of the Transport Strategy 2022-2042.
Dodder Greenway	Along Dodder and through parks and existing roads. The project is carried out in phases.	No	Planning application has not yet been submitted.
Dublin District Heating	The Dublin District Heating System (DDHS) will be a thermal energy network that uses energy from waste heat and distributes it as hot water through insulated dual (supply and return) pipelines to homes and business for space heating, hot water and industrial purposes. The initial project phase is focused on the, Poolbeg West, North Lotts and Grand Canal Dock	Yes	This project has the potential to partly overlap with the construction phase of the proposed project.

Project	Description	Considered cumulatively (yes/no)	Reasoning
	SDZ's. The Project is expected to take up to five years (between 2021 and 2026) to install and commission the initial network, with customer connection and realisation of the benefits being delivered on a phased basis, over the next ten years in line with development within the catchment areas.		
Grand Canal Greenway- Grand Canal Dock Section	The proposed works involve the installation of a smoother cycle friendly lane within the existing Grand Canal Quay cobbled roads. This is part of the Grand Canal Greenway as described in the GDA Cycle Network Plan.	Yes	The project is in early planning stage. It is likely to coincide with timing of construction phase of the Grand Canal Stormwater Outfall Extension.
Grand Canal Quay East development works	The development will consist of demolition of existing vacant warehouse structure (2,241sqm) on-site, construction of part 8 to part 15 storey (proposed 8-storey element facing west and proposed 15-storey element facing Grand Canal Quay to the east), over basement level, contemporary glazed office building incorporating a ground floor cafe and reception area.	Yes	The project has been granted planning permission in Q1 of 2022. It is likely to coincide with timing of construction phase of the Grand Canal Stormwater Outfall Extension.
Maintenance dredging in Dublin Port	Maintenance of dredging activity in the basin will involve dredging and relocation of sediment with potential impact on benthic communities in the bay.	Yes	Involve dredging and relocation of sediment with potential impact on benthic communities in the bay.
Luas Red Line Poolbeg Extension	The Transport Strategy 2022-2042 outlines that the extension may be considered during the later periods of the Transport Strategy or after 2042.	No	No overlap with the construction phase of the proposed project.
Greater Dublin Area Cycle Network Plan	Sets out proposals for new cycle routes, including Dodder Greenway, but no detailed planning.	No	Each individual project will have to be assessed at the planning stage.
Metrolink	Transport Infrastructure Ireland (TII) will apply for a Railway Order for the project in Q2, 2022. The planning process with An Bord Pleanála is likely to take 12-18 months to complete. Once a Railway Order has been granted, work can commence on site. It is anticipated that the construction work will take between 6-8 years to complete.	No	Works are not likely to overlap with the proposed project, therefore no cumulative impacts anticipated.
Ringsend Waste Water Treatment Plant Upgrade	The Greater Dublin Drainage Strategy includes the upgrade of Ringsend WWTP. In June 2018 Irish Water applied for (and subsequently received) planning permission for upgrade works to the Ringsend WWTP facility. These are currently on-going and will increase the capacity of the facility from 1.6 million PE to 2.4 million PE. This plant upgrade will result in an overall reduction in the final effluent discharge of several parameters from the facility including	Yes	The upgrade works are currently on-going at the Ringsend WWTP.

Project	Description	Considered cumulatively (yes/no)	Reasoning
	BOD, suspended soils, ammonia, DIN and MRP. An EIAR was submitted by Irish Water as part of this application.		
South Campshire Flood Defence Wall Project	The South Campshires Flood Defence Scheme, consists of approximately 1.0 km of flood wall situated on the quayside, extending from Butt Bridge on George's Quay to approximately 50m east of the Samuel Beckett Bridge on Sir John Rogerson's Quay.	Yes	The project is in early planning stage. It is likely to coincide with timing of construction phase of the Grand Canal Stormwater Outfall Extension.
Treasury Building	Google Ireland Limited have been granted planning permission for development comprising the refurbishment and extension of the existing 'Treasury Building' to provide c. 7,802sqm of additional office floor space on the c. 0.40ha site at Grand Canal Street Lower, Dublin 2	Yes	The project has been granted planning in Q1 of 2022. It is likely to coincide with timing of construction phase of the Grand Canal Stormwater Outfall Extension.

Assessment of Cumulative Impacts

Construction

The residual impact from the proposed development following appropriate mitigation will be negligible. Therefore, no adverse cumulative or in combination impacts will occur.

The Alexandra Basin redevelopment and MP2 Project and maintenance of dredging activity in the basin will involve dredging and relocation of sediment with potential impact on benthic communities in the bay. The biological communities are adapted to disturbance due to water and sediment movement in the tidal area. Mitigation measures include Water Quality Management Plan, Pollution Incident Response Plan, Dredging Management Plan, Suspended Sediment and Sedimentation Measures, Concrete and Cement Pollution Measures. Temporary negative impacts are anticipated on the benthic fauna, but recovery is expected to take <1 year and no residual impact is anticipated. No cumulative impacts with the proposed GCSWOE project are anticipated.

A preliminary assessment of the Bus Connect Ringsend to City Centre identified potential impact to surface water. There is the potential for reduction in surface water quality in the receiving environment as a result of surface water runoff and discharge into any surface water feature. This in turn could result in the degradation of aquatic/wetland habitats and indirect impacts on the aquatic species that these habitats may support, such as otters, amphibians and fish (if present). The project would require an impact assessment to be carried out prior to commencement. Such an assessment will identify potential impacts and outline any mitigation measures required. No cumulative impacts with the proposed GCSWOE project are anticipated.

The following projects are still at early planning stages: Dodder Public Transportation Opening Bridge, Dublin District Heating System, Grand Canal Greenway- Grand Canal Dock Section, Grand Canal Quay East development works and South Campshire Flood Defence Wall Project and Treasury Building. Their construction phases may overlap with the proposed project. These projects will be subject to a separate Stage 1 AA Screening and potentially a Stage 2 AA and ecological impact assessment prior to commencement. Those assessments will identify potential impacts and outline any mitigation measures required. Provided mitigation measures are in place, no cumulative impacts with the proposed GCSWOE project are anticipated.

The other projects with granted planning permission in the vicinity of the development have been screened out for appropriate assessment with the conclusion that they will have no significant impact, alone or in combination with other projects, on any Natura 2000 sites. However, planning application 3220/21 which involves construction of a new 1.4km pedestrian walkway and a 2-way cycle lane along East Wall Road and Bond Road had an NIS prepared. The NIS identified potential for pollution via hydrological pathway. Mitigation measures are incorporated, including pollution prevention (including concrete) and suspended sedimentation. Having applied the mitigation measures to manage and reduce the risk of pollution, there will be no adverse upon the integrity of the European sites concerned and no scientific doubt remains as to the absence of such effects. Therefore, no cumulative impacts with the proposed GCSWOE project are anticipated.

Operation

The Dublin City Development Plan has a range of policies and objectives outlining mitigation measures to offset any potential impact on the Dublin Bay Natura 2000 sites. These relates particularly to water quality and enhancement of aquatic ecosystems. The potential for the proposed project to contravene these mitigations by extending the combined stormwater outfall to the quay of River Liffey could result in a significant in-combination impact on the Natura 2000 sites and receiving habitats and species outside of the designated sites. However, the discharge from the new stormwater outfall is expected to be intermittent and the WQM report modelled the change in water quality in River Liffey based on concentrations of MRP, DIN, BOD and *E. coli* as a result of the new stormwater outfall. There was no discernible change in the achievement of the EQS compared to the baseline in regards to MRP and DIN. For BOD there was seen to be an ~1% reduction in the time that the receiving waters achieved the EQS compared to the baseline and located in the immediate vicinity of the proposed outfall. For *E. coli* the increases due to the GCSWOE were seen to be less than 2% in the time varying scenario reducing rapidly away from the outfall and between 2 and 5% for the storm-based scenarios. Importantly, at the downstream boundary these both reduced to less than a 1% increase compared to the baseline. Therefore, the operation of the new outfall is not anticipated to have a significant in-combination impact on the ecological features together with the Dublin City Development Plan.

The Greater Dublin Drainage Strategy includes the upgrade of Ringsend WWTP. In June 2018 IW applied for (and subsequently received) planning permission for upgrade works to the Ringsend WWTP facility. These are currently on-going and will increase the capacity of the facility from 1.6 million PE to 2.4 million PE. This plant upgrade will result in an overall reduction in the final effluent discharge of several parameters from the facility including BOD, suspended soils, ammonia, DIN and MRP. An EIAR was submitted by IW as part of this application. The EIAR contains sections relating to Marine Biodiversity and Terrestrial Biodiversity, and each contains a section on the 'do-nothing scenario'. These review the effects of the WWTP on biodiversity in Dublin Bay in the absence of the upgrade works.

The Ringsend WWTP Upgrade EIAR report acknowledges that under the do-nothing scenario "the areas in the Tolka Estuary and North Bull Island channel will continue to be affected by the cumulative nutrient loads from the river Liffey and Tolka and the effluent from the Ringsend WWTP", which could result in a decline in biodiversity and the deterioration of the biological status of Dublin Bay (IW, 2018b). Nevertheless, these negative impacts of nutrient over-enrichment are considered "unlikely" (IW, 2018b). This is because historical data suggests that pollution in Dublin Bay has had little or no effect on the composition and richness of the benthic macroinvertebrate fauna. The EIAR notes that "although a localised decline could occur, it is not envisaged to be to a scale that could pose a threat to the shellfish, fish, bird or marine mammal populations that occur in the area." Furthermore, the EIAR notes that significant impacts on waterbird populations foraging on invertebrates in Dublin Bay due to nutrient over-enrichment are "unlikely" to occur (IW, 2018b). What is important in the context of this Biodiversity Section is that the do-nothing scenario predicts that nutrient and suspended solid loads from the WWTP will "continue at the same levels and the impact of these loadings should maintain the same level of effects on marine biodiversity" and that "if the status quo is maintained there will be little or no change in the majority of the intertidal faunal assemblages found in Dublin Bay which would likely continue to be relatively diverse and rich across the bay." Therefore, given that no impacts are anticipated from the new stormwater outfall and that the current discharges from the Ringsend WWTP pose no threat to biodiversity in Dublin Bay, there will be no cumulative impacts.

6.7.5 Summary of Impact Assessment

Table 6.12 below presents a summary of the ecological impact assessment when mitigation approaches are considered and included. Residual impacts are also described.

Table 6.12: Summary of impacts

Ecological Features	Impact	Importance of Feature	Impact without Mitigation	Mitigation	Significance of Effects of Residual Impacts	Cumulative / In combination impacts
Construction Impacts						
Grand Canal pNHA	None anticipated	National	Neutral impact	-	Not significant	No adverse cumulative or in combination impacts will occur.
Dolphins, Dublin Docks pNHA	During construction potential pollutants may negatively impact on the overall health of the Common Tern population and indirectly impact on the species through reduction in food availability and quality.	National	Minor to moderate impact, short-term	- Water quality controls, including: - Pollution control and spill prevention methods, detailing suitable spill kit equipment and management on site. - Silt control, including installation of silt curtain within basin and appropriate bunding as specified - Wet concrete leachate control, including the use of fast curing concrete mix for aquatic environment and appropriate measures in place to capture any spilled concrete, sealants or other materials	Not significant	The residual impact from the proposed development following appropriate mitigation will be negligible. Therefore, no adverse cumulative or in combination impacts will occur.
Grand Canal Dock Basin (aquatic benthic habitat)	Disturbance/ loss of benthic habitat During construction	Local	Low impact, short-term	- Water quality controls, including: - Pollution control and spill	Minor (Low significance), due to disturbance/loss of benthic habitat	The residual impact on water quality from the proposed development following appropriate

Ecological Features	Impact	Importance of Feature	Impact without Mitigation	Mitigation	Significance of Effects of Residual Impacts	Cumulative / In combination impacts
	reduction in water quality due to resuspension of sediment and potential leak/spill of pollutants			prevention methods, detailing suitable spill kit equipment and management on site. - Silt control, including installation of silt curtain within basin and appropriate bunding as specified. - Wet concrete leachate control, including the use of fast curing concrete mix for aquatic environment and appropriate measures in place to capture any spilled concrete, sealants or other materials		mitigation will be negligible. Therefore, no adverse cumulative or in combination impacts will occur. None of the other projects will cause a loss of benthic habitat.
Lower River Liffey (SS.SMu.SMuVS Sublittoral mud in variable salinity (estuaries))	During construction reduction in water quality due to resuspension of sediment and potential leak/spill of pollutants	Regional	Low impact, short-term	- Water quality controls, including: - Pollution control and spill prevention methods, detailing suitable spill kit equipment and management on site. - Silt control, including installation of silt curtain within basin and appropriate bunding as specified. - Wet concrete leachate control, including the use of fast curing concrete mix for aquatic environment and appropriate measures in place to capture any spilled concrete, sealants or other materials	Not significant	The residual impact from the proposed development following appropriate mitigation will be negligible. Therefore, no adverse cumulative or in combination impacts will occur.
Quay wall (LR.LLR.FVS.Fcer *Fucus ceranoides* on reduced salinity eulittoral rock)	Loss of habitat	Local	Negligible impact	N/A	Not significant	The residual impact from the proposed development following appropriate mitigation will be negligible.

Ecological Features	Impact	Importance of Feature	Impact without Mitigation	Mitigation	Significance of Effects of Residual Impacts	Cumulative / In combination impacts
						Therefore, no adverse cumulative or in combination impacts will occur.
Aquatic fauna	During construction potential pollutants may negatively impact on the overall health of this species group and indirectly impact on the species through reduction in food availability and quality.	Regional	Low impact, short-term	- Water quality controls, including: - Pollution control and spill prevention methods, detailing suitable spill kit equipment and management on site. - Silt control, including installation of silt curtain within basin and appropriate bunding as specified. - Wet concrete leachate control, including the use of fast curing concrete mix for aquatic environment and appropriate measures in place to capture any spilled concrete, sealants or other materials	Not significant	The residual impact from the proposed development following appropriate mitigation will be negligible. Therefore, no adverse cumulative or in combination impacts will occur.
Common Tern	During construction stage potential disturbance to nesting pair of Common Tern at Camden Lock.	Regional	Minor impact, short-term	An ECoW will inspect the nesting site prior to construction works starting. If deemed necessary, a barrier will be put in place to prevent access to the nest.	Not significant	The residual impact from the proposed development following appropriate mitigation will be negligible. Therefore, no adverse cumulative or in combination impacts will occur
Invasive species:	During construction the removal and translocation of silt contaminated with invasive Nuttall's Waterweed or Zebra Mussel could be transferred to	Invasive	Long term, major impact	Biosecurity – Measures will be put in place to ensure that there is no spread of invasive non-native species or diseases. There will be no disturbance of the Grand Canal Basin outside of the proposed project area. Sediment removed will be treated as contaminated	Not significant	The residual impact from the proposed development following appropriate mitigation will be negligible. Therefore, no adverse cumulative or in combination impacts

Ecological Features	Impact	Importance of Feature	Impact without Mitigation	Mitigation	Significance of Effects of Residual Impacts	Cumulative / In combination impacts
	other water bodies. Likewise barges and boats used during the works could contaminate other water bodies if Zebra Mussel has attached to their hulls			and disposed of to a licensed facility off site. The Check-Clean-Dry approach will be followed, ensuring that all barges/boats, PPE and equipment is cleaned before entering and leaving site. For more information refer to: www.nonnativespecies.org/checkcleandry		will occur.
Operation Impacts						
Grand Canal pNHA	The reduced input of polluted water will improve the water quality within the basin and the overall WFD status of the waterbody.	National	Neutral impact on the canal section of the pNHA and positive impact, long term on the Grand Canal Basin	N/A	Major positive significance	The residual impact from the proposed development following appropriate mitigation will be positive. Therefore, no adverse cumulative or in combination impacts will occur.
Dolphins, Dublin Docks pNHA	None anticipated.	National	Neutral impact	N/A	Not significant	The residual impact from the proposed development will be neutral. Therefore, no adverse cumulative or in combination impacts will occur.
Grand Canal Dock Basin (aquatic benthic habitat)	The reduced input of polluted water will improve the water quality within the basin and the overall WFD status of the waterbody.	Local	High positive impact, long term	N/A	Moderate positive significance	The residual impact from the proposed development following appropriate mitigation will be positive. Therefore, no adverse cumulative or in combination impacts will occur.
Lower River Liffey (SS.Smu.SmuVS Sublittoral mud in variable salinity	None anticipated.	Regional	Neutral	N/A	Not significant	The residual impact from the proposed development will be neutral. Therefore, no

Ecological Features	Impact	Importance of Feature	Impact without Mitigation	Mitigation	Significance of Effects of Residual Impacts	Cumulative / In combination impacts
(estuaries))						adverse cumulative or in combination impacts will occur.
Quay wall (LR.LLR.FVS.Fcer *Fucus ceranoides* on reduced salinity eulittoral rock)	Potential pollutants from the stormwater with an intermittent overflow from combined sewer may reduce the water quality locally in the immediate vicinity of the outfall. The potential change in in water quality is considered to be imperceptible, the WQM report identifies ~1% change in background concentration locally in the immediate vicinity of the outfall.	Local	Neutral	N/A	Not significant	The residual impact from the proposed development will be neutral. Therefore, no adverse cumulative or in combination impacts will occur
Aquatic fauna	None anticipated	Regional	Neutral	N/A	Not significant	The residual impact from the proposed development will be neutral. Therefore, no adverse cumulative or in combination impacts will occur.
Common Tern	None anticipated	Regional	Neutral	N/A	Not significant	The residual impact from the proposed development will be neutral. Therefore, no adverse cumulative or in combination impacts

Ecological Features	Impact	Importance of Feature	Impact without Mitigation	Mitigation	Significance of Effects of Residual Impacts	Cumulative / In combination impacts
						will occur.
Invasive Species	None anticipated	National	Neutral	N/A	Not significant	The residual impact from the proposed development will be neutral. Therefore, no adverse cumulative or in combination impacts will occur.

6.8 Monitoring

The Grand Canal Basin will be monitored during the construction phase of the project. The monitoring will measure the level of suspended solids in the water at different locations within the basin while works are taking place within the Grand Canal Basin. If a significant increase of suspended solids is recorded, the works will be temporarily stopped and be re-assessed and further mitigation measures be put in place before works can continue.

During the operational phase, the water quality in the River Liffey will be monitored by the EPA (as part of the WFD). DCC will monitor the water quality from the new stormwater outfall. The water monitoring will enable comparison with the results of the modelling of the predicted water quality to ensure there will be no negative impact on River Liffey and downstream habitats and species. Adequate measures will be taken if the monitoring finds the discharge to have a negative impact on water quality and such measures take the Water Framework Directive into account.

6.9 References

The following sources have been consulted in the preparation of this EIAR:

BEC Consultants Ltd (2020) *Grand Canal Dock Storm Water Outfall Project: Aquatic Ecology and Alien Invasive Species Survey.*

CIEEM (2018) '*Guidelines For Ecological Impact Assessment in the UK and Ireland - Terrestrial, Freshwater, Coastal and Marine*'.

DoHPLG (2018) '*River Basin Management Plan for Ireland 2018-2021*', available: https://www.housing.gov.ie/sites/default/files/publications/files/rbmp_report_english_web_version_final_0.pdf [accessed 22 Jan 2019].

Dublin City Council (2008) '*Dublin City Biodiversity Action Plan 2008-2012*', available: http://www.dublincity.ie/sites/default/files/content//SiteCollectionDocuments/DCC%20Biodiversity%20Action%20Plan.pdf [accessed 12 May 2019].

Dublin City Council (2016a) '*Dublin City Biodiversity Action Plan 2015-2020*', available: https://www.dublincity.ie/sites/default/files/content/RecreationandCulture/DublinCityParks/Biodiversity/Documents/DublinCityBiodiversityActionPlan2015-2020.pdf [accessed 6 Dec 2019].

Dublin City Council (2016b) '*Dublin City Development Plan 2016-2022*', available: http://www.dublincity.ie/sites/default/files/content/Planning/DublinCityDevelopmentPlan/Written%20Statement%20Volume%201.pdf [accessed 19 Jun 2019].

Dublin Port Company (2018) *Dublin Port Masterplan 2040*. Reviewed 2018, available: https://www.dublinport.ie/wp-content/uploads/2018/07/DPC_Masterplan_2040_Reviewed_2018.pdf [accessed 12 Feb 2021].EPA (2022) *Guidelines on the Information to Be Contained in Environmental Impact Assessment Reports,* Environmental Protection Agency, available: https://www.epa.ie/publications/monitoring--assessment/assessment/EIAR_Guidelines_2022_Web.pdf [accessed 1st May 2022].

EPA (2017) *Guidelines on the Information to Be Contained in Environmental Impact Assessment Reports DRAFT*, Environmental Protection Agency, available: http://www.epa.ie/pubs/advice/ea/EPA%20EIAR%20Guidelines.pdf [accessed 24 Aug 2017].

EPA (2020) EPA Maps [online], Next Generation EPA Maps, available: https://gis.epa.ie/EPAMaps/ [accessed 22 Jan 2019].

EPA Catchments Unit (2018) 09_16 Dodder_SC_010 Subcatchment Assessment WFD Cycle 2, Environmental Protection Agency, available: https://catchments.ie/wp-content/files/subcatchmentassessments/09_16%20Dodder_SC_010%20Subcatchment%20Assessment%20WFD%20Cycle%202.pdf [accessed 13 Aug 2020].

GSI (2021) Geological Survey Ireland Spatial Resources [online], available: https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228 [accessed 15 Jan 2020].

IFI (2010) Sampling Fish for the Water Framework Directive- Transitional Waters 2010- Liffey Estuary. Inland Fisheries Ireland. [online], available: Liffey_estuary_report_2010 IFI.pdf

Irish Water (2018a) *'Greater Dublin Drainage Strategy - Overview & Future Strategic Needs'*, available: https://www.ringsendwwtpupgrade.ie/planning-sites/ringsend-planning/docs/planning-documents/technical-reports/180601_RGD%20Planning%20App%20-%20GDDS%20-%20Overview.pdf [accessed 18 Jun 2019].

Irish Water (2018b) *Ringsend Wastewater Treatment Plant Upgrade Project Environmental Impact Assessment Report*, available: https://www.water.ie/planning-sites/ringsend-planning/environmental-documents/ [accessed 1 Apr 2021].

Irish Water (2021) Ringsend Wastewater Treatment Plant Upgrade Project [online], Irish Water, available: https://www.water.ie/projects-plans/ringsend/ [accessed 12 Jan 2021].

J. B. Barry & Partners (2020a) *Grand Canal Storm Water Outfall Extension - EIA Screening Report.*

J. B. Barry & Partners (2020b) *Grand Canal Storm Water Outfall Extension - AA Screening Report.*

JBA (2021) Grand Canal Storm *Water Outfall Extension - Natura Impact Statement.*

JNCC (2015) *Marine Habitat Classification for Britain and Ireland Version 15.03* [online], available: https://mhc.jncc.gov.uk/ [accessed 16 Dec 2020].

Kelly, F.L., Connor, L., Matson, R., Feeney, R., Morrissey, E., Coyne, J. (2015) *Sampling Fish for the Water Framework Directive - Summary Report 2014*, Inland Fisheries Ireland, Citywest Business Campus, Dublin 24, Ireland, available: http://wfdfish.ie/wp-content/uploads/2010/05/WFD_Report_2014_FINAL.pdf [accessed 23 Dec 2020].

Macklin, R., Brazier, B., Sleeman, P. (2019) *Dublin City Otter Survey. Report Prepared by Triturus Environmental Ltd. for Dublin City Council as an Action for Dublin City Biodiversity Action Plan 2015-2020*, available: https://a.storyblok.com/f/47927/x/609e85ec32/dublin-city-otter-report-2019.pdf [accessed 23 Dec 2020].

Minchin, D., Maguire, C. and Rosell, R. (2003) *The zebra mussel (Dreissena polymorpha Pallas) invades Ireland: human mediated vectors and the potential for rapid intranational dispersal*. Biology and Environment: Proceedings of the Royal Irish Academy, 103B: 23-30.

NBDC (2021) Biodiversity Maps - Map Viewer [online], National Biodiversity Data Centre Biodiversity Maps, available: https://maps.biodiversityireland.ie/Map [accessed 14 Jan 2021].

NPWS (2009) *'Site Synopsis Grand Canal 002104'.*

NPWS (2019a) *The Status of EU Protected Habitats and Species in Ireland. Volume 1: Summary Overview.*, Unpublished NPWS Report, National Parks and Wildlife Service / Department of Culture, Heritage and the Gaeltacht, available: https://www.npws.ie/sites/default/files/publications/pdf/NPWS_2019_Vol1_Summary_Article17.pdf [accessed 30 Sep 2019].

NPWS (2019b) *The Status of EU Protected Habitats and Species in Ireland. Volume 2: Habitat Assessments.*, Edited by: Dierdre Lynn and Fionnuala O'Neill, available:

https://www.npws.ie/sites/default/files/publications/pdf/NPWS_2019_Vol2_Habitats_Article17.pdf [accessed 31 Oct 2019].

NPWS (2019c) T*he Status of EU Protected Habitats and Species in Ireland. Volume 3: Species Assessments*, Edited by: Dierdre Lynn and Fionnuala O'Neill, available: https://www.npws.ie/sites/default/files/publications/pdf/NPWS_2019_Vol3_Species_Article17.pdf [accessed 31 Oct 2019].

NRA (2008) *Environmental Impact Assessment of National Road Schemes- A Practical Guide, National Roads Authority,* available: https://www.google.ie/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0ahUKEwjF_IO8q8bZAhWBJcAKHdIpDyMQFggpMAA&url=http%3A%2F%2Fwww.tii.ie%2Ftechnical-services%2Fenvironment%2Fplanning%2FEnvironmental-Impact-Assessment-of-National-Road-Schemes-Practical-Guide.pdf&usg=AOvVaw07sfytJ4CpCrkBjKUS1TAe [accessed 27 Feb 2018].

NRA (2009) *National Roads Authority Guidelines for Assessment of Ecological Impacts of National Road Schemes.,* Transport Infrastructure Ireland, available: http://www.tii.ie/technical-services/environment/planning/Guidelines-for-Assessment-of-Ecological-Impacts-of-National-Road-Schemes.pdf [accessed 10 Apr 2017].

RPS Group Ireland (2018) *Dublin Port Masterplan 2040 - Natura Impact Statement,* Dublin Port Company, available: https://www.dublinport.ie/wp-content/uploads/2018/07/DPC_Masterplan_2040_NIS.pdf [accessed 12 Feb 2021].

Smith, G.F., O'Donoghue, P., O'Hora, K., Delaney, E. (2011) '*Best practice guidance for habitat survey and mapping*', The Heritage Council: Ireland.

SECTION 7: Water Quality and Hydrology

7.1 Introduction

This assessment was drafted by Kieran O'Dwyer who is a Technical Director with J. B. Barry and Partners and has over 40 years' experience in the field of environmental management and consultancy. He holds a BE from UCD and is Member of the Institution of Engineers Ireland (MIEI) and International Association of Hydrogeologists (IAH). He is the overall project manager responsible for the coordination of this EIAR. He was formerly a director with K. T. Cullen and Co. Ltd (Environmental Consultants) and a Regional Director with WYG Ireland. Kieran has been responsible for the Water and Hydrology element of numerous Environmental Impact Assessments (including TII tranche 4 motorway service areas (3 No.), NRA Tranche 4 Motorway Service Areas (5 No. oral hearings) and Ringsend Wastewater Treatment Plant Upgrade Project) and has presented specialist evidence at numerous oral planning hearings.

The hydraulic and water quality modelling element has been carried out by DHI Water Environments UK. Over the last decade, DHI have performed a number of modelling studies in the Liffey Estuary and the wider Dublin Bay area. Assessment of water quality has been at the core of many of these projects. These include Ringsend Waste-water Treatment Plant Upgrade, Waste to Energy, Poolbeg, Dublin Bay Sediment modelling for DCC and modelling in connection with the Dublin Bay Flood Protection Barrages.

This section of the EIAR presents the hydrological assessment for the proposed construction and operation phases of the Grand Canal Stormwater Outfall Extension (GCSWOE) project. This section examines the quality of water in the River Liffey and the Grand Canal Dock basin together with the impact which the proposed stormwater outfall extension will have on the water quality within these water bodies. This section details out the potential impacts on the surface water receiving environment, while the analysis of potential impacts on groundwater receiving environment is considered in Volume 2, Section 8 Land, Soils, Geology and Hydrogeology. The local hydrology and drainage of the area is also inter-related to other sections within Volume 2 of the EIAR such as Section 6 Biodiversity and Section 8 Land, Soils, Geology and Hydrogeology.

The scope of the water quality assessment is focused on the extension of the stormwater outfall from its existing discharge point within the Grand Canal Basin to a new outfall at SJRQ into the River Liffey and on whether the change of this discharge location will impact on the water quality in the River Liffey estuary. The assessment also considers compliance with the relevant European and Irish legislation. A detailed description of the project is contained in Volume 2, Section 2 of this EIAR.

A water quality modelling study was undertaken to assess the impacts that the proposed GCSWOE project will have on the existing water quality of the River Liffey. The water quality modelling study collated the available information on stormwater discharge, River Liffey flows and water quality. A conceptual model of the existing situation was developed to describe the important processes and identify the potential interactions. A numerical modelling approach was scoped to determine the impact on waterbodies designated under the Water Framework Directive. This was followed by surveys and model build calibration and validation. Volume 3, Appendix 7A contains full reports on the modelling exercises carried out, with the summary details set out in the main text of this section.

The aims of this assessment include:

- To describe/define the methodology used for the assessment;
- To establish the baseline hydrological characteristics of the receiving environment;
- To identify the likely potential impacts of the proposed activities (positive, negative or both) on the surface water environment;
- To identify mitigation measures to avoid, mitigate or reduce significant negative impacts (if any identified);
- To identify residual impacts post-mitigation and the significance of their effects;
- To assess hydrological cumulative impacts of the proposed activities along with other nearby development projects in the area; and

- To set out measures for monitoring of the hydrological environment during the construction phase of the project.

7.2 Methodology

7.2.1 Legislation and Guidelines

This section has been prepared in accordance with the following specific guidelines.

- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports by the Environmental Protection Agency, EPA 2022;
- Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports by the Environmental Protection Agency, EPA 2017;
- Draft- Advice Notes on Current Practice (in the preparation of Environmental Impact Statements), EPA 2015;
- National Roads Authority (NRA) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes, NRA 2009;
- European Communities Environmental Objectives (Surface Waters) Regulations, 2009 (S.I. No. 272 of 2009) (as amended);
- European Communities (Water Policy) Regulations, 2003 (S.I. No. 722 of 2003) (as amended);
- European Communities (Drinking Water) (No. 2) Regulations 2007 (S.I. No. 278 of 2007);
- European Communities (Quality of Salmonid Waters) Regulations, 1988 (S.I. No. 293 of 1988);
- European Communities (Quality of Shellfish Waters) Regulations, 2006 (S.I. No. 268 of 2006) (as amended);
- Water Pollution Act 1977 (as amended);
- Bathing Water Quality Regulations, 2008 (S.I. No. 79 of 2008);
- European Communities (Natural Habitats) Regulations, 1997 (S.I. No. 94 of 1997) and European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011) (as amended);
- The EU Floods Directive 2007/60/EC;
- The EU Water Framework Directive 2000/60/EC;
- European Communities (Assessment and Management of Flood Risks) Regulations, 2010 (S.I. No. 122 of 2010) (as amended);
- The Planning System and Flood Risk Management Guidelines for Planning Authorities, OPW 2009; and
- Control of Water Pollution from Construction Sites- Guidance for Consultants and Contractors, CIRIA C532, 2001.

7.2.2 Desktop Studies

The desktop study undertaken as part of the assessment, consulted the following sources of data:

- Online databases of the Environmental Protection Agency (EPA) gis.epa.ie/EPAMaps/ and www.catchments.ie for information on:
    - Watercourses in the vicinity of the project, flow network, water quality monitoring data and status;
    - Water Framework Directive (WFD) data;
    - Catchment characterisation;
    - Special Areas of Conservation (SAC), Special Protection Areas (SPA) and other protected area;
- OPW national flood information portal was consulted to review historic flood data, national Catchment Flood Risk Assessment Management Study (CFRAMS) predicted flood maps, tidal flood extent maps (www.floodinfo.ie/);
- The Tidal flood extent map was obtained from the Irish Coastal Protection Strategy Study (ICPSS);
- Dublin Development Plan 2016 – 2022, Strategic Flood Risk Assessment;
- Draft Dublin Development Plan 2022-2028, Strategic Flood Risk Assessment;
- River Basin Management Plans and reports;

- Met Eireann website for historical rainfall and evapotranspiration data (www.met.ie/climate/available-data/historical-data);
- National Parks and Wildlife Services (NPWS) data on designated sites;
- Geological Survey of Ireland (GSI) online database and Map Viewers (www.gsi.ie/en-ie/data-and-maps/Pages/default.aspx);
- Teagasc Soil Maps (www.teagasc.ie/environment/soil/soil-maps/);
- National Planning Framework 2040;
- Dublin City Council Development Plan 2016-2022;
- North Lotts and Grand Canal Dock Planning Scheme 2014;
- Proposed Amendments to the North Lotts and Grand Canal Dock SDZ Planning Scheme 2019;
- Annual Environmental Reports by EPA;
- Feedback from consultations with statutory consultees, interested organisations and affected third parties;
- Ordnance Survey Ireland aerial photographs and historical mapping; and
- Assessment of water quality samples and water modelling data.

7.2.3 Site Specific Surveying

Hydrographic Surveying

Hydrographic surveys were conducted between 17th October 2020 and 2nd December 2020. A midterm survey took place on the 5th and 6th of November 2020. Two bottom mounted Acoustic Doppler Current Profilers (ADCPs) were used to acquire the following data:

- Water pressure, current speed and direction every 600s at 0.2m cells through the water column over time-period of 46 days;
- Discharge transects during three tidal conditions- spring tide, average tidal range and neap tide;
- Conductivity-Temperature-Dept (CTD) profiles including the below listed variables were recorded at three locations during the three tide conditions, spring tide, average tidal range and neap tide:
  - Chlorophyll;
  - Conductivity;
  - Salinity;
  - Phycocyanin Blue-Green Algae Sensor;
  - Total Dissolved Solids;
  - Turbidity; and
  - Temperature

Water Quality Monitoring

The water quality monitoring data from the following sources was reviewed and assessed:

- Water quality monitoring undertaken by Waterways Ireland in the Grand Canal Basin;
- Site specific water monitoring undertaken by Dublin City Council in the storm compartment of the Grand Canal Tunnel (Estate Cottages Manhole No. 1 Mount Street, see Figure 1.1);
- Water quality monitoring undertaken by Dublin City Council in the River Liffey; and
- National water monitoring undertaken by EPA in the River Liffey and Dublin Bay under WFD.

The sampling locations are shown in Figure 7.8. These datasets were analysed to establish typical baseline concentration of pollutants. The purpose of the assessment included:

- To provide background loads/concentration that enter the system via the rivers, streams, canals and outfall; and
- To validate the concentrations predicted by the water quality model at various locations in the River Liffey.

Flood Risk Assessment

As per 'The Planning System and Flood Risk Management, Guidelines for Planning Authorities' (2009)', Stage 1 Flood Risk Identification and Stage 2 Initial Flood Risk Assessment (FRA) was undertaken and the risk of flooding from the each of the five sources of flooding (coastal, fluvial (river), groundwater, pluvial (rainfall) and from artificial drainage systems) to the proposed development was considered. The FRA was undertaken to identify, quantify and communicate to decision makers and other stakeholders the risk of flooding associated with the proposed development.

The flood risk assessment report has been provided as part of the submitted planning documents.

7.2.4 Water Quality Modelling

DHI Water Environments UK Ltd. were retained to provide water quality modelling services for the GCSWOE project. Specifically, the services they provided focus on assessing the impacts that the proposed GCSWOE discharge to the River Liffey will have on the existing water quality of the River Liffey. The results are compared with the Water Framework Directive (WFD) Environmental Quality Standards (EQS) for the receiving waters. For this study it was agreed that the parameters of interest were the EQS that were relevant for transitional and coastal waters, namely:

- DIN (dissolved inorganic nitrogen);
- MRP (molybdate reactive phosphate);
- E. Coli; and
- BOD (biological oxygen demand).

It is noted that *E. coli* only has relevance with respect to bathing waters. However, as bacteriological concentrations within the Grand Canal Basin under the existing scenario was one of the principal drivers for the relocation of the outfall, E.coli was included in this assessment to provide an understanding of the potential impact of the change in discharge location to this indicator of concern.

The DHI water quality modelling report is contained in Volume 3, Appendix 7A Numerical Model Report.

Model selection

Hydrodynamic Model
The hydrodynamic modelling has been performed using the MIKE 3 modelling package (2021) developed by DHI. MIKE 3 includes the simulation tools to model 3D free surface flows and associated sediment or water quality processes. This module simulates the water level variations and flows in response to a variety of forcing functions. It includes a wide range of hydraulic phenomena in the simulations and it can be used for any 3D free surface flow. The Flexible Mesh version, which uses a depth and surface adaptive vertical grid, is particularly suitable in areas with a high tidal range.

Water Quality Model
The MIKE ECO-Lab add on module was applied to assess the key water quality parameters of interest.

For this study, a series of alterations were made to the standard MIKE ECOLab templates.

- Benthic vegetation (BC) was removed in the EU1 template as it was not deemed relevant for the purpose of this study;
- E. Coli as a state variable (and associated decay processes) was instead added to the EU1 template; and
- A derived output for BOD was created, by calculating Total Organic Carbon (Detritus Carbon(DC) +Phytoplankton Carbon(PC)+ Zooplankton (ZC)) and multiplying with a BOD: TOC ratio due to the correlation between these two parameters. The ratio used for simulations was set to 1.8.

The modelling is supported by data gathered from field surveys and desktop studies.

Model Domain

The model domain includes the area starting downstream at the ferry terminal quays (Terminal 5) and ending at the Islandbridge sill in the River Liffey and at Ballsbridge in the River Dodder. Dublin Port land contours were simplified discarding docks and terminals.

The model has three open boundaries. Two, corresponding to the Liffey and Dodder rivers, where discharges are specified and one, corresponding to the seaward limit, where the water level is specified. Discharges for the River Liffey were obtained from four river gauges, these are: Leixlip (09001), Lucan (09002), Killeen Road (09035) and Leixlip Power Station (P.S.). Discharges for the River Dodder were obtained from two river gauges, these are: Waldron's Bridge (09010) and Frankfort (09011).

Computational Mesh

The computational mesh was based on a mixture of unstructured rectangular and triangular elements with varying spatial resolution. The coarsest mesh resolution was at the upstream boundaries with rectangular element sizes typically 80m×10m. The resolution increases gradually with distance towards the region of interest, i.e., in the proximities of the GCSWOE, with rectangular element sizes of 35m×10m.

All bathymetric datasets were converted to the vertical reference of Ordnance Datum Malin (OD Malin) before being interpolated to the computational mesh.

Boundary conditions (hydrodynamic modelling)

The model was forced by temporally and spatially varying water levels, and temporally varying wind velocities, salinity profiles and specified discharges applied across the open boundaries. Discharges from the GCSWOE were input as a source discharge. A constant bottom roughness height of 0.05m was defined in all the domain. The details of boundary condition are summarised in Table 7.1 below.

The hydrodynamic model was run considering the baroclinic effects (as a function of both salinity and temperature) and with heat exchange enabled.

Table 7.1 Details of the boundary conditions

Boundary	Type	Data
Seaward	▪ Specified water level: varying in time, constant along boundary; ▪ Salinity: varying in time, constant along boundary; ▪ Temperature: constant value; and ▪ Turbulence: constant valued.	▪ Water level data from Port of Dublin; ▪ Salinity data interpolated from observations (ARR Ltd. Survey); ▪ Temperature, inferred from observations, 10.5°C; and ▪ Turbulence: Default settings.
R. Liffey	▪ Specified discharge: varying in time, constant along boundary; ▪ Salinity: constant value; ▪ Temperature: varying in time, constant along boundary; and ▪ Turbulence: constant valued.	▪ Discharge data retrieved from the EPA; ▪ Hydronet platform (https://www.epa.ie/hydronet) and from Leixlip Power Station. Includes discharges from: Leixlip (09001), Lucan (09002), Killeen Road (09035) and Leixlip Power Station; ▪ Salinity: Fresh water (0 psu); ▪ Temperature: extrapolated from observations made in a UK river; and ▪ Turbulence: Default settings.

Boundary	Type	Data
R. Dodder	▪ Specified discharge: varying in time, constant along boundary; ▪ Salinity: constant value; ▪ Temperature: varying in time, constant along boundary; and ▪ Turbulence: constant value.	▪ Discharge data retrieved from the EPA; ▪ Hydronet platform (https://www.epa.ie/hydronet) and from: Leixlip Power Station. Includes discharges from: Waldron's Bridge (09010) and Frankfort (09011); ▪ Salinity: Fresh water (0 psu); ▪ Temperature: extrapolated from observations made in a UK river; and ▪ Turbulence: Default settings.
GCSWOE	▪ Source - Specified discharge: varying in time, constant along boundary; ▪ Source - Salinity: constant value; and ▪ Source - Temperature: varying in time, constant along boundary.	▪ Discharge data: Long-term flow monitor (LTF28) at manhole S0163205011_289, monitored by Irish Water; ▪ Salinity: Fresh water (0 psu); and ▪ Temperature: extrapolated from observations made in a UK river.
Domain - surface	▪ Wind: Varying in time, constant in domain; ▪ Heat exchange: – Specified net short wave radiation: Varying in time, constant in domain; – Longwave radiation: empirical; – Atmospheric conditions - Air temperature, relative humidity, clearness coefficient: Varying in time, constant in domain.	▪ Wind: data from Dublin Airport; and ▪ Heat exchange variables: obtained from observations in a UK lake.
Domain - bottom	Roughness height.	Constant throughout the domain, 0.05m.

Validation (hydrodynamic model)

Table 7.2 summarises the settings applied in the hydrodynamic model. The model was run in decoupled form for a period of 61-days for calibration and validation purposes, corresponding to the ARR Ltd. survey campaigns period, and for 371 days (more than a year) for production runs. The model considered tidal, meteorological effects (wind velocities), river discharges and baroclinic effects. Time series were obtained as described in Table 7.1.

Validation confirmed that the hydrodynamic model was able to capture the main hydrodynamic processes and salinity structure observed in the study region.

Table 7.2 Summary of the configuration of the hydrodynamic model for the initial dispersion study

Setting	Description/Value
Mesh resolution	Varying flexible mesh typically 10-20m in the areas of interest
Vertical mesh	10 layer, sigma type evenly spaced
Number of elements	3,304 elements per layer giving a total of 33,040 elements
Simulation period	▪ Calibration / Validation: 61 days (2020-10-05 to 2020-12-06) ▪ Production: 371 days (2020-12-25 to 2020-12-31)
Output time interval	15 minutes
Basic equations	Shallow waters
Solution technique	Low-order calculation, fast order algorithm
Density	Baroclinic – Function of temperature and salinity
Eddy viscosity	Smagorinsky formulation with a constant value of 0.28
Temperature / Salinity module	
Equation	Default settings
Solution technique	Low-order calculation, fast order algorithm
Dispersion	▪ Scaled eddy viscosity formulation - constant – Horizontal: 0.5 – Vertical: 0.001
Heat exchange	Included
Turbulence module	
Equation	Default settings
Solution technique	Low-order calculation, fast order algorithm
Dispersion	Default settings

Boundary Conditions (water quality model)

River Liffey

Values for DIN, MRP, DO and *E. Coli* were set to values based on the baseline measurement campaign undertaken by DCC for nearby developments in the area. The River Liffey input was based on the measurements at Station 40090 (Figure 7.8). As these were typically spot measurements, it was necessary to develop seasonal averages for these values temporally to provide continuous input to the model for the year. It should also be noted that:

- BOD in the model is predominately made up by DC (Detritus Carbon) which was estimated as average measured BOD/1.8;
- Values of DN (Detritus Nitrogen) and DP (Detritus Phosphorous) were set to 0.3 and 0.02; and
- Default values of PC (Phytoplankton Carbon), PN (Phytoplankton Nitrogen), CH (Chlorophyll-a), and ZC (Zooplankton) were used.

River Dodder

Based on the work from the scoping and data collection stages, the values of DIN, MRP, *E. Coli* and DO were set to be equal to the seasonally averaged values reported for station 40095 (Figure 7.8) at the downstream end of the Dodder.

- BOD in the model is predominately made up by DC (Detritus Carbon) which was estimated as average measured BOD/1.8;

- Values of DN and DP were set to 0.3 and 0.02; and
- Default values of PC, PN, PC, CH, and ZC were applied.

Open sea

- Default model values of DC, DN, DP, PC, PN, PC, CH, ZC and DO were applied;
- Values of MRP, DIN, DO and *E. coli* are as per the EPA monitoring.

GCSWOE (time varying load)

The seasonal average source concentrations of DIN, MRP and BOD as reported for the Estate Cottages location were applied.

Due to the nature of the measured data for *E. coli* in the GCSWOE tunnel, no clear relationship between flow and *E. coli* is possible. As such the proposed approach is to apply the average measured concentration (5,862 MPN/100ml) when flows in the tunnel are below 0.1m^3/s. The highest value measured was 48,392 MPN/100 ml. For flows above this value, only three measurements are available. As the highest of these is equivalent to the highest value measured in the tunnel, these are used for a linear fit to the remaining two data points. This provides the relationship for *E. coli* concentration for flows above 0.1m^3/s. As the average concentration of *E. coli* value intersects this line at 0.13m^3/s, this is the cut off between the average value being applied and the storm led value based on the relationship with flow.

The application of this fit results in a *E. coli* v's flow relationship for the measured flows in the GCSWOE. This equates to 90% of the one-year model run the concentration is at the average for E. Coli, 9% of the time it is in the range 10-50,000 MPN/100ml, 0.8% of the time it is between 50-100,000 and 0.1% of the time it is in excess of 100,000 MPN/100ml.

Water Quality Model: Impact Assessment

The approach adopted was to use a period of time where there was time series data available for both the receiving water and the flow in the stormwater component of the Grand Canal Tunnel. Flow data was available for the tunnel from March 2019. The model was run for a period of approximately a year (January 2020 to December 2020).

The validated Mike 3 and ECOlab models were then run for the following scenarios.

Baseline

In this scenario it is assumed that the concentration of all the sources is as per the ambient or baseline conditions. As such, the GCSWOE still discharges water into the Estuary and thus adds mass to the system, but with no effect on ambient concentration levels (conservative approach). This provides spatial and temporal data on water quality before the operation of the outfall extension to the River Liffey. This represents the "do nothing" scenario.

Time Series

The model is run again and includes the discharge and quality data from the new discharge. This presents time series water quality data for the scenario where the discharge is to the River Liffey from the proposed outfall at SJRQ. The impact is assessed by comparing with the baseline scenario. The compliance with the WFD EQSs are assessed as well as the % change in concentration for each parameter.

Storm Based E.coli Scenario

In order to provide greater confidence with respect to the potential concentration of the *E. coli* coming from the GCSWOE, an additional storm-based assessment was proposed. This considered the potential for more extreme concentrations during storm events when CSO spills were likely to occur (at a level similar to raw sewage).

Similar to the 'time varying' scenario for *E. coli*, the discharge volume is based on the measured data from the period. However, the concentration of *E. coli* is set to be 5,000,000 MPN/100ml (a value representative of a CSO discharge) constantly for 3 hours over the 10 highest discharges in the period of measurement, to provide a storm led conservative assessment of the potential of a raw sewage discharge. This equates to 30 hours of discharge or 0.4% of the entire year.

At all other times (99.6%), the discharge is at the background level of *E. coli* in the system (5,862 MPN/100ml).

It should be also noted that that during extreme rainfall events the spills from the CSOs are diluted in the stormwater compartment of the tunnel itself prior to discharging to the River Liffey.

This is considered a worst-case scenario.

7.2.5 Impact Assessment

The existing baseline environment was described in terms of its attributes. Data were gathered from desk studies, site visits and public consultation.

- Importance criteria were selected for attributes that reflect the hydrological environments. The attribute importance was evaluated on the basis of the existing baseline data and the criteria in Table 7.3;
- The impacts of the proposed project (during both the construction phase and operation phase) on these attributes were described and considered in terms of duration and the proportion of the attribute that was impacted. The magnitude of the impact was assessed based on the criteria described in
- Table 8.3;
- The significance of the impact was then assessed using the criteria in Table 8.4. The significance of an impact is based on the magnitude and the importance of the attribute being impacted; and
- Mitigation measures to minimise these impacts were proposed and the residual impacts following mitigation were then reassessed.

Table 7.3 Criteria Rating for Attribute Importance –Hydrology (NRA, 2009)

Importance	Criteria	Typical Examples
Extremely high	Attribute has a high quality or value on an international scale.	River, wetland or surface water body ecosystem protected by EU legislation e.g. 'European sites' designated under the Habitats Regulations or 'Salmonid waters' designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988.
Very high	Attribute has a high quality or value on a regional scale.	River, wetland or surface water body ecosystem protected by national legislation – NHA status Regionally important potable water source supplying >2500 homes Quality Class A (Biotic Index Q4, Q5) Flood plain protecting more than 50 residential or commercial properties from flooding Nationally important amenity site for wide range of leisure activities
High	Attribute has a high quality or value on a local scale.	Salmon fishery Locally important potable water source supplying >1000 homes Quality Class B (Biotic Index Q3-4) Flood plain protecting between 5 and 50 residential or commercial properties from flooding Locally important amenity site for wide range of leisure activities
Medium	Attribute has a medium quality or value on a local scale.	Coarse fishery Local potable water source supplying >50 homes Quality Class C (Biotic Index Q3, Q2-3)

Importance	Criteria	Typical Examples
		Flood plain protecting between 1 and 5 residential or commercial properties from flooding
Low	Attribute has a low quality or value on a local scale.	Locally important amenity site for small range of leisure activities Local potable water source supplying <50 homes Quality Class D (Biotic Index Q2, Q1) Flood plain protecting 1 residential or commercial property from flooding Amenity site used by small numbers of local people

Table 7.4: Rating Criteria for Estimation Magnitude of Impact on Hydrology Attributes (NRA, 2009)

Magnitude of Impact	Criteria	Typical Examples
Large Adverse	Results in loss of attribute and /or quality and integrity of attribute	Loss or extensive change to a waterbody or water dependent habitat Increase in predicted peak flood level >100mm Extensive loss of fishery Calculated risk of serious pollution incident >2% annually Extensive reduction in amenity value
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute.	Increase in predicted peak flood level >50mm Partial loss of fishery Calculated risk of serious pollution incident >1% annually Partial reduction in amenity value
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute.	Increase in predicted peak flood level >10mm Minor loss of fishery Calculated risk of serious pollution incident >0.5% annually Slight reduction in amenity value
Negligible	Results in an impact on attribute but not of sufficient magnitude to affect either use or integrity.	Negligible change in predicted peak flood level Calculated risk of serious pollution incident <0.5% annually
Minor Beneficial	Results in minor improvement of attribute quality.	Reduction in predicted peak flood level >10mm Calculated reduction in pollution risk of 50% or more where existing risk is <1% annually
Moderate Beneficial	Results in moderate improvement of attribute quality.	Reduction in predicted peak flood level >50mm Calculated reduction in pollution risk of 50% or more where existing risk is >1% annually
Major Beneficial	Results in major improvement of attribute quality.	Reduction in predicted peak flood level >100mm

Table 7.5:Rating Significance of Impacts (NRA, 2009)

Importance of Attribute	Magnitude of Impact			
	Negligible	**Small adverse**	**Moderate adverse**	**Large adverse**
Extremely high	Imperceptible	Significant	Profound	Profound
Very high	Imperceptible	Significant/Moderate	Profound/Significant	Profound

Importance of Attribute	Magnitude of Impact			
High	Imperceptible	Moderate/Slight	Significant/Moderate	Profound/Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight/Moderate

Mitigation measures to minimise these impacts were proposed and the residual impacts following mitigation were then reassessed.

7.3 Receiving Environment

7.3.1 Overview

The development is located in the Grand Canal Docks, Dublin 2, Ireland. The Grand Canal Basin consists of an inner and outer harbour where the Grand Canal terminates before it meets the River Liffey. The Grand Canal Tunnel serves a large part of metropolitan Dublin currently and discharges stormwater into the inner basin. The tunnel has separate foul and storm water compartments and runs adjacent to the route of the Grand Canal from Crumlin to Mount Street. At Mount Street the tunnel bifurcates and the foul sewage is conveyed by a tunnel to the Ringsend Pumping station for transfer to the main treatment works at Poolbeg. The storm water compartment, which caters for large areas of Dublin south of the Canal, is conveyed via a separate tunnel from Mount Street and discharges to the inner basin of the Grand Canal Dock at Barrow Street. After heavy rainfall, combined sewer overflows (CSO) in the catchment can spill into the stormwater component and discharge sewage contaminated flows into the Grand Canal Basin.

The main hydrological features of the area are the River Liffey, the River Dodder, the Grand Canal and Dublin Bay, as shown in Figure 7.1. The River Dodder flows in a north easterly direction to the east of the site and discharges to the River Liffey downstream of the proposed discharge point. The Grand Canal flows through the Grand Canal Dock at the site and discharges to the River Dodder immediately upstream of the confluence with the River Liffey. The River Liffey flows in an easterly direction to the north of the site and discharges to Dublin Bay approximately 3 km downstream from the site. Due to its proximity to Dublin Bay, the River Liffey is tidally influenced at the proposed development site due to direct connectivity to the Dublin Bay. The Grand Canal Basin is not subject to tidal influences due to the presence of the lock gates which maintain the water level within the basin at a constant 3.4 mOD.

The proposed development is located within the Grand Canal pNHA (Site Code: 002104). South Dublin Bay and River Tolka SPA and North Dublin Bay SPA are located 3.5km and 5.1 km to the east respectively. Further detail on Natura 2000 Sites is presented in Volume 2, Section 6 Biodiversity of this report.

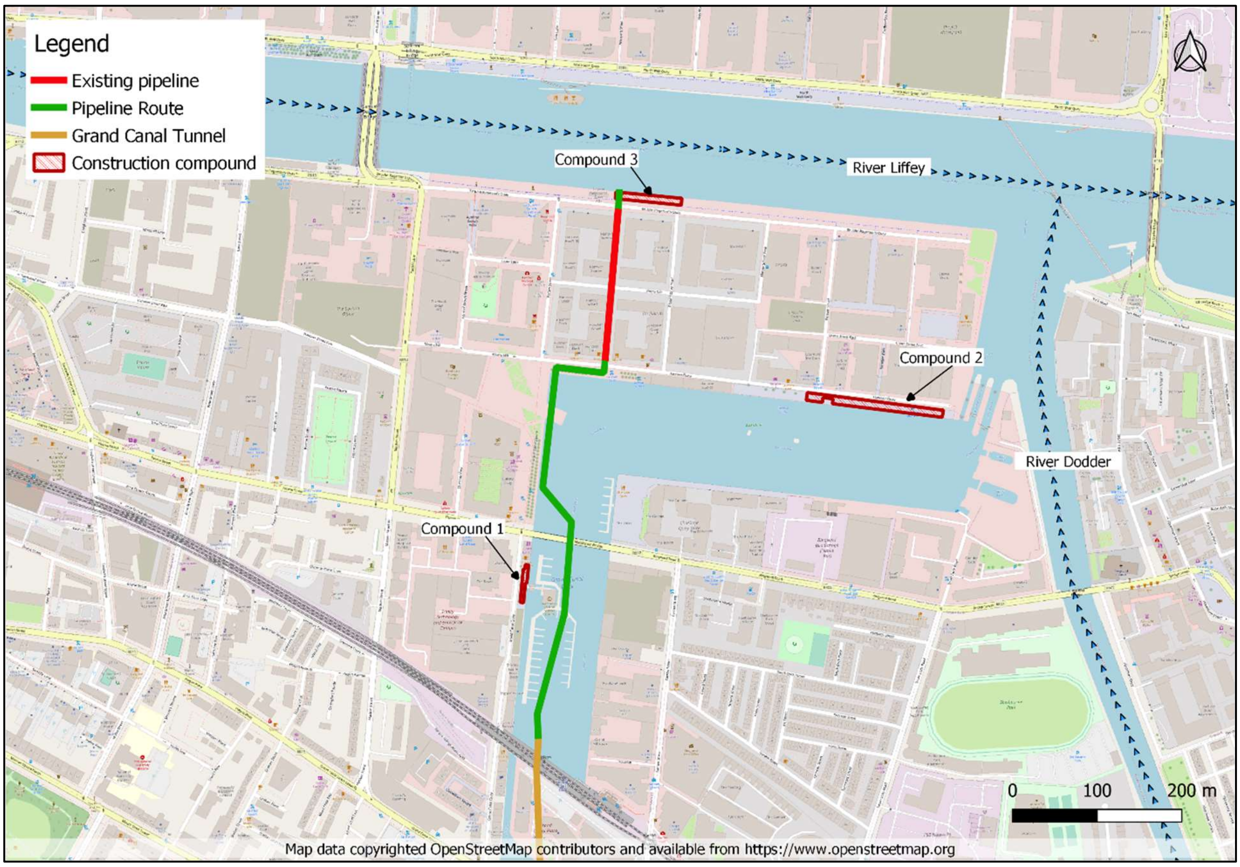


Figure 7.1 Hydrological Features of the Area

7.3.2 Catchment Characterisation

The proposed development is located within Liffey and Dublin Bay Catchment (WFD Catchment ID 09) and Dodder_SC_010 Sub-catchment (WFD Sub-catchment ID 09_16). The Liffey and Dublin Bay catchment contains the largest population of any catchment in Ireland.

The catchment characteristics for River Liffey are listed in Table 7.6.

Table 7.6 River Liffey Catchment Characteristics (OPW FSU Web Portal)

Catchment Characteristics	Value
Catchment Area	1218.74 km^2
Baseflow Index (Soil)	0.5683
Average Annual Rainfall	959 mm
Drainage Density	0.956 km/km^2
Catchment Slope	1.9164 m/km
Urban extent	0.0532

The catchment characteristics for River Dodder are listed in Table 7.7.

Table 7.7 River Dodder Catchment Characteristics (OPW FSU Web Portal)

Catchment Characteristics	Value
Catchment Area	112.821 m^2
Baseflow Index (Soil)	0.5463

Catchment Characteristics	Value
Average Annual Rainfall	917.61 mm
Drainage Density	1.339 km/km^2
Catchment Slope	12.9833 m/km
Urban extent	0.3471

Grand Canal Basin is a contained waterbody in the Grand Canal Docks. Water quality in the Grand Canal Basin is being adversely affected by the existing stormwater outfall of the Grand Canal Tunnel which periodically contains combined/foul sewerage and discharges into the southern end of the Inner Basin after periods of high rainfall. The basin is not under tidal influence and the water is held back at 3.4mOD in the basin by the lock gates, over which the through flow discharges into River Liffey.

7.3.3 Existing Drainage

The Grand Canal Tunnel has two separate compartments namely the 'foul sewage' and the 'storm water' conduit. The tunnel bifurcates at Mount Street with the foul sewage being directed to the Main Lift Pumping Station at Ringsend while flows in the stormwater compartment are conveyed to the Grand Canal Basin.

The stormwater compartment of the Grand Canal Tunnel and outfall tunnel to the dock were designed to accommodate flows from the suburban areas south of the Grand Canal as follows:

- North Crumlin storm drainage system;
- South Crumlin storm drainage system;
- River Poddle/Tymon Catchment; and
- Rathmines and Pembroke (Swan River) – storm overflows and storm drainage systems.

The Poddle/Tymon Surface Water Drainage Scheme is overflowed into the tunnel. The Crumlin North and Crumlin South storm water drainage systems are presently connected to the tunnel.

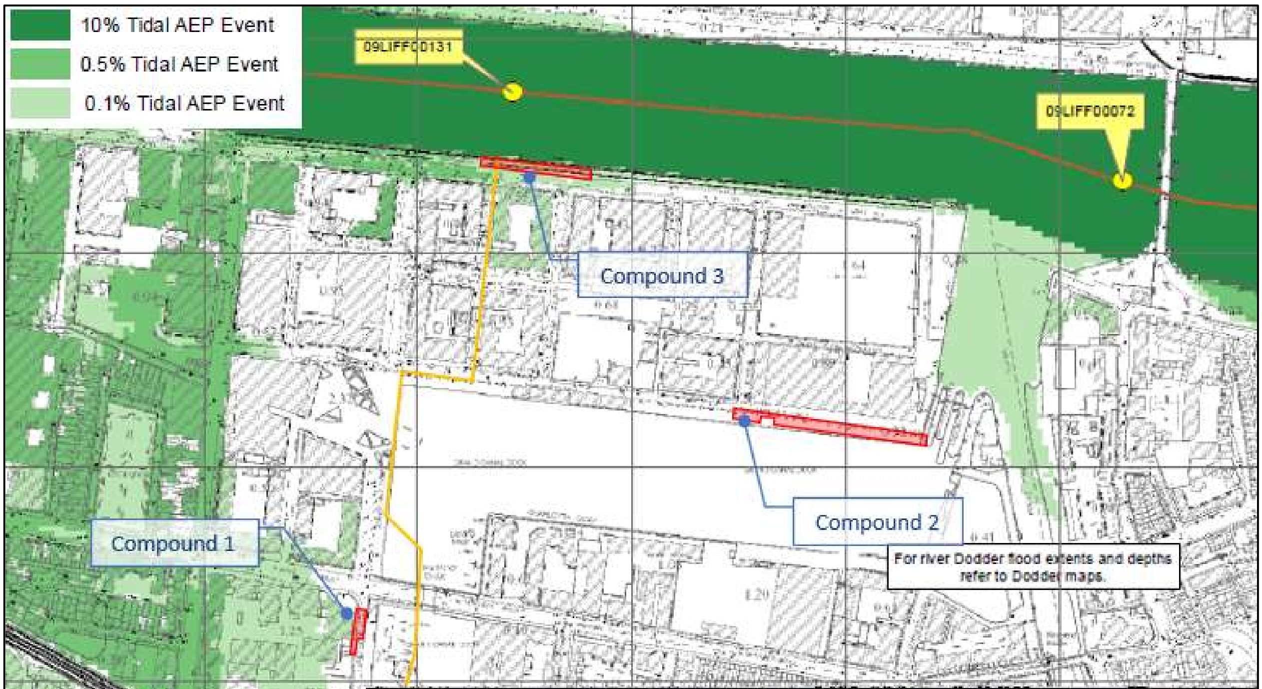
The surface water drainage from Rathmines and Pembroke is also connected to the tunnel. The overflows from the Rathmines and Pembroke (Mountpleasant and Sallymount) CSOs occur after periods of intense rainfall when the collection sewers reach capacity. It should be noted that these spills do not correlate directly with spills into the GCTS storm cell, as there is a vortex (plughole) and weir arrangement directing this flow back into the GCTS foul cell. Only when there is no capacity in the foul cell or when the flow in the overflow pipe exceeds the capacity of the vortex, will the flow surcharge and spill over the weir into the storm cell. The times coincide with high rainfall runoff to the storm cell from catchment diluting the foul sewage contribution from the CSOs.

7.3.4 Flood Risk Assessment

A flood risk assessment was undertaken for the proposed project and the stand-alone report has been provided as part of the submitted planning documents. The area of proposed development is a hub of modern apartment buildings and office and retail spaces which has been zoned as a Strategic Development Regeneration Area (SDRA) in the Dublin City Council Development Plan, 2016 – 2022.

As the pipeline will be constructed underground/ underwater it will not be vulnerable to flooding, however there could be some small flood risk during the construction of the terrestrial elements of the pipeline and structures. 3 No. construction compounds will be required during the construction phase of this project. All construction compounds are temporary during the construction phase. The first construction compound will be erected on the quayside of the Inner Basin, near the Waterways Ireland Visitor centre, and last for the duration of the works in the Inner Basin. When the pipeline reaches the Outer Basin, the first compound will be taken down. The second (and main) construction compound will be located on Hanover Quay. The third construction compound will be built on SJRQ and will only be there for the duration of the works for the outfall structure.

The Catchment Flood Risk Assessment and Management (CFRAMS) map and Dublin City Council Strategic Flood Risk Assessment (SFRA) flood extent map indicated that the terrestrial element of the proposed development site and construction compounds are located outside the fluvial flood extents and hence are located in fluvial Flood Zone C, where the risk of flooding is lowest. The OPW Summary Local Area Report shows no indication of previous fluvial related flooding at the proposed site. However, Compound 3 on SJRQ which is required for the construction of the development is located in Coastal Flood Zone A as identified in the ICPSS flood map and CFRAMS Coastal flood map. The Dublin City Council Strategic Flood Risk Assessment 2016 – 2022 also demonstrates this. Refer to Figure 7.2 and Figure 7.3 below.



Node Label	Water Level (OD) 10% AEP	Flow (m³/s) 10% AEP	Water Level (OD) 0.5% AEP	Flow (m³/s) 0.5% AEP	Water Level (OD) 0.1% AEP	Flow (m³/s) 0.1% AEP
09LIFF00180	2.67	N/A	3.12	N/A	3.35	N/A
09LIFF00131	2.67	N/A	3.11	N/A	3.34	N/A
09LIFF00072	2.67	199.56	3.11	205.11	3.34	208.47

Figure 7.2 Extract from the CFRAMS Current Scenario Coastal Flood Extent Map

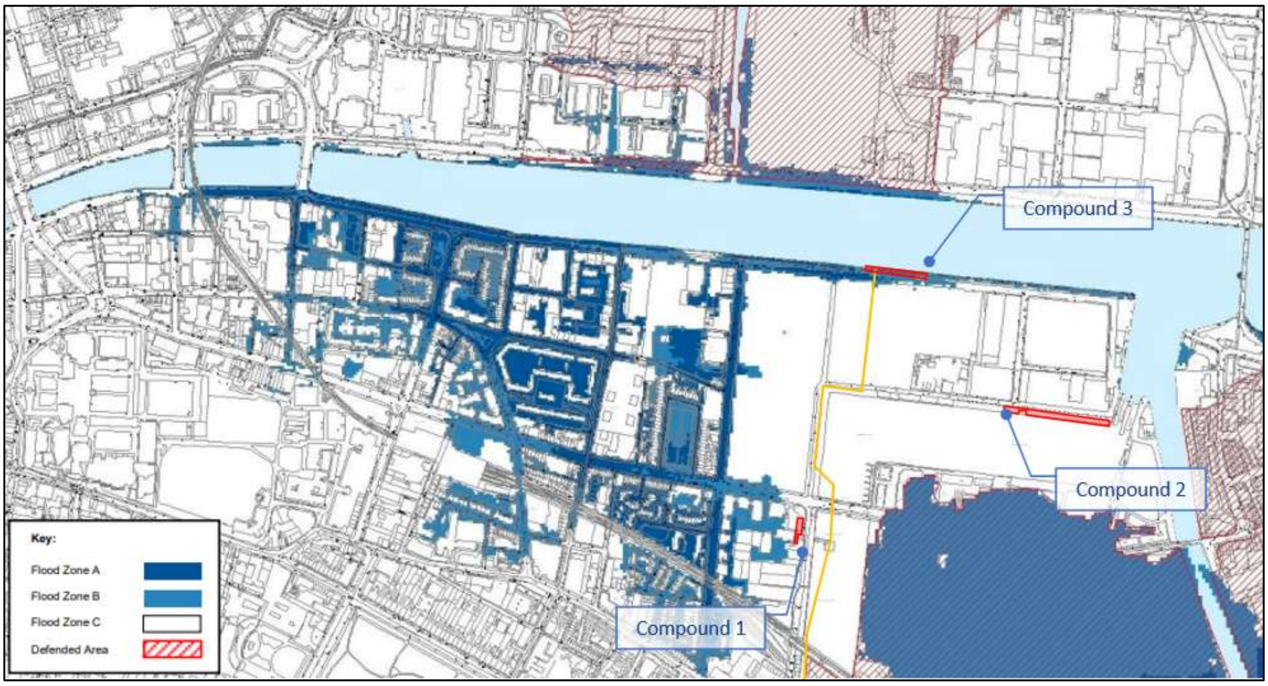


Figure 7.3 Extract from the Dublin City Council SFRA Flood Zone Map

The aquifer vulnerability map classifies the site as having 'low vulnerability' which indicates a low risk of groundwater related flooding. There is no historical evidence of groundwater flooding at the site. Also, there is no indication on the maps of any springs or wells on this site. Groundwater risk is therefore not considered to be significant.

The proposed development site is well drained, hence surface water flooding is unlikely to be a significant issue. The OPW Summary Local Area Report also shows no indication of previous pluvial related flooding at the site. The Dublin SFRA indicates that the proposed development site has a low pluvial flood hazard. Pluvial flood risk is therefore not considered to be significant.

The Compound 3 will be temporarily located in the coastal flood plain for the duration of the works in SJRQ. There will be no increase in future coastal flood levels as a result of this temporary compound.

A number of mitigation measures are proposed and further detailed in Section 7.7.1 below, to minimise flood risk at Compound 3. It is recommended that the finished floor level of the compound be constructed at a level greater than the 0.5% AEP flood level at the site and to carefully store any materials at the compound to prevent spillage in the event of an extreme flood.

It is envisaged that there will be minimal flood risk to the site and the project based on the proposed recommendation and mitigation measures. Therefore, a Stage 3 Detailed Flood Risk Assessment was not undertaken.

7.3.5 Baseline Water Quality and Protected Areas

Water Framework Directive

The European Union Water Framework Directive (WFD) (2000/60/EC) establishes a framework for the protection of surface waters and groundwaters within Member States and requires that Member States implement a range of measures to classify, assess and improve water bodies to a *good status.* It applies to rivers, lakes, groundwater, transitional and coastal waters. The good status is assessed by ecological status of waterbodies, trends in hydrochemistry and environmental quality standards. The objectives of WFD include prevention of deterioration of water bodies, to protect, enhance and restore them with the aim of achieving good status at minimum and to achieve compliance with the requirements for designated protected areas.

Under the WFD, Ireland is required to produce a river basin management plan. The River Basin Management Plan for Ireland 2018-2021 sets out the actions that Ireland will undertake to improve water quality and achieve 'good' ecological status in water bodies by 2027.

Water Quality and WFD Status

The EPA Water Quality Report 2013-2018 was published in 2019 and provides an update on the status and trends of Irish waters following the completion of the first six-year cycle of the Water Framework Directive for 2013 to 2018. The water quality information outlined in this report is sourced from the national monitoring programme undertaken by the EPA as well as other organisations including the Inland Fisheries Ireland, local authorities, Marine Institute, National Parks and Wildlife Service, and Waterways Ireland. In addition, assessments of the conservation status of protected areas carried out by National Parks and Wildlife Service (NPWS) were also taken into account.

Based on the 2013-2018 EPA monitoring information and data, both the Liffey Estuary Lower and Dublin Bay have 'Good' WFD status classification, see Figure 7.4. A breakdown of receiving water quality status 2013-2018 is detailed in the Table 7.8 below.

The WFD Status for Grand Canal Basin (Liffey and Dublin Bay) has downgraded from 'Good' in the 2010-2015 WFD cycle to 'Moderate' in the 2013-2018 WFD assessment cycle and it identified under 'Risk' of failing to meet the WFD objectives by 2027. The Liffey Estuary Lower transitional waterbody has received 'Good' status in the 2013-2018 WFD cycle and is under 'review' for waterbodies at risk.

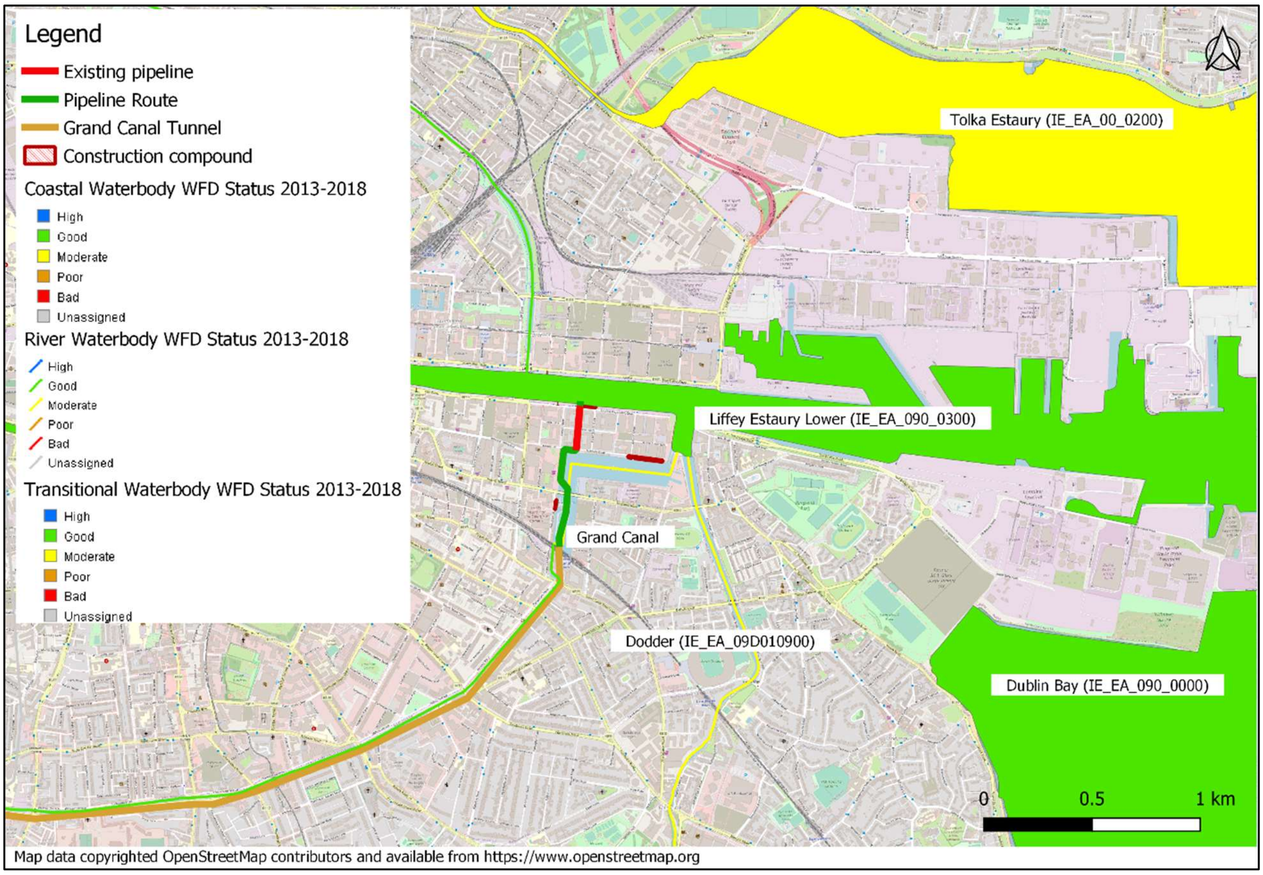


Figure 7.4 WFD Status 2013-2018

Table 7.8 Receiving Water Bodies Quality Status 2013-2018 (EPA)

Waterbody	Category	Status Category		WFD Status 2013-2018	WFD Status 2010-2015
Liffey Estuary Lower (IE_EA_090_0300)	Transitional	**Overall Status**		**Good**	**Moderate**
		Ecological Status		Good	Moderate
			Biological Status	Good	Moderate
			Phytoplankton Status	Good	Good
			Other Aquatic Flora Status	-	-
			Invertebrate Status	-	High
			Hydromorphological Status	Moderate	Poor
			Supporting Chemistry	Good	Good
		Chemical Status		Good	Good
Dublin Bay (IE_EA_090_0000)	Coastal	**Overall Status**		**Good**	**Good**
		Ecological Status		Good	Good
			Biological Status	Good	Good
			Phytoplankton Status	High	High
			Other Aquatic Flora Status	Good	Good
			Invertebrate Status	High	Good
			Hydromorphological Status	Good	Good
			Supporting Chemistry	High	Good
		Chemical Status		Good	Good
Grand Canal Basin (Liffey and Dublin Bay) (IE_09_AWB_GCB)	River/ Canal	**Overall Status**		**Moderate**	**Good**
		Ecological Status		Moderate	Good

Bathing Water Directive

The European Union Bathing Water Directive (2006/7/EC) establishes procedures and standards for bathing waters. The Directive is implemented in Ireland by the Bathing Water Regulations. The bathing water quality at the beaches and lakes are classified as 'excellent', 'good', 'sufficient' or 'poor'. Under the WFD, bathing waters are one of the protected areas. The status for designated bathing waters nearest to the development are shown in Table 7.9 below.

Table 7.9 Annual Bathing Water Quality 2018-2021 (EPA)

Bathing Water	Water Status 2021	Water Status 2020	Water Status 2019	Water Status 2018
Dollymount Strand	Good	Good	Excellent	Good
Sandymount Strand	Sufficient	Sufficient	Sufficient	Poor
Seapoint	Excellent	Excellent	Excellent	Excellent

Nutrient Sensitive Areas

Under the EU Urban Waste Water Treatment (UWWT) Directive, the Liffey Estuary (WFD Code: EA_090_0300) from Irish National War Memorial Gardens to Poolbeg Lighthouse, including the River Tolka Basin has been designated as a nutrient sensitive area.

Biodiversity- Protected Sites

The proposed development has also been identified to have surface water connectivity with seven Natura 2000 sites. These have been assessed in Volume 2, Section 6 Biodiversity of this EIAR. The designated sites closest to the development include South Dublin Bay and River Tolka SPA (3.5km downstream), North Dublin Bay SAC (5.1km downstream), North Bull Island SPA (5.9km downstream) and South Dublin Bay SAC (7km downstream). Grand Canal pNHA (Site Code 002103) occurs within the proposed project site. The ecological value of the Grand Canal pNHA lies in the diversity of species it supports along its linear habitats. The entire Grand Canal is part of the pNHA, however, no ecological features of the pNHA are found within the Basin itself, therefore no impacts are anticipated.

7.3.6 Water Quality Monitoring

Grand Canal Basin

A programme of intensive sampling and analysis has been underway within the Grand Canal Basin since September 2017 by Dublin City Council and Waterways Ireland to identify the pollution causes in the Grand Canal Basin. The main objectives of the Grand Canal Basin survey are summarised below:

- Identify the level, type and location of contamination within the Grand Canal Basin;
- Identify the pattern or spread of contamination across the inner and outer basin;
- Identify other sources of contamination contributing to poor water quality within the dock and basin;
- Complete a water quality survey to check for pollutants derived from historical industrial activities and discharges from the outfall that may potentially impact on the water quality in the basin; and
- Working in partnership with Irish Water, develop protocols for the quantitative assessment of discharge flows into the Grand Canal Basin, correlated with microbiological and rain gauge data and applied to the establishment of tentative threshold values for use in predicting short term pollution events.

The water quality sampling carried out demonstrated that the primary source of pollution of waters in the Grand Canal Basin is the discharge from the surface water section of the Grand Canal Tunnel. The sampling locations are listed in Table 7.10 below and shown on Figure 7.8.

As shown in Figure 7.5 and Figure 7.6, the concentration of coliforms show a gradual decline towards the northern region of the basin as there are no other significant sources of pollution into the Grand Canal Basin. These data confirm that the Grand Canal Tunnel overflow discharges are the principal reason for the pollution of the Grand Canal Basin.

Table 7.10 Water Sampling Locations- Grand Canal Basin

Sampling Location	Location Number	Proposed Frequency
15 metres North of Grand Canal Tunnel Outfall	GCB 3	Weekly (ongoing)
Most Southeast Marina Point	GCB 4	Bimonthly (ongoing)
Most Northeast Marina Point	GCB 5	Bimonthly (ongoing)
North-west corner of Charlotte Quay Moorings	GCB 5a	
Hanover Quay at SW Corner of City Bike Stand	GCB 5b	
Southeast Corner of Grand Canal Plaza Sticks	GCB 6	Bimonthly (ongoing)
Hanover Quay in line with Wake Dock Western A Frame	GCB 6a	
Middle of outer basin, in line with Wake Dock Western A Frame	GCB 6b	Weekly (ongoing)
Charlotte Quay, Western end of Narrow Walkway	GCB 6c	
Grand Canal Basin—Northeast Corner of Outer Basin at Eastern corner of lock gates/tilting weir	GCB 7	Bimonthly (ongoing)
North Eastern corner of Plurabelles Pontoon	GCB 7a	
Grand Canal House- Upstream- 1st Level Grand Canal	GCB 8	Weekly (ongoing)
2nd Level Grand Canal	GCB 9	

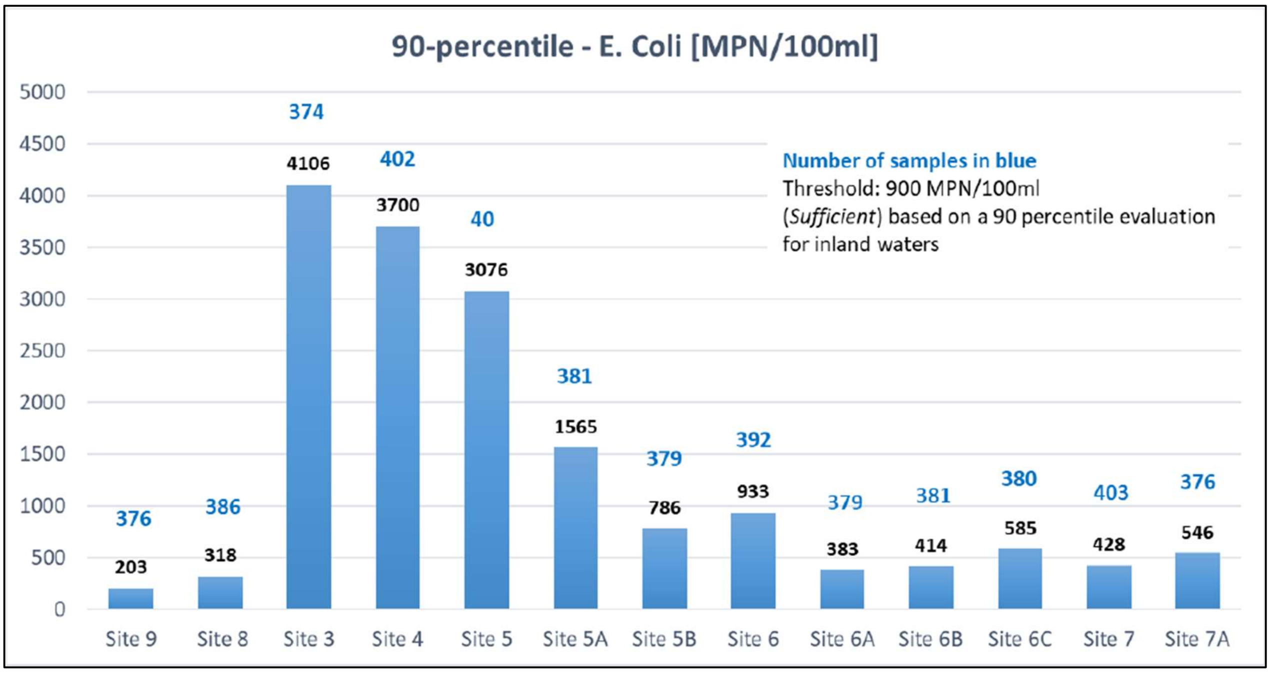


Figure 7.5 90-percentile of *E. coli* concentrations observed during the period between July 2015 to March 2020. The full name of each sample point is defined in Table 7.10.

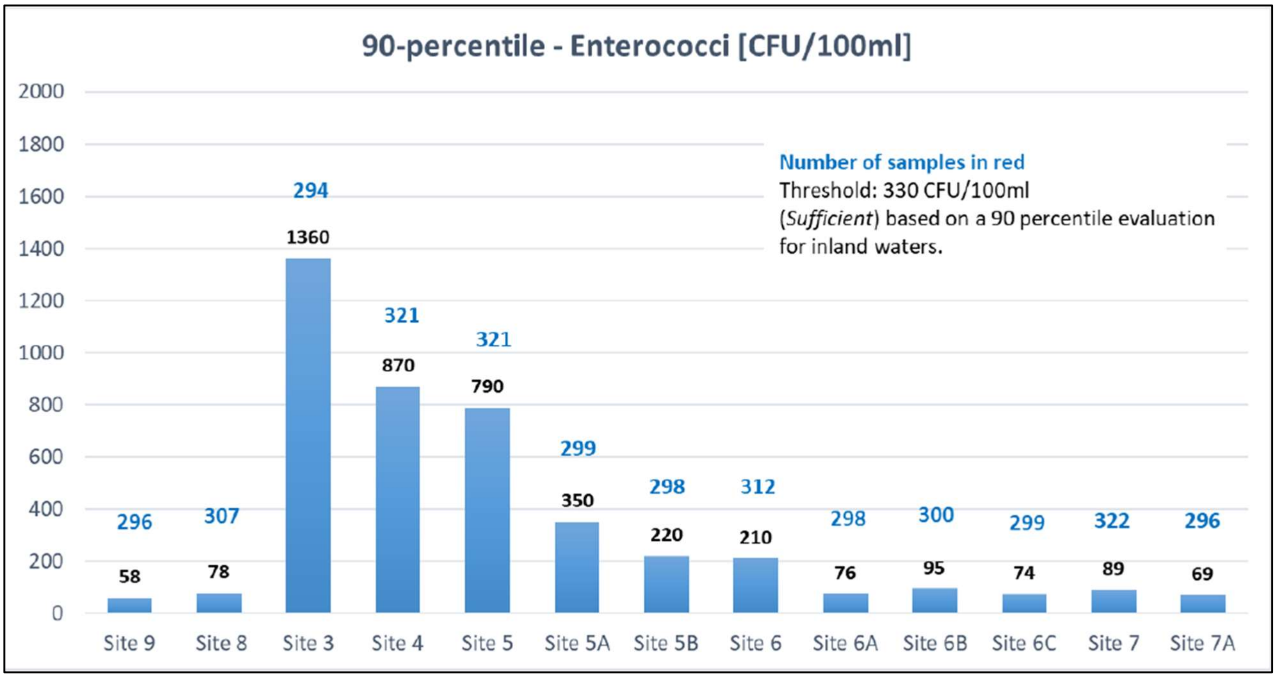


Figure 7.6 90-percentile of Enterococci concentrations observed the period between July 2015 to March 2020. The full name of each sample point is defined in Table 7.10.

River Liffey

A programme of intensive sampling and analysis was undertaken within the River Liffey during 2019-2020 by Dublin City Council for monitoring purposes.

The sampling locations are listed in Table 7.11 below and shown on Figure 7.8.

As shown in Figure 7.7 the locations assessed do not comply with the regulation for bathing waters and that the discharge from the Dodder aggravates the water quality of the Liffey. As noted, the Liffey is not designated as a bathing water, however the measurements are relevant to assess the potential impact with respect to the WFD Status of the receiving waters.

Table 7.11 Water Sampling Locations- River Liffey

Sampling Location	Location Number	Proposed Frequency
River Liffey- Samuel Beckett Bridge	40090	Weekly (2019-2020)
River Liffey- Blood Stoney Road	40091	Weekly (2019-2020)
River Liffey- New Wapping Road	40092	Weekly (2019-2020)
River Dodder- SJRQ	40093	Weekly (2019-2020)
River Dodder- Thorncastle Street	40094	Weekly (2019-2020)
River Dodder- Grand Canal Street Upper	40095	Weekly (2019-2020)
River Liffey- Tom Clarke Bridge	40096	Weekly (2019-2020)

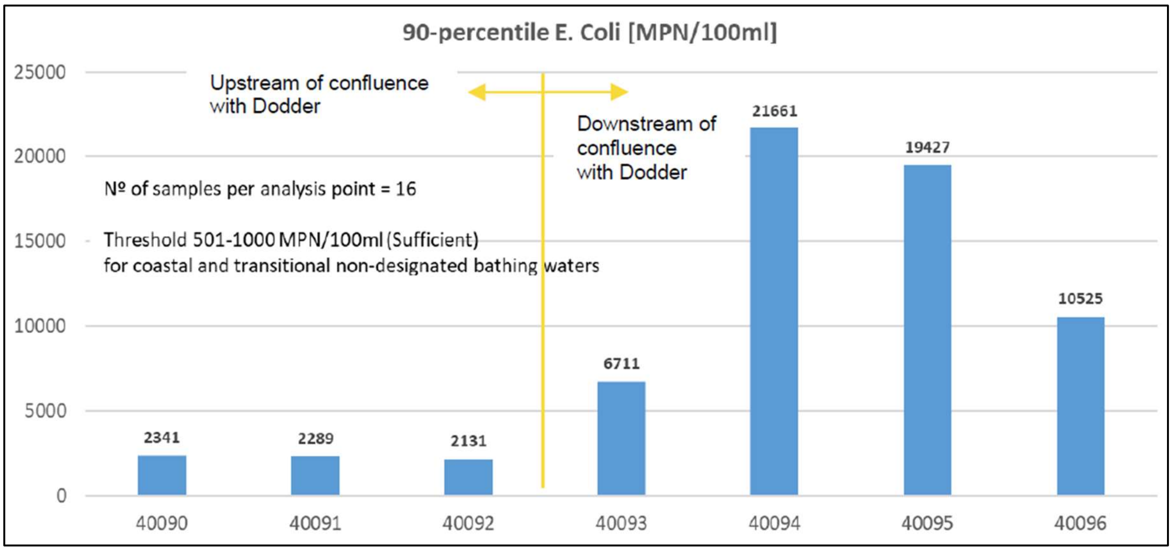


Figure 7.7 90-percentile of *E. coli* concentrations for DCC sampling locations of the Lower Liffey and in the intersection with the Dodder River. The full name of each sample point is defined in Table 7.11.

Grand Canal Tunnel (Stormwater Compartment)

Water quality sampling and analysis undertaken within the storm section of the Grand Canal Tunnel by Dublin City Council provides a baseline of pollutants entering the stormwater component of the Grand Canal Tunnel and identifies the pollution causes in the Grand Canal Basin. The analysis was undertaken bimonthly at Estate Cottages. The highest recorded *E. coli* count was 48,392 MPN/100ml in October 2021. Refer to Volume 3, Appendix 7B. The sampling location is shown on Figure 7.8 below.

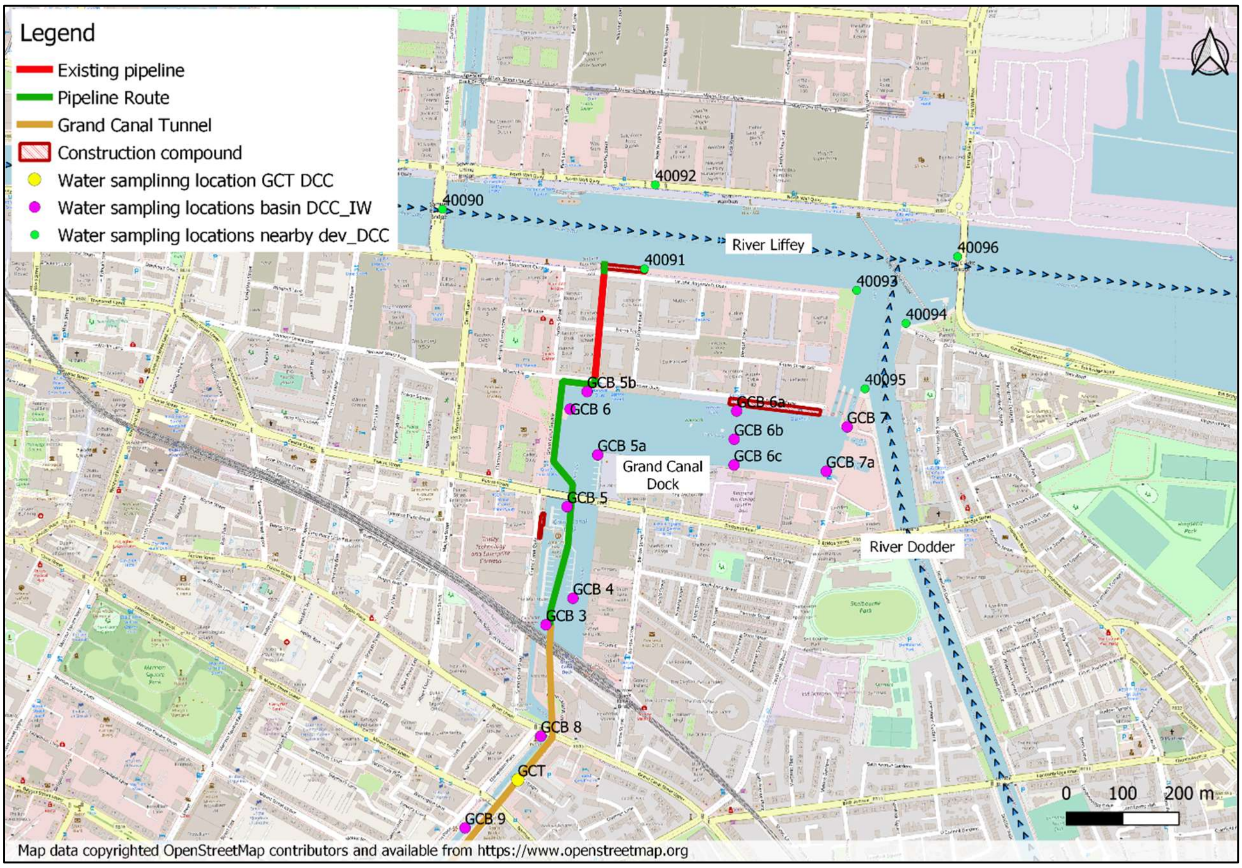


Figure 7.8 DCC and WI Water Sampling Locations

7.4 Characteristics of the Development

The development will entail works that has the potential to impact on hydrological receptors in the vicinity of the site.

7.4.1 Culvert/Pipeline Within the Basin

During the construction phase bed material will be moved/displaced within the basin. This involves dredging and pushing aside silt from the bed of the basin. A 200mm gravel bed will be laid down on the footprint of the pipeline, with deeper areas on soft spots where required. As much of the material as possible will be left within the basin and placed around the pipeline. Material that will be removed will be treated as contaminated material and transported to a suitably licensed facility.

The pipeline will be lowered into place within the basin. Lengths of the precast U-shaped housing and pipeline sections will be lowered directly onto the silt bed. Concrete will be poured below the water level to fill up the U-shaped housing between the individual pipelines.

7.4.2 Transition Chamber 1 (3m), Transition Chamber 2 (3m)

The cofferdams for these chambers 1 and 2 within the basin will be constructed using conventional sheet piling.

7.4.3 Transition Chamber 3 (7.4m) and Culvert beneath Hanover Quay

Excavations along Hanover Quay to allow for the new pipeline will be at a depth of 6.55m.

Sheetpiles will not be permitted along the back of Hanover Quay wall i.e. in the Campshire itself. It is anticipated that Transition Chamber 3 and the Hanover Quay culvert will be constructed within a secant piled wall. This secant piled wall will be required to minimise working width, to contain the existing contaminated material and to limit any water ingress from the dock and surrounding ground. This will tie into the cofferdam or other temporary works provided by the Contractor in the dock to ensure a watertight seal.

7.4.4 Outfall Works and Tie-in at SJRQ

The Contractor must provide a cofferdam or other temporary works to ensure a watertight seal around the excavation/works in SJRQ and the River Liffey.

For the works in SJRQ, low vibration, CFA piles are required, as a condition specified by the Bord Gáis Transmission Main Department.

On completion, The Grand Canal Tunnel stormwater outfall will now discharge directly to the River Liffey. The discharge will periodically contain a CSO spill component from overflows within the catchment after periods of heavy rainfall. The Liffey has much greater assimilative capacity than the Grand Canal Basin. There will be no longer any discharge from the tunnel to the Grand Canal Basin.

7.5 Potential impacts

This section identifies, describes, and presents an assessment of the likely significant impacts of the proposal on the hydrological environment. The hydrological impacts can either be quantitative in form of increased flood risk or qualitative in the form of water quality impacts on the receiving environment. The characteristics of the proposal with regards to the water and hydrological environment relates to the construction and operation phases of the proposed outfall extension from Grand Canal Basin to the River Liffey.

7.5.1 Do Nothing Impacts

Under a ‘Do nothing’ scenario, storm water flows would continue to discharge to the Grand Canal Basin.

The available storage within the dock is insufficient to cater for incoming flood flows and that uncontrolled over-topping would occur. Such over-topping of the quay walls would lead to flooding of adjacent streets and properties. The effect of major flood flows exiting over the existing lock gates could lead to damage of the lock floors and erosion of the river-bed downstream of the locks if the peak flows coincide with low tide levels in the Dodder/Liffey confluence downstream of the locks.

From a water quality perspective, water quality in the River Liffey would remain unchanged. However, water quality within the Grand Canal Basin would continue to experience periodic pollution events and would become unsuitable for recreational use. This would have adverse impact on the future development of water-based activities within the basin and the overall amenity value of the area. The water quality in the basin has deteriorated and the WFD status for the Grand Canal Basin has shifted ‘Good’ status in 2010-2015 to ‘Moderate’ in 2013-2018 and it is at ‘Risk’ of not achieving the WFD objectives by 2027. With the continued periodic discharge of polluted water with high concentrations of bacterial contaminants and nutrients the water quality of the basin would not be able to achieve the desired WFD objectives of ‘Good’ status.

Also, under the current scenario there will be no direct discharge of stormwater into the River Liffey and thus no impact on the water quality there.

7.5.2 Construction Phase Impacts

The proposed works for the project are detailed in Volume 2, Section 2. During the construction phase, there is potential for temporary impacts on water quality to occur due to the mobilisation of sediments or accidental releases into the water bodies.

The construction phase activities that can result in potential impacts include:

Dredging and piling

Grand Canal Basin

The disturbance and displacement of the silt bed of the Basin from lowering sections of the pipeline and construction of three no. transition chambers will result in the redistribution and suspension of silt on the bed of the Basin. The impact will be *permanent in duration, small adverse in magnitude and slight negative in significance.*

River Liffey

The installation of the cofferdam in the River Liffey to facilitate the construction of the outfall has the potential to mobilise silt and sediments from the river bed. There is a significant flow in the Liffey and taking into account the dilution effects and tidal flush the magnitude of the impact will be *negligible in magnitude and imperceptible in significance.*

Release of suspended solids into surrounding waters

Grand Canal Basin

There is also potential for release of pollutants (e.g. hydrocarbon from machineries, concrete, silt laden water, fine materials, etc) and sediments within the Grand Canal Basin which could impact the water quality in the basin and potentially impact on the aquatic ecology in the basin. The risk and impact of such spills have been dealt with within the CEMP, which will be updated and finalised by the Contractor prior to construction commencing. The unmitigated effect to this development, in terms of potential pollutants, would result in a *short-term impact which is moderate adverse in magnitude and moderate negative in significance.*

River Liffey

During the construction phase, potential short-term release of pollutants and sediment within the Grand Canal Basin could impact on water quality and ecological receptors downstream, such as the Lower River Liffey. The impact will be *small adverse in magnitude, slight negative in significance and short-term.*

Contaminated soils and surface run-off

The soils at Hanover Quay and SJRQ are contaminated. The excavation of contaminated material from Hanover Quay, and SJRQ will require disposal. The storage of contaminated soils has the potential to be mobilised by rainfall and run off to surface water (the Basin or the Liffey). The impact will be *temporary in duration, small adverse in magnitude and slight negative in significance.*

Temporary Construction Dewatering

No significant volumes of water will be abstracted during dewatering operations. The abstracted groundwater will be groundwater that currently discharges to the Liffey as baseflow. The proposed dewatering exercise is not considered likely to result in significant effects on the hydrogeological environment. The Contractor will be required to apply for a Section 16 Wastewater Discharge Licence for the disposal of groundwater.

Accidental spillages

The construction machinery on site has the potential to contribute to accidental discharge to the receiving waterbodies from leakage or refuelling on site. Chemicals being stored on site at the temporary site construction compounds have the potential to contribute to accidental discharge to the receiving waterbodies. The impact without mitigation will be *moderate adverse in magnitude and moderate in significance.*

Invasive Species

An aquatic ecology survey was undertaken in the Grand Canal Basin and River Liffey. Aquatic alien invasive species recorded in the course of the aquatic survey include zebra mussel and Nuttall's Waterweed, both recorded within Grand Canal Dock. Both of these species are listed on the Third

Schedule of the European Communities (Birds and Natural Habitats) Regulations (S.I. 477/2011) (as amended). Both these species are found in freshwater habitats and therefore, there will be no spread of these species downstream to estuarine and coastal habitats Silt contaminated with Nuttall's Waterweed or Zebra Mussel that is removed and transported from the Basin in the process of the works has the potential to contaminate other freshwater bodies. Barges or boats used during the works also have the potential to spread these species to other water bodies outside of the site after works are completed. The unmitigated effect would potentially result in *long-term, major* impacts on water bodies outside of the site.

Flood Risk

The Flood Risk Assessment identified no flood risk to the proposed development, as it will be constructed underground. The CFRAMS fluvial flood extent maps of the River Liffey and the River Dodder demonstrate that the fluvial flood extents of the rivers do not extend to the proposed development site. However, the coastal CFRAMS map shows that Compound 3 is located within the coastal flood extent. The ICPSS flood extent map indicates that Compound 3 will be located in coastal Flood Zone A.

The compound will be temporary during the construction phase of the project and will be used for site offices and storage of equipment and materials. The impact will be *temporary in duration, small adverse in magnitude and slight negative in significance.*

7.5.3 Operational Phase Impacts

Grand Canal Basin

The removal of the stormwater outfall from the Grand Canal Basin will lead to a reduction in input of polluted water. This would have a positive effect on the Basin as it would improve the water quality within the Basin and has the potential to improve the overall WFD status of the waterbody. The magnitude of impact will be *permanent moderate beneficial.*

River Liffey

The principal operational effect of the project will be a change in the water quality characteristics in the receiving waters. Stormwater with an intermittent overflow from combined sewers will be discharged into River Liffey and transported downstream and could indirectly impact on the water quality and thereby on ecological receptors downstream. In order to assess and quantify the impact the water quality model was run for a number of scenarios.

The constructed MIKE3 and ECO-Lab models were then used to compare the spatial and temporal water quality data for the River Liffey for a 1 year period for which time series water quality and flow data were available. The details of the water quality modelling exercise are contained in DHI report Numerical Modelling Report in Volume 3, Appendix 7A while the analysis of the model outputs is summarised below.

The model was run using available time series for flows and water quality in the River Liffey with and without the discharge from the stormwater outflow to the River Liffey at SJRQ.

For the baseline,the model was run to reflect the present situation without any water quality inputs from the stormwater discharge at its new location on SJRQ.

The parameters selected to assess impacts are the EQS for "good" status in transitional and coastal waters (S.I. No. 272/2009 - European Communities Environmental Objectives (Surface Waters) Regulations 2009 (as amended)).

It should be noted that the EPA Trophic Status Assessment Scheme (TSAS) adjusts the EQS to include a winter and summer value which vary with salinity. For each of the parameters of interests the following values, based on the EPA salinity interpolated EQS's for TSAS nutrients, are used as an assessment of the potential impact on water quality:

- DIN (Dissolved Inorganic Nitrogen) (salinity adjusted) (As per EPA Trophic Status Assessment Scheme (TSAS) threshold values)

- Winter (Exceedance criteria <0.506 mg/l at median)
- Summer (Exceedance criteria <0.442 mg/l at median)

- MRP (salinity adjusted) (As per EPA Trophic Status Assessment Scheme (TSAS) threshold values)
  - Winter (Exceedance criteria <0.044 mg/l at median)
  - Summer (Exceedance criteria <0.043 mg/l at median)
- BOD (Exceedance criteria < 4.0 mg/l at 95% percentile)
- E. Coli (Exceedance criteria < 500 MPN/100ml at 95% percentile for "good" quality)

It is noted that for E.coli, the receiving waters of the Liffey are not designated bathing waters and as such there are no applicable bacteriological standards, however the model was run for E.coli to determine the magnitude of the effect on the receiving waters.

For the baseline, a summary plot is produced showing the result of the existing situation compared against the EQS for that parameter. From assessment of the results there is variability seen through the year that leads to the final calculated results. As the model is a 3D model, the values can vary through water depth and the key feature controlling circulation in this part of the Liffey is the presence of the salt wedge. In many situations, the surface values are higher than the bottom values due to this circulation. The baseline scenario seeks to determine, based on the available data, a representation of the present situation.

For the operating scenario the % change in the various water quality parameters was determined from the model run. The modelled concentrations were compared with EQS to determine if the WFD status changed as a result of the proposed discharge.

The results of the modelling exercise are summarised below.

DIN (Dissolved Inorganic Nitrogen)

For DIN, it is apparent that the Dodder provides a significant input of lower quality water, which travels downstream past the Tom Clarke Bridge. The model indicates that within the model domain the values are always below the exceedance threshold in the existing situation. DIN values in the historical monitoring in the area between the two bridges show similar ranges to the model results, with values from 0.3-0.4 mg/l seen in the winter to 0.05-0.1 mg/l seen in summer. Refer to Figure 7.9 below.

Winter

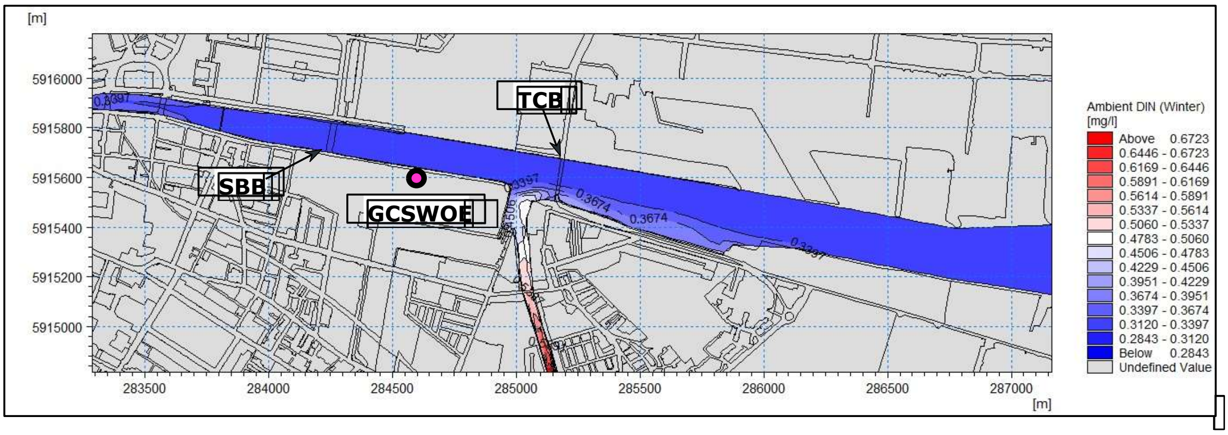


Figure 7.9 Baseline – Winter temporal median DIN values, vertically averaged

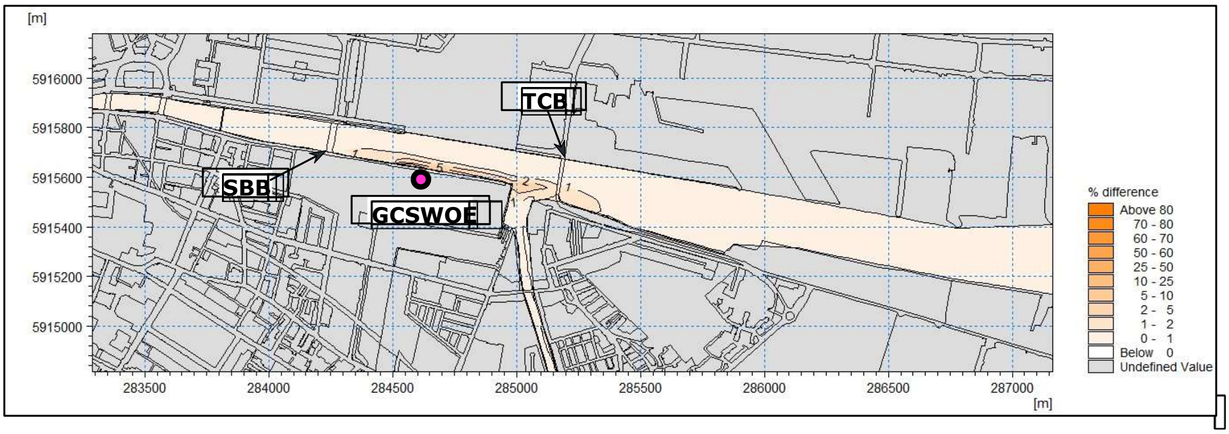


Figure 7.10 Percentage difference in winter DIN (median), vertically averaged

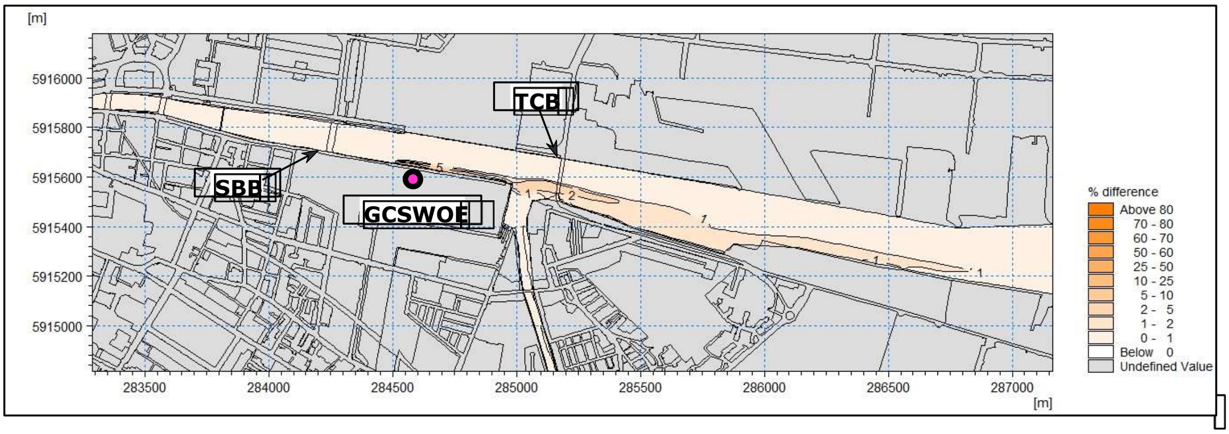


Figure 7.11 Percentage difference in winter DIN (median) maximum through the water column

Figure 7.10 and Figure 7.11 show that % change in water quality for the winter scenario is less than 1% outside the immediate vicinity of the new discharge location. Consequently, there will be no discernible change in WFD water quality status. The significance of the impact on DIN in the receiving water is considered to be imperceptible downstream and in Dublin Bay.

Summer

For the summer values, a similar baseline pattern is seen however the effect of the Dodder is less noticeable. The model suggests that the values are always below the exceedance threshold in the existing situation. Refer to Figure 7.12 below.

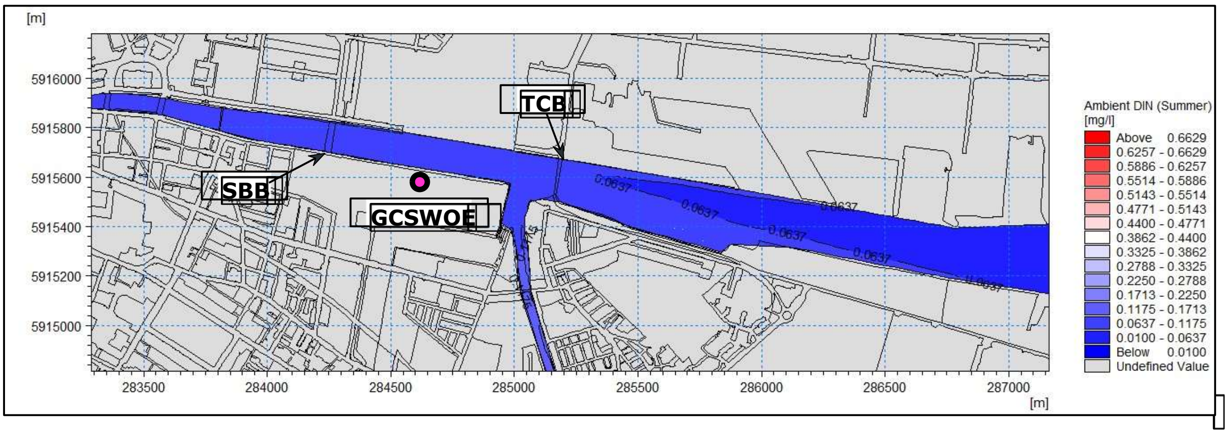


Figure 7.12 Baseline- Summer temporal median DIN values, vertically averaged

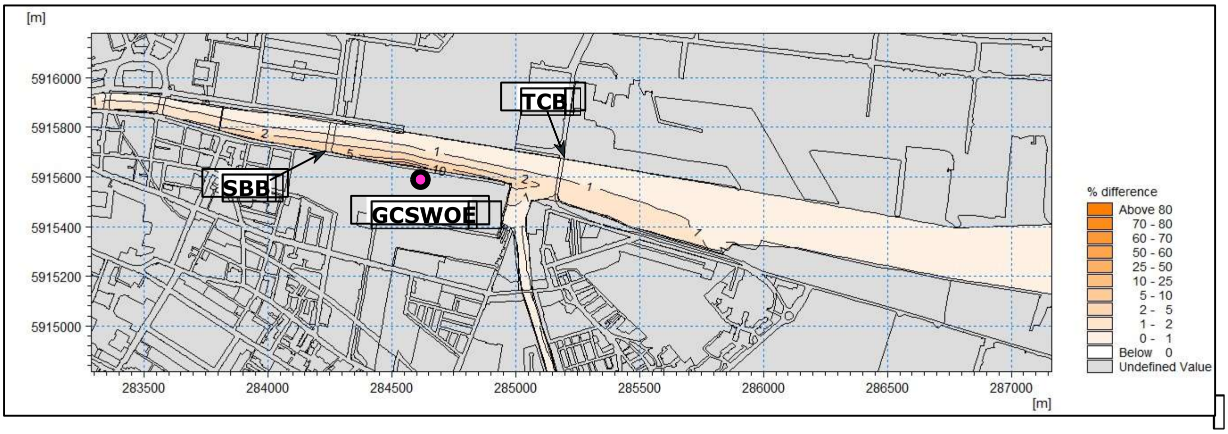


Figure 7.13 Percentage difference in summer DIN (median), vertically averaged

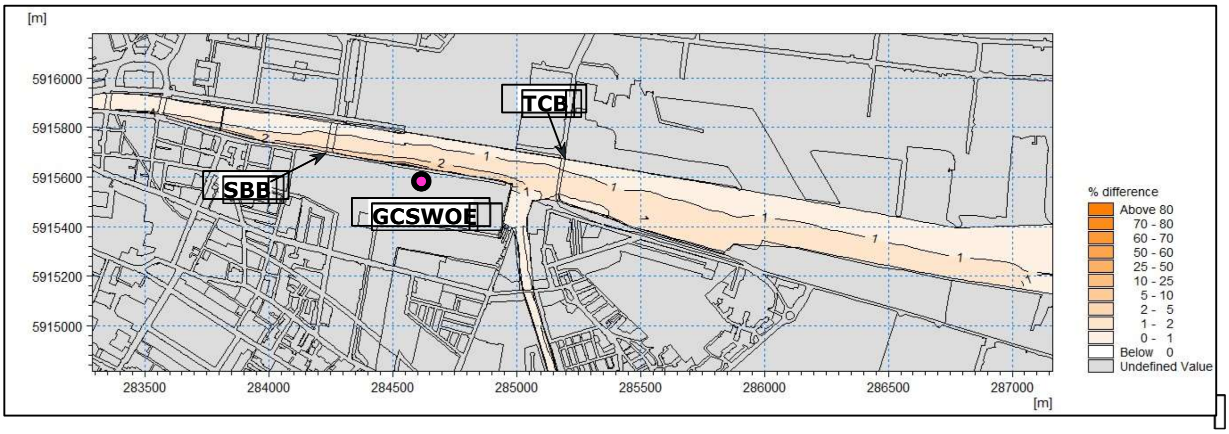


Figure 7.14 Percentage difference in summer DIN (median), maximum through the water column

Figure 7.13 and Figure 7.14 show that the % change in water quality for the summer scenario is less than 1% outside the vicinity of the new discharge location. Consequently, there will be no discernible change in WFD water quality status. The significance of the impact on summer DIN in the receiving water is considered to be imperceptible downstream and in Dublin Bay.

MRP (Molybdate Reactive Phosphate)

For MRP, the Liffey is the main contributor, along with the background values from the sea. Compared to the EQS, it is seen that in both the existing winter and summer conditions, MRP is below the EQS threshold. It is noted that in winter the main water body shows a relatively time invariant median value, with figures being 0.04 through much of the water column. Again, compared to the measured concentrations, the range of MRP from 0.040-0.042 in winter and around 0.01 in summer seen in the model is considered representative of the existing situation. Again, surface plumes coming from the Liffey and the Dodder are noted. Refer to Figure 7.15 and Figure 7.18 below.

Winter

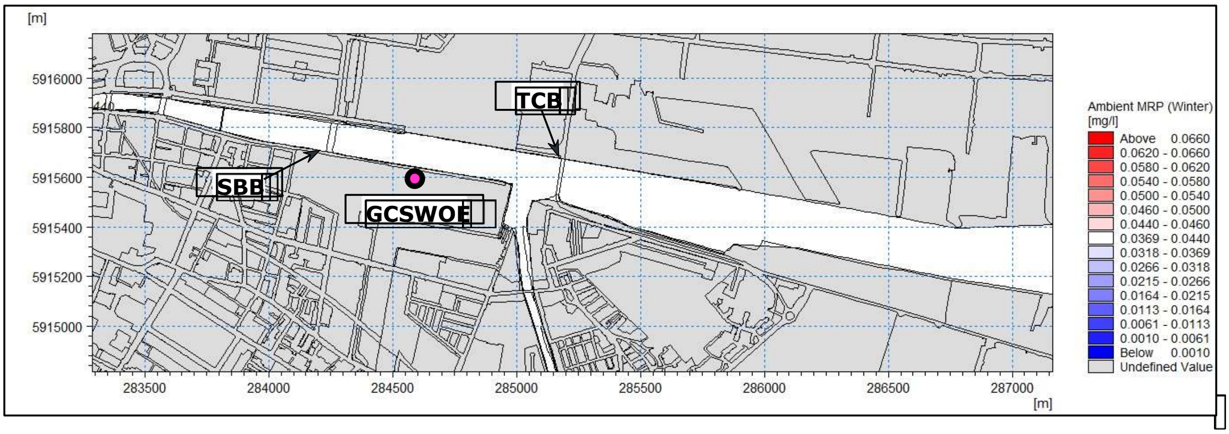


Figure 7.15 Baseline- Winter temporal median MRP values, vertically averaged

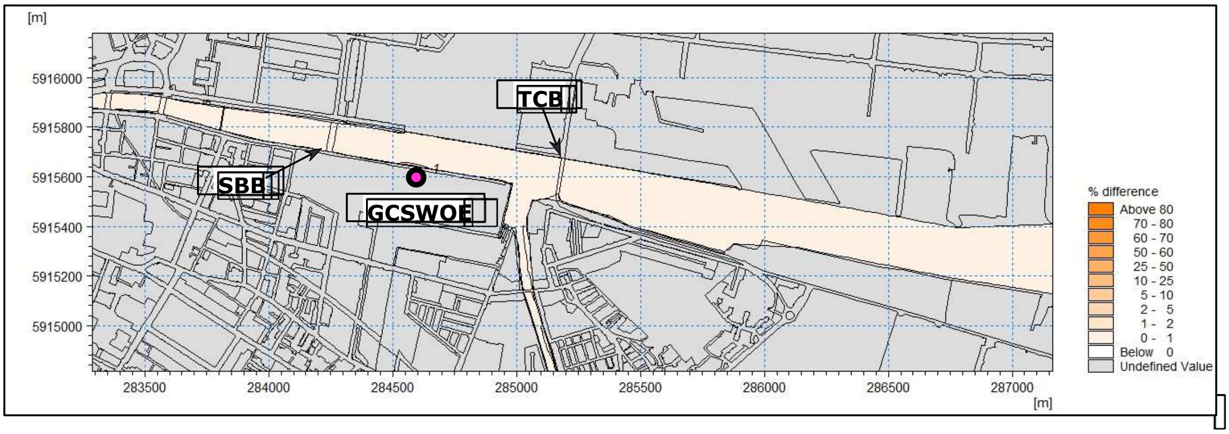


Figure 7.16 Percentage difference in winter MRP (median), vertically averaged

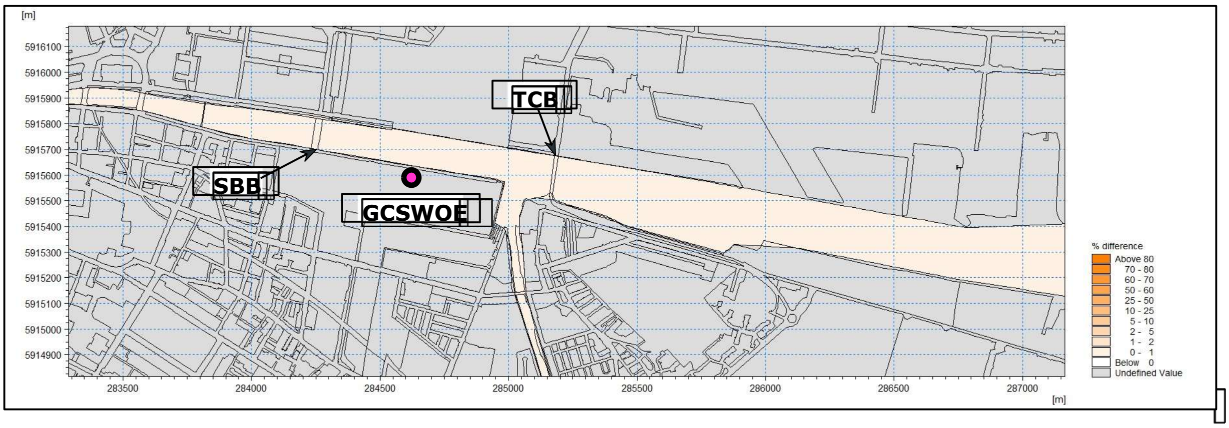


Figure 7.17 Percentage difference in winter MRP (median), maximum through the water column

Figure 7.16 and Figure 7.17 show that % change in water quality for the winter scenario is less than 1% outside the immediate vicinity of the new discharge location. Consequently, there will be no discernible change in WFD "good" water quality status. The significance of the impact on MRP in the receiving water is considered to be imperceptible downstream and in Dublin Bay.

Summer

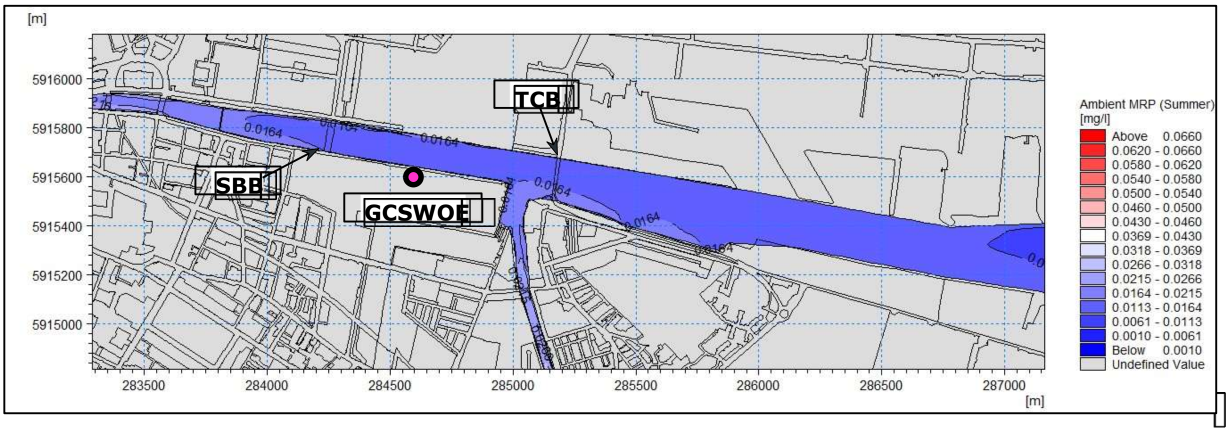


Figure 7.18 Baseline - Summer temporal median MRP values, vertically averaged.

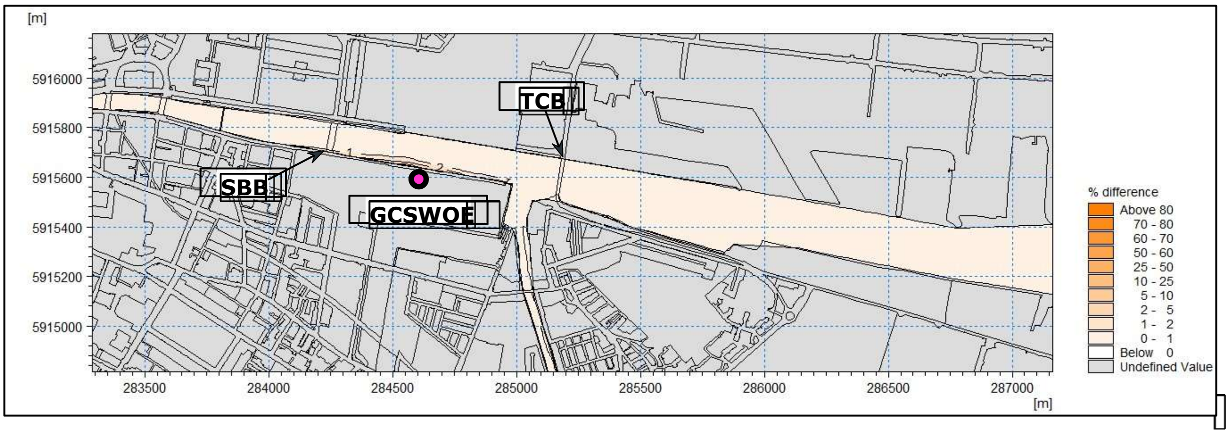


Figure 7.19 Percentage difference in Summer MRP (median), vertically averaged.

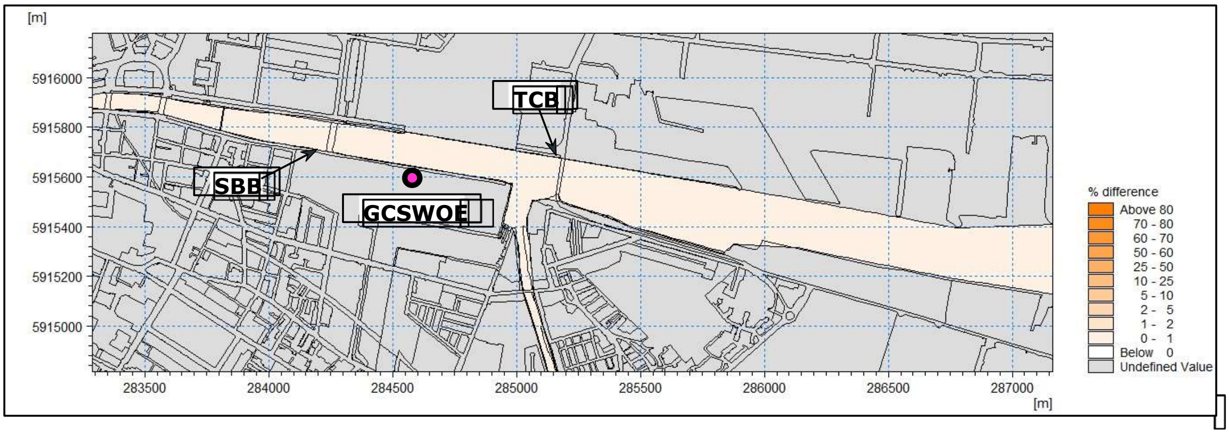


Figure 7.20 Percentage difference in summer MRP (median), maximum through the water column

Figure 7.19 and Figure 7.20 show that % change in water quality for the winter scenario is less than 1% outside the immediate vicinity of the new discharge location. Consequently, there will be no discernible change in WFD water quality status. The significance of the impact on DIN in the receiving water is considered to be imperceptible downstream and in Dublin Bay.

BOD (Biochemical Oxygen Demand)

For BOD, the baseline values are seen to be high coming from the Dodder, however, the median values remain relatively constant, suggesting that BOD maxima are relatively infrequent in the model period. Importantly for the EQS, it is seen to be below the threshold 100% of the time, suggesting no exceedance for this parameter in the existing situation. Refer to Figure 7.21, Figure 7.22 and Figure 7.23below.

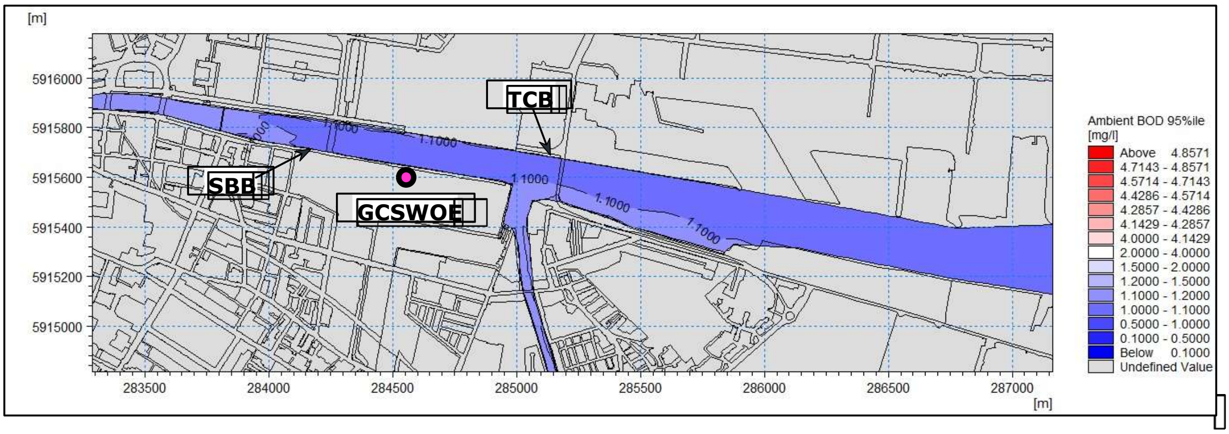


Figure 7.21 Baseline- All year 95%ile BOD values, vertically averaged

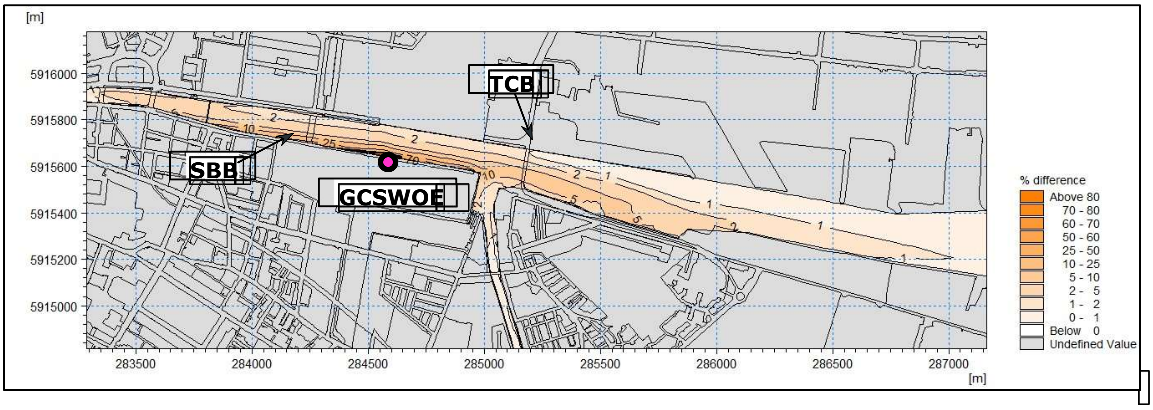


Figure 7.22 Percent difference in a year 95%ile of BOD, vertically averaged

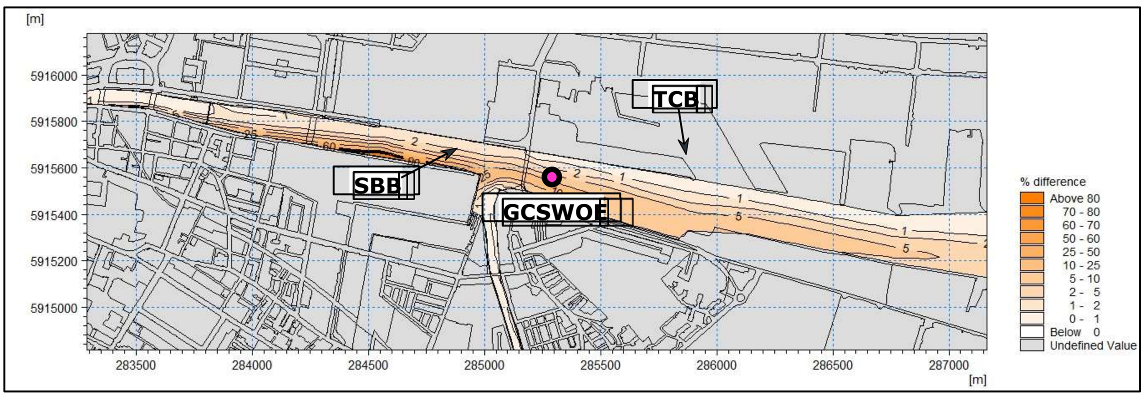


Figure 7.23 Percentage difference in all year 95%ile of BOD, maximum through the water column

BOD is seen to be below the 95%ile EQS at all locations, with no specific exceedance of the "good" status (4.0 mg/l) anywhere in the receiving water. It is noted that BOD shows the largest percentage differences from the modelling runs, suggesting a more extensive impact than other parameters including DIN, MRP and E. coli.

The main increase in impact is noted to be localised to the immediate area of the outfall, however the region of change in excess of 2% is seen to be greater than any of the other parameters. Consequently, for BOD a larger change is seen as the values in the receiving waters were low. Importantly, the absolute values of this change peak at 1.6 mg/l. With the ambient conditions of 1.1 mg/l this remains well below the EQS, suggesting a low risk. Consequently, as the operational receiving water quality is considerably below the “good” status EQS throughout, the impact is considered to be slight/imperceptible.

E.coli (Time-Series Scenario)

There is no EQS for E.coli under the surface water regulations for transitional or coastal waters. However, concern regarding the periodic increases in E.coli within the Grand Canal Basin was one of the drivers to relocate the outfall directly to the River Liffey where there was a greater dilution and flushing available. Consequently, it has been decided to assess the change in E.coli counts as a result of the discharge. Refer to Figure 7.24, Figure 7.25 and Figure 7.26 below.

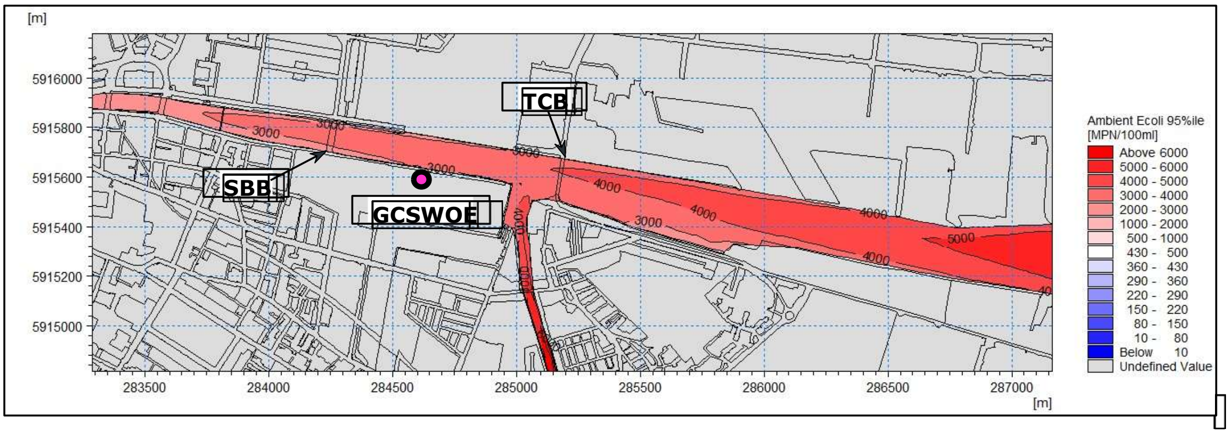


Figure 7.24 Baseline- All year 95%ile E.coli values, vertically averaged

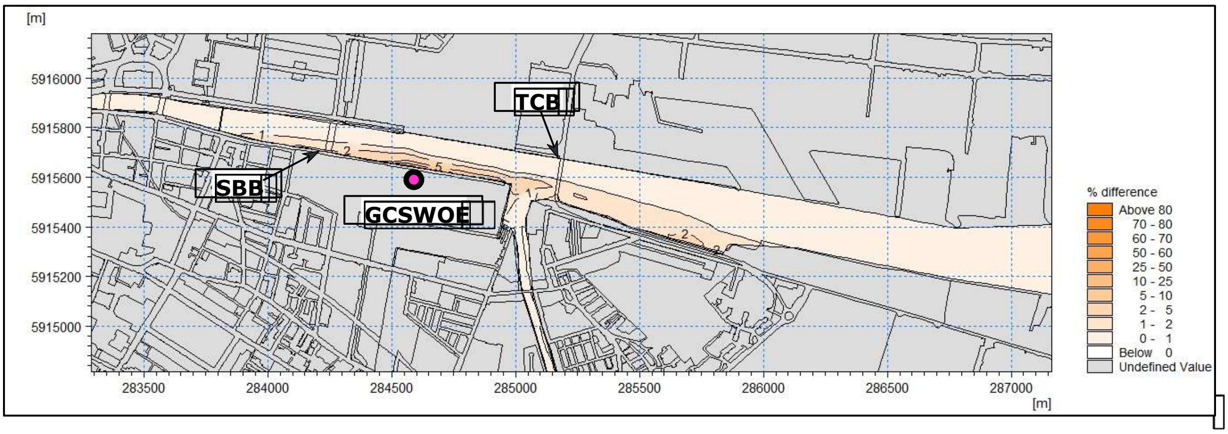


Figure 7.25 Percent difference in all year 95%ile of E.coli, vertically averaged

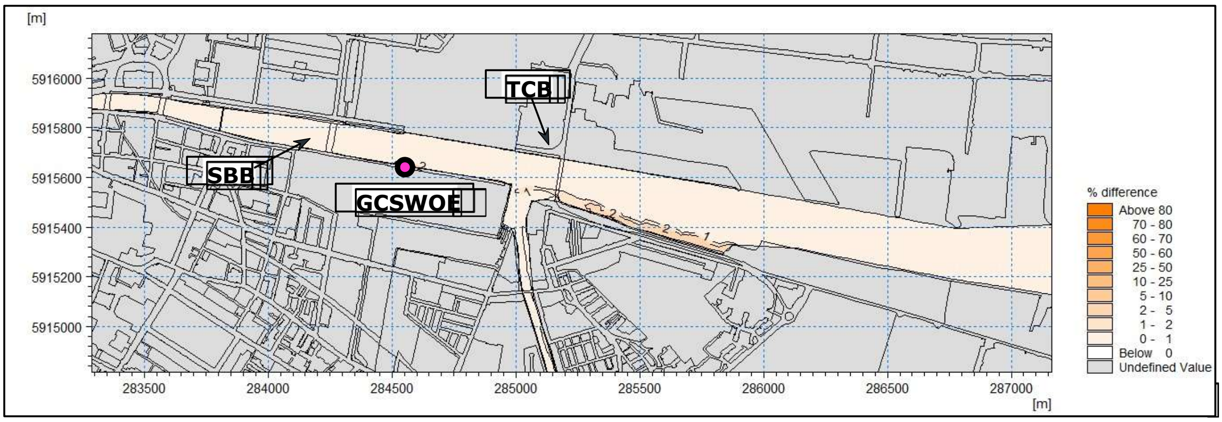


Figure 7.26 Percentage difference in all year 95%ile of E.coli, maximum through the water column.

For the vertically averaged results, the greatest change is up to 10% increase in the immediate vicinity of the outfall, however this falls rapidly to only 0.02% increase at the seaward boundary of the model.

For the maximums, the differences are smaller, and the patterns show that in addition to the localised increased at the GCSWOE, there is an area of 1-2% increase seen between the Tom Clarke bridge and the marina.

At the very downstream end of the model, indicative of the outflow towards the sea, the difference reduces to a maximum of 0.01% difference between the baseline and the time varying scenario.

This demonstrates that the dilution and dispersion in the River Liffey is such that the impact on the *E. coli* counts downstream of the proposed is imperceptible. It follows that the impact on the designated bathing area bathing waters within Dublin Bay must therefore be less and therefore imperceptible also.

E.coli (Storm-based Scenario)

In order to provide greater confidence with respect to the potential concentration of the *E. coli* coming from the GCSWOE, an additional storm-based assessment was proposed. This considered the potential for more extreme concentrations during storm events when CSO spills were likely to occur (at a level similar to raw sewage).

Similar to the 'time varying' scenario for *E. coli* the discharge volume is based on the measured data from the period, however the concentration of *E. coli* is set to be 5,000,000 MPN/100ml (a value considered representative of a CSO discharge) constantly for 3 hours over the 10 highest discharges in the period of measurement, to provide a storm led conservative assessment of the potential of a raw sewage discharge. This equates to 30 hours of discharge or 0.4% of the entire year.

At all other times (99.6%), the discharge is at the background level of *E. coli* in the system of 5,862 MPN/100ml, some 10 times higher than the recommended level to achieve 'Sufficient' for bathing waters.

This is considered a worst-case scenario. Refer to Figure 7.27 and Figure 7.28 below.

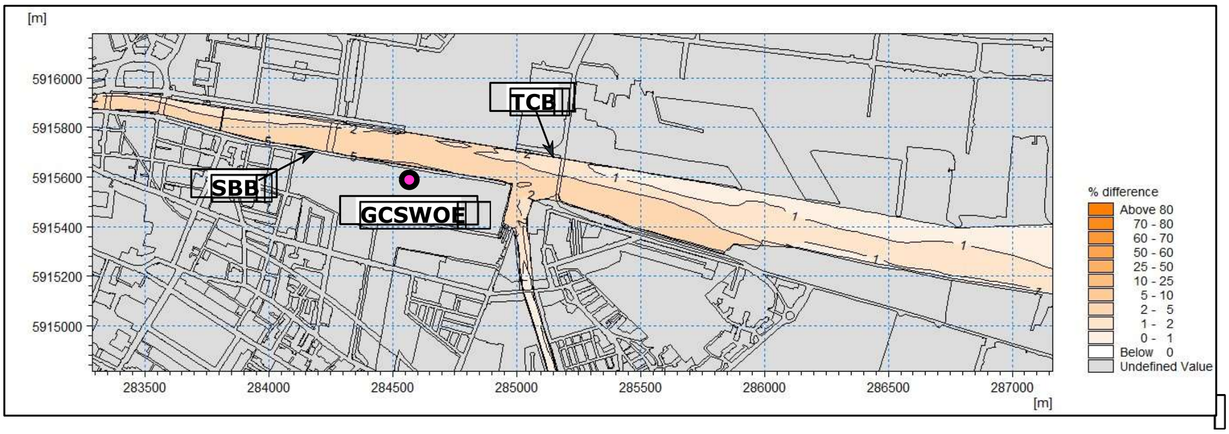


Figure 7.27 Percent difference in all year 95%ile of E.coli (storm conditions), vertically averaged.

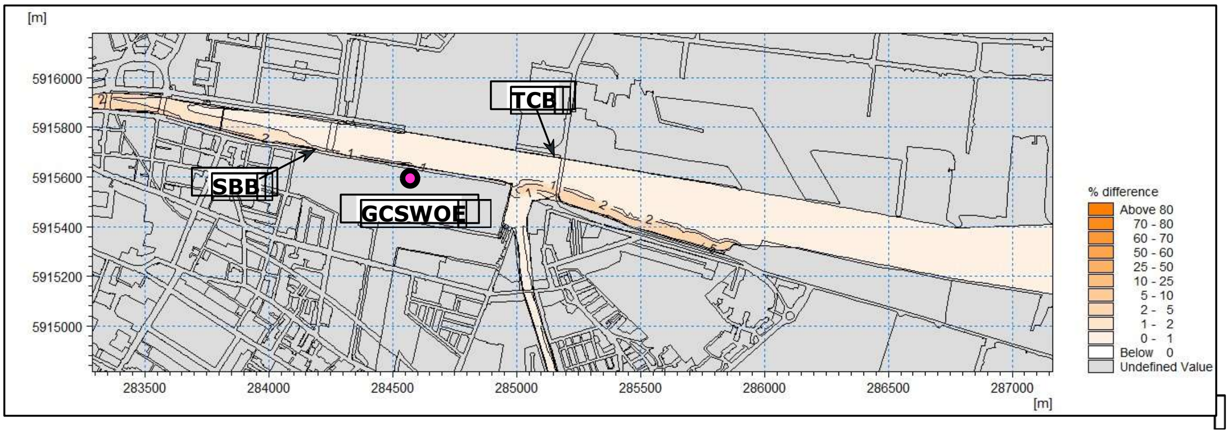


Figure 7.28 Percentage difference in all year 95%ile of E.coli (storm conditions), maximum through the water column.

The results show that in the same manner as seen in the time varying E.coli run, the 95%ile values are in the range 2,500-5000 MPN/100ml, similar to that seen in the baseline.

The difference plots show that generally there is a worsening of conditions of about 2% over much of the Lower Liffey, with a peak to 5% difference at the outfall. The extent of the impact is greater than in the time varying result, due to the extreme concentration (worst case scenario) of the outflow, with higher concentrations focused along the southern bank. This is seen to be also more extensive upstream of the Samuel Beckett bridge than in the time varying run. Downstream, the 1% difference contour is slightly further downstream than the time varying run, though it is again seen to be finishing close to the southern bank.

At the downstream end of the model, indicative of the outflow towards the sea, the difference reduces to less than 1% between the baseline and the storm-based scenario. The storm scenario impact of the GCWSOE on the background E.coli counts in the River Liffey slight/imperceptible with no impact predicted on designated bathing waters in Dublin Bay.

7.6 Impacts on Receiving Water Quality Summary.

The numerical model was developed using measured and modelled data as boundary conditions for the hydrodynamics and was demonstrated to re-create the key hydrodynamic processes known to control this part of the estuary. This was coupled with advanced ecological models to provide an assessment of the fate of four key water quality parameters including DIN, MRP, *E. coli* and BOD.

The results of the time series model run sought to assess the change in water quality parameters concentrations as result of the extension of the stormwater outfall to the River Liffey. The modelling identified that:

- For DIN there was **no discernible change** in the achievement of the EQS compared to the baseline, with the % difference in concentration in much of the Lower Liffey being below 1% and the higher levels constrained to the outfall area.
- For MRP there was **no discernible change** in the achievement of the EQS compared to the baseline, with the % difference in concentration in much of the Lower Liffey being less than 1%.
- BOD showed **no discernible change** in the achievement of the EQS compared to the baseline, however this parameter showed the greatest increases compared to the baseline. It was noted that even with this large percentage increase, the resultant values were still well below the EQS thresholds.
- For *E. coli* the increases due to the GCSWOE were seen to be less than 2% in the time varying scenario reducing rapidly away from the outfall and between 2 and 5% for the storm-based scenarios. Importantly, at the downstream boundary these both reduced to less than a 1% increase compared to the baseline.

All of the modelling highlighted the potential for localised increases in the occurrence of the water quality parameters, however the ability of the hydrodynamic system to dilute and remove these increases over relatively short spatial scales is demonstrated by the rapid reduction seen in the results as you move away from the proposed GCSWOE. Overall, the impact of the GCSWOE on the water quality in the receiving waters is considered to be *slight/imperceptible adverse*.

The removal of the stormwater outfall from the Grand Canal Basin will lead to a reduction in input of polluted water. This would have a positive effect on the Basin as it would improve the water quality within the Basin and has the potential to improve the overall WFD status of the waterbody. The magnitude of impact will be *permanent moderate and beneficial*. This *positive impact* on the Grand Canal Basin is considered to outweigh the *slight/imperceptible adverse effect* on the River Liffey water quality.

7.7 Mitigation Measures

7.7.1 Construction Phase

A CEMP has been prepared and will be included in Volume 3, Appendix 17A to the EIAR which will be updated and finalised by the Contractor prior to construction commencing.

Relevant legislation and best practice guidance that have been considered includes but not limited to the following:

- CIRIA C532 Control of water pollution from construction sites. Guidance for consultants and contractors (CIRIA, 2019 - www.ciria.org);
- CIRIA C515 Groundwater control – design and practice, 2nd ed. (CIRIA, 2019 - www.ciria.org);
- CIRIA Guidance C741: Environmental good practice on site guide (Charles & Edwards, 2015; CIRIA, 2019 - www.ciria.org);
- Inland Fisheries Ireland 2016 Guidance on Protection of Fisheries During Construction Works In and Adjacent to Waters;
- National Roads Authority (NRA) Guidelines for the Crossing of Watercourses During the Construction of National Road Schemes; and
- National Roads Authority (NRA) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.

Dredging, piling and release of suspended solids into surrounding waters

In order to reduce the impact of silt, the Contractor will be required to adopt the use of a silt curtain for the works within the Grand Canal Basin. The silt curtain is to reach from top water level to the bed level. This will limit the silt generated from dispersing through the Basin.

- The contractor will prepare and implement a surface water plan including appropriate barrier controls to prevent potentially polluted surface water from the site reaching Grand Canal Basin or the River Liffey (e.g. bunding);
- The dispersion of mud will be controlled at entry and exits to the site using wheel washes and/or road sweepers, and tools and plant will be washed out and cleaned in designated areas. Containment of wheel washings for treatment prior to discharge will be required;
- Where sheet piles and cofferdams are being installed, the contractor will update the CEMP and provide method statements as to how the proposed mitigation measures will be achieved to minimise the disturbance and resuspension of sediments in the water;
- Silt fencing/curtain or similar will be installed along/around excavated ground where the risk of sediment runoff to the River Liffey or the Grand Canal basin exists; and
- Bunding will be installed along Hanover Quay, between the area of works along the quay and the Grand Canal Basin prior to works commencing in this area. All surface water run-off from the construction site will be directed to a temporary facility, where the flow will be attenuated, and sediment allowed to settle, before passing through a hydrocarbon interceptor prior to discharge. Bunding will only be removed when sediment movement is no longer a risk.

Contaminated soils and surface run-off

- Silt-traps will be maintained and cleaned regularly during the course of site works;
- Lock gates will be kept closed while the construction works take place within the basin. Only necessary controls of water levels within the basin will be permitted;
- In order to prevent input of cementitious materials into the Grand Canal Basin from the below water elements of the construction, concrete structural elements will be precast, wherever possible;
- Concrete to be used below water will be a concrete mix for aquatic/marine environment, e.g. fast curing with good anti-washout properties;
- Where concrete or other wet materials are to be used over/below water, appropriate bunded platforms will be in place to capture any spilled concrete, sealants or other materials;
- Concrete mixing will be undertaken in designated impermeable areas to reduce the risk of runoff entering surface or groundwater environment;
- On-site concrete batching and mixing activities will only be allowed at the identified construction compound areas;
- A geotextile screen (silt curtain) and boom with oil barrier will be required around such aquatic works to prevent runoff, silt or oil from polluting the water; and
- Concrete waste and wash-down water will be contained and managed on site to prevent pollution of all surface watercourses.

Accidental spillages

- Measures set out in the Construction Industry Research and Information Association (CIRIA) on the control and management of water pollution from construction sites (2006) will be adhered to by the Contractor. Good construction management practices will be employed;
- During the construction stage, all potentially harmful substances (e.g. oils, diesel, concrete etc.) will be stored in accordance with the manufacturer's guidelines regarding safe and secure buildings/compounds;
- The contractor will ensure that adequate means to absorb or contain any spillages of these chemicals are available at all times. Suitable measures will be taken to minimise the potential for pollution arising from accidental spillage;
- Oil booms and oil soakage pads will be maintained on-site to enable a rapid and effective response to any accidental spillage or discharge. These will be disposed of correctly and records will be maintained by the environmental manager of the used booms and pads taken off site for disposal;
- Bunding through drip trays on plant and machinery will be provided to prevent discharge of chemical spillage from the sites to surface water;
- The site compound storage areas and cleaning areas will be rendered impervious and will be constructed to ensure no discharges will cause pollution to surface or ground waters;
- Designated locations for refuelling land-based plant and machinery off site, >100m from waterbody;
- Refuelling protocol to include:

- Refuelling of barge/vessels to take place at designated area at/adjacent to site compound at Hanover Quay;
- Vessels to be securely docked before attempting to refuel;
- Clear and easy access for personnel to get from tank on quay to refuelling point on boat/barge;
- Refuelling to be carried out under strict supervision of Environmental Officer;
- Refuelling by trained, authorised and named personnel only;
- Refuelling pipe to be supervised at all times;
- Refuelling from storage tank by pump only, with automatic cut-off, and automatic retraction of hose pipe. Adequate length of hose required, to enable full and easy access to fuelling point on vessel;
- No fuel to be stored at site compound; and
- Spill kits and booms to be available in case of accidental spillage.

- Potentially contaminated run off from plant and machinery maintenance areas will be managed within the site compound surface water collection system;
- Spill kits will be stored in the site compound with easy access for delivery to site in the case of an emergency. A minimum stock of spill kits will be maintained at all times and site vehicles will carry spill kits at all times. Spill kits will include suitable spill control materials to deal with the type of spillage that may occur and where it may occur;
- Leaking or empty oil drums will be removed from site immediately and disposed of via an appropriately licensed waste disposal contractor;
- All hazardous substances on-site will be controlled within an enclosed storage compounds that will be fenced off and locked when not in use to prevent theft and vandalism; and
- The appointed contractor will ensure that no harmful materials will be deposited into the River Liffey or the Grand Canal Basin, including the drainage network, on or adjacent to the site.

Biosecurity

The eradication of the invasive species from freshwater systems is virtually impossible, so biosecurity measures will be required to ensure that the proposed development does not result in their spread to other waterbodies.

Flood risk

As a significant number of people will be located at the compound during the construction phase, a number of measures will be put in place to minimise flood risk. It is recommended that the finished floor level of the compound be constructed at a level greater than the 0.5% AEP flood level at the site. The 0.5% AEP coastal flood level nearest to Compound 3 is +3.11mOD, therefore the FFL of the compound will be set above this level. Materials will be carefully stored to prevent spillage in the event of an extreme flood.

7.7.2 Operational Phase

No significant impacts have been identified during the operation phase, therefore mitigation measures are not proposed.

7.8 Residual Impacts

7.8.1 Construction Phase

The construction of the new stormwater outfall will cause a re-suspension of sediment within the Grand Canal Basin. Potential pollution incidents caused by accidental spills or leaks, e.g. oil/ diesel from machinery and concrete have the potential to be transported in water from the Grand Canal Basin and thus impact on water quality downstream, such as the Lower River Liffey.

On implementation of the appropriate mitigation measures, it is expected that the potential impact during construction will be effectively mitigated.

The residual impact of the construction phase is assessed to be of *small adverse magnitude and slight negative significance and temporary in duration* on account of the short-term works to be carried out in the basin.

7.8.2 Operational Phase

The removal of the stormwater outfall from the Grand Canal Basin will lead to a reduced input of polluted water to the basin. This will have a long-term positive effect as it will improve the water quality within the basin and has the potential to improve the overall WFD status of the waterbody.

The residual impact during operation is assessed to be *positive* due to the improvement of water quality within the Grand Canal Basin.

The discharge from the combined stormwater overflow outfall will cause a very slight change in water quality in the River Liffey. The WQM report has shown that the hydrodynamic properties of the River Liffey will dilute and disperse contaminants over relatively short spatial scales with changes in pollution concentrations from the baseline being less than 1% in much of the Lower Liffey. There will be no discernible change in the ability to meet the surface water environmental quality standards (EQS). The impact will be *slight/imperceptible*.

There will be no change in the WFD status of the Lower River Liffey or Dublin Bay.

There will be no impact on the designated bathing waters of Dublin Bay.

7.8.3 Interactions

The interaction of Water Quality and Hydrology with other sections is described below:

Population and Human Health

During the construction phase there is potential for impacts on the water quality within the Grand Canal Basin through resuspension of particles or accidental spill of pollutants. This will impact to varying degrees on the recreational users and water-based residents in the Dock. In the absence of mitigation there is the potential for *short-term, small adverse in magnitude and slight negative in significance impacts.* No potential impacts on human health as a result of changes in water quality at River Liffey are predicted. The enhanced water quality arising from the proposed development will facilitate growth in the local water activity employment sector.

Biodiversity

As a result of the project, the water quality within the Grand Canal Basin will improve. This in turn will improve aquatic habitats in the basin and the environment for species inhabiting the basin.

Impacts on sediment include disturbance to the silt bed of the Grand Canal Basin from dredging the footprint of the pipeline, lowering pipeline sections and construction of Transition Chambers. This could impact on the quality and distribution of aquatic habitats and species. However, potential impact will be short-term and the pipeline will provide substrate for species to recolonise. Contamination of benthic sediment during construction due to accidental spillages and fugitive emissions could end up in the Grand Canal Basin or River Liffey due to surface water run-off.

The change in water quality of the receiving waters could indirectly impact on ecological receptors downstream. The water quality modelling results of the change in water quality were reviewed to enable impacts to be assessed.

Land, Soils, Geology and Hydrogeology

The disturbance and displacement of the silt bed due to construction activities in the Basin and River Liffey will result in the redistribution and suspension of silt and sediments. The impact in the basin will be permanent in duration, small adverse in magnitude and slight negative in significance. There is a significant flow in the Liffey and taking into account the dilution effects and tidal flush the magnitude of the impact will be negligible in magnitude and imperceptible in significance.

Potential impacts during the construction phase also include the potential for leakage or spillage of construction related materials on site. Earthworks for the works on Hanover Quay and SJRQ will also require temporary dewatering to facilitate construction.

As contaminated soil will be removed from site, the contaminant flux to groundwater will be reduced. As such, the predicted impact on the hydrogeological environment is permanent, positive and imperceptible.

Waste Management

The soils at Hanover Quay and SJRQ are contaminated. The excavation of contaminated material from Hanover Quay, and SJRQ will require disposal. The storage of contaminated soils has the potential to be mobilised by rainfall and run off to surface water (the Basin or the Liffey). There is also potential for spillage of contaminated material arising from minor dredging works and piling works in the Basin.

Material Assets

During construction, water-based recreation activities will not be permitted in the vicinity of the works within the Basin. A number of house boats adjacent the Waterways Ireland Visitor Centre will be removed from the Inner Basin, as well as a number of their floating moorings. This will result in a *short-term moderate adverse impact* on the recreational activities in the area.

Construction in the vicinity of the 8ft city sewer under the basin bed at MacMahon Bridge has the potential to result in a *large/moderate adverse in magnitude and significant temporary negative* impact in the event that the sewer is damaged during construction. Water mains may be required to be temporarily diverted or supported during the construction works.

The improved water quality within the Grand Canal Basin will have a positive impact on the amenity value

7.8.4 Cumulative Impacts

The following projects or plans were identified as potential sources of cumulative impacts:

- Alexandra Basin Redevelopment (ABR)
- Bus Connects
- Dodder Public Transportation Opening Bridge
- Dublin District Heating System
- Grand Canal Greenway- Grand Canal Dock Section.
- Grand Canal Quay East development works
- Maintenance dredging in Dublin Port
- MP2 Project, Dublin Port Company
- Ringsend Waste Water Treatment Plant Upgrade
- South Campshire Flood Defence Wall Project
- Treasury Building
- Dublin City Development Plan 2016-2022
- Dublin Port Masterplan 2012-2040
- Greater Dublin Area Cycle Network Plan (NTA, 2013)

Ringsend WWTP - There is a potential for cumulative impacts on water quality with the discharge from the Ringsend wastewater treatment plant. However, as the changes in water quality anticipated upstream of the Ringsend WWTP due to the proposed GCSWOE project are so small, the contribution of the GCWSOE to any cumulative impacts on water quality will be imperceptible. There will be no significant negative cumulative impacts or in combination impacts during the operational phase.

Having applied the mitigation measures to manage and reduce the risk of pollution, there will be no adverse significant impact upon the integrity of the European sites and receiving environment concerned. Also, following appropriate mitigation measures the residual impacts from the proposed GCSWOE development are small adverse in magnitude and slight negative in significance and short-term during construction phase. Therefore, no significant negative cumulative or in combination impacts will occur.

7.9 Monitoring

The Grand Canal Basin will be monitored during the construction phase of the project to check for the level of suspended solids in the water at different locations while works are taking place within the Basin. If a significant increase of suspended solids is recorded, the works will be temporarily stopped and be re-assessed and further mitigation measures be put in place before works can continue.

During the operational phase, the water quality in the River Liffey will be monitored by the EPA (as part of the WFD). DCC will monitor the water quality from the new stormwater outfall. The water monitoring will enable comparison with the results of the modelling of the predicted water quality to ensure there will be no negative impact on River Liffey and downstream habitats and species. Adequate measures will be taken if the monitoring finds the discharge to have a negative impact on water quality and such measures take the Water Framework Directive into account.

7.10 References

The following sources have been consulted in the preparation of this EIAR:

BEC Consultants Ltd (2020) *Grand Canal Dock Storm Water Outfall Project: Aquatic Ecology and Alien Invasive Species Survey.*

CIRIA (2001) *Control of Water Pollution from Construction Sites- Guidance for Consultants and Contractors.*

EPA (2022) *Guidelines on the Information to Be Contained in Environmental Impact Assessment Reports,* Environmental Protection Agency, available: https://www.epa.ie/publications/monitoring--assessment/assessment/EIAR_Guidelines_2022_Web.pdf [accessed 1st May 2022]

EPA (2017) *Guidelines on the Information to Be Contained in Environmental Impact Assessment Reports DRAFT,* Environmental Protection Agency, available: http://www.epa.ie/pubs/advice/ea/EPA%20EIAR%20Guidelines.pdf [accessed 1st April 2022].

EPA (2020) EPA Maps [online], Next Generation EPA Maps, available: https://gis.epa.ie/EPAMaps/ [accessed 25 Jan 2022].

DHI (2022) *Grand Canal Storm Water Outfall Extension Water Quality Assessment: Numerical Model Report.*

GSI (2021) Geological Survey Ireland Spatial Resources [online], available: https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228 [accessed 25 Jan 2022].

Irish Water (2018b) *Ringsend Wastewater Treatment Plant Upgrade Project Environmental Impact Assessment Report*, available: https://www.water.ie/planning-sites/ringsend-planning/environmental-documents/ [accessed 1 Feb 2022].

Irish Water (2021) *Ringsend Wastewater Treatment Plant Upgrade Project* [online], Irish Water, available: https://www.water.ie/projects-plans/ringsend/ [accessed 1 Feb 2022].

J. B. Barry & Partners (2020a) *Grand Canal Storm Water Outfall Extension - EIA Screening Report.*

J. B. Barry & Partners (2020b) *Grand Canal Storm Water Outfall Extension - AA Screening Report.*

JBA (2021) *Grand Canal Storm Water Outfall Extension - Natura Impact Statement.*

National Roads Authority (NRA) (2009) *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.*

Office of Public Works (OPW) (2009) *The Planning System and Flood Risk Management Guidelines for Planning Authorities.*

OPW National Flood Information Portal [accessed 25 Jan 2022].

SECTION 8: Land, Soils, Geology, and Hydrogeology

8.1 Introduction

This section of the EIAR will address the likely significant impacts on land, soils, geology, and hydrogeology during the construction and operational phases of the proposed development.

Phase 1 of this project was completed in 2002 and comprised the installation of a culvert under Asgard Road between Hanover Quay and SJRQ. Phase 2 of the project is required to complete the Grand Canal Storm Water Outfall Extension project.

A detailed description of the proposed project is contained in Volume 2, Section 2 of this EIAR.

The existing surface water outfall will be intercepted in Transition Chamber 1 in the Inner Dock and then continue via 5 no. 1.5m diameter pipelines under MacMahon Bridge as far as Transition Chamber 2 in the Outer Dock. At this point 2 no. 2.4m diameter pipelines will be constructed under the platform as far as Transition Chamber 3 located in Hanover Quay. From here a 4.0m by 2.7m box culvert will be constructed as far as the existing Phase 1 Culvert at Asgard Road. The proposed new outfall structure at SJRQ will connect back to the existing Phase 1 Culvert on Asgard Road. The pipeline within the basin will be laid along concrete cradles placed along the basin bed.

The land-based element of the pipeline along Hanover Quay and on SJRQ will be constructed using open cut methods within a secant wall.

This assessment was drafted by Kieran O'Dwyer who is a Technical Director with J. B. Barry and Partners and has over 40 years' experience in the field of environmental and hydrogeological consultancy. He holds a BE from UCD and is Member of the Institution of Engineers Ireland (MIEI) and International Association of Hydrogeologists (IAH). He is the overall project manager responsible for the coordination of this EIAR. He was formerly a director with K. T. Cullen and Co. Ltd (Environmental Consultants) and a Regional Director with WYG Ireland. Kieran has been responsible for the Land Soils and Hydrogeology element of numerous Environmental Impact Assessments (including TII tranche 4 motorway service areas (3 No.), NRA Tranche 4 Motorway Service Areas (5 No. oral hearings), Ringsend Wastewater Treatment Plant Upgrade Project) and Greater Dublin Drainage (GDD) project and has presented specialist evidence at numerous planning oral hearings.

8.2 Methodology

8.2.1 Guidance

This section has been prepared in accordance with the following specific guidelines.

- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports by the Environmental Protection Agency (EPA) (EPA, 2022);
- Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports by the Environmental Protection Agency (EPA) (EPA, 2017);
- Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements by the Institute of Geologists of Ireland (2013);
- Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes by National Roads Authority (NRA) (NRA, 2009);
- Guidance on the Management of contaminated Land and Groundwater at EPA Licensed Sites, EPA 2013;
- European Communities Environmental Objectives (Groundwater) Regulations, 2010 (S.I. No. 9 of 2010) (as amended);
- Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration (Groundwater Directive);
- Waste Management Act of 1996, 2001 and 2003;

- Waste Management (Facility Permit and Registration) Regulations 2007, S.I. No. 821 of 2007 (as amended); and
- Waste Management (Collection Permit) Regulations 2007, S.I. No. 821 of 2007 (as amended).

8.2.2 Desktop Data Sources

- Geological Survey of Ireland (GSI) online database and Map Viewers have been consulted (https://www.gsi.ie/en-ie/data-and-maps/Pages/default.aspx);
- EPA maps (https://gis.epa.ie/EPAMaps/);
- Catchments.ie;
- Geological Survey of Ireland (GSI) 1:100,000 scale Bedrock Geology Map, Sheet 16 (Kildare-Wicklow);
- Teagasc soil mapping;
- Aerial Photographs;
- Historical mapping;
- WFD classification for groundwater bodies;
- Water quality assessment reports;
- River basin management plan;
- GSI Bedrock Geological Map of Ireland;
- Dublin City Council Development Plan 2016-2022;
- North Lotts and Grand Canal SDZ Planning Scheme 2014;
- Feedback from consultations with statutory consultees, interested organisations and affected third parties; and
- Site Visits.

8.2.3 Site Specific Data.

Several site investigation campaigns have been carried out to determine the subsurface conditions of the proposed development site. Site investigation data has been collected from a number of sources, some of which were conducted for this proposed development and some for nearby developments, as shown in Table 8.1.

Table 8.1: Summary of ground investigations

Contractor	Description of investigation	Details of investigation	Date of works
Geotechnical Specialists Ltd (GSL)	Dublin Gas Project	Geotechnical Report.	1989
Site Investigations Ltd (SIL)	Thomas Garland and Partners (Ringsend Information Centre)	4 Boreholes.	1991
IGSL	Grand Canal Docks Stormwater Outfall Extension	15 Boreholes. 3 Rotary cores. 3 Trial pits.	1996
IGSL	Parkman DDDA Site	3 Boreholes.	1999
IGSL	Ellier Developments (Hanover Quay)	Geotechnical Report.	2001
Geotechnical Specialists Ltd	Grand Canal Docks Stormwater Outfall Extension	15 Boreholes. 3 Rotary cores.	2002
Halcrow Group Limited	Grand Canal Docks Stormwater Outfall Extension	GIR based upon GSL 2002 results.	2002
Site Investigations Ltd	Grand Canal Docks Stormwater Outfall Extension	2 Boreholes.	2008
Glover Site Investigation Ltd	Grand Canal Docks Stormwater Outfall Extension	2 Boreholes.	2008

Contractor	Description of investigation	Details of investigation	Date of works
Causeway Geotech Ltd	Blood Stoney Bridge – Ground Investigation Factual Report	13 Boreholes.	March 2019

This section does not address the management/ disposal of potentially contaminated waste/ soils; which is referred to in Volume 2, Section 13 Waste Management.

8.2.4 Assessment Methodology.

The existing baseline environment is described in terms of its attributes. Data were gathered from desk studies, site visits and public consultation.

- Importance criteria were selected for attributes that reflect the hydrological and hydrogeological environments. The attribute importance was evaluated on the basis of the existing baseline data and the criteria in Table 8.2: Criteria Rating for Attribute Importance – Soils and Geology, and Hydrogeology.
- The impacts of the proposed project (during both the Construction Phase and Operational Phase) on these attributes were described and considered in terms of duration, the proportion of the attribute that was impacted. The magnitude of the impact was assessed based on the criteria described in Table 8.3 Rating Criteria for Estimation Magnitude of Impact on Geological and Hydrogeological Attributes.
- The significance of the impact was then assessed using the criteria in Table 8.4. The significance of an impact is based on the magnitude and the importance of the attribute being impacted.
- Mitigation measures to minimise these impacts were proposed and the residual impacts following mitigation were then reassessed.

Table 8.2: Criteria Rating for Attribute Importance – Soils and Geology, and Hydrogeology (NRA, 2009)

Importance	Criteria	Typical Examples	
		Soils and Geology	**Hydrogeology**
Extremely high	Attribute has a high quality or value on an international scale.		Groundwater supports river, wetland or surface water body ecosystem protected by EU legislation e.g. SAC or SPA status.
Very high	Attribute has a high quality or value on a regional scale.	Geological feature rare on a regional or national scale (NHA). Large existing quarry or pit. Proven economically extractable mineral resource.	Regionally Important Aquifer with multiple wellfields. Groundwater supports river, wetland or surface water body ecosystem protected by national legislation – NHA status. Regionally important potable water source supplying >2500 homes. Inner source protection area for regionally important water source.
High	Attribute has a high quality or value on a local scale.	Contaminated soil on site with previous heavy industrial usage Large recent landfill site for mixed wastes. Geological feature of high value on a local scale (County Geological Site). Well drained and/or highly fertility soils. Moderately sized existing quarry or pit. Marginally economic extractable mineral resource.	Regionally important Aquifer Groundwater provides large proportion of baseflow to local rivers. Locally important potable water source supplying >1000 homes. Outer source protection area for regionally important water source Inner source protection area for locally important water source.

Importance	Criteria	Typical Examples	
		Soils and Geology	**Hydrogeology**
Medium	Attribute has a medium quality or value on a local scale.	Contaminated soil on site with previous light industrial usage. Small recent landfill site for mixed wastes. Moderately drained and or moderate fertility soils. Small existing quarry or pit.	Locally Important Aquifer. Potable water source supplying >50 homes. Outer source protection area for locally important water source.
Low	Attribute has a low quality or value on a local scale.	Large historical and/or recent site for construction and demolition wastes. Small historical and/or recent landfill. Site for construction and demolition wastes. Poorly drained and/or low fertility soils. Uneconomically extractable mineral resource.	Poor Bedrock Aquifer. Potable water source supplying <50 homes.

Table 8.3: Rating Criteria for Estimation Magnitude of Impact on Geological and Hydrogeological Attributes (NRA, 2009)

Magnitude	Criteria	Typical Examples	
		Soils and Geology	**Hydrogeology**
Large Adverse	Results in loss of attribute	Loss of high proportion of future quarry or pit reserves. Irreversible loss of high proportion of local high fertility soils. Removal of entirety of geological heritage feature. Requirement to excavate / remediate entire waste site. Requirement to excavate and replace high proportion of peat, organic soils and/or soft mineral soils beneath alignment.	Removal of large proportion of aquifer. Changes to aquifer or unsaturated zone resulting in extensive change to existing water supply springs and wells, river baseflow or ecosystems. Potential high risk of pollution to groundwater from routine run-off. .
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute.	Loss of moderate proportion of future quarry or pit reserves. Removal of part of geological heritage feature. Irreversible loss of moderate proportion of local high fertility soils. Requirement to excavate / remediate significant proportion of waste site. Requirement to excavate and replace moderate proportion of peat, organic soils and/or soft mineral soils.	Removal of moderate proportion of aquifer. Changes to aquifer or unsaturated. zone resulting in moderate change to existing water supply springs and wells, river baseflow or ecosystems. Potential medium risk of pollution to groundwater from routine run-off.
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute.	Loss of small proportion of future quarry or pit reserves. Removal of small part of geological heritage feature.	Removal of small proportion of aquifer. Changes to aquifer or unsaturated zone resulting in

Magnitude	Criteria	Typical Examples	
		Soils and Geology	Hydrogeology
		Irreversible loss of small proportion of local high fertility soils and/or high proportion of local low fertility soils. Requirement to excavate / remediate small proportion of waste site. Requirement to excavate and replace small proportion of peat, organic soils and/or soft mineral soils.	minor change to water supply springs and wells, river baseflow or ecosystems. Potential low risk of pollution to groundwater from routine run-off.
Negligible	Results in an impact on attribute but not of sufficient magnitude to affect either use or integrity.	No measurable changes in attributes.	.
Minor Beneficial	Results in minor improvement of attribute quality.	Minor enhancement of geological heritage feature.	
Moderate Beneficial	Results in moderate improvement of attribute quality.	Moderate enhancement of geological heritage feature.	
Major Beneficial	Results in major improvement of attribute quality.	Major enhancement of geological heritage feature.	

Table 8.4:Rating Significance of Impacts (NRA, 2009)

Importance of Attribute	Magnitude of Impact			
	Negligible	**Small adverse**	**Moderate adverse**	**Large adverse**
Extremely high	Imperceptible	Significant	Profound	Profound
Very high	Imperceptible	Significant/Moderate	Profound/Significant	Profound
High	Imperceptible	Moderate/Slight	Significant/Moderate	Profound/Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight/Moderate

8.3 Characteristics of the Project

Project elements that will impact on the land, soils, geology and hydrogeology environments at the Grand Canal Docks are described below.

8.3.1 Culvert/Pipeline Within the Basin

During the construction phase, bed material will be moved/displaced within the basin. This involves dredging and pushing aside silt from the bed of the basin. A 200mm gravel bed will be laid down on the footprint of the pipeline, with deeper areas on soft spots where required. As much of the material as possible will be left within the basin and placed around the pipeline.

The pipeline will be lowered into place within the basin. Lengths of the precast U-shaped housing and pipeline sections will be lowered directly onto the silt bed. Concrete will be poured below the water level to fill up the U-shaped housing between the individual pipelines.

8.3.2 Transition Chamber 1 (3m), Transition Chamber 2 (3m)

The cofferdams for these chambers 1 and 2 within the basin will be constructed using conventional sheet piling.

8.3.3 Transition Chamber 3 (7.4m) and Culvert beneath Hanover Quay.

Excavations along Hanover Quay to allow for the new pipeline will be at a depth of 6.55m.

Sheet piles will not be permitted along the back of Hanover Quay wall i.e. in the Campshire itself. It is anticipated that Transition Chamber 3 and the Hanover Quay culvert will be constructed within a secant piled wall. This secant piled wall will be required to minimise working width, to contain the existing contaminated material and to limit any water ingress from the dock and surrounding ground. This will tie into the cofferdam or other temporary works provided by the Contractor in the dock to ensure a watertight seal.

8.3.4 Outfall Works and Tie-in at SJRQ

The Contractor must provide a cofferdam or other temporary works to ensure a watertight seal around the excavation/works in SJRQ and the River Liffey.

For the works in SJRQ, low vibration, Continuous Flight Augur (CFA) piles are required, as a condition specified by the Bord Gáis Transmission Main Department.

8.3.5 Temporary Construction Compounds

Three temporary construction compounds will be used will be used as a store for dry materials (steel, cladding, precast concrete etc) and potentially as a staging area for the works and car parking areas. Details of the construction compounds are provided in Volume 2, Section 2 of this EIAR.

The main construction compound will be located on the eastern end of Hanover Quay. This will be in situ for the duration of the construction stage.

A temporary construction compound is proposed for the culvert and outfall on SJRQ. This will be located within the works footprint on SJRQ.

For the duration of works in the Inner Basin a temporary compound will be made on Grand Canal Quay adjacent to the Waterways Ireland visitor centre.

8.4 Receiving Environment

8.4.1 Site Description

The proposed development site encompasses a linear stretch of submerged pipeline within the Grand Canal Basin and a land-based section on Hanover Quay and SJRQ. A section of pipeline has already been constructed underneath Asgard Road during Phase 1 of this project. The proposed development is located entirely within a man-made environment and the construction works will interact with hardstanding road and pavement surfacing, quay walls, the bed of the Basin, and the River Liffey.

The existing land in and around the Grand Canal Dock was originally reclaimed following the construction of a quay wall to the River Liffey. Historically, the Grand Canal Docks and its environs comprised heavily industrialised docklands. The area has undergone extensive rejuvenation and regeneration. The Grand Canal Basin itself is being developed as an amenity and facilitates a variety of watersports.

8.4.2 Topography

The quay walls at the Grand Canal Docks stand at approximately 4.2-4.5mOD (Ordnance Datum), and the water level within the basin is at 3.4mOD. There is an average water depth within both the Inner and Outer Basin of 4.9m. The silt bed of the Basin varies from approximately -1.9mOD to -0.2mOD.

The ground level at the works on Hanover Quay is approximately 4.4 mOD. The top of the quay wall at the proposed outfall structure at SJRQ at the River Liffey stands at approx. 3mOD, and the water level is 0mOD. The Mean High Water Springs (MHWS) at this location are +1.59m and the Mean Low Water Springs (MLWS) are -2.0m.

The surrounding terrestrial area is predominantly flat and made up of man-made surfaces including roads and pavements.

8.4.3 Bedrock Geology

GSI Mapping indicates that the proposed development area is underlain by dark limestone and shale from the Lucan Formation (GSI, 1:100,000 scale map, 2020). Refer to Figure 8.1. The Lucan formation (formerly the Dublin Formation) comprises Carboniferous dark grey to black, predominantly fine grained and occasionally cherty, micritic limestones that weather paler, usually to pale grey. The beds are predominantly fine grained distal turbidites in the north Dublin Basin. The formation is intermittently exposed on the coast between Rush and Drumanagh Head and ranges from 300m to 800m in thickness.

The geotechnical report by Halcrow, 2002 compiled borehole information from previous site investigation on nearby development projects. Bedrock recorded as "presumed weathered rock" was encountered in four boreholes within the Basin (SPT1, SPT2, SIL3, and SIL4, Site Investigations Ltd, 1991) at -10.51mOD, -10.26mOD, -8.61mOD, and -10.21mOD, respectively. Refer to Figure 8.7, below and to Volume 3, Appendix 8A and Appendix 8B.

Bedrock recorded as "fine grained moderately weathered argillaceous limestone locally weak to moderate strong" was encountered at -15.15mOD (BH38, Parkmann DDA Site) west of Asgard Road.

Bedrock was not encountered at the location of the proposed outfall at the River Liffey, and Boulder Clay was found to a depth of -14.71mOD at the boreholes' termination. A borehole (BH 10) drilled for the Blood Stoney Bridge project encountered medium strong indistinctly thickly laminated dark grey argillaceous limestone with widely spaced very thin beds of weak thinly laminated black carbonaceous mudstone was encountered at -15.8 mOD. Refer to Volume 3, Appendix 8C.

No excavation or construction will take place within the bedrock.

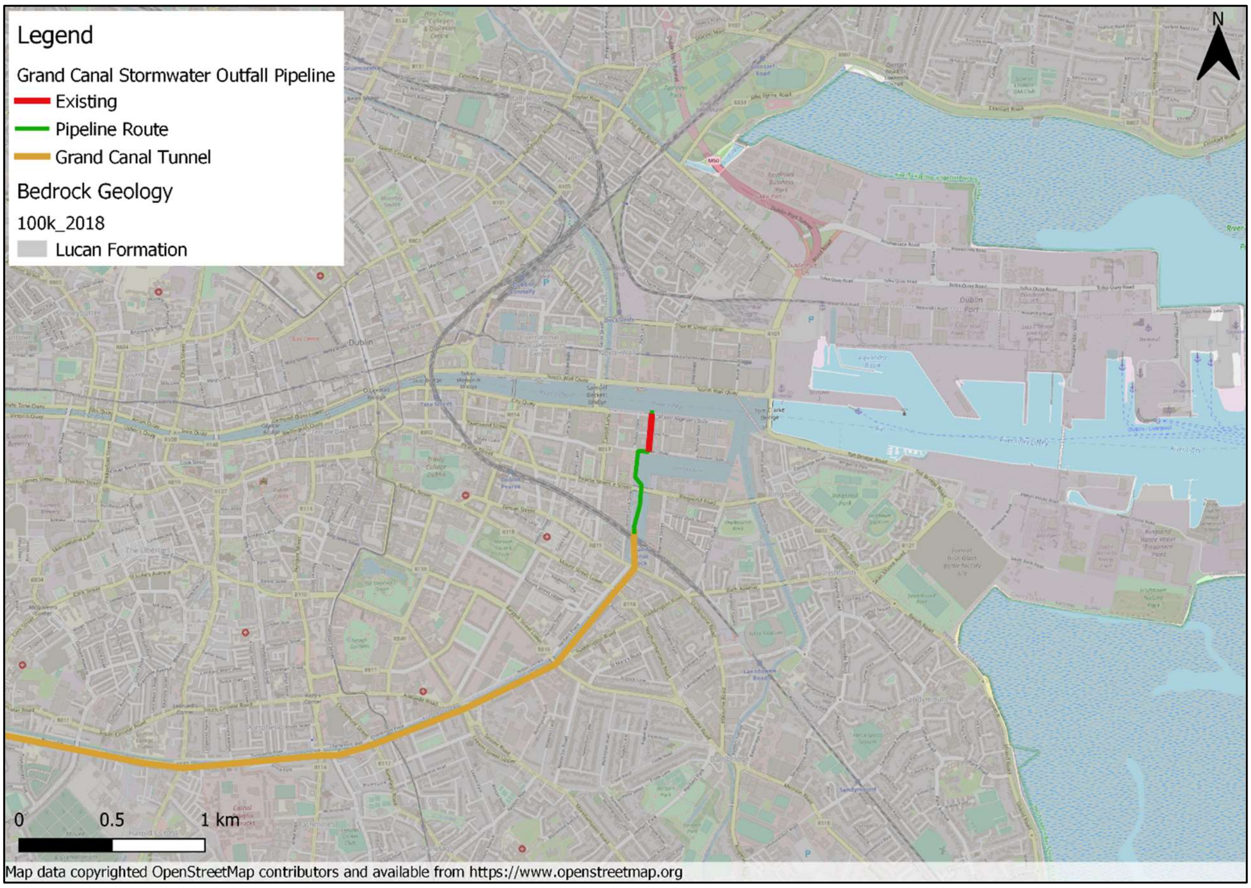


Figure 8.1 Bedrock Geology

8.4.4 Quaternary Deposits

GSI Mapping indicates that the proposed development area is underlain by made ground and the lithology sediment is classified as 'Urban'. Refer to Figure 8.2.

Site investigation data has confirmed that the terrestrial environment here predominantly comprises an uppermost stratum of made ground.

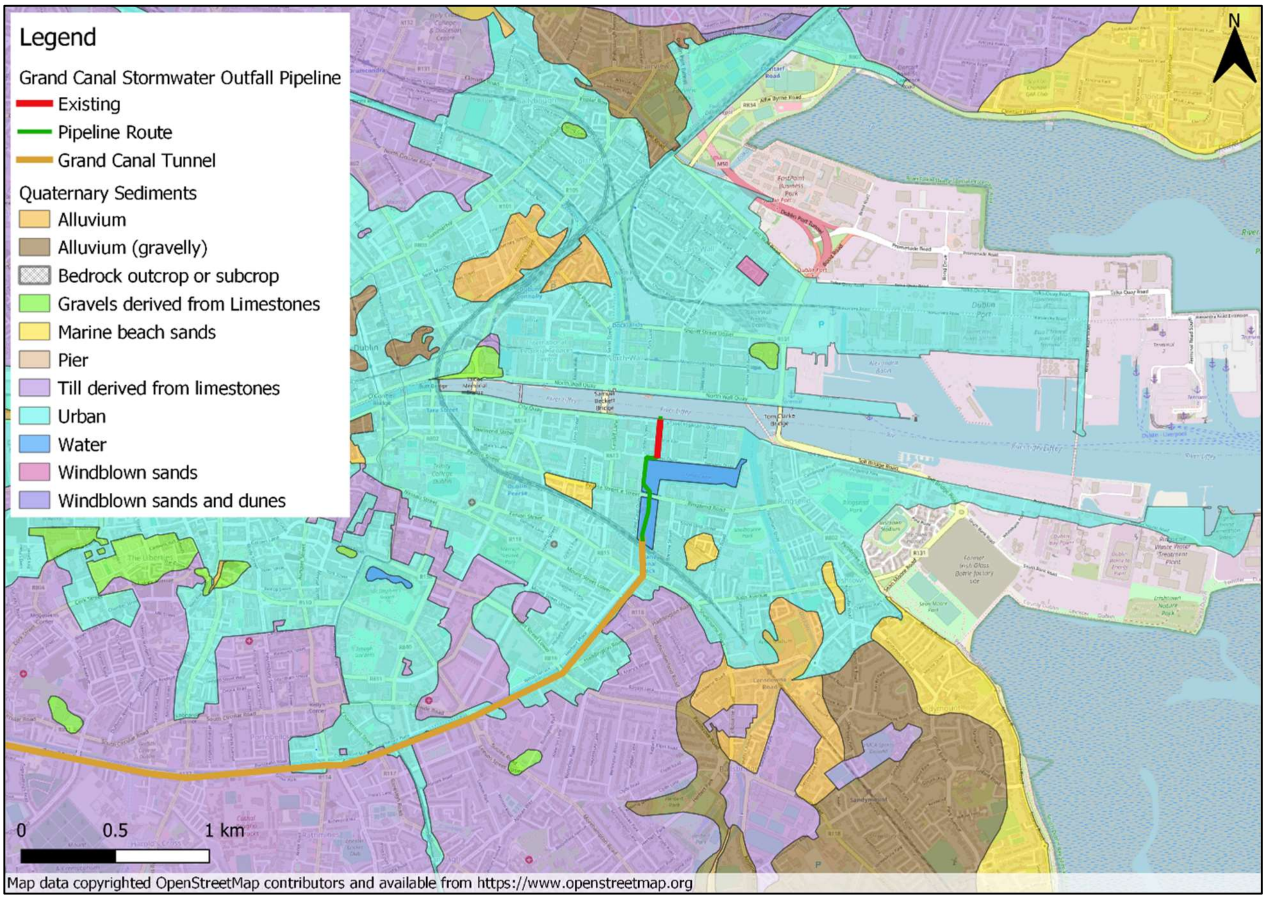


Figure 8.2 Quaternary Sediments

8.4.5 Karst Features

Karst is the name given to a landscape characterised by remarkable surface and underground forms, created from the action of the water on the permeable limestones. Surface and underground features occur where fissures and fractures have been widened by dissolution to allow the passage of groundwater. As groundwater flows through fissures and fractures, the rock is dissolved to form caves and caverns of varying sizes that are referred to as 'solution features'.

A review of the GSI karst database indicated there are no karst features within 5 km of the proposed development.

8.4.6 Economic Geology

Due to the urban environment in which the development is proposed there are no potential future quarry or pit reserves.

8.4.7 Hydrogeology

Aquifer Classification

GSI Mapping indicates that the entire route of the proposed development is underlain by the Lucan Formation which is classified as a Li (Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones). Refer to Figure 8.3. It should be noted that due to the proximity to Dublin Bay and the Lower Liffey Estuary (saline conditions), and the fact that the site is underlain by made ground, the aquifer is not considered suitable as a groundwater source in this area.

Low permeability clay deposits lie above the bedrock in this location and act as "aquitards". These limit vertical infiltration and restrict percolating water from reaching the bedrock aquifer. The overlying granular deposits have a much higher permeability and therefore present a greater recharge potential and storage capacity. As previously stated, given the proximity to Dublin Bay and the Lower Liffey Estuary these deposits do not represent an exploitable source of groundwater.

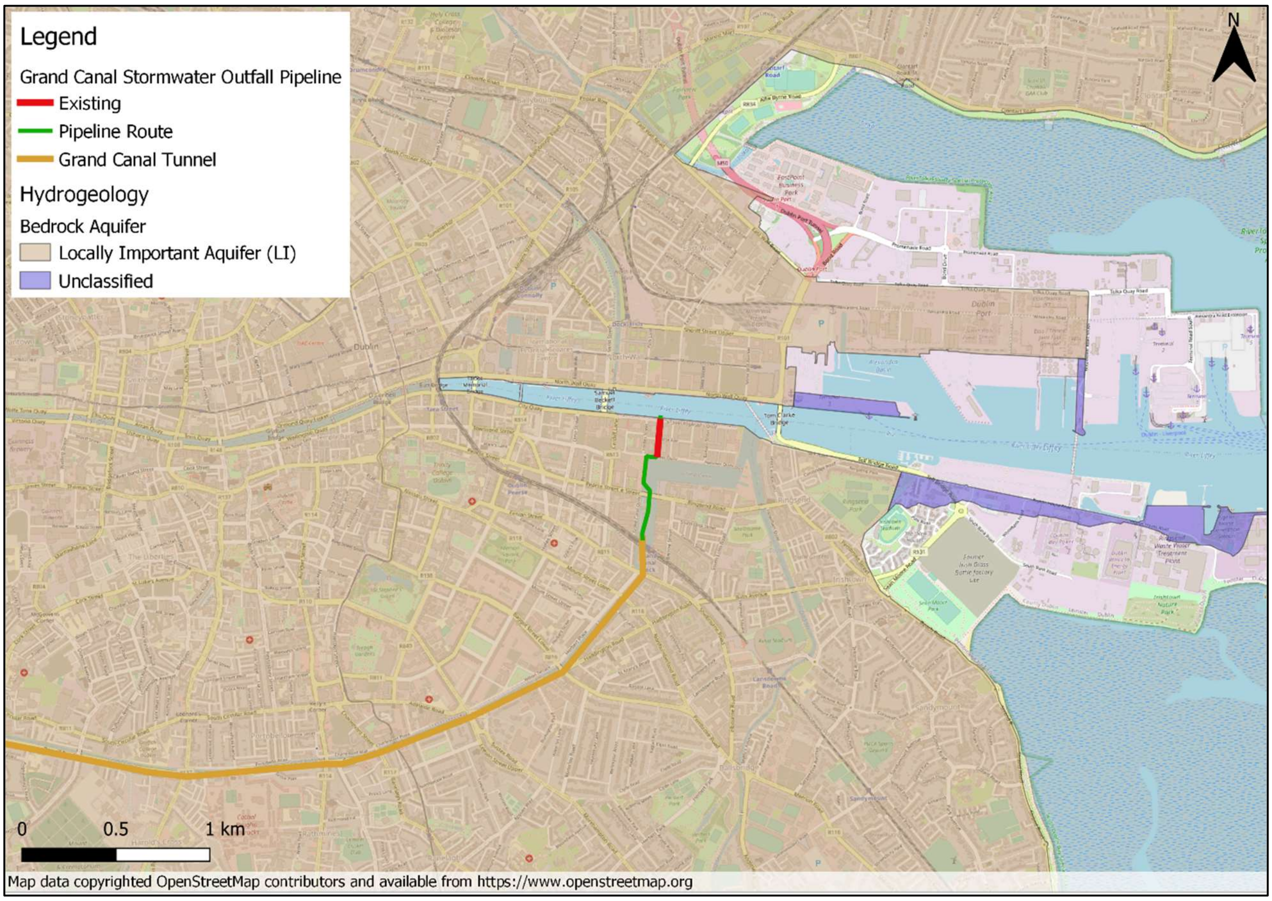


Figure 8.3 Bedrock Aquifer

Groundwater Vulnerability

Groundwater vulnerability provides an indication of the ease at which potential contaminants may vertically migrate down through sub surface strata to an underlying aquifer. GSI Mapping indicates that the groundwater vulnerability in the proposed development area is classified as “Low”. Refer to Figure 8.4.

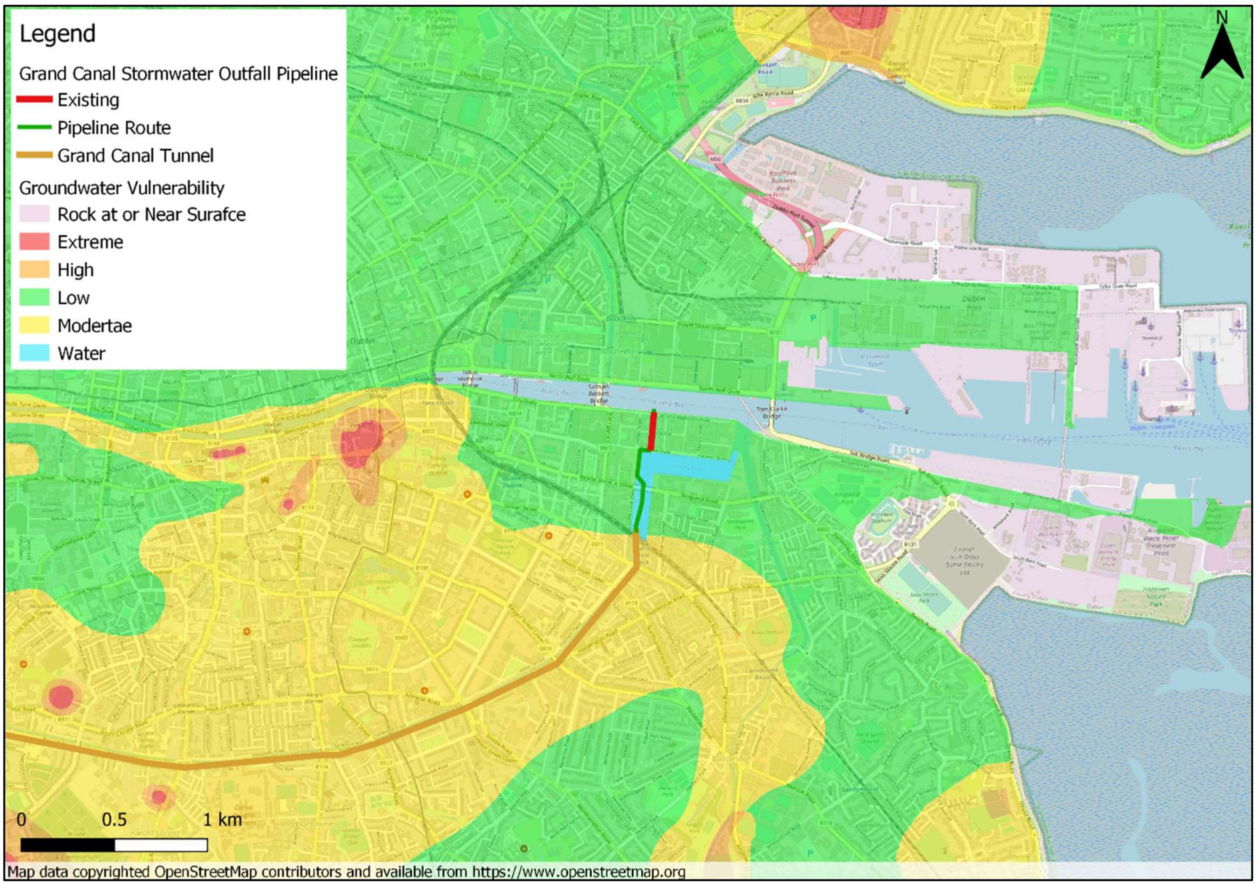


Figure 8.4 Groundwater Vulnerability

Groundwater Status

Groundwater Bodies (GWBs) have been designated for the purpose of the Water Framework Directive (WFD) (Directive 2000/60/EC). GWBs are subdivisions of large geographical areas of aquifers that allow more effective management to protect the groundwater and linked surface water or groundwater dependent features.

The site lies within the Dublin (IE_EA_G_008) GWB which is comprised primarily of rocks that have a low permeability and most of the groundwater flow occurs close to the surface with potential for additional isolated flow along fractures and fissures occasionally located up to depths of 50mbgl.

The overall groundwater flow will be East towards the coast or to the River Liffey. There are discharge pipes along the North and South Quay walls, indicating a swift removal of surface water (rainfall) from the impermeable surfaces preventing very little if any water to recharge the GWB in either the soil or bedrock aquifer.

The GWB Water Framework Directive (WFD) status (2013-2018) is "Good". The groundwater risk status for the region is 'under review'.

Water Supply

There are no recorded public groundwater supply abstractions within 2 km of the proposed development.

GSI well locations near the proposed Grand Canal Storm Water Outfall Extension are shown in Figure 8.5. Most of the well users within 2km of the proposed development are 'unknown' or for 'industrial' purposes, refer to Table 8.5.

Table 8.5 Wells within 2km buffer zone of the proposed development

GSI Name	Well Type	Use	Yield (m^3d)
2923SEW030	Borehole	Other	n/a
2923SEW029	Borehole	Other	n/a
2923SEW014	Borehole	Industrial use	261.8 (Good)
2923SEW053	Borehole	n/a	n/a
2923SEW051	Borehole	n/a	n/a
2923SEW054	Borehole	n/a	n/a
2923SEW052	Borehole	n/a	n/a
2923SEW050	Borehole	n/a	n/a
2923SEW037	Borehole	Unknown	60 (Moderate)
2923SEW038	Borehole	Unknown	22 (Poor)
2923SEW013	Borehole	Unknown	114.5 (Good)
2923SEW012	Borehole	Unknown	163.6 (Good)

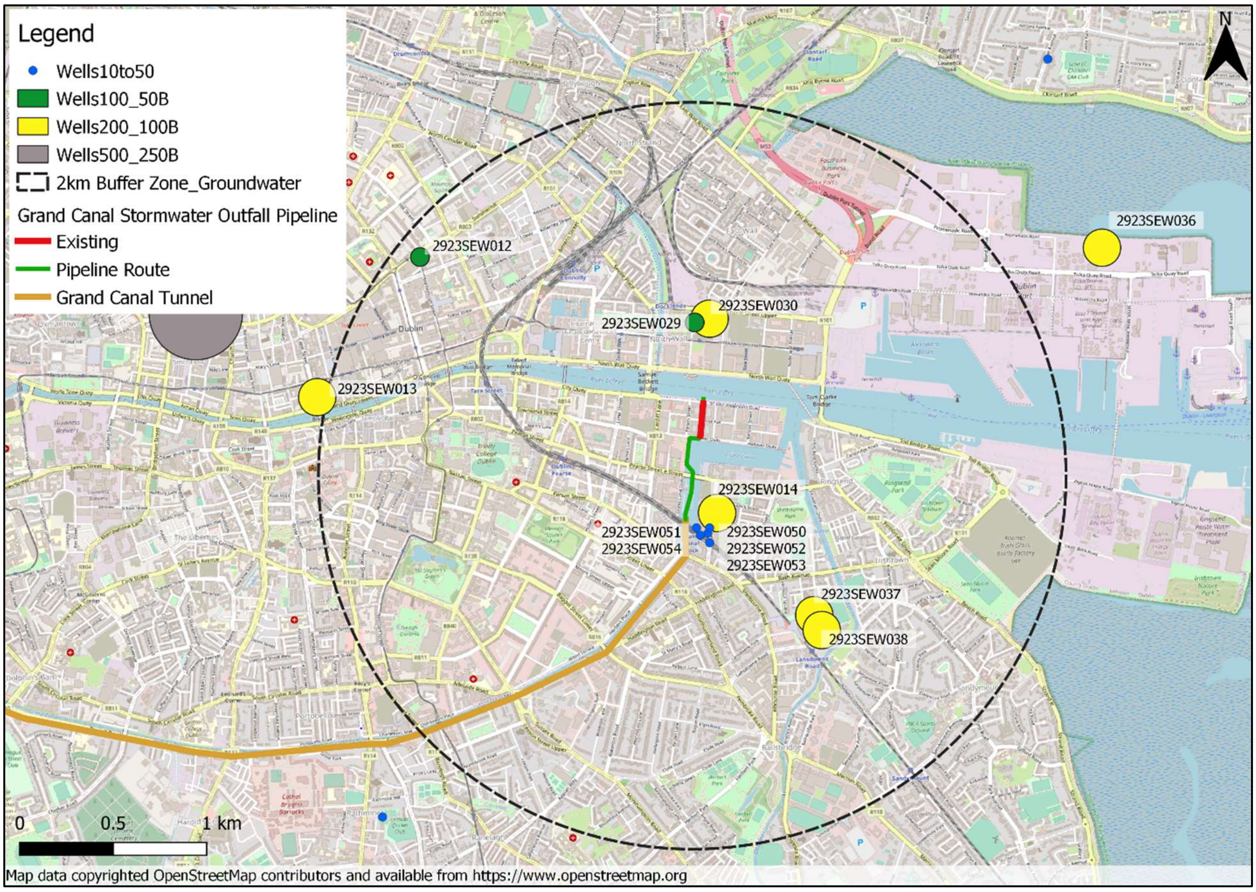


Figure 8.5 Wells within 2 km buffer zone

8.4.8 Geological Heritage

Geological heritage sites are defined by the GSI, based on an audit undertaken by County Geological Sites. These geological heritage sites are of national importance. Identified areas of geological heritage in close proximity to the proposed development and they are presented in Figure 8.6.

There are no designated Geological Heritage Sites within the 500m of the proposed development area.

The construction and operational effects of the proposed development will not interact with the geological qualifying interests of any Geological Heritage Site.

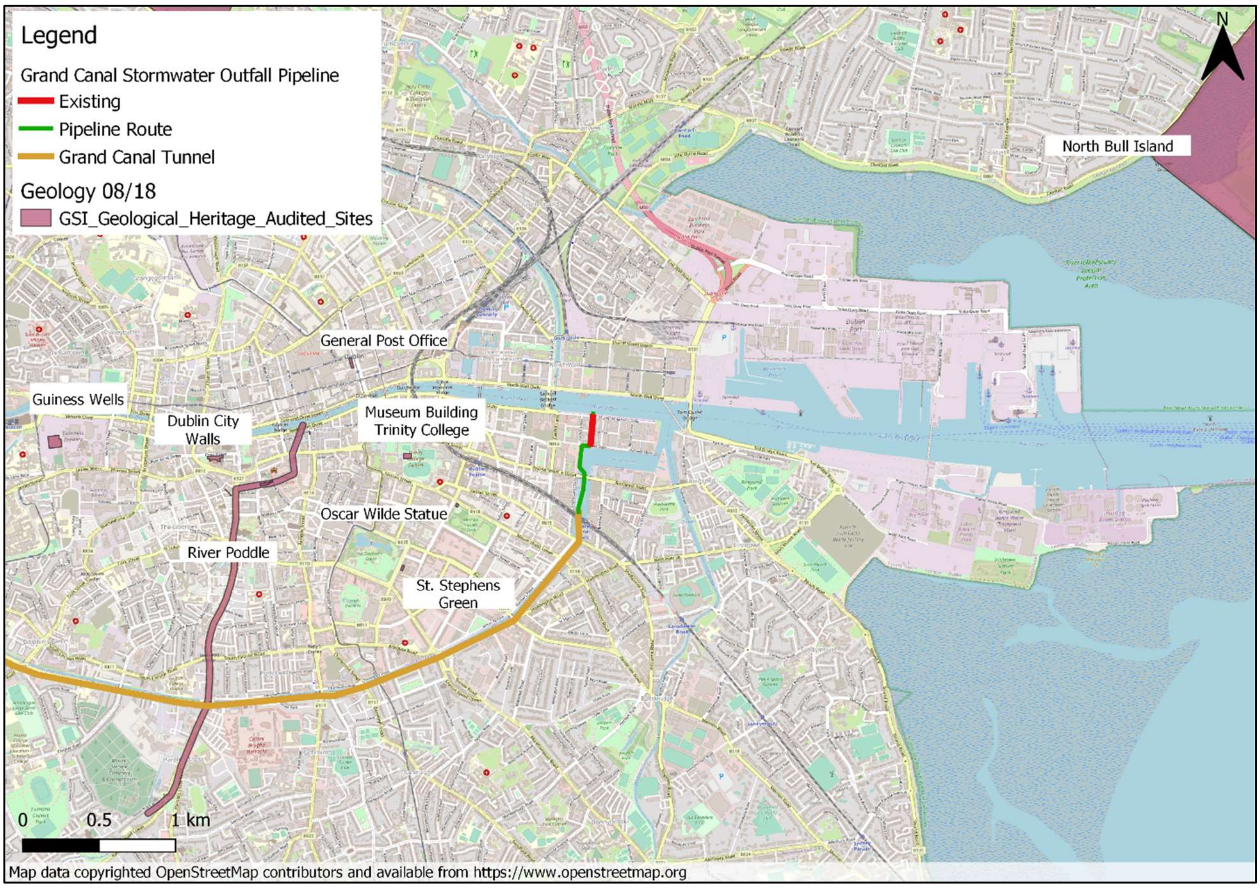


Figure 8.6 Geological Heritage Sites

8.4.9 Summary of Ground Conditions

Grand Canal Basin

The geotechnical report by Halcrow, 2002 compiled borehole information from previous site investigation on nearby development projects, refer to Figure 8.7 below and Volume 3, Appendix 8A and Appendix 8B. Site investigation boreholes relevant to the ground conditions within the Basin include:

- BH13 ((IGSL, 1999) (Halcrow, 2002));
- BH9 ((GSL, 2002) (Halcrow, 2002));
- JB32 ((JBB,1996) (Halcrow, 2002));
- BH12 (IGSL, 1996);
- BH8 ((GSL, 2002);
- SPT1 ((SIL, 1991) (Halcrow, 2002));
- SPT2 ((SIL, 1991) (Halcrow, 2002));
- BH7 (GSL, 2002);
- BH11 (IGSL, 1996);
- BH10 (IGSL, 1996);
- BH9 (IGSL, 1996);
- GSL19 (GSL, 1989) (Halcrow, 2002));
- BH6 (GSL, 2002);
- SIL3 ((SIL, 1991) (Halcrow, 2002));
- SIL4 ((SIL, 1991) (Halcrow, 2002));
- BHG5 (GSL, 2002);

- BH8 (IGSL, 1996);
- CSL18 ((GSL, 1989) (Halcrow, 2002));
- BH4 (GSL, 2002); and
- BH7 (IGSL, 1996).

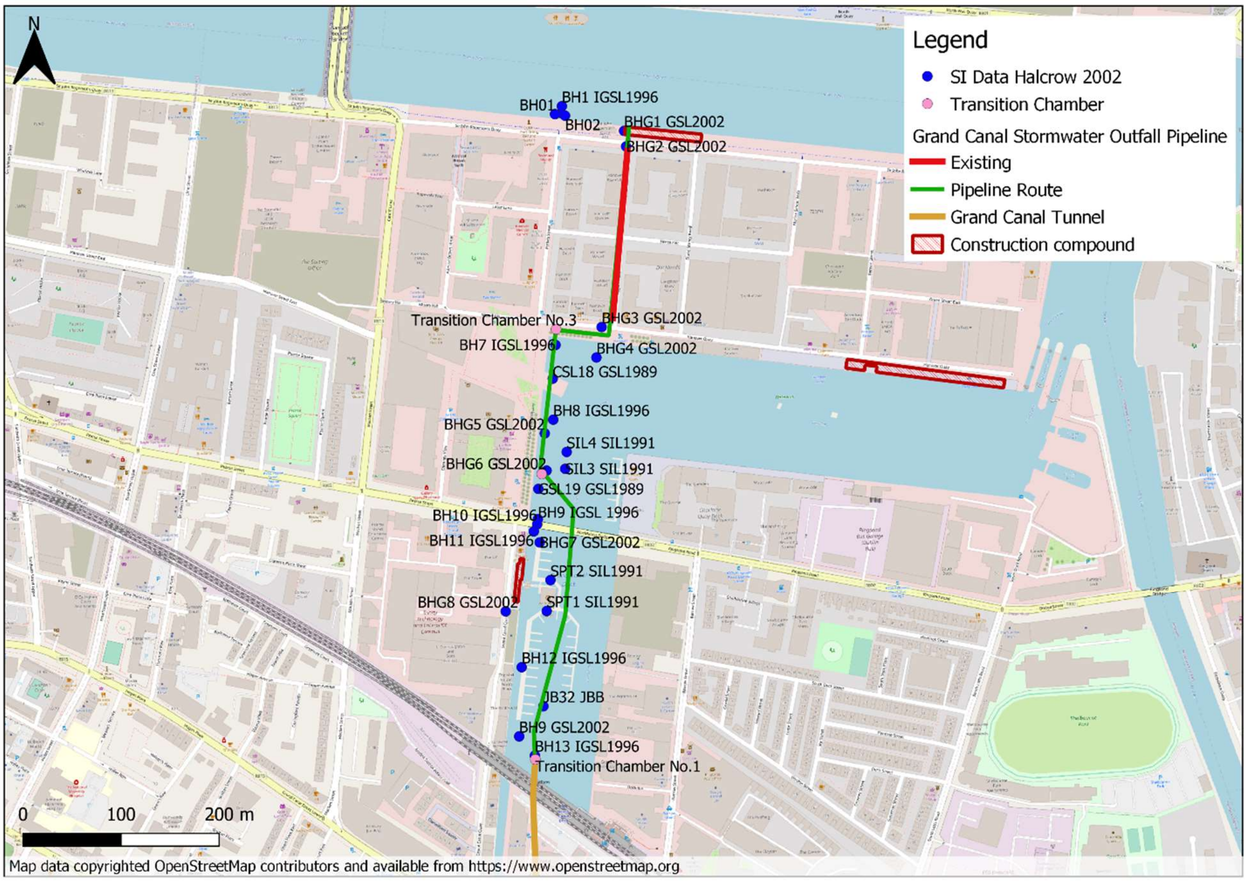


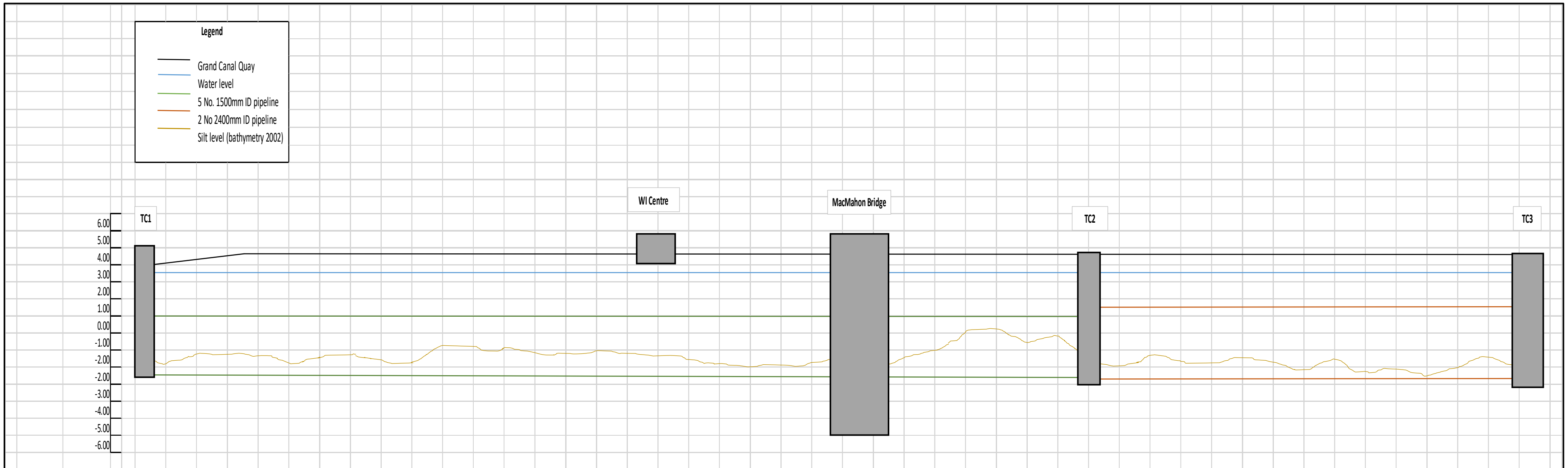
Figure 8.7 Compiled borehole information from previous site investigation on nearby development projects

The strata within the Basin is likely to generally comprise:

- Silt (basin deposits);
- Coarse grained glacial till;
- Fine grained glacial till; and
- Bedrock.

Figure 8.8 presents an indicative longitudinal profile of the pipeline within the Basin. The pipeline itself is presented along with the existing silt layer of the Basin. The indicated level of silt derives from a bathymetric survey undertaken in 24/02/2002 by Hydrographic surveys Ltd. The silt levels of the Basin are believed not to have changed significantly since the bathymetric survey was carried out.

The proposed pipeline will be placed on the silt layer of the Basin. This will involve pushing aside of the silt along the footprint of the proposed pipeline to achieve the desired invert level as presented in Figure 8.8. The deepest section of silt is present at approximately Ch.270.00m with approximately 1.6m of silt to be redistributed. The shallowest section of silt is present at approximately Ch.420.00m with approximately 0.4m of silt to be redistributed.



Chainage (m)	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0
Quay level (mOD)	3.8	3.9	4.0	4.2	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
Water level (mOD)	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4
Top of submerged structure (mOD)	0.6	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Silt level (mOD)	-1.8	-1.3	-0.9	-0.9	-1.0	-1.2	-1.0	-0.9	-1.2	-1.2	-0.5	-0.5	-0.6	-0.7	-0.7
Invert level (mOD)	-1.2	-1.2	-1.2	-1.2	-1.2	-1.2	-1.2	-1.2	-1.2	-1.2	-1.2	-1.2	-1.2	-1.2	-1.2

Chainage (m)	150.0	160.0	170.0	180.0	190.0	200.0	210.0	220.0	230.0	240.0	250.0	260.0	270.0	280.0	290.0
Quay level (mOD)	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
Water level (mOD)	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4
Top of submerged structure (mOD)	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Silt level (mOD)	-0.8	-0.9	-1.1	-1.3	-1.5	-1.3	-1.9	-1.2	-	-1.2	-1.1	-0.7	0.3	0.6	-0.2
Invert level (mOD)	-1.2	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3

Chainage (m)	300.0	310.0	320.0	330.0	340.0	350.0	360.0	370.0	380.0	390.0	400.0	410.0	420.0	430.0	440.0	450.0
Quay level (mOD)	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	-
Water level (mOD)	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	-
Top of submerged structure (mOD)	0.7	1.2	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.5	-
Silt level (mOD)	0.1	-1.3	-2.0	-1.0	-1.2	-1.4	-1.0	-1.3	-1.8	-1.1	-1.9	-1.6	-1.9	-1.5	-1.1	-
Invert level (mOD)	-1.3	-1.4	-1.4	-1.4	-1.4	-1.4	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-

Figure 8.8 Conceptual Ground Model - Basin

Hanover Quay

The site investigations relevant to the ground conditions at Hanover Quay include:

- BH3 (Geotechnical Specialists Ltd, 2002).

The site investigation data indicates that the strata likely to be present at Hanover Quay comprise the following as represented in Table 8.6 below.

Table 8.6 Ground conditions at Hanover Quay

Unit	Material	Description	Thickness (m)	Depth (mBGL)
1	MADE GROUND	Made ground comprising firm - stiff slightly sandy gravelly CLAY	2.3	0 – 2.3
2	CLAY	Stiff slightly sandy gravelly CLAY	0.7	2.3 – 3.0
3	GRAVEL	Med dense clayey very sandy GRAVEL	2.8	3.0 – 5.8
4	CLAY	Stiff slightly sandy gravelly CLAY	3.3	5.8 – 9.1
5	WEATHERED ROCK	Very dense limestone recovered as slightly silty sandy GRAVEL and COBBLES	0.5	9.1 – 9.6

Made ground was present in the uppermost strata of ground encountered in BH3 (GSL, 2002). This was underlain by a thin layer of clay, followed by coarse grained glacial till, gravel, then fine grained glacial till, clay, and finally a weathered limestone bedrock. BH3 terminated at 9.6mBGL. Groundwater was struck twice at 2.6mBGL and 9.1mBGL rising to 2.5mBGL and 3mBGL, respectively. The built structures on Hanover Quay include Transition Chamber 3, and a 4x2.7m culvert which will tie into the existing culvert underneath Asgard Road.

A Conceptual Ground model for Hanover Quay is presented in Figure 8.9, below. This figure illustrates a terrestrial cross section of the anticipated ground conditions, with the proposed culvert, at Hanover Quay at approximately Ch+470m.

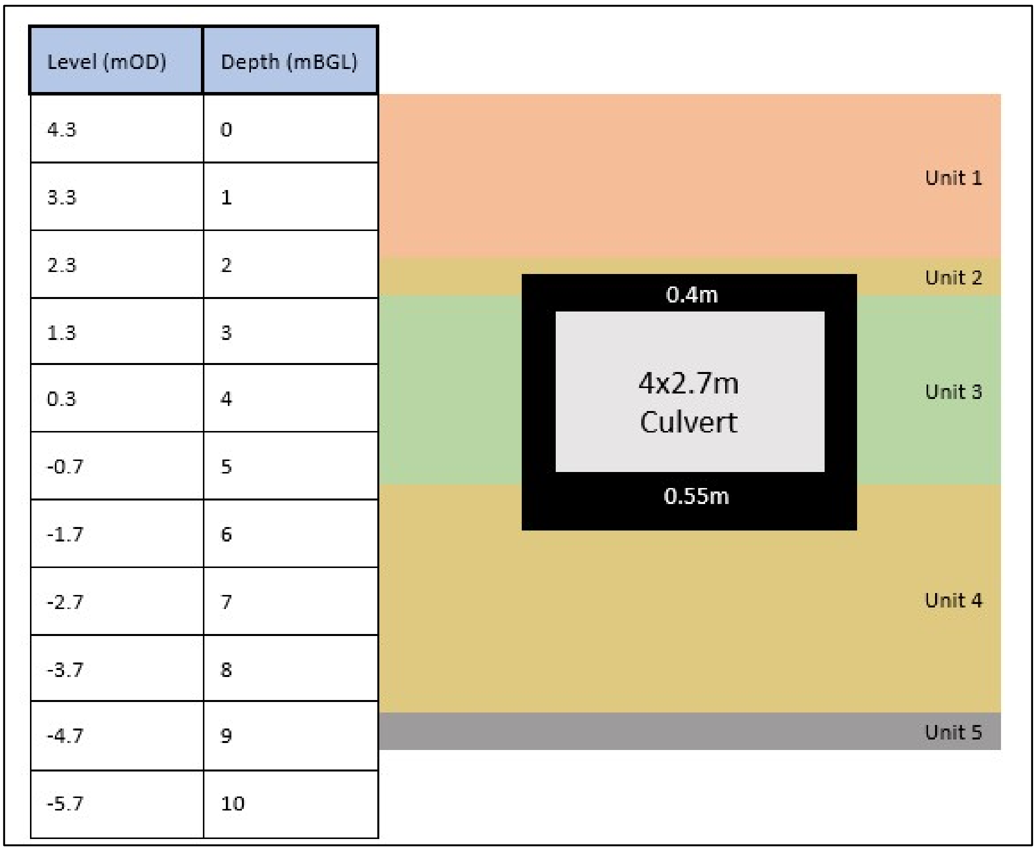


Figure 8.9 Conceptual Ground Model – Hanover Quay

Sir John Rogerson's Quay (SJRQ)

The site investigations relevant to the ground conditions on SJRQ include:

- BH01 (Geotechnical Specialists Ltd, 2002);
- BH02 (Geotechnical Specialists Ltd, 2002); and
- BH10B (Causeway Geotech, 2019).

The site investigation data indicates that the strata likely to be present at SJRQ comprise the following as represented in Table 8.7 below.

Table 8.7 Ground conditions at SJRQ

Unit	Material	Description	Thickness (m)	Depth (mBGL)
1	MADE GROUND	Made ground comprising slightly clayey sandy slightly gravelly SILT	3.0	0 – 3.0
2	SILT	Slightly sandy slightly gravelly SILT	0 - 1.0	3.0 – 4.0
3	GRAVEL	Loose slightly clayey SAND and GRAVEL	3.8 – 4.3	3.0 – 7.8
4	SILT	Soft sandy slightly gravelly SILT	1.4 – 3.0	6.0 – 11.0
5	GRAVEL	Medium dense – dense SAND and GRAVEL	5.8	9.2 – 15.0
6	CLAY	Stiff BOULDER CLAY	4.1	15
7	WEATHERED ROCK	Dark Limestone		19.1

Made ground was present in the uppermost strata of ground encountered in BH01 and BH02 (GSL, 2000). This was underlain by a thin layer of silt, following by a significant depth of loose coarse-grained till, fine grained till, and finally dense coarse grained till. BH01 and BH02 terminated at 15mBGL and 11.5mBGL, respectively. Groundwater was not struck in either borehole.

A Conceptual Ground model for SJRQ is presented in Figure 8.10, below. This figure illustrates a terrestrial cross section of the anticipated ground conditions, with the proposed outfall structure, at SJRQ at approximately Ch+717m.

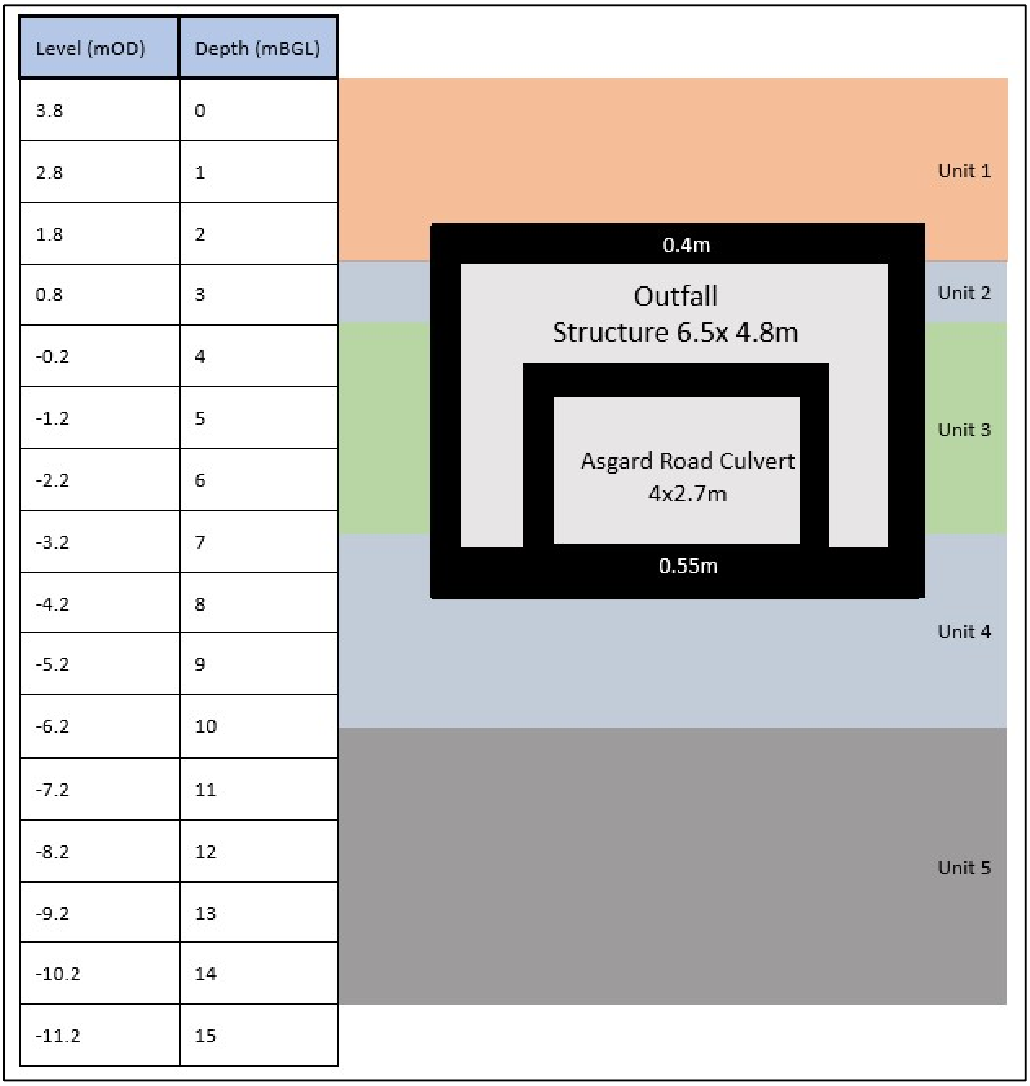


Figure 8.10 Conceptual Ground Model – SJRQ

River Liffey

The site investigations relevant to the ground conditions within the River Liffey near the location of the proposed outfall structure include:

- BH01 (Glovers, 2008);
- BH02 (Glovers, 2008);
- BH01 (IGSL, 1996); and
- BH02 (IGSL, 1996).

These boreholes are located approximately 70m north of the proposed outfall structure location. The site investigation data indicates that the strata likely to be present in the River Liffey near SJRQ comprise the following as represented in Table 8.8 below.

Table 8.8 Ground conditions at the River Liffey

Unit	Material	Description	Thickness (m)	Depth (mBGL)
1	SILT	Soft slightly sandy SILT	1.0 – 4.7	0 – 4.7
2	CLAY	Hard silty sandy gravelly CLAY with boulders	5.0 – 6.0	0 – 6.0
3	GRAVEL	Silty very sandy GRAVEL	0 - 3.4	3.8 – 7.2
4	CLAY	Stiff sandy gravelly CLAY	7.0	7.2 – 14.2
5	WEATHERED ROCK	Moderately weak highly weathered Limestone	>5.2	9.6 – 10.6

BH01 and BH02 (IGSL, 1996) recorded ground level (the silt bed of the River Liffey) as -8.71mOD and -8.55mOD, respectively. BH01 and BH02 (Glovers, 2008) recorded ground level as -8.0mOD and -10.3mOD, respectively. Silt was present in the uppermost strata of ground encountered in boreholes BH01 and BH02 (Glovers, 2008) and BH01 (IGSL, 1996) with thickness ranging from 1m to 4.7m. Silt was not encountered in BH02 (IGSL, 1996). This stratum of silt was generally underlain by fine grained till, then gravel, then a significant depth of stiff clay, and finally, highly weathered limestone rock.

8.5 Potential Impacts

Potential impacts anticipated on the land, soils, and hydrogeological environments at the proposed site are principally related to dredging and excavation activities during construction.

8.5.1 Do-Nothing Impacts

The do-nothing scenario involves the continued use of the existing outfall within the Basin. There will be continued periodic pollution events following periods of heavy rainfall. During these times water-based activities within the basin will be restricted. There are no potential impacts on the land, soils, geological and hydrogeological environments associated with the do-nothing scenario.

8.5.2 Construction Phase

The impacts on the land, soils, geological and hydrogeological environments are related to excavation and dredging. There will be no excavation of bedrock or the overlying boulder clay.

The construction phase activities that can result in potential impacts include:

Excavation and Disposal of Contaminated Soils

The soils at Hanover Quay and SJRQ are contaminated. The excavation of contaminated material from Hanover Quay, and SJRQ will require disposal. The storage of contaminated soils has the potential to be mobilised by rainfall and run-off to surface water (the Basin or the Liffey). The impact will be *temporary in duration, small adverse in magnitude and slight negative in significance.*

Dredging and Piling

<u>Grand Canal Basin</u>

The disturbance and displacement of the silt bed of the Basin from lowering sections of the pipeline and construction of three no. Transition Chambers will result in the redistribution and suspension of silt on the bed of the Basin. The impact will be *permanent in duration, small adverse in magnitude and slight negative in significance.*

<u>River Liffey</u>

The installation of the cofferdam in the River Liffey to facilitate the construction of the outfall has the potential to mobilise silt and sediments from the river bed. There is a significant flow in the Liffey and taking into account the dilution effects and tidal flush the *magnitude of the impact will be negligible in magnitude and imperceptible in significance.*

Quay Walls

Excavations and piling have the potential to damage the existing Quay walls and other structures as a result of vibration and induced earth movements. The potential damage to quay walls as a result of pilling activities could result in an impact that will be *moderate adverse in magnitude and significant/moderate in significance.*

Accidental Spillages

Potential impacts during the construction phase include the potential for leakage or spillage of construction related materials on site. For e.g. raw or uncured concrete and grouts, wash down water from exposed aggregate surfaces, cast-in-place concrete from concrete trucks, fuels, lubricants and hydraulic fluids for equipment used on the development site, bitumen and sealants used for waterproofing concrete surfaces can all potentially impact on soils and groundwater during the construction stage. The natural groundwater flow in the shallow sediments will be towards the River Liffey where it discharges as baseflow. There are no groundwater users between the proposed works and the Liffey. Impacts on groundwater quality and soils would be *negative, short term in duration and imperceptible in significance.*

Temporary Construction Dewatering

Earthworks for the works on Hanover Quay and SJRQ will comprise excavations below the water table to approximately 6m and 7.8m bgl respectively. Temporary dewatering will be required to facilitate construction. Due to the nature and variability of the permeability of the made ground and the response of groundwater levels to the tides it is difficult to predict the rate of inflow. Dewatering will require a barrier to prevent groundwater inflows during excavation. Consequently, only the groundwater contained within the sealing wall will need to be pumped. No significant volumes of water will be abstracted during dewatering operations. The abstracted groundwater will be groundwater that currently discharges to the Liffey as baseflow. The proposed dewatering exercise is not considered likely to result in significant effects on the hydrogeological environment. The Contractor will be required to apply for a Section 16 Wastewater Discharge Licence for the disposal of groundwater.

The impact on the water quality of the River Liffey will *be negligible in magnitude and imperceptible in significance and will be temporary in duration.*

As contaminated soil will be removed from site, the contaminant flux to groundwater will be reduced. As such, the predicted impact on the hydrogeological environment is *permanent, positive and imperceptible.*

Temporary Site Compounds

Three locations have been identified (Volume 4, Project Drawings) as temporary construction compounds which will be made available during the construction works. They will be used as a store for dry materials (steel, precast concrete, etc.) and as a staging area for the works. It is not proposed to remove any significant volumes of soil from these sites. The proposed construction compound sites activities have low likelihood for significant impact/interaction with the land, soils, geological and hydrogeological environment.

8.5.3 Operational Phase

There are no identified potential impacts on the land soils and geology environment associated with operational phase.

8.6 Mitigation Measures

8.6.1 Construction Phase

A CEMP has been prepared and will be included in Volume 3, Appendix 17A to the EIAR which will be updated and finalised by the Contractor prior to construction commencing. A Resource and Waste Management Plan (RWMP) is contained in the Volume 3, Appendix 13A which will also be updated and finalised by the Contractor prior to construction commencing.

Management of Contaminated Material and Spoil Disposal

In order to mitigate potential impacts associated with contaminated material and spoil disposal, the contract documents for the scheme will include the following provisions:

- The Contractor will be required to update and finalise the RWMP addressing inter alia the treatment, storage, and disposal of contaminated material;
- All unsuitable (contaminated) material will be disposed of in accordance with all relevant legislation including the:
  - Department of the Environment and Local Government (DoELG) (1996 to 2008);
  - Waste Management Acts, the DoELG (1996);
  - Waste Management (Facility Permit and Registration) Regulations 2007, S.I. No. 821 of 2007 (as amended);
  - Waste Management (Collection Permit) Regulations 2007, S.I. No. 821 of 2007 (as amended); and
  - NRA (2008) Guidelines for the Management of Waste from National Road Construction Project.
- Material that cannot be re-used will be handled in accordance with the Landfill Directive (2003/33/EC);
- The Contractor will update and finalise the RWMP to provide details of the exact methods it is proposed to employ to remove spoil from the site and will include details of the location and end use of the spoil;
- As soil characteristics will vary during the construction operations, the Contractor will be required to implement, prior to the commencement of construction works, and thereafter maintain throughout the construction phase a comprehensive environmental monitoring programme in respect of the soil characteristics. If necessary, disposal outlets will be modified to ensure continuous compliance with all relevant regulations and with this EIAR; and
- A Project Waste Manager will be appointed by the Contractor to oversee the implementation and adherence to the plan during the construction phase of the project.

Dredging and Silt Displacement and Mobilisation

In order to reduce the impact of silt, the Contractor will be required to adopt the use of a silt curtain for the works within the Grand Canal Basin. The silt curtain is to reach from top water level to the bed level. This will limit the silt suspended from dispersing throughout the Basin.

Ground Movements and Damage to Quay Walls

All construction methods employed will protect the existing quay walls and other structures from damage.

Management of vibration and earth movement will be required for the proposed works on Hanover Quay and SJRQ. In order to mitigate potential impacts, the contract documents for the proposed works will include the following provisions:

- Condition surveys of the adjacent structures will be carried out prior to construction to provide a baseline for excavation monitoring and piling works;
- Appropriate batters or appropriate temporary works solutions such as sheet piling and trench boxes will be adopted during excavations above groundwater to ensure cut face stability;
- Settlement monitoring will be carried out during construction to ensure settlements are within tolerable limits; and
- A specialist design and methodology to be approved by the Employer.

<u>Hanover Quay</u>

A sheet piled wall will not be permitted to be used to construct Transition Chamber 3 or the 2.7m by 4.0m culvert section in Hanover Quay. Construction will be carried out behind a secant wall. The use of secant piled wall will minimise working width, contain the existing contaminated material, limit any water ingress from the Basin and surrounding ground and reduce vibration mitigating the impact on the Quay walls and nearby buildings.

Sir John Rogerson's Quay (SJRQ)

Continuous Flight Augur (CFA) piling will be used to install the outfall structure and culvert on SJRQ. Due to the fact that this a non-percussive piling technique this option will inherently reduce the level of piling vibration generated.

Temporary Construction Dewatering

Where excavations extend below groundwater, appropriate retention and construction dewatering systems will be adopted to mitigate the potential effects of drawdown on nearby structures, roads and major services.

Piled cofferdams and secant piled walls will be installed. These structures will provide a barrier to prevent groundwater inflows during excavation. Consequently, only the groundwater contained within the sealing wall will need to be pumped. No significant volumes of water will be abstracted during dewatering operations. The abstracted groundwater will be groundwater that currently discharges to the Liffey as baseflow. The proposed dewatering exercise is not considered likely to result in significant effects on the hydrogeological environment. The Contractor will be required to apply for a Section 16 wastewater discharge licence for the disposal of groundwater.

Accidental Spillage

Measures set out in the *Construction Industry Research and Information Association* (CIRIA) on the *Control and Management of Water Pollution from Construction Sites (*2006) will be adhered to by the Contractor. Good construction management practices will be employed. During the construction stage, all potentially harmful substances (e.g. oils, diesel, concrete etc.) will be stored in accordance with the manufacturer's guidelines regarding safe and secure buildings/compounds. The Contractor will ensure that adequate means to absorb or contain any spillages of these chemicals are available at all times. Suitable measures will be taken to minimise the potential for pollution arising from accidental spillage.

8.6.2 Operational Phase

Excavation of contaminated material will take place from open trench excavations on Hanover Quay and SJRQ. Surplus material may arise within the Basin also when positioning the pipeline. All surplus materials will be treated as contaminated material and will be disposed of in accordance with relevant legislation including the Department of the Environment and Local Government (DoELG) (1996 to 2008), Waste Management Acts, the DoELG (1998) Waste Management (Permit) Regulations, and the NRA (2008) *Guidelines for the Management of Waste from National Road Construction Projects.*

8.7 Residual Impacts

Once the mitigation measures as proposed are implemented, no residual significant impacts (construction or operational) on the land, soils, geological and hydrogeological environment are expected to arise as a result of the construction and operation of the proposed development.

8.7.1 Interactions

The interactions between Land, Soils, Geology and Hydrogeology and other Sections within the Volume 2 of the EIAR as discussed in this section include, Section 6 Biodiversity, Section 7 Water Quality and Hydrology, Section 9 Air Quality and Climate, Section 10 Noise and Vibration and Section 12 Archaeology and Cultural Heritage, Section 13 Waste Management, Section 14 Material Assets and Section 15 Landscape and Visuals. Refer to detailed assessment in Volume 2, Section 16 Interactions.

The mitigation measures presented in this section are consistent with measures outlined in these individual sections.

8.7.2 Cumulative Impacts

There are a number of other projects proposed for the area and there will be a potential cumulative impact resulting from the construction stage if the projects are constructed simultaneously as detailed in Volume 2, Section 19 Cumulative Impacts. However, in terms of land, soil, geology and hydrogeology there are likely to be no significant cumulative impacts from the operation of proposed development.

8.8 Monitoring

Any excavation will be monitored during earthworks to ensure the stability of side slopes and to ensure that the soils excavated for disposal are consistent with the descriptions and classifications according to the waste acceptance criteria testing carried out as part of the site investigations.

Movement monitoring will be carried out during any activities which may result in ground movements or movements of any nearby structures.

8.9 References

Causeway Geotech (2019). *Blood Stoney Bridge- Ground Investigation Factual Report.*

Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration (Groundwater Directive).

Dublin City Council (2016). *Dublin City Council Development Plan 2016-2022.*

Environmental Protection Agency (EPA), (2013). *Guidance on the Management of contaminated Land and Groundwater at EPA Licensed Sites.*

European Communities Environmental Objectives (Groundwater) Regulations, 2010 (S.I. No. 9 of 2010) (as amended).

Environmental Protection Agency (Ireland) (EPA), (2022). *Guidelines on the information to be contained in Environmental Impact Assessment Reports.*

Environmental Protection Agency (Ireland) (EPA), (2017). *Guidelines on the information to be contained in Environmental Impact Assessment Reports, Draft.*

EPA maps (https://gis.epa.ie/EPAMaps/).

Geological Survey of Ireland (GSI) online database and Map Viewers have been consulted (https://www.gsi.ie/en-ie/data-and-maps/Pages/default.aspx).

Geological Survey of Ireland (GSI) 1:100,000 scale Bedrock Geology Map, Sheet 16 (Kildare-Wicklow).

Geotechnical Specialists Ltd (2002). *Ground Investigation Contract Final Report No. 172045.*

Glover Site Investigations Ltd (2008*). Grand Canal Dock, Dublin Storm Water Outfall Report No: 07-1010.*

Halcrow Group Ltd (2002). *Grand Canal Dock Stormwater Outfall Geotechnical Report.*

Institute of Geologists of Ireland (IGI), (2013). *Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements.*

I.G.S.L (1996). *Report on a Site Investigation for a Proposed Stormwater Outfall at Grand Canal Dock, Dublin.*

National Roads Authority (NRA), (2009). *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.*

Dublin City Council (2014). *North Lotts and Grand Canal SDZ Planning Scheme 2014.*

Site Investigations Ltd (2008). *Site Investigation for a Proposed Storm Outfall at Grand Canal Dock, Dublin.*

Waste Management Act of 1996, 2001 and 2003.

Waste Management (Facility Permit and Registration) Regulations 2007, S.I. No. 821 of 2007 (as amended).

Waste Management (Collection Permit) Regulations 2007, S.I. No. 821 of 2007 (as amended).

SECTION 9: Air Quality and Climate

9.1 Introduction

This section assesses the potential air quality and climate related impacts associated with the proposed Grand Canal Storm Water Outfall Extension (GCSWOE) project.

This section was completed by Ciara Nolan, an environmental consultant in the air quality section of AWN Consulting Ltd. She holds a MSc. (First Class) in Environmental Science from University College Dublin and has also completed a BSc. in Energy Systems Engineering. She is an Associate Member of both the Institute of Air Quality Management (AMIAQM) and the Institution of Environmental Science (AMIEnvSc). She has been working in the field of air quality for over 4 years, with a primary focus on consultancy.

9.2 Methodology

9.2.1 Criteria For Rating of Impacts

Air Quality

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. The applicable standards in Ireland include the Air Quality Standards Regulations 2011 (S.I. No. 180/2011), which incorporate EU Directive 2008/50/EC, which has set limit values for a number of pollutants. The limit values in relation to Nitrogen Dioxide (NO_2) and Particulate Matter (PM_{10} and $PM_{2.5}$) are applicable to the proposed development (see Table 9.1) as these are associated with traffic emissions and construction dust emissions.

With regards to larger dust particles that can give rise to nuisance dust, 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 stipulated for nuisance dust in respect of this development. With regard to dust deposition, the German TA-Luft standard for dust deposition (non-hazardous dust) (German VDI, 2002) sets a maximum permissible emission level for dust deposition of 350 mg/(m^2*day) averaged over a one-year period at any receptors outside the site boundary. Recommendations from the Department of the Environment, Heritage & Local Government (DEHLG, 2004) apply the TA Luft limit value of 350 mg/(m^2*day) to the site boundary of quarries using the Bergerhoff methodology. This limit value can also be implemented with regard to potential dust impacts from construction of the proposed development.

Table 9.1 Ambient Air Quality Standards 2011 & Dust Deposition Limit

Pollutant	Regulation	Limit Type	Value
Nitrogen Dioxide (NO_2)	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	200 µg/m^3
		Annual limit for protection of human health	40 µg/m^3
Nitrogen Oxide (NO_X)	2008/50/EC	Critical level for protection of vegetation	30 µg/m^3 NO + NO_2
Particulate Matter (as PM_{10})	2008/50/EC	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	50 µg/m^3
		Annual limit for protection of human health	40 µg/m^3
Particulate Matter (as $PM_{2.5}$)	2008/50/EC	Annual limit for protection of human health	25 µg/m^3
Dust Deposition	TA Luft (German VDI 2002)	Annual average limit for nuisance dust deposition at site boundary	350 mg/m^2/day

Climate

Ireland is party to both the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. The Paris Agreement, which entered into force in 2016, is an important milestone in terms of international climate change agreements and includes an aim of limiting global temperature increases to no more than 2°C above pre-industrial levels with efforts to limit this rise to 1.5°C. The aim is to limit global GHG emissions to 40 gigatonnes as soon as possible whilst acknowledging that peaking of GHG emissions will take longer for developing countries. Contributions to GHG emissions will be based on Intended Nationally Determined Contributions (INDCs) which will form the foundation for climate action post 2020. Significant progress was also made in the Paris Agreement on elevating adaption onto the same level as action to cut and curb emissions.

In order to meet the commitments under the Paris Agreement, the EU enacted *Regulation (EU) 2018/842 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No. 525/2013* (the Regulation). The Regulation aims to deliver, collectively by the EU in the most cost-effective manner possible, reductions in GHG emissions from the Emission Trading Scheme (ETS) and non-ETS sectors amounting to 43% and 30%, respectively, by 2030 compared to 2005. Ireland's obligation under the Regulation is a 30% reduction in non-ETS greenhouse gas emissions by 2030 relative to its 2005 levels.

In 2015, the Climate Action and Low Carbon Development Act 2015 (No. 46 of 2015) was enacted (the Act). The purpose of the Act was to enable Ireland '*to pursue, and achieve, the transition to a low carbon, climate resilient and environmentally sustainable economy by the end of the year 2050*' (3.(1) of No. 46 of 2015). This is referred to in the Act as the '*national transition objective*'. The Act made provision for a national mitigation plan, and a national adaptation framework. In addition, the Act provided for the establishment of the Climate Change Advisory Council with the function to advise and make recommendations on the preparation of the national mitigation and adaptation plans and compliance with existing climate obligations.

The first Climate Action Plan (CAP) was published by the Irish Government in June 2019 (Government of Ireland, 2019a). The Climate Action Plan 2019 outlined the current status across key sectors including Electricity, Transport, Built Environment, Industry and Agriculture and outlined the various broadscale measures required for each sector to achieve ambitious decarbonisation targets. The 2019 CAP also detailed the required governance arrangements for implementation including carbon-proofing of policies, establishment of carbon budgets, a strengthened Climate Change Advisory Council and greater accountability to the Oireachtas. The Government published the second Climate Action Plan in November 2021 (Government of Ireland, 2021a). The plan contains similar elements as the 2019 CAP and aims to set out how Ireland can reduce our greenhouse gas emissions by 51% by 2030 (compared to 2018 levels) which is in line with the EU ambitions, and a longer-term goal of to achieving net-zero emissions no later than 2050. The 2021 CAP outlines that emissions from the Built Environment sector must be reduced to 4 -5 $MtCO_2e$ by 2030 in order to meet our climate targets. This will require further measures in addition to those committed to in the 2019 CAP. This will include phasing out the use of fossil fuels for the space and water heating of buildings, improving the fabric and energy of our buildings, and promoting the use of lower carbon alternatives in construction.

Following on from Ireland declaring a climate and biodiversity emergency in May 2019 and the European Parliament approving a resolution declaring a climate and environment emergency in Europe in November 2019, the Government approved the publication of the General Scheme for the Climate Action (Amendment) Bill 2019 in December 2019 (Government of Ireland 2019b) followed by the publication of the Climate Action and Low Carbon Development (Amendment) Act 2021 (No. 32 of 2021) (hereafter referred to as the 2021 Climate Act) in July 2021 (Government of Ireland, 2021b). The 2021 Climate Act was prepared for the purposes of giving statutory effect to the core objectives stated within the CAP.

The purpose of the 2021 Climate Act is to provide for the approval of plans '*for the purpose of pursuing the transition to a climate resilient, biodiversity rich and climate neutral economy by no later than the end of the year 2050'*. The 2021 Climate Act will also '*provide for carbon budgets and a decarbonisation target range for certain sectors of the economy*'. The 2021 Climate Act defines the carbon budget as '*the total amount of greenhouse gas emissions that are permitted during the budget period*'. The 2021 Climate Act removes any reference to a national mitigation plan and instead refers to both the Climate Action Plan, as published in 2019, and a series of National Long Term Climate Action Strategies. In addition, the Environment Minister shall request each local authority to make a '*local authority climate action plan'* lasting five years and to specify the mitigation measures and the adaptation measures to be adopted by the local authority.

9.2.2 Construction Phase Methodology

Air Quality

The Institute of Air Quality Management in the UK (IAQM) guidelines (2014) outline an assessment method for predicting the impact of dust emissions from demolition, earthworks, construction and haulage activities based on the scale and nature of the works and the sensitivity of the area to dust impacts. The IAQM methodology has been applied to the construction phase of this development in order to predict the likely magnitude of the dust impacts in the absence of mitigation measures.

Construction phase traffic has the potential to impact air quality. The UK Design Manual for Roads and Bridges (DMRB) guidance (UK Highways Agency, 2019a), states that road links meeting one or more of the following criteria can be defined as being 'affected' by a proposed development and will be included in the local air quality assessment.

- Annual average daily traffic (AADT) changes by 1,000 or more;
- Heavy duty vehicle (HDV) AADT changes by 200 or more;
- A change in speed band; and
- A change in carriageway alignment by 5m or greater.

The TII guidance document '*Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes, 2011'* recommends the use of the UK DMRB guidance. This methodology can be applied to any development that causes a change in traffic. By definition of the criteria above, there are no road links 'affected' in the context of air quality as a result of the proposed development. Therefore, no assessment using the DMRB model was required for the proposed development as there is no potential for significant impacts to air quality as a result of construction traffic emissions.

Climate

The impact of the construction phase of the development on climate was determined by a qualitative assessment of the nature and scale of greenhouse gas generating construction activities associated with the proposed development.

The UK Highways Agency has published an updated DMRB guidance document in relation to climate impact assessments *LA 114 Climate* (UK Highways Agency 2019b). This guidance is specific to road projects but can be used for any project that causes a change in traffic. The following scoping criteria are used to determine whether a detailed climate assessment is required for a proposed project. If any of the road links impacted by the proposed development meet or exceed the below criteria, then further assessment is required.

- A change of more than 10% in AADT;
- A change of more than 10% to the number of heavy duty vehicles; and
- A change in daily average speed of more than 20 km/hr.

None of the road links impacted by the proposed development meet the scoping criteria above and therefore a detailed assessment has been scoped out as there is no potential for significant impacts to climate as a result of construction traffic emissions.

In addition, there is the potential for embodied carbon associated with construction materials and activities to impact climate during the construction phase. The carbon emissions are calculated by multiplying the emission factor by the quantity of the material that will be used over the entire construction phase. Emissions factors are available from a number of recognized sources including the Civil Engineering Standard Method of Measurement (CESSM) Carbon and Price Book database (CESSM, 2013). However, due to the small scale of the proposed development and the short-term construction phase a detailed assessment of embodied carbon emissions has been scoped out of this assessment as there is no potential for significant impacts to climate from this element of the project.

9.2.3 Operational Phase Methodology

Due to the nature of the proposed development, there are no predicted emissions to atmosphere during the operational phase. Therefore, there is no potential for operational phase impacts to air quality or climate and no assessment is required.

9.3 Receiving Environment

9.3.1 Air Quality

Air quality monitoring programs have been undertaken in recent years by the EPA and Local Authorities. The most recent annual report on air quality in Ireland is "*Air Quality In Ireland 2020*" (EPA, 2021a). The EPA website details the range and scope of monitoring undertaken throughout Ireland and provides both monitoring data and the results of previous air quality assessments (EPA, 2022). In 2020 the EPA reported (EPA, 2021a) that Ireland was compliant with EU legal air quality limits at all locations, however this was largely due to the reduction in traffic due to Covid-19 restrictions. The EPA *Air Quality in Ireland 2020* report details the effect that the Covid-19 restrictions had on air monitoring stations, which included reductions of up to 50% at some monitoring stations which have traffic as a dominant source. The report also notes that CSO figures show that while traffic volumes are still slightly below 2019 levels, they have significantly increased since 2020 levels. 2020 concentrations are therefore predicted to be an exceptional year and not consistent with long-term trends. For this reason, they have not been included in the baseline section and previous long-term data has been used to determine baseline levels of pollutants in the vicinity of the proposed development.

As part of the implementation of the Air Quality Standards Regulations 2002 (S.I. No. 271 of 2002), four air quality zones have been defined in Ireland for air quality management and assessment purposes. Dublin is defined as Zone A and Cork as Zone B. Zone C is composed of 23 towns with a population of greater than 15,000. The remainder of the country, which represents rural Ireland but also includes all towns with a population of less than 15,000, is defined as Zone D (EPA, 2022).

In terms of air monitoring and assessment, the proposed development is within Zone A (EPA, 2022). The long-term EPA monitoring data has been used to determine background concentrations for the key pollutants in the region of the proposed development. The background concentration accounts for all non-traffic derived emissions (e.g. natural sources, industry, home heating etc.).

With regard to NO_2, continuous monitoring data from the EPA (EPA, 2021a) at suburban Zone A locations in Rathmines, Dun Laoghaire, Swords and Ballyfermot show that current levels of NO_2 are below both the annual and 1-hour limit values, with annual average levels ranging from 15 – 22 μg/m^3 in 2019 (see Table 9.2). Sufficient data is available for these stations to observe the long-term trend since 2015 (EPA, 2021a) with results ranging from 13 – 22 μg/m^3 and few exceedances of the one-hour limit value of 200 μg/m^3 (Table 9.2). In addition, continuous monitoring data from the EPA at urban Zone A locations in Winetavern Street and Ringsend show that annual concentrations of NO_2 were 28 μg/m^3 and 24 μg/m^3 at both locations respectively in 2019. Based on the results at suburban and urban Zone A locations, an estimate of the background NO_2 concentration in the region of the proposed development is 22 μg/m^3.

Table 9.2 Trends in Zone A Air Quality – Nitrogen Dioxide (NO_2)

Station	Station Classification	Averaging Period Notes 1,2	Year				
			2015	2016	2017	2018	2019
Ringsend	Urban	Annual Mean NO_2 (μg/m^3)	-	-	22	27	24
		Max 1-hr NO_2 (μg/m^3)	-	-	138	121	109
Winetavern Street	Urban Traffic	Annual Mean NO_2 (μg/m^3)	31	37	27	29	28
		Max 1-hr NO_2 (μg/m^3)	182	194	196	165	142
Rathmines	Suburban Background	Annual Mean NO_2 (μg/m^3)	18	20	17	20	22
		Max 1-hr NO_2 (μg/m^3)	106	102	116	138	183
Dún Laoghaire	Suburban Background	Annual Mean NO_2 (μg/m^3)	16	19	17	19	15
		Max 1-hr NO_2 (μg/m^3)	103	142	153	135	104
Swords	Suburban Background	Annual Mean NO_2 (μg/m^3)	13	16	14	16	15
		Max 1-hr NO_2 (μg/m^3)	170	206	107	112	108
Ballyfermot	Suburban Background	Annual Mean NO_2 (μg/m^3)	16	17	17	17	20
		Max 1-hr NO_2 (μg/m^3)	142	127	148	217	124

Continuous PM_{10} monitoring carried out at the Zone A locations of Winetavern Street, Rathmines, Phoenix Park and Dún Laoghaire showed 2015 – 2019 annual mean concentrations ranging from 9 - 16 μg/m^3, with at most 9 exceedances (in Rathmines) of the 24-hour limit value of 50 μg/m^3 (35 exceedances are permitted per year). Refer to Table 9.3. Long term average concentrations are below the annual limit value of 40 μg/m^3. Based on the EPA data a conservative estimate of the current background PM_{10} concentration in the region of the proposed development is 16 μg/m^3.

Table 9.3 Trends in Zone A Air Quality – Particulate Matter (PM_{10})

Station	Station Classification	Averaging Period	Year				
			2015	2016	2017	2018	2019
Ballyfermot	Suburban Background	Annual Mean PM_{10} ($\mu g/m^3$)	12	11	12	16	14
		24-hr Mean > 50 $\mu g/m^3$ (days)	3	0	1	0	7
Dún Laoghaire	Suburban Background	Annual Mean PM_{10} ($\mu g/m^3$)	13	13	12	13	12
		24-hr Mean > 50 $\mu g/m^3$ (days)	3	0	2	0	2
Winetavern Street	Urban Traffic	Annual Mean PM_{10} ($\mu g/m^3$)	14	14	12	15	12
		24-hr Mean > 50 $\mu g/m^3$ (days)	4	0	2	1	3
Rathmines	Suburban Background	Annual Mean PM_{10} ($\mu g/m^3$)	15	15	13	15	15
		24-hr Mean > 50 $\mu g/m^3$ (days)	5	3	5	2	9
Phoenix Park	Urban Background	Annual Mean PM_{10} ($\mu g/m^3$)	12	11	9	11	11
		24-hr Mean > 50 $\mu g/m^3$ (days)	2	0	1	0	2

Continuous $PM_{2.5}$ monitoring carried out at the Zone A location of Rathmines showed $PM_{2.5}/PM_{10}$ ratios ranging from 0.60 – 0.68 over the period 2015 – 2019. Based on this information, a conservative ratio of 0.7 was used to generate a background $PM_{2.5}$ concentration in the region of the proposed development of 11.2 $\mu g/m^3$.

9.3.2 Climate

Anthropogenic emissions of greenhouse gases in Ireland included in the EU 2020 strategy are outlined in the most recent review by the EPA which details provisional emissions up to 2020 (EPA, 2021b). The data published in 2021 states that Ireland will exceed its 2020 annual limit set under the EU's Effort Sharing Decision (ESD), 406/2009/EC1 by an estimated 6.73 Mt. For 2021, total national greenhouse gas emissions are estimated to be 57.70 million tonnes carbon dioxide equivalent (Mt CO_2eq) with 44.38 MtCO_2eq of emissions associated with the ESD sectors for which compliance with the EU targets must be met. Agriculture is the largest contributor in 2021 at 37.1% of the total, with the transport sector accounting for 17.9% of emissions of CO_2.

GHG emissions for 2020 are estimated to be 3.6% lower than those recorded in 2019. Emission reductions have been recorded in 6 of the last 10 years. However, compliance with the annual EU targets has not been met for five years in a row. Emissions from 2016 – 2020 exceeded the annual EU targets by 0.29 MtCO_2eq, 2.94 MtCO_2eq, 5.57 MtCO_2eq,6.85 MtCO_2eq and 6.73 MtCO_2eq respectively. Agriculture is consistently the largest contributor to emissions with emissions from the transport and energy sectors being the second and third largest contributors respectively in recent years.

The EPA 2020 GHG Emissions Projections Report for 2020 – 2040 (EPA, 2021c) notes that there is a long-term projected decrease in greenhouse gas emissions as a result of inclusion of new climate mitigation policies and measures that formed part of the National Development Plan (NDP) which was published in 2018 and the Climate Action Plan published in 2019. Implementation of these are classed as a "*With Additional Measures scenario*" for future scenarios. A change from generating electricity using coal and peat to wind power and diesel vehicle engines to electric vehicle engines are envisaged under this scenario. While emissions are projected to decrease in these areas, emissions from agriculture are projected to grow steadily due to an increase in animal numbers. However, over the period 2013 to 2020 Ireland is projected to cumulatively exceed its compliance obligations with the EU's Effort Sharing Decision (Decision No. 406/2009/EC) 2020 targets by approximately 12.2MtCO_2eq under the "With Existing Measures" scenario and under the "With Additional Measures" scenario. The projections indicate that Ireland can meet its non-ETS EU targets over the period 2021 – 2030 assuming full implementation of the Climate Action Plan and the use of the flexibilities available (EPA, 2021c).

9.3.3 Sensitivity of the Receiving Environment

In line with the UK Institute of Air Quality Management (IAQM) guidance document '*Guidance on the Assessment of Dust from Demolition and Construction'* (2014) prior to assessing the impact of dust from a proposed development the sensitivity of the area must first be assessed as outlined below. Both receptor sensitivity and proximity to proposed works areas are taken into consideration. For the purposes of this assessment, high sensitivity receptors are regarded as residential properties where people are likely to spend the majority of their time. Commercial properties and places of work are regarded as medium sensitivity while low sensitivity receptors are places where people are present for short periods or do not expect a high level of amenity.

In terms of receptor sensitivity to dust soiling, there are several apartment blocks and office buildings within 50m of the proposed works along Grand Canal Quay, Barrow Street, Hanover Quay and SJRQ. Therefore, the overall sensitivity of the area to dust soiling impacts is considered **medium** based on the IAQM criteria outlined in Table 9.4.

Table 9.4 Sensitivity of the Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Number Of Receptors	Distance from source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	**Medium**	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

In addition to sensitivity to dust soiling, the IAQM guidelines also outline the assessment criteria for determining the sensitivity of the area to human health impacts from dust emissions. The criteria take into consideration the current annual mean PM_{10} concentration, receptor sensitivity based on type (residential receptors are classified as high sensitivity) and the number of receptors affected within various distance bands from the construction works. A conservative estimate of the current annual mean PM_{10} concentration in the vicinity of the proposed development is 16 μg/m^3 and there are several apartment blocks within 50m of the proposed works. Based on the IAQM criteria outlined in Table 9.5, the worst case sensitivity of the area to human health is considered to be **low**.

Table 9.5 Sensitivity of the Area to Dust Related Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number Of Receptors	Distance from source (m)				
			<20	<50	<100	<200	<350
High	< 24 µg/m^3	>100	Medium	Low	Low	Low	Low
		10-100	Low	**Low**	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	< 24 µg/m^3	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	< 24 µg/m^3	>1	Low	Low	Low	Low	Low

The IAQM guidance also outlines the criteria for determining the sensitivity of an ecological receptor to dust impacts. The sensitivity is determined based on the distance to the source, the designation of the site, (European, National or local designation) and the potential dust sensitivity of the ecologically important species present (see Table 9.6). Works will take place within a section of the Grand Canal pNHA (site code 002104). In consultation with the project ecologist, the species within the relevant section of the Grand Canal pNHA are unlikely to be dust sensitive. Therefore, it is considered a low sensitivity receptor to potential dust soiling impacts. As the works will take place directly within a section of the pNHA the overall sensitivity of the area to dust related ecological impacts is considered **low** as per Table 9.6.

Table 9.6 Sensitivity of the Area to Dust Related Ecological Impacts

Receptor Sensitivity	Distance from the Source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	**Low**	Low

9.4 Characteristics of the Development

The proposed development will involve construction of a 550m length of pipeline which will pass from the Grand Canal Tunnel Outfall, near the Grand Canal Dock Dart Station, north through the Grand Canal Basin where it will pass through a section of Hanover Quay. It will then link up with an existing culvert on Asgard Road, built in 2002 as part of the Phase 1 works for this project. At the northern end of this existing culvert, a pipeline will be constructed underneath SJRQ together with an outfall structure to the River Liffey. The storm water will therefore have bypassed its previous outfall within the Grand Canal Basin and will discharge into the River Liffey/ Lower Liffey Estuary. A full description of the proposed development can be found in Volume 2, Section 2.

Construction impacts to air quality and climate can occur as a result of vehicle and machinery exhaust emissions and construction dust emissions. Due to the nature of the development operational impacts are not predicted as there will be no emissions to atmosphere once the proposed development is constructed.

9.5 Potential Impacts

9.5.1 Do Nothing Impacts

Under the do nothing scenario no development will take place and there will be no construction activities likely to generate dust or air pollutant emissions. In this scenario, ambient air quality and GHG emissions will remain as per the baseline and will change in accordance with trends within the wider area (including influences from potential new developments in the surrounding area, changes in road traffic, etc). The do nothing scenario is considered neutral in terms of air quality and climate.

9.5.2 Construction Phase Impacts

Air Quality

The greatest potential impact on air quality during the construction phase of the proposed development is from construction dust emissions and the potential for nuisance dust. While construction dust tends to be deposited within 350m of a construction site, the majority of the deposition occurs within the first 50m. The extent of any dust generation depends on the nature of the dust (soils, peat, sands, gravels, silts etc.) and the nature of the construction activity. In addition, the potential for dust dispersion and deposition depends on local meteorological factors such as rainfall, wind speed and wind direction.

The nearest representative weather station collating detailed weather records is Dublin Airport meteorological station, which is located approximately 9 km north of the proposed development. Dublin Airport Met data has been examined to identify the prevailing wind direction and average wind speeds over a five-year period. For data collated during five representative years (2016 - 2020), the predominant wind direction is westerly to south-westerly with predominantly moderate wind speeds. In addition, dust generation is considered negligible on days where rainfall is greater than 0.2 mm. A review of historical 30-year average data (1981 – 2010) for Dublin Airport indicates that on average 191 days per year have rainfall over 0.2 mm (Met Eireann, 2021) and therefore it can be determined that over 50% of the time dust generation will be reduced. In general, local meteorological conditions are favourable to dust suppression the majority of the time.

In order to determine the level of dust mitigation required during the proposed works, the potential dust emission magnitude for each dust generating activity needs to be taken into account, in conjunction with the previously established sensitivity of the area (see Section 9.3.3). The primary activities involved in the storm water outfall project which have the potential to generate dust include piling activities, construction of concrete box culverts, excavation and storage of materials at site compounds.

The majority of these works are over relatively small areas and will result in very localised emissions of dust which is unlikely to travel significant distance beyond the immediate works area. The most significant works with dust generation potential are those that involve excavations, filling and piling. Other works are likely to have very minor dust emissions due to their small scale. Worst-case assumptions have been used as part of this assessment. As such, the dust mitigation measures proposed are those associated with a worst-case assessment and actual levels of dust which may arise from the proposed construction activities may be lower than estimated. The major dust generating activities have been divided into three categories as detailed below to reflect their different potential impacts.

Earthworks & Piling Activities

Earthworks primarily involve excavating material, loading and unloading of materials, tipping and stockpiling activities. Activities such as levelling the site and landscaping works are also considered under this category. The dust emission magnitude from earthworks can be classified as small, medium or large based on the definitions from the IAQM guidance as transcribed below:

- **Large:** Total site area > 10,000 m^2, potentially dusty soil type (e.g. clay which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds > 8 m in height, total material moved >100,000 tonnes;
- **Medium:** Total site area 2,500 m^2 – 10,000 m^2, moderately dusty soil type (e.g. silt), 5 - 10 heavy earth moving vehicles active at any one time, formation of bunds 4 – 8 m in height, total material moved 20,000 – 100,000 tonnes;
- **Small:** Total site area < 2,500 m^2, soil type with large grain size (e.g. sand), < 5 heavy earth moving vehicles active at any one time, formation of bunds < 4 m in height, total material moved < 20,000 tonnes, earthworks during wetter months.

As part of the proposed development there will be the requirement for excavation of some materials in order to install the pipeline. It is expected that there will be 5,500 m^3 of material removed from site during construction works. There is also the potential for a secant pile wall to be installed along the required section at Hanover Quay to facilitate the box culvert. Piling will also be required at SJRQ. According to the IAQM guidance as a worst-case these activities could be considered small in scale as the quantity of material is significantly less than 20,000 tonnes and the works areas are minor.

The sensitivity of the area, as determined in Section 9.3.3, is combined with the dust emission magnitude for each dust generating activity to define the risk of dust impacts in the absence of mitigation. As outlined in Table 9.7, this results in an overall low risk of dust soiling impacts and a negligible risk of dust related human health impacts and ecological impacts as a result of the proposed earthworks activities.

Table 9.7 Risk of Dust Impacts – Earthworks

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Trackout

Trackout is the movement of heavy vehicles from site. Factors which determine the dust emission magnitude are vehicle size, vehicle speed, number of vehicles, road surface material and duration of movement. Dust emission magnitude from trackout can be classified as small, medium or large based on the definitions from the IAQM guidance as transcribed below:

- **Large:** > 50 HGV (> 3.5 t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length > 100 m;
- **Medium:** 10 - 50 HGV (> 3.5 t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 - 100 m;
- **Small:** < 10 HGV (> 3.5 t) outward movements in any one day, surface material with low potential for dust release, unpaved road length < 50 m.

The dust emission magnitude for the proposed trackout is classified as medium and can be considered as worst-case as it reflects worst-case peak construction periods when there will be 38 HGV movements per day.

As outlined in Table 9.8, combining this with the previously established sensitivity of the area as per Section 9.3.3 results in an overall medium risk of dust soiling impacts, a low risk of dust related human health impacts and a low risk of dust related ecological impacts as a result of the proposed trackout activities.

Table 9.8 Risk of Dust Impacts – Trackout

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Summary of Dust Emission Risk

The risk of dust impacts as a result of the proposed development are summarised in Table 9.9 for each activity. The magnitude of risk determined is used to prescribe the level of site-specific mitigation required for each activity in order to prevent significant impacts occurring.

Overall, there is at most a medium risk of dust impacts as a result of the proposed development and therefore best practice dust mitigation measures are proposed. In the absence of mitigation there is the potential for *short-term, negative, imperceptible impacts* to air quality.

Table 9.9 Summary of Dust Impact Risk used to Define Site-Specific Mitigation

Potential Impact	Dust Emissions Risk	
	Earthworks	Trackout
Dust Emission Magnitude	Small	Medium
Dust Soiling	Low Risk	Medium Risk
Human Health Impacts	Negligible Risk	Low Risk
Ecological Impacts	Negligible Risk	Low Risk

There is also the potential for traffic emissions to impact air quality in the short-term over the construction phase. Particularly due to the increase in HGVs accessing the site. Traffic emissions would be the primary source of NO_2 associated with the proposed development. However, as per Section 9.2.2 a detailed assessment of traffic emissions associated with the construction phase of the proposed development has been scoped out as per the UK DMRB screening criteria (UK Highways Agency, 2019a), therefore, the proposed development will not significantly impact NO_2 concentrations in the vicinity of the site and concentrations will remain similar to background levels. The construction stage traffic has the potential for a *neutral, imperceptible and short-term impact* on air quality.

Climate

There is the potential for a number of greenhouse gas emissions to atmosphere during the construction of the development. Construction vehicles, generators etc., may give rise to CO_2 and N_2O emissions. The Institute of Air Quality Management document '*Guidance on the Assessment of Dust from Demolition and Construction'* states that site traffic and plant is unlikely to make a significant impact on climate. Therefore, the potential impact on climate is considered to be *imperceptible, neutral and short-term.*

Human Health

Dust emissions from the construction phase of the proposed development have the potential to impact human health through the release of PM_{10} and $PM_{2.5}$ emissions. As per Section 9.3.3 the surrounding area is of low sensitivity to potential human health impacts as a result of construction dust emissions. In addition, it was found that there is an overall low risk of human health impacts from dust emissions in the absence of mitigation. Therefore, in the absence of mitigation there is the potential for *imperceptible, negative, short-term* impacts to human health as a result of the proposed development.

9.5.3 Operational Phase Impacts

Due to the nature of the proposed development, there will be no emissions to atmosphere during the operational phase. Therefore, there is no potential for impacts to air quality or climate as a result of the proposed development. No odorous emissions are predicted at the outfall pipe to the River Liffey during the operational phase due to the nature of the water passing through the outfall being stormwater, which is unlikely to contain particularly odorous components. The operational phase is considered *neutral* in terms of air quality and climate.

Climate change has the potential to alter weather patterns and increase the frequency of rainfall in future years. As a result of this there is the potential for an increased risk of flooding related impacts in future years. The proposed development will divert stormwater flows as a result of heavy rainfall events and discharge them into the River Liffey thereby reducing the potential flooding impacts further upstream. The proposed development has been designed to account for increased flows associated with heavy rainfall events and therefore the impact as a result of climate change will be *imperceptible.*

9.6 Mitigation Measures

9.6.1 Construction Phase

The proactive control of fugitive dust will ensure the prevention of significant emissions. The key aspects of controlling dust are listed below. These measures are incorporated into the CEMP, included in Volume 3, Appendix 17A to the EIAR which will be updated and finalised by the Contractor prior to construction commencing. Care has specifically been paid to the requirements and recommendations within the Dublin City Council's guidance entitled *"Air Quality Monitoring and Noise Control Unit's Good Practise Guide for Construction and Demolition".*

In summary the measures which will be implemented will include:

- Hard surface roads will be swept to remove mud and aggregate materials from their surface while any un-surfaced roads will be restricted to essential site traffic;
- Any road that has the potential to give rise to fugitive dust will be regularly watered, as appropriate, during dry and/or windy conditions;
- Vehicles exiting the site will make use of a wheel wash facility where appropriate, prior to entering onto public roads;
- Vehicles using site roads will have their speed restricted, and this speed restriction will be enforced rigidly. On any un-surfaced site road, this will be 20 kph, and on hard surfaced roads as site management dictates;
- Public roads outside the site will be regularly inspected for cleanliness and cleaned as necessary.
- Material handling systems and site stockpiling of materials will be designed and laid out to minimise exposure to wind. Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods; and
- During movement of materials both on and off-site, trucks will be stringently covered with tarpaulin at all times. Before entrance onto public roads, trucks will be adequately inspected to ensure no potential for dust emissions.

At all times, these procedures will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, movements of materials likely to raise dust would be curtailed and satisfactory procedures implemented to rectify the problem before the resumption of construction operations.

9.6.2 Operational Phase

As there are no predicted impacts to air quality or climate during the operational stage, there are no mitigation measures proposed.

9.7 Residual Impacts

9.7.1 Construction Phase

Air Quality

Once the dust minimisation measures outlined in Section 9.6.1 are implemented, the impact of the proposed development in terms of dust soiling will be *short-term, negative, localised and imperceptible* at nearby receptors.

Climate

According to the IAQM guidance site traffic, plant and machinery are unlikely to have a significant impact on climate. Therefore, the predicted impact is *neutral, short-term and imperceptible.*

Human Health

Best practice mitigation measures are proposed for the construction phase of the proposed development which will focus on the pro-active control of dust to minimise generation of emissions at source. The mitigation measures that will be put in place during construction of the proposed development will ensure that the impact of the development complies with all EU ambient air quality legislative limit values which are based on the protection of human health (see Table 9.1). Therefore, the impact of construction of the proposed development is likely to be *negative, short-term, localised and imperceptible* with respect to human health.

9.7.2 Operational Phase

There are no predicted impacts to air quality or climate as a result of the operational phase of the proposed development.

9.7.3 Interactions

Air quality does not have a significant number of interactions with other topics. The most significant interactions are between population and human health and air quality. An adverse impact due to air quality in either the construction or operational phase has the potential to cause health and dust nuisance issues. There is an overall low risk of human health related dust impacts as a result of the construction works. The mitigation measures that will be put in place at the proposed development will ensure that the impact of the proposed development complies with all ambient air quality legislative limits and therefore the predicted impact is short-term and imperceptible with respect to human health.

Interactions between air quality and traffic can be significant. With increased traffic movements and reduced engine efficiency, i.e. due to congestion, the emissions of vehicles increase. The impacts of the proposed development on air quality have been assessed by reviewing the change in annual average daily traffic on roads close to the site. In this assessment, the impact of the interactions between traffic and air quality are considered to be imperceptible.

There is the potential for interactions between air quality and biodiversity as works will take place within a section of the The Grand Canal proposed Natural Heritage Area (pNHA) (site code 002104). There is the potential for NO_X and NO_2 emissions from traffic accessing the site to impact the pNHA. However, the traffic associated with the proposed development does reach the scoping criteria for a detailed assessment and it has been determined that there is no potential for significant impacts to the designated site as a result of traffic emissions. It has been determined that there is an overall low risk of dust related emissions causing ecological impacts. Once the mitigation measures outlined within Section 9.6.1 are implemented dust related impacts are predicted to be short-term, neutral and imperceptible.

Construction phase activities such as excavations and stockpiling of materials have the potential for interactions between air quality and land and soils in the form of dust emissions. With the appropriate mitigation measures to prevent fugitive dust emissions, it is predicted that there will be no significant interactions between air quality and land and soils.

No other significant interactions with air quality and climate have been identified.

9.7.4 Cumulative Impacts

Construction Phase

According to the IAQM guidance (2014) should the construction phase of the proposed development coincide with the construction phase of any other developments within 350m then there is the potential for cumulative construction dust related impacts to nearby sensitive receptors. However, provided the mitigation measures outlined in Section 9.6.1 are implemented throughout the construction phase of the proposed development significant cumulative dust impacts are not predicted.

Due to the short-term duration of the construction phase and the low potential for significant CO_2 and N_2O emissions cumulative impacts to climate are considered neutral.

There are no significant cumulative impacts to air quality or climate predicted for the construction phase.

Operational Phase

There are no predicted impacts to air quality or climate during the operational phase. Due to the nature of the proposed development there will be no emissions to atmosphere once operational, therefore, there are no predicted cumulative impacts.

9.8 Monitoring

There is at most a medium risk of dust soiling impacts associated with the construction phase of the proposed development. In addition, there is a low risk of dust related human health impacts from construction activities. During the construction phase, monitoring of dust emissions is not proposed as once the dust mitigation measures are implemented impacts will be imperceptible. Monitoring is not proposed for the operational phases of the proposed development as there are no significant impacts to air quality or climate predicted.

9.9 References

Civil Engineering Standard Method of Measurement (CESSM) (2013) Carbon and Price Book database.

Department of the Environment, Heritage and Local Government (2004) Quarries and Ancillary Activities, Guidelines for Planning Authorities.

Environmental Protection Agency (2021a) *Air Quality Monitoring Report 2020 (& previous annual reports).*

Environmental Protection Agency (2021b) *Ireland's Provisional Greenhouse Gas Emissions 1990 – 2020.*

Environmental Protection Agency (2020c) *GHG Emissions Projections Report - Ireland's Greenhouse Gas Emissions Projections 2019 – 2040.*

Environmental Protection Agency (2022) EPA website Available at: http://www.epa.ie/whatwedo/monitoring/air/.

German VDI (2002) *Technical Guidelines on Air Quality Control – TA Luft.*

Government of Ireland (2015) *Climate Action and Low Carbon Development Act.*

Government of Ireland (2019a) *Climate Action Plan 2019*

Government of Ireland (2019b) *Draft General Scheme of the Climate Action (Amendment) Bill 2019*

Government of Ireland (2021a) *Climate Action Plan 2021*

Government of Ireland (2021b) Climate Action and Low Carbon Development (Amendment) Act 2021

Institute of Air Quality Management (IAQM) (2014*) Guidance on the Assessment of Dust from Demolition and Construction Version 1.1.*

Met Éireann (2021) Met Eireann website: https://www.met.ie/.

Transport Infrastructure Ireland (2011) *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes.*

UK Highways Agency (2019a) *UK Design Manual for Roads and Bridges (DMRB), Volume 11, Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 1 LA 105 Air quality.*

UK Highways Agency (2019b) *UK Design Manual for Roads and Bridges (DMRB) Volume 11 Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 14 LA 114 Climate.*

World Health Organisation (2006) *Air Quality Guidelines - Global Update 2005 (and previous Air Quality Guideline Reports 1999 & 2000).*

SECTION 10: Noise and Vibration

10.1 Introduction

This section has been prepared by Ronan Murphy (Senior Acoustic Consultant). Ronan holds a BSc in Environmental Management from DIT and a Diploma in Acoustics and Noise Control. Ronan is a corporate member of the Institute of Acoustics (IOA) and has been working in the field of Acoustics since 2006. He has a broad knowledge base in the measurement, modelling, and assessment of environmental noise for a range of sectors including transport, commercial and industry.

The following section assesses the potential noise and vibration impacts of the proposed development. The assessment has been prepared in accordance with the Environmental Protection Agency's *Guidelines on the Information to be contained In Environmental Impact Assessment Reports* (EPA, May 2022).

The following guidance has also been considered where necessary:

- Protection of the Environment Act 2003, and associated Regulations;
- Dublin Agglomeration Noise Action Plan (December 2018 – July 2023);
- Dublin City Council's Air Quality Monitoring and Noise Control Unit's Good Practice Guide for Construction and Demolition;
- BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites - Noise;
- BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites - Vibration; and
- BS 8233:2014 Guidance on sound insulation and noise reduction for buildings.

The following methodology has been adopted in for the assessment of noise and vibration associated with the proposed development:

- Confirm specific noise and vibration sources relevant to the proposed development;
- Establish existing noise levels at noise sensitive receptors in the vicinity of the proposed development;
- Assess potential noise and vibration impacts of construction activities;
- Assess potential noise impacts during the operational phase; and
- Assess potential impacts of additional road traffic associated with the proposed development during the construction and operational phase.

The assessment covered in this section considers noise and vibration impact to Noise Sensitive Locations (NSL's) relevant to the proposed development. The EPA NG4 definition of an NSL will be used in the assessment, as reproduced below:

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

10.2 Methodology

10.2.1 Construction Phase – Noise

There is no published statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. Local authorities normally control construction activities by imposing limits on the hours of operation and consider the setting of noise limits at their discretion.

In the absence of specific noise limits, appropriate criteria relating to permissible construction noise levels for a development of this scale may be found in the British Standard BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites - Noise*.

The approach adopted here calls for the designation of a noise sensitive location into a specific category (A, B or C) based on existing ambient noise levels in the absence of construction noise. This then sets a threshold noise value that, if exceeded at this location, indicates that a significant noise impact is associated with the construction activities.

This document sets out guidance on permissible noise levels relative to the existing noise environment. Table 10.1 sets out the values which, when exceeded, signify a significant effect at the facades of residential receptors as recommended by BS 5228-1:2009+A1:2014.

Table 10.1 Example threshold of significant effect at dwellings

Assessment category and threshold value period (L_{Aeq})	Threshold value, in decibels (dB)		
	Category A [A]	Category B [B]	Category C [C]
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75
Evenings and weekends [D]	55	60	65
Night-time (23:00 to 07:00hrs)	45	50	55

- Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values;
- Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values;
- Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values; and
- 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.

It should be noted that this assessment method is only valid for residential properties. Commercial premises would generally be considered to be less sensitive to construction noise depending on the nature of the commercial operation.

For the appropriate periods (i.e. daytime, evening and night time) the ambient noise level is determined and rounded to the nearest 5 dB. Baseline monitoring carried out as part of this assessment indicates that the categories detailed in Table 10.2 are appropriate in terms of the nearest noise sensitive locations being considered in this instance. Due to the fact that no evening or night construction works are being proposed, only the daytime average noise level and limit has been presented.

Table 10.2 Rounded Baseline Noise Levels and Associated Categories

Period	Rounded Baseline Noise Level L_{Aeq} (dB)	Category	Applicable Noise Limit L_{Aeq} (dB)
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	55 to 60	A	65

If the construction noise level exceeds the appropriate category value, then a significant effect is deemed to occur.

In order to assist with the interpretation of the noise associated with additional construction road traffic on public roads, Table 10.3 offers guidance as to the likely impact associated with any particular change in traffic noise level.

Table 10.3 Likely impact associated with change in traffic noise level

Change in Sound Level (dB L_{A10})	Subjective Reaction	Impact
< 3	Inaudible	Imperceptible
3 – 5	Perceptible	Slight
6 – 10	Up to a doubling of loudness	Moderate
11 – 15	Over a doubling of loudness	Significant
> 15		Profound

10.2.2 Construction Phase - Vibration

Vibration standards are generally split into two categories, those dealing with human comfort and those dealing with cosmetic or structural damage to buildings. In both instances, it is appropriate to consider the magnitude of vibration in terms of Peak Particle Velocity (PPV).

It is acknowledged that humans are particularly sensitive to vibration stimuli and that any perception of vibration may lead to concern. In the case of road traffic, vibration is perceptible at around 0.5 mm/s and may become disturbing or annoying at higher magnitudes. However, higher levels of vibration are typically tolerated for single events or events of short duration. For e.g., rock breaking and piling, two of the primary sources of vibration during construction, are typically tolerated at vibration levels up to 12 mm/s and 5 mm/s respectively. This guidance is applicable to the daytime only; it is unreasonable to expect people to be tolerant of such activities during the night.

Guidance relevant to acceptable vibration within buildings is contained in the following documents:

- British Standard BS 7385: 1993 - Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration; and,
- British Standard BS 5228-1:2009+A1:2014 - Code of practice for noise and vibration control on construction and open sites - Vibration.

BS 7385 states that there should typically be no cosmetic damage if transient vibration does not exceed 15 mm/s at low frequencies rising to 20 mm/s at 15 Hz and 50 mm/s at 40 Hz and above. These guidelines relate to relatively modern buildings and should be reduced to 50% or less for more critical buildings.

BS 5228-1:2009+A1:2014 recommends that, for soundly constructed property and similar structures that are generally in good repair, a threshold for minor or cosmetic (i.e. non-structural) damage should be taken as a peak component particle velocity (in frequency range of predominant pulse) of;

- 15 mm/s at 4 Hz
- 20 mm/s at 15 Hz and
- 50 mm/s at 40 Hz and above.

Below these values minor damage is unlikely. Where continuous vibration is such as to give rise to dynamic magnification due to resonance, the guide values may need to be reduced by up to 50%. BS 5228-2:2009+A1:2014 also comments that important buildings which are difficult to repair might require special consideration on a case by case basis.

It is noted that a structural survey of the quay walls has indicated that they are not structurally sound and may be susceptible to structural damage from lower levels of construction vibration. Consideration of lower vibration criteria is therefore appropriate to ensure that structural damage does not occur due to works occurring in close proximity to the structure. In this instance, it is therefore proposed to apply the lower limits outlined in the German Standard DIN 4150-3 (1999-02) Structural Vibration - Effects of

Vibration on Structures. Allowable vibration (in terms of peak particle velocity) at the quay walls outside of the permitted works area should not exceed:

- 3 mm/s at less than 10 Hz;
- 3 – 8 mm/s at 10 to 50 Hz; and
- 8 – 10 mm/s at 50 to 100 Hz (and above).

10.2.3 Operational Phase – Noise

During the operational phase, the potential noise generating activities associated with the proposed development will be limited in both scale and frequency. The activities will not give rise to any significant levels of noise and therefore the associated impact is not significant.

10.2.4 Operational Phase – Vibration

It should be noted that the proposed development will not give rise to any significant levels of vibration and therefore the associated impact is not significant.

10.3 Receiving environment

10.3.1 Environmental Noise Survey

An environmental noise survey was conducted to determine baseline noise levels at the nearest noise sensitive locations to the development. The survey was conducted in general accordance with ISO 1996-2:2017 *Acoustics - Description, measurement and assessment of environmental noise - Determination* of sound pressure levels. Specific details are set out below.

Choice of Measurement Locations

Eight measurement locations were selected; each is described in turn below and illustrated on Figure 10.1 below.

- Location S01 - dockside adjacent the Google offices, representative of baseline noise levels for receptors located east of Transition Chamber 1;
- Locations S02 - dockside adjacent the Millennium Towers, representative of baseline noise levels for receptors located to the east of Transition Chamber 2;
- Location S03 - dockside adjacent the proposed southern construction compound, representative of baseline noise levels for at the Altro Vitro apartment block;
- Location S04 - dockside adjacent the Grand Canal Dock building, representative of baseline noise levels for receptors located to the west of Transition Chamber 2;
- Location S05 - dockside at the Red Sticks public amenity area;
- Location S06 - dockside opposite No. 9 Hanover Quay, representative of baseline noise levels for receptors located to the north of Transition Chamber 3;
- Location S07 - located on Asgard Road, representative of baseline noise levels for the dense residential amenity in this area; and
- Location S08 – located on SJRQ, representative of baseline noise levels for receptors located to the Outfall works area.

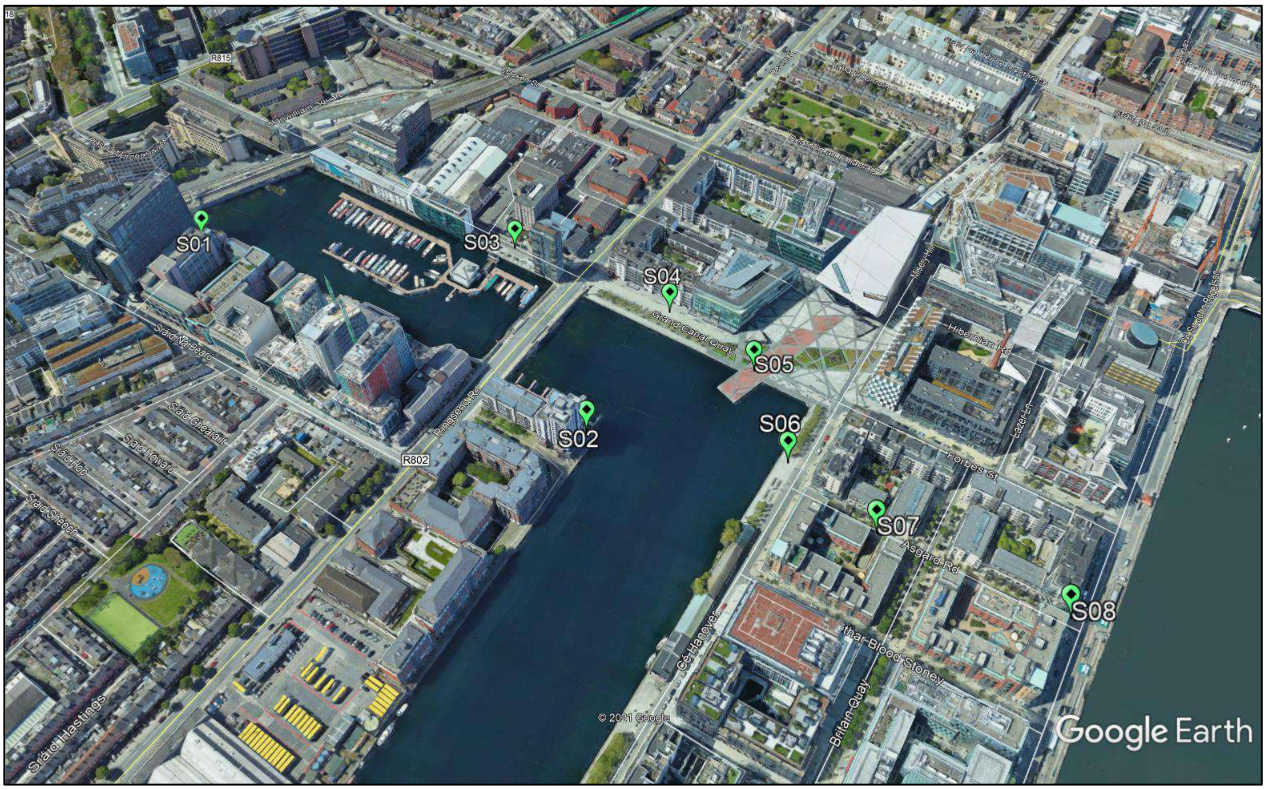


Figure 10.1 Baseline Survey Positions

Survey Periods

Noise measurements were conducted at all locations over the daytime period, representative of when construction activity would occur. The measurements periods were selected in order to provide a typical snapshot of the existing noise climate, with the primary purpose being to ensure that the proposed noise criteria associated with the development are commensurate with the prevailing environment.

The weather during the survey period was dry and calm with a 1 to 3 ms breeze and temperature of approximately 10° Celsius.

Instrumentation

Noise measurements were conducted using a Rion NL-52 Type 1 sound level meter. The measurement apparatus was check calibrated both before and after each survey using a Brüel & Kjær Type 4231 Sound Level Meter Calibrator.

Procedure

Measurements were conducted at all locations were conducted on a cyclical basis. Sample periods for the noise measurements were nominally 15 minutes during all survey periods. Survey personnel noted all primary noise sources contributing to noise build-up.

Measurement Parameters

The noise survey results are presented in terms of the following five parameters:

L_{Aeq} is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period.

L_{Amax} is the instantaneous maximum sound level measured during the sample period.

L_{Amin} is the instantaneous minimum sound level measured during the sample period.

L_{A10} is the sound level that is exceeded for 10% of the sample period. It is typically used as a descriptor for traffic noise.

L_{A90} is the sound level that is exceeded for 90% of the sample period. It is typically used as a descriptor for background noise.

The "A" suffix denotes the fact that the sound levels have been "A-weighted" in order to account for the non-linear nature of human hearing.

10.3.2 Results and Discussion

Survey Position S01

The baseline noise levels for survey position S01 have been presented in Table 10.4.

Table 10.4 Summary of noise measurements at Location S01

Period	Start Time	Sound Pressure Levels (dB RE 2x10^{-5} Pa)				
		L_{Aeq}	L_{AFmax}	L_{AFmin}	L_{AF10}	L_{AF90}
Day	08:44 - 08:59	60	73	52	64	53
	10:14 - 10:29	60	75	51	64	55
	11:41 - 11:56	57	76	51	59	53

Construction noise from Boland's Quay dominant, DART dominant intermittently, light road traffic noise audible from Ringsend Road.

Survey Position S02

The baseline noise levels for survey position S02 have been presented in Table 10.5.

Table 10.5 Summary of noise measurements at Location S02

Period	Start Time	Sound Pressure Levels (dB RE 2x10^{-5} Pa)				
		L_{Aeq}	L_{AFmax}	L_{AFmin}	L_{AF10}	L_{AF90}
Day	09:05 - 09:20	57	63	50	59	53
	10:37 - 10:52	56	66	48	59	51
	12:04 - 12:19	57	70	49	60	52

Road traffic noise from Ringsend Road dominant noise source, construction noise from Boland's Quay generating high levels intermittently.

Survey Position S03

The baseline noise levels for survey position S03 have been presented in Table 10.6.

Table 10.6 Summary of noise measurements at Location S03

Period	Start Time	Sound Pressure Levels (dB RE 2x10^{-5} Pa)				
		L_{Aeq}	L_{AFmax}	L_{AFmin}	L_{AF10}	L_{AF90}
Day	09:27 - 09:42	60	74	51	62	54
	10:56 - 11:11	60	79	52	63	54
	12:25 - 12:40	60	74	52	63	54

Road traffic noise from Ringsend Road dominant noise source, construction noise from Boland's Quay audible, pedestrians conversing nearby.

Survey Position S04

The baseline noise levels for survey position S04 have been presented in Table 10.7.

Table 10.7 Summary of noise measurements at Location S04

Period	Start Time	Sound Pressure Levels (dB RE 2x10^{-5} Pa)				
		L_{Aeq}	L_{AFmax}	L_{AFmin}	L_{AF10}	L_{AF90}
Day	09:48 - 10:03	58	68	50	61	54
	11:15 - 11:30	59	75	51	61	54
	12:44 - 12:59	58	79	50	61	54

Road traffic from Ringsend Road dominant source, construction noise audible in distance, pedestrians conversing nearby.

Survey Position S05

The baseline noise levels for survey position S05 have been presented in Table 10.8.

Table 10.8 Summary of noise measurements at Location S05

Period	Start Time	Sound Pressure Levels (dB RE 2x10^{-5} Pa)				
		L_{Aeq}	L_{AFmax}	L_{AFmin}	L_{AF10}	L_{AF90}
Day	13:16 - 13:31	54	68	48	57	51
	14:29 - 14:44	54	72	48	56	50
	15:42 - 15:57	56	72	49	57	52

Road traffic from Ringsend Road dominant source, construction noise audible in distance, some local traffic on Hanover Quay, pedestrians conversing nearby.

Survey Position S06

The baseline noise levels for survey position S06 have been presented in Table 10.9.

Table 10.9 Summary of noise measurements at Location S06

Period	Start Time	Sound Pressure Levels (dB RE 2x10^{-5} Pa)				
		L_{Aeq}	L_{AFmax}	L_{AFmin}	L_{AF10}	L_{AF90}
Day	13:33 - 13:48	58	71	52	60	54
	14:46 - 15:01	57	71	50	60	53
	15:59 - 16:14	56	70	51	58	54

Road traffic from Hanover Quay dominant, traffic from Ringsend Road also contributing, pedestrians conversing nearby.

Survey Position S07

The baseline noise levels for survey position S07 have been presented in Table 10.10.

Table 10.10 Summary of noise measurements at Location S07

Period	Start Time	Sound Pressure Levels (dB RE 2x10^{-5} Pa)				
		L_{Aeq}	L_{AFmax}	L_{AFmin}	L_{AF10}	L_{AF90}
Day	13:50 - 14:05	54	71	47	57	49
	15:04 - 15:19	54	66	46	57	48
	16:36 - 16:51	55	85	45	56	48

Road traffic on Asgard Road dominant but infrequent, construction noise audible, some light road traffic audible from both Hanover Quay and SJRQ.

Survey Position S08

The baseline noise levels for survey position S08 have been presented in Table 10.11.

Table 10.11 Summary of noise measurements at Location S08

Period	Start Time	Sound Pressure Levels (dB RE 2x10^{-5} Pa)				
		L_{Aeq}	L_{AFmax}	L_{AFmin}	L_{AF10}	L_{AF90}
Day	14:09 - 14:24	57	72	50	60	52
	15:22 - 15:37	61	85	49	63	52
	16:54 - 17:09	58	74	50	61	52

Road traffic noise from North Wall Quay dominant, siren influencing second measurement, construction noise audible intermittently throughout, some limited road traffic noise on SJRQ.

10.4 Characteristics of the Development

The potential noise and vibration impact of the proposed development on the surroundings must be considered for two distinct stages:

- Construction phase; and,
- Operational phase.

The greatest potential for noise and vibration impact will arise during the construction phase. During this period, potential noise and vibration impacts will arise from a range of activities including:

- Breaking of existing hardstand including footpaths and roads;
- Dredging or removal of material from dock prior to drainage;
- Pumps associated with drained work areas within the Grand Canal Dock and SJRQ;
- Driving of sheet piles to form temporary cofferdam around work area at Grand Canal Dock and SJRQ;
- Crane operation hoisting cofferdam sheets and pipe sections into place;
- Installation of temporary work areas and compounds;
- HGV movement including removal of spoil and excavated or dredged material;
- Operation of hand tools, small machinery and site offices (grinders, SDS drills, impact drivers and generators).

In this instance, operational noise impacts will be limited to infrequent maintenance of the transition chambers.

10.5 Potential Impacts

10.5.1 Do-Nothing Impacts

The existing infrastructure does not incorporate any noise generating elements. Prevailing ambient noise levels would vary depending on the prevalence of construction activity within the area and road traffic volumes on the local road network.

10.5.2 Construction Phase - Noise

The proposed general construction hours are 08:00 to 18:00 hrs, Monday to Friday and 08:00 to 14:00 hrs on Saturdays in accordance with standard working hours. Work will not be completed on Sundays or Bank holidays.

Site and Compound Activity

Due to the fact that the construction programme has been established in outline form only, it is not possible to determine accurately, the specific magnitude of noise emissions from site and compound related construction activity. Even with a detailed construction programme and schedule, a large degree of uncertainty is involved in such calculations due to issues such as plant on-time, machinery specification and variation in operator work practices.

From a noise and vibration perspective, the proposed construction activities can be subdivided into distinct activities or stages:

- Construction of the Transition Chambers and Outfall Structure;
- Construction of the culvert at Hanover Quay;
- Laying of the pipework; and
- Activity within the site compounds.

Each of these stages has been discussed in the following sections in terms of the potential noise and vibration generating plant items involved.

Construction of Transition Chambers and Outfall Structure

In the first instance, in order to create a dry work area for the transition and outfall chambers, temporary cofferdams will be installed at each work site.

The cofferdams at Transition Chamber 1 and 2 will be comprised of sheet piles, driven from a barge or pontoon mounted piling rig. The primary source of noise and vibration generated during this stage will depend on the sheet piling method selected. Traditional hammer driven or vibratory sheet piling will generate a high level of noise. The lowest level of noise generation would typically be through the use of a press in sheet piling. Although this rig can sometimes require an ancillary hydraulic power pack, noise levels are generally considerably lower than traditional methods. It is likely that ancillary plant such a power pack and crane hoist may also be required on the barge to load and manoeuvre sheet piles.

The type of plant required for the next stage of the Transition Chamber construction will vary significantly between each. Transition Chamber 2 will not require any demolition and move straight to concrete formwork or emplacement if precast components are to be used. Transition Chambers 1, 3 and the Outfall will require some demolition of the existing outfall structure (Chamber No. 1) and quay walls (Chamber 3 and the outfall on SRJQ). Piling is only required in the case of the Outfall construction on SJRQ.

Demolition in all instances is likely to require a mini-excavator hoisted in the cofferdam work area where the existing structures would be reduced with a breaker fitting. Material will likely be hoisted from the work area for dockside removal.

Construction of the transition chambers using traditional concrete formwork would include a range of noise generating sources including nail guns and circular saws for formwork, consaws and angle grinders for rebar which would need to be lifted into place using a dockside or barge mounted crane. It is likely that a long reach concrete pumping truck and mixer would then be required to fill the formwork from dockside.

A secant pile wall construction has been proposed for the SJRQ outfall. It is proposed that the continuous flight auger (CFA) piling would be utilised in this regard. This would constitute best practice in terms low noise and vibration piling methods.

Construction of the culvert at Hanover Quay

In the first instance, outside the works associated with the construction of Transition Chamber 3, the construction of the culvert at Hanover Quay will include extension excavation. Currently, it is proposed that a secant pile wall is installed using rotary bored piles to contain the works area associated with the culvert construction. It is proposed that works will involve design and installation of the temporary secant piled wall at Hanover Quay and the Continuous Flight Auger (CFA) piles for the outlet structure on SJRQ. The adoption of CFA piling as proposed for the SJRQ outfall constitutes best practice for minimising noise and vibration.

Once the secant pile wall is installed, extensive excavation of the culvert will be undertaken using a range of noise generating plant and machinery. It may be possible that one or more mini-excavators would be used with breaker arms or buckets depending on the under burden and underground services. Dump trucks and power tools such as consaws and angle grinders will also be required at this stage and have the potential to generate elevated levels of noise.

Once the area has been excavated, the precast culvert sections will be hoisted into place, pipe laid and screen and finished with appropriate superstructure to ground level.

Laying of the pipework

The culvert sections will be hoisted into place from a barge or pontoon, once the pipes are laid and welded, concrete will be pumped to fill the concrete culvert and encase the pipework. Noise generating plant and machinery will primarily include crane hoists, generators and compressors for divers.

Compound Activities

Due to the very limited work areas available, the construction compounds are likely to serve not just as storage but also workshop and fabrication areas. Noise generating machinery that may be operating here include teleporters, generators, compressors, angle grinders, and impact drivers amongst others.

Summary

In summary, the construction phase will include a wide range of activities and noise sources. Due to the proximity of the works areas to noise sensitive areas, there is potential for significant noise impacts to occur.

Since the construction programme has been established in outline form only, it is not possible to accurately quantify construction noise or vibration levels. The results of the baseline survey confirm that construction noise levels will need to be limited to 65 dB $L_{Aeq,16hour}$ at the nearest noise sensitive locations to prevent significant impacts occurring. Vibration levels associated with construction activity at the nearest dwellings will not exceed those outlined in Section 10.2.2. The development and implementation of an appropriate Construction Noise and Vibration Management Plan will be crucial to ensure that these noise levels can be complied with. Further information on this has been provided in Section 10.6.1.

Additional Construction Traffic on Public Roads

It is understood that peak construction haulage from the site will generate approximately 38 movements per day.

The noise level associated with an event of short duration, such as a passing vehicle movement, may be expressed in terms of its Sound Exposure Level (L_{AX}). The Sound Exposure Level can be used to calculate the contribution of an event or series of events to the overall noise level in a given period. The appropriate formula is given below.

$$L_{Aeq,T} = L_{AX} + 10\log10(N) - 10\log10(T) + 20\log10(r_1/r_2)\text{dB}$$

where:

$L_{Aeq,T}$ is the equivalent continuous sound level over the time period T (in seconds).

L_{AX} is the "A-weighted" Sound Exposure Level of the event considered (dB).

N is the number of events over the course of time period T.

r_1 is the distance at which L_{AX} is expressed.

r_2 is the distance to the assessment location.

The mean Sound Exposure Level for a heavy goods vehicle (HGV) moving at low to moderate speeds (i.e. 15 to 45 km/hr) is in the order of 82 dB L_{AX} at a distance of 5 metres from the vehicle. These figures are based on a series of measurements conducted under controlled conditions.

Assuming the worst case of 38 HGV's, the worst case predicted noise level at the nearest receptor to the Hanover Quay (10 metres) would be expected to fall in the region of 56 dB $L_{Aeq,\ 1hour}$. In consideration of the fact that the prevailing ambient noise level during the daytime is dominated by traffic and falls in the region of 57 dB dB $L_{Aeq,}$ would give rise to a 3 dB increase in noise levels cumulatively. Making reference to Table 10.3, the impacts of construction related traffic on public roads can be regarded as *slight.*

10.5.3 Construction Phase- Vibration

Impact of Piling on Vibration Sensitive Structures

The main source of vibration during the construction programme is likely to be the piling process. A bored piling method is currently proposed. Due to the fact that this a non-percussive piling technique this option will inherently reduce the level of piling vibration generated.

The nearest vibration sensitive structure to the proposed work are the rail tracks at Grand Canal Dock. The only potential vibration generating works at this location will be the partial demolition of the existing outfall chamber. It will be necessary for vibration monitoring to be installed at the tracks to provide real-time monitoring of construction related vibration at Transition Chamber 1.

Vibration Generated by HGVs on Public Road

Elevated levels vibration arising from HGV movements can occur where the vehicle is traversing irregular or poorly surfaced roads at speed. A review of the haul routes confirms that that the local road network is generally in good condition. As such the level of vibration expected to be generated by unladen or laden HGVs would be expected to be very low.

Therefore, the impact of vibration arising from construction traffic is expected to be *insignificant.*

10.5.4 Operational Phase

The only mechanical plant that may be required is a small motor to operate the penstock gate. Mechanical noise from this motor will be completely inaudible at both the nearest noise sensitive location and the nearest public amenity area or walkway. The impact from operational plant associated with the development will therefore be *negligible.*

Otherwise, noise impacts during the operational phase of the development will be limited works associated with maintenance of the outfall which may include movement of manhole covers and occasional operation of grab arm HGV to remove trapped detritus from the outfall chamber. It is expected that whilst this may generate high levels of noise, it would be expected that such operations would last a few hours and may only occur once or twice a year during the daytime period. The impact of these activities is therefore considered to be *negligible.*

10.6 Mitigation Measures

10.6.1 Construction Phase

The Contractor will ensure that construction noise levels are limited to 65 dB $L_{Aeq,16hour}$ at the nearest noise sensitive location.

To mitigate impacts as a result of vibration the following thresholds will not be exceeded.

Allowable vibration (in terms of peak particle velocity) at the quay walls outside of the permitted works area should not exceed:

- 3 mm/s at less than 10 Hz;
- 3 – 8 mm/s at 10 to 50 Hz; and
- 8 – 10 mm/s at 50 to 100 Hz (and above).

For soundly constructed property and similar structures that are generally in good repair, a threshold for minor or cosmetic (i.e. non-structural) damage should be taken as a peak component particle velocity (in frequency range of predominant pulse) of:

- 15 mm/s at 4 Hz;
- 20 mm/s at 15 Hz; and
- 50 mm/s at 40 Hz and above.

The Contractor will be required to develop a comprehensive construction Noise and Vibration Management Plan having regard to the best practice outlined in BS 5228-1:2009+A1:2014 and BS 5228-2:2009+A1:2014. Amongst others, it is proposed that the following practices be adopted as a matter of course:

- Limiting the hours during which site activities likely to create high levels of noise are permitted;
- Establishing channels of communication between the Contractor, local authority and residents;

- Appointing a site representative responsible for matters relating to noise;
- Monitoring typical levels of noise during critical periods and at sensitive locations;
- Selection of plant with low inherent potential for generation of noise;
- Siting of noisy plant as far away from sensitive properties as permitted by site constraints; and
- To ensure all plant is serviced and maintained and the plant used is of latest technology with inbuilt noise mitigation.

The impact assessment conducted for the construction activity during the construction phase has highlighted that the predicted construction noise levels will be within the adopted criteria. Nevertheless, it will be a requirement for the Contractor to employ and implement best practice construction noise and vibration management techniques throughout the construction phase in order to further reduce the noise and vibration impact to nearby noise sensitive receptors.

In the first instance, the Contractor will compile a Noise and Vibration Management Plan (NVMP) which will deal specifically with management processes and strategic mitigation measures to remove or reduce significant noise and vibration impacts, and cumulative noise and vibration impacts from the construction works. The Plan will also define noise and vibration monitoring and reporting. The NVMP will also include method statements for each phase of the works, the associated specific measures to minimise noise and vibration in so far as is reasonably practicable for the specific works covered by each plan and a detailed appraisal of the resultant construction noise and vibration generated.

The Contractor will provide proactive community relations and will notify the public and vibration sensitive premises before the commencement of any works forecast to generate appreciable levels of noise or vibration, explaining the nature and duration of the works.

The Contractor will distribute information circulars informing people of the progress of works and any likely periods of significant noise and vibration.

With regard to potential mitigation measures during construction activities, the standard planning condition typically issued by DCC states:

> *"During the construction and demolition phases, the proposal development shall comply with British Standard 5228 "Noise Control on Construction and open sites Part 1. Code of practice for basic information and procedures for noise control."*

The BS5228 standards include guidance on several aspects of construction site mitigation measures, including, but not limited to:

- selection of quiet plant;
- control of noise sources;
- screening;
- hours of work;
- liaison with the public; and
- monitoring.

Noise control measures that will be considered include the selection of quiet plant, enclosures and screens around noise sources, limiting the hours of work and noise monitoring.

10.6.2 Operational Phase

The appointed maintenance Contractor will ensure that the works will be undertaken in a manner that ensure that the limits set out in Section 10.2.1 and Section 10.2.2 are achieved.

10.7 Residual Impacts

Once the mitigation measures as proposed are implemented, no residual significant noise or vibration impacts are expected to arise as a result of the construction and operation of the proposed development.

10.7.1 Interactions

In compiling this impact assessment, reference has been made to the project description provided by the project co-ordinators, project drawings provided by the project designers and traffic flow projections associated with the development provided by the traffic consultants. Reference has also been made to the Section 12 Archaeology and Cultural Heritage section to confirm where vibration sensitive structures may exist. The interaction of this section with Section 5 Population and Human Health, Section 6 Biodiversity, Section 11 Traffic and Transport and Section 15 Landscape and Visual Impact has also been considered.

10.7.2 Cumulative Impacts

The existing transport and road networks are not likely to experience capacity increases of sufficient volume to give rise to even moderate to significant increases in the prevailing noise climate. The local area has been extensively developed over the last 5 to 10 years and so there is also limited scope for extraneous construction activities to give rise to significant increases in the cumulative noise levels.

10.8 Monitoring

10.8.1 Construction Phase

Noise and vibration monitoring will be undertaken during the construction phase at the nearest noise sensitive location to the works area. Noise and vibration monitoring will be undertaken in accordance with Iarnród Éireann requirement at Transition Chamber 1. Vibration monitoring will also be completed during piling work at the Outfall works area.

10.8.2 Operational Phase

On-going noise and vibration monitoring during the operational phase of the development is not required.

10.9 References

British Standards Institution (2014) BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites - Noise*

British Standards Institution (2014) BS 5228-2:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites - Vibration*

British Standards Institution (2014) BS 8233:2014 Guidance on sound insulation and noise reduction for buildings

British Standard Institution (2014) BS 7385-2: 1993 *Evaluation and measurement for vibration in buildings - Guide to damage levels from ground borne vibration*

DIN 4150-3 (1999-02) Structural Vibration - Effects of Vibration on Structures

Dublin City Council (2018) *Dublin Agglomeration Noise Action Plan (December 2018 – July 2023)*

Dublin City Council (2016) *Air Quality Monitoring and Noise Control Unit's Good Practice - Guide for Construction and Demolition*

ISO 1996-2:2017 *Acoustics - Description, measurement and assessment of environmental noise - Determination* of sound pressure levels

Protection of the Environment Act 2003, and associated Regulations

SECTION 11: Traffic and Transport

11.1 Introduction

The traffic and transportation section has been prepared to assess the potential traffic related impacts associated with the construction and operation of the proposed Grand Canal Storm Water Outfall Extension (GCSWOE).

This section was completed by Alan Moriarty who is a Senior Engineer with J. B. Barry and Partners and has over 10 years' experience in the area of traffic and transport assessments. Alan holds an MSc in Engineering from Trinity College Dublin as well as a BEng in Civil Engineering from Dublin Institute of Technology. He is a Chartered Engineer with Engineers Ireland (CEng MIEI) and a member of the Transport Planning Society (TPS). Alan has been responsible for the traffic and transport element of numerous Environmental Impact Assessments, including TII tranche 4 motorway service areas (3 No.), Microsoft Ireland Dublin Campus, Ringsend Wastewater Treatment Plant Upgrade Project and the Regional Biosolids Storage Facility.

11.2 Methodology

11.2.1 Assessment Methodology

The methodology adopted for this assessment is summarised as follows:

- Reference was made to site layout drawings;
- Existing and proposed access arrangements for the development onto the surrounding road network were considered;
- Historical traffic count surveys were obtained for the junctions most likely to be impacted by the proposed development;
- The project's trip generation was estimated for the construction phase;
- The project specific trip generation was assigned and distributed throughout the study area; and
- The junctions considered to be most likely to be impacted upon by traffic movements associated with the proposed development were assessed in terms of capacity and road safety.

The assessment is based on the findings of site visits, observations, on-site traffic counts, plans associated with the proposed project and consultation with the Design Team. Consultation meetings were held with Roads & Traffic Planning Division, DCC on 1st March 2021.

11.2.2 Modelling Methodology

Due to the restrictions and guidance in place in response to the Covid-19 pandemic, traffic flows on the adjoining road network are lower than would be anticipated both pre and post Covid-19. Various levels of restrictions were in place from March 2020 until January 2022. However, it has been noted at the time of writing that traffic levels on the adjoining road network are approximately 85% of pre-Covid-19 levels (Based on TII TMU N01 040.0 S: 2019 AADT – 44,765, 2022 AADT – 38,031 & TII TMU M50 000.0 N: 2019 AADT – 86,729, 2022 AADT – 73,887 (accessed on 30th March 2022)). In order to produce a conservative estimate of traffic behaviour in the vicinity of the subject site, historic traffic data previously collected within the local area was obtained. These historic traffic counts were undertaken in 2020 prior to the Covid-19 pandemic as well as in 2016 and in 2019. The 2016 and 2019 traffic figures were factored up to estimate the 2020 base year traffic flows on the adjacent road network.

To establish the baseline and future year flows the historic traffic count data will be factored up to the base year 2020 and the final construction year 2025 using *TII Project Appraisal Guidelines: Unit 5.3 Travel Demand Projections* (Transport Infrastructure Ireland, 2019). Due to the nature of the proposed scheme, no traffic associated with the scheme is anticipated beyond the construction stage and it has been determined that no assessment of the traffic impacts in either the year of opening or the any future design year is required.

Traffic volumes associated with the construction phase of the proposed GCSWOE were developed by calculating the average number of HGV traffic per hour per element of the project. It is anticipated that elements will be constructed sequentially, either in part or in whole. However, to provide a robust analysis of the impact caused by construction traffic, it has been assumed that all elements of the work will be undertaken concurrently.

Construction generated HGV trips were applied to the road network, following the identified HGV haul route. It has been assumed that light vehicles associated with staff and smaller deliveries are likely to be attracted to and distributed from the subject site in a similar proportion to the baseline traffic model. In this regard, the peak turn-in and turn-out flows calculated for the proposed development were distributed and assigned throughout the junctions considered in similar proportions to the overall traffic flows identified as part of the baseline traffic model.

11.3 Receiving environment

11.3.1 Site Location

The proposed GCSWOE is located in Grand Canal Dock, Grand Canal Quay and SJRQ. Construction works will take place within the Basin, on Hanover Quay, and SJRQ.

11.3.2 Local Road Network

Linking the site with the Regional Road Network are a series of local roads and streets. These local roads and streets include Grand Canal Quay, Pearse Street, Macken Street, SJRQ and the Samuel Beckett Bridge as shown in Figure 11.1.

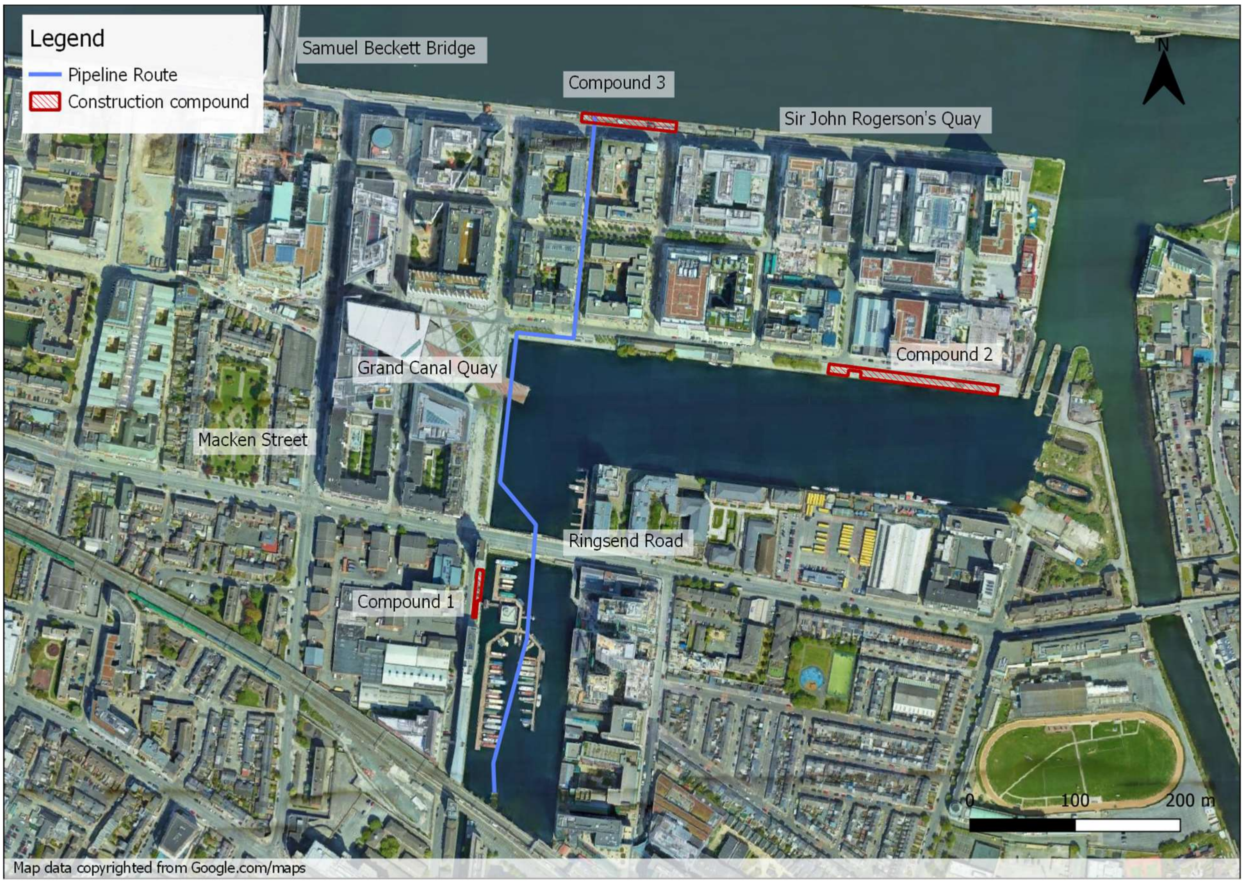


Figure 11.1 Local Road Network

The construction compounds associated with the construction of the proposed scheme are located within the DCC HGV Cordon Area as per the HGV Management Strategy (DCC, 2021). The HGV Strategy provides for a ban on 5+ axle vehicles during the hours of 07.00-19.00 seven days a week from a designated cordon area, as shown in Figure 11.2 below and provides a limited permit scheme for 5+ axle vehicles that need to load/ unload within the city centre area.

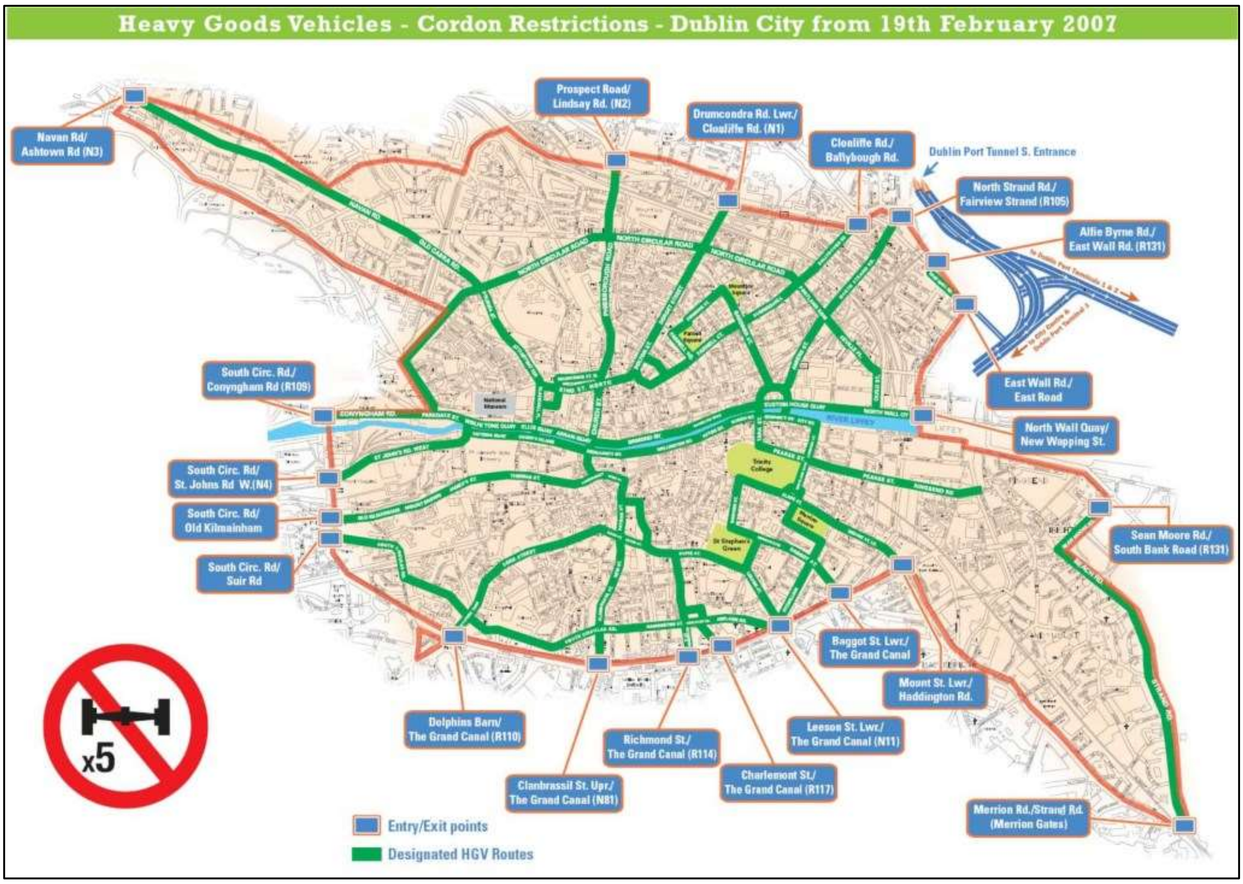


Figure 11.2 DCC HGV Cordon Area (DCC, 2018)

Due to the HGV Management Strategy, if needed, access to the site for 5+ axle HGVs will be via M50, Sheriff Street Upper (R101), Guild St, Samuel Beckett Bridge, SJRQ, Forbes Street or Macken Street, Pearse St and Grand Canal Quay, as per Figure 11.3 and will be outside the hours of operation for the cordon or by permit as granted by DCC during the hours of operation of the HGV cordon. Refer to Section 11.5.2 Construction Trip Distribution and Trip Assignment for further information relating to the proposed HGV haul route.

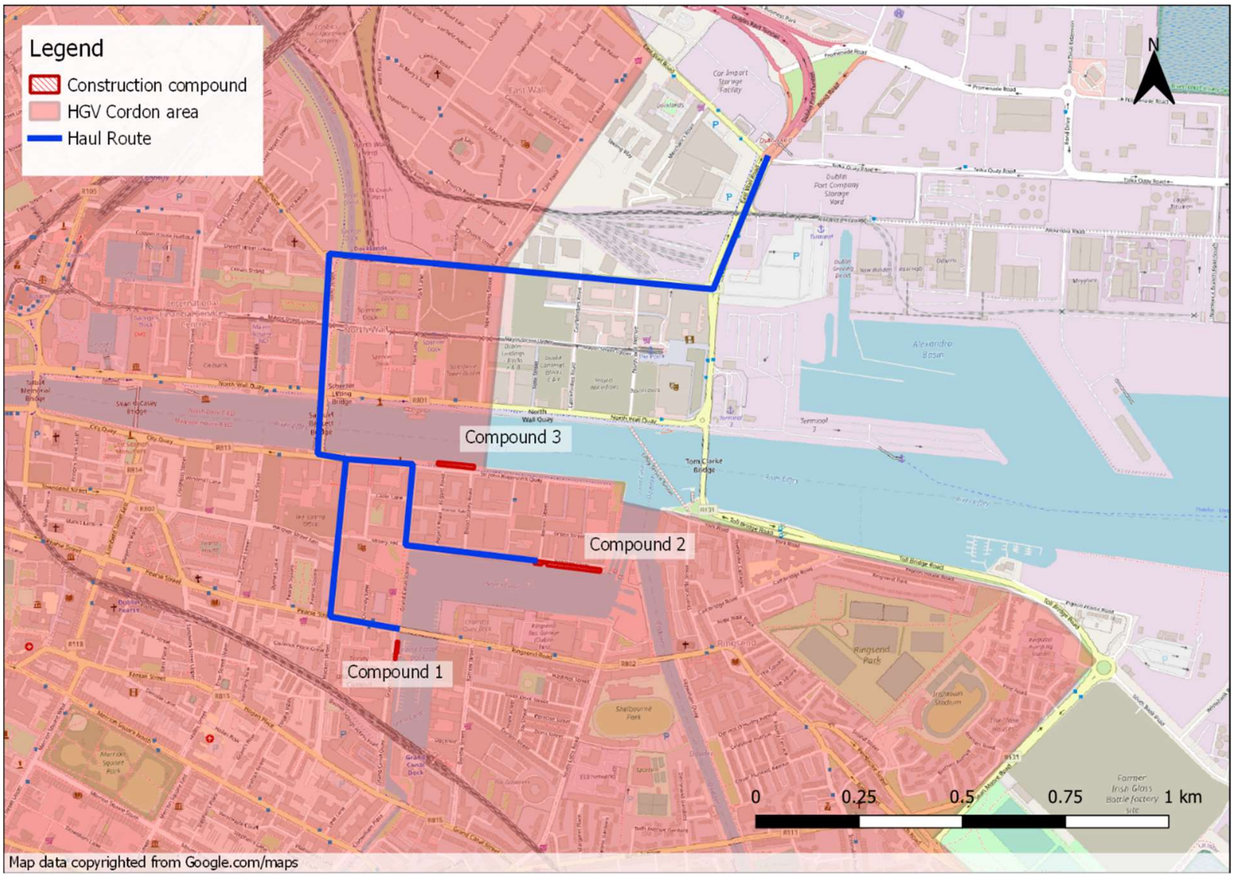


Figure 11.3 DCC HGV Cordon Area in relation to site and proposed HGV route (OpenStreetMap, 2021), Annotation by J. B. Barry

11.3.3 Traffic Surveys

Due to the restrictions and guidance in place in response to the Covid-19 pandemic, traffic flows on the adjoining road network are lower than would be anticipated both pre and post Covid-19. Various levels of restrictions were in place from March 2020 until January 2022. However, it has been noted at the time of writing that traffic levels on the adjoining road network are approximately 85% of pre-Covid-19 levels (Based on TII TMU N01 040.0 S: 2019 AADT – 44,765, 2022 AADT – 38,031 & TII TMU M50 000.0 N: 2019 AADT – 86,729, 2022 AADT – 73,887 (accessed on 30th March 2022)) (Transport Infrastructure Ireland, 2022). In order to produce a conservative estimate of traffic behaviour in the vicinity of the subject site for the baseline scenario, historic traffic data previously collected for five junctions near the subject site was obtained. The locations obtained are illustrated in Figure 11.4 and comprise:

- Site 1- Guild St/R801 (Samuel Beckett Bridge) junction;
- Site 2- SJRQ/Macken St junction;
- Site 3- Pearse St (R802)/Grand Canal Quay/Ringsend St junction;
- Site 4- Sheriff Street Upper (R101)/East Wall Road (R131) junction; and
- Site 5- Sheriff Street Upper (R101)/Guild St junction.

The vehicle turning movement surveys for Site 4 and Site 5 were undertaken in February 2019 and carried out over a 24-hour period. The vehicle turning movement survey for Site 1 and Site 2 were undertaken in January/ February 2020 (prior to any Covid-19 related restrictions) and were carried out over a 12-hour period. The vehicle turning movement survey for Site 3 was undertaken in May 2016 and was carried out over two 3-hour periods to cover the AM and PM peak hour periods.

The counts captured all turning movements at these junctions and data was collected in 15-minute intervals. The AM peak hour was identified as 08:00-09:00, and the afternoon peak hour was identified as 17:00-18:00 for all junctions. The following count classifications were employed, Light Vehicles (LV) and Heavy Goods Vehicles (HV).

The AM and PM peak hour traffic flows through the junction are illustrated in Figure 11.5 and Figure 11.6, respectively.

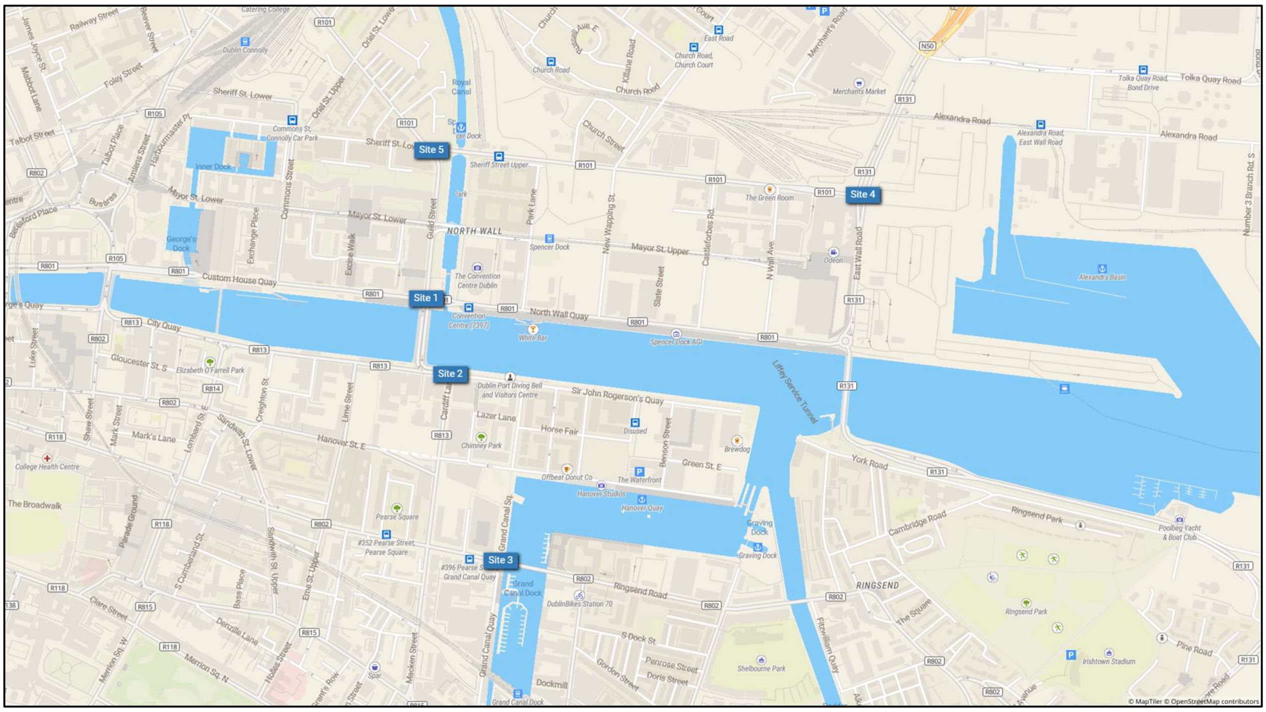


Figure 11.4 Traffic Count Locations (IDASO,2021)

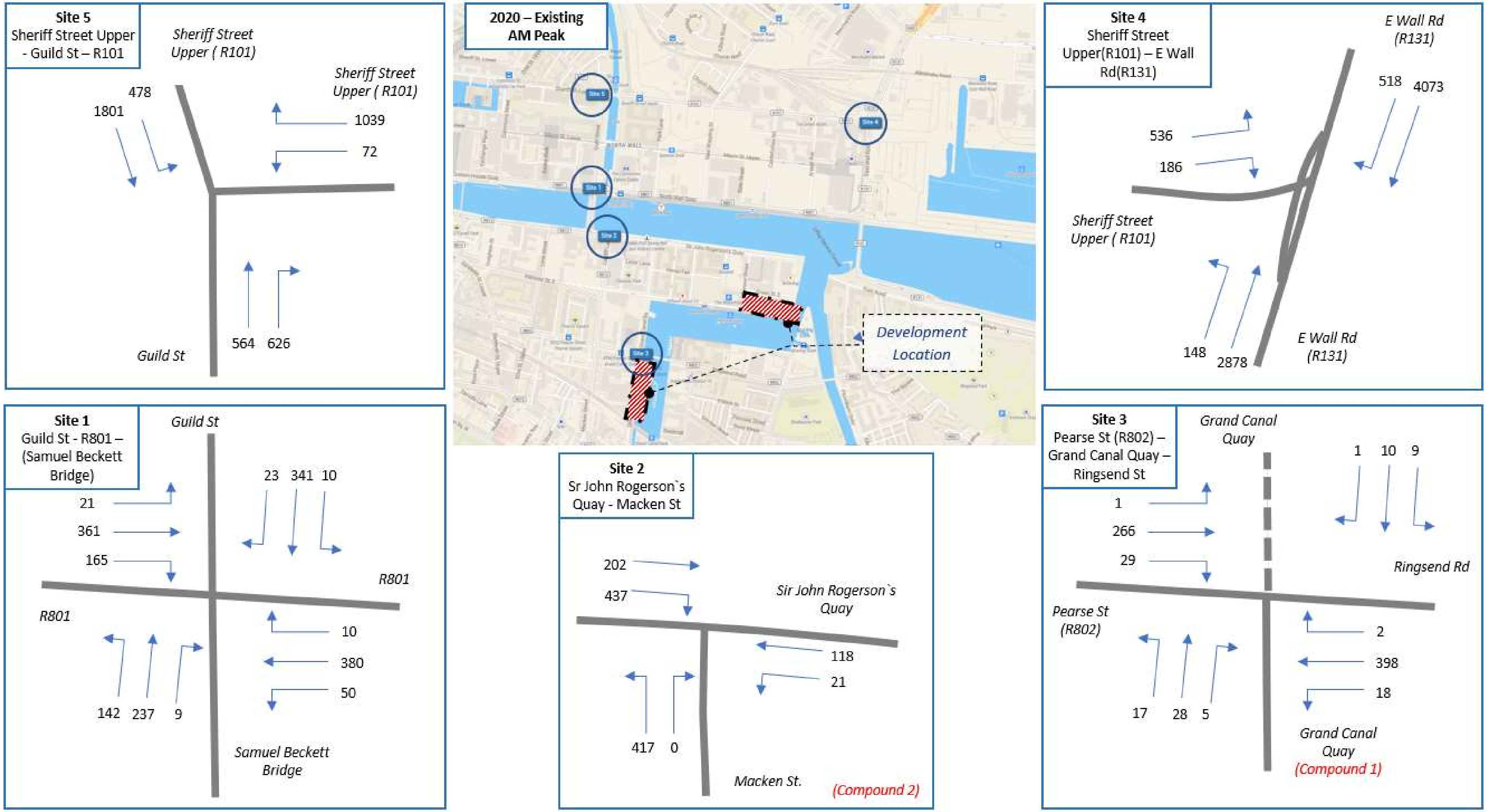


Figure 11.5 AM Peak Hour Traffic Flows

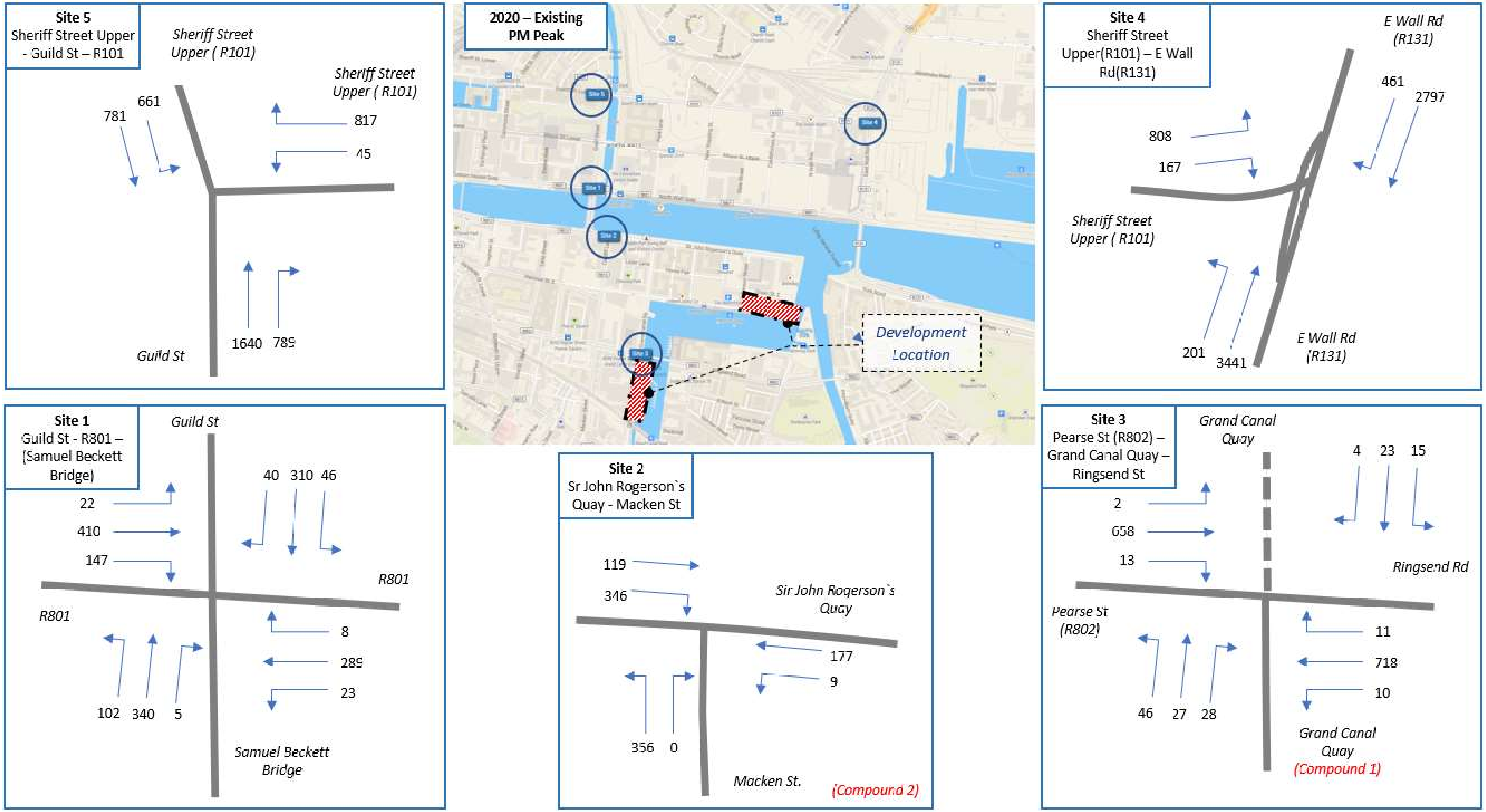


Figure 11.6 PM Peak Hour Traffic Flows

11.3.4 Base Year 2020 Annual Average Daily Traffic Flows (AADT)

TII (NRA) Project Appraisal Guidelines - Unit 16.2: Expansion Factors for Short Period Traffic Counts specifies a methodology to obtain an AADT flow. Based on this, the AADT flows for the following roads adjoining the proposed development are as detailed in Table 11.1.

Table 11.1 AADTs Derived from Traffic Count Data

Link	AADT
Samuel Beckett Bridge	18,036
Macken St	17,496
Pearse St	17,879
Ringsend St	18,087
Sheriff Street Upper	8,366

11.3.5 Base Year Capacity Assessment

A capacity assessment of SJRQ/ Macken St junction and Pearse St (R802)/ Grand Canal Quay/ Ringsend St junction was undertaken utilising the surveyed results described in Section 11.3.3 and the Transport Research Laboratory's (TRL) OSCADY (Optimised Signal CApacity and DelaY) software for signal-controlled junctions.

A summary of the results of the analysis for the AM and PM peak hours are shown in Table 11.2 and Table 11.3, respectively.

Table 11.2 2020 Baseline AM Peak Junction Capacity Analysis

Junction	Highest RFC	Junction Delay (sec)	Queue Length (PCU)
SJRQ - Macken St	0.63	14.61	6.9
Pearse St (R802) – Grand Canal Quay – Ringsend St	0.78	15.87	9.6

Table 11.3 2020 Baseline PM Peak Junction Capacity Analysis

Junction	Highest RFC	Junction Delay (sec)	Queue Length (PCU)
SJRQ - Macken St	0.65	19.22	6.1
Pearse St (R802) – Grand Canal Quay – Ringsend St	0.65	14.88	8.1

The normal design threshold for the ratio of flow to capacity (RFC) is 0.90 for a signal-controlled junction. The results shown in in Table 11.2 and Table 11.3 demonstrate that both SJRQ/ Macken St junction and Pearse St (R802)/ Grand Canal Quay/ Ringsend St junction are operating within the normal design threshold in the AM and PM peak periods in the 2020 baseline scenario.

11.4 Characteristics of the Development

It is proposed to provide 3 no. compounds to facilitate the construction of the proposed scheme. These compounds are located on Grand Canal Quay, Hanover Quay and SJRQ as illustrated in Figure 11.7.

Works will be required on Grand Canal Quay, Hanover Quay, Asgard Road and SJRQ which may require lane and/ or footpath closures. Additionally, a road closure may be required on Asgard Road, however, it is anticipated that vehicular access to the carpark on Asgard Road will be maintained for the duration of the works. It is anticipated that either a stop and go or a temporary traffic signal system will be utilised to maintain two-way traffic flow on SJRQ for the duration of the works.

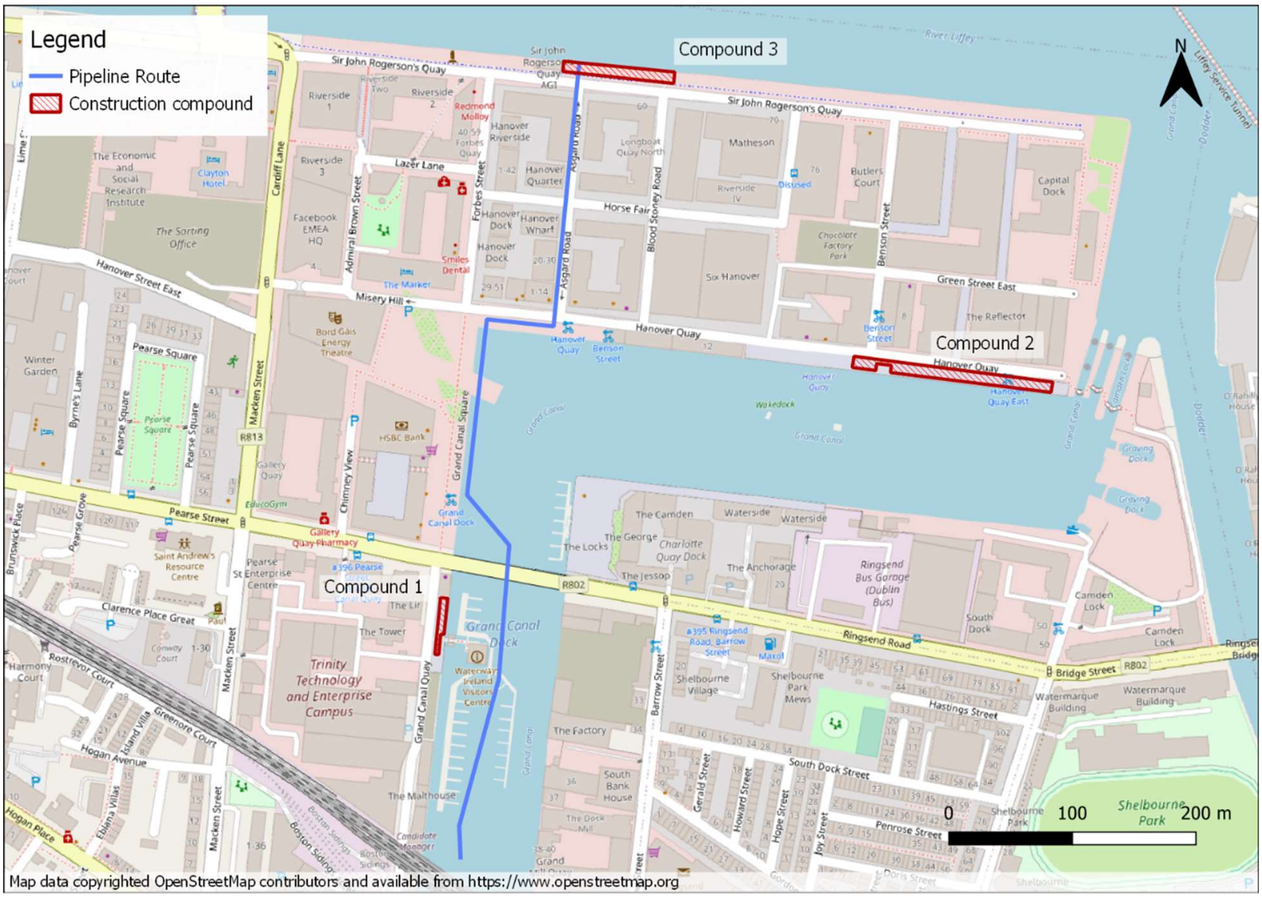


Figure 11.7 Construction compound locations

11.5 Potential Impacts

It is anticipated that the construction works will commence in Q2 2023 and are expected to last for 2 years, with all works completed in Q2 2025. Traffic analysis associated with the impact of the construction works will, therefore, focus on the following future scenarios:

- Final Year of Construction – 2025.

It is not anticipated that the proposed development will result in any trip generation in the operational phase. Therefore, no assessment of years beyond the construction phase will be examined.

11.5.1 Do-Nothing Impacts

The future operation of the road network was examined in the do-nothing scenario. To establish the future year flows the historic traffic count data will be factored up to the construction year 2025 using *TII Project Appraisal Guidelines: Unit 5.3 Travel Demand Projections*. Due to the nature of the proposed scheme, no traffic associated with the scheme is anticipated beyond the construction stage and it has been determined that no assessment of the traffic impacts in either the year of opening or the any future design year is required.

Traffic Impacts

A capacity assessment of SJRQ/ Macken St junction and Pearse St (R802)/ Grand Canal Quay/ Ringsend St junction was undertaken for the final year of construction - 2025 utilising the historic traffic count data which were factored up to the construction year 2025 using *TII Project Appraisal Guidelines: Unit*

5.3 Travel Demand Projections and the Transport Research Laboratory's (TRL) OSCADY (Optimised Signal CApacity and DelaY) software for signal-controlled junctions.

A summary of the results of the analysis for the AM and PM peak hours are shown in Table 11.4 and Table 11.5, respectively.

Table 11.4 2025 Do-Nothing AM Peak Junction Capacity Analysis

Junction	Highest RFC	Junction Delay (sec)	Queue Length (PCU)
SJRQ - Macken St	0.65	15.32	7.7
Pearse St (R802) – Grand Canal Quay – Ringsend St	0.91	24.20	11.9

Table 11.5 2025 Do-Nothing PM Peak Junction Capacity Analysis

Junction	Highest RFC	Junction Delay (sec)	Queue Length (PCU)
SJRQ - Macken St	0.65	19.66	6.6
Pearse St (R802) – Grand Canal Quay – Ringsend St	0.72	16.80	9.1

The normal design threshold for the ratio of flow to capacity (RFC) is 0.90 for a signal-controlled junction. The results shown in in Table 11.4 and Table 11.5 demonstrate that SJRQ/ Macken St junction in the AM and PM peak periods and Pearse St (R802)/ Grand Canal Quay/Ringsend St junction in the PM peak period are operating within the normal design threshold in in 2025 do-nothing scenario. Pearse St (R802)/ Grand Canal Quay/ Ringsend St junction will operate at marginally above the normal design threshold in the AM peak period, however, it should be noted that it will operate within its theoretical capacity of 1.0.

11.5.2 Construction Phase

The future operation of the road network was examined in the do-something scenario during the construction phase. The results of this do-something assessment were compared to the do-nothing scenarios to determine the impact of the proposed scheme on the road network.

To establish the future year flows the historic traffic count data will be factored up to the Final Year of Construction - 2025 using *TII Project Appraisal Guidelines: Unit 5.3 Travel Demand Projections.* Construction traffic associated with the proposed development was then applied to these future year flows to develop the do-something scenario.

Construction Traffic Trip Generation

Estimates of the total construction traffic and future staff numbers associated with the development were obtained from the design team for each element of the proposed scheme. Table 11.6 following summarises the anticipated construction traffic trips associated with the works.

Table 11.6 Total Trip Generation During Construction

Element	Arrivals	Departures	Total
Earthworks	1,030	1,030	2,060
Concrete	198	198	396
Basin Pipes	844	844	1,688
Non-Bulky Loads	570	570	1,140
Total	2,642	2,642	5,284

The exact sequence and programme of works will be determined by the Contractor, however assuming an even distribution of deliveries throughout the construction period, it has been estimated that an average of 7 HGV arrivals and 7 HGV departures will occur daily. In order to provide a robust assessment of the impact of the proposed development it has been conservatively assumed that the average daily arrivals and departures will occur in both the AM and PM peak periods. An additional allowance of 35% of the average daily HGV traffic occurring in the off-peak period, based on *TII Project Appraisal Guidelines: Unit 16.1 Expansion Factors for Short Period Traffic Counts* for the time period 10:00 to 16:00, was then applied. The resultant worse-case scenario is 38 HGV trips daily.

In order to provide a robust assessment of the impact of the proposed development on adjoining junctions during the AM and PM peak periods it has been assumed that all the daily arrivals and departures occur in the AM and PM peak period. Whilst these construction trip estimates are for the entire development, it has also been conservatively assumed that each compound will attract 7 HGV arrivals and 7 HGV departures in the AM and PM peak periods.

It has been estimated that 20 staff will be based on Compound 1 and 40 staff on Compound 2 during construction and it has been conservatively estimated that all staff will arrive on site in single occupancy vehicles. The combined AM peak hour trip generation for HGVs and staff is presented in Table 11.7.

Table 11.7 AM Peak Trip Generation During Construction

	HGVs	Staff	Total
Arrivals	14	60	74
Departures	14	6	20
Total	28	66	94

The PM peak hour is assumed to be the inverse of the AM peak hour presented in Table 11.7, with 60 staff departures and 6 staff arrivals.

Trip Distribution and Trip Assignment

Light vehicular traffic associated with the proposed development is likely to be attracted to and distributed from the subject site in a similar proportion to the baseline traffic model.

In this regard, the peak turn-in and turn-out flows calculated for the proposed development were distributed and assigned throughout the two junctions considered in similar proportions to the overall traffic flows established recorded as part of the baseline traffic model.

The proposed HGV haul route is via M50, Sheriff Street Upper (R101), Guild St, Samuel Beckett Bridge, SJRQ, Forbes Street or Macken Street, Pearse St and Grand Canal Quay**.**

Due to the HGV Management Strategy, if needed, access to the site for 5+ axle HGVs will be outside the hours of operation for the cordon or by permit as granted by DCC during the hours of operation of the HGV cordon.

Traffic Impacts

A summary of the results of the analysis for the Final Year of Construction - 2025 for the AM and PM peak hours are shown below in Table 11.8 and Table 11.9, respectively.

Table 11.8 2025 Do-Something AM Peak Junction Capacity Analysis (Do-Nothing values presented in red for comparison)

Junction	Highest RFC	Junction Delay (sec)	Queue Length (PCU)
SJRQ - Macken St	0.67 0.65	15.98 15.32	8.3 7.7

Junction	Highest RFC	Junction Delay (sec)	Queue Length (PCU)
Pearse St (R802) – Grand Canal Quay – Ringsend St	1.03 0.91	52.01 24.20	29.3 11.9

Table 11.9 2025 Do-Something PM Peak Junction Capacity Analysis (Do-Nothing values presented in red for comparison)

Junction	Highest RFC	Junction Delay (sec)	Queue Length (PCU)
SJRQ - Macken St	0.71 0.65	22.80 19.66	8.0 6.6
Pearse St (R802) – Grand Canal Quay – Ringsend St	0.79 0.72	21.52 16.80	10.4 9.1

The normal design threshold for the ratio of flow to capacity (RFC) is 0.90 for a signal-controlled junction. The results shown in Table 11.5 and Table 11.6 demonstrate that both SJRQ/ Macken St junction and Pearse St (R802)/ Grand Canal Quay/ Ringsend St junction are operating within the normal design threshold in the PM peak period in 2025 do-nothing and do-something scenarios. SJRQ/ Macken St junction is also operating within the normal design threshold in the AM peak period in 2025 do-nothing and do-something scenarios. However, Pearse St (R802)/ Grand Canal Quay/ Ringsend St junction will operate above the normal design threshold in both the do-nothing and do-something scenarios. It should be noted that that this junction will operate within its theoretical traffic carrying capacity of 1.0 in the do-something scenario and that the proposed development results in significant increases in RFC and queue lengths in the AM and peak period at this junction. However, it should be noted that this assessment is based on the conservative assumption that all construction will be undertaken concurrently in the final year of construction. It is anticipated that construction vehicles will utilise Pearse St (R802)/ Grand Canal Quay/ Ringsend St junction early in the construction programme, when do-nothing traffic will be lower, and will not utilise this junction in the final year of construction.

The local road network north of the SJRQ/ Macken Street junction was not modelled as part of this study. The construction phase of the proposed scheme will result in an increase of traffic of approximately 3.2% in the AM Peak period and 3.6% in the PM Peak period which is less than the 5% threshold for transport assessments where congestion exists or the location is sensitive as stated in the TII (NRA) Traffic and Transport Assessment Guidelines (Transport Infrastructure Ireland, 2014) and as such it is not anticipated that the proposed scheme will result in any quantifiable changes in operation of these junctions.

Overall, it is clear that the traffic generated by the development *will not result in any significant impact* to the operation of the SJRQ/ Macken St junction in the AM or PM peak scenarios or the Pearse St (R802) /Grand Canal Quay/ Ringsend St junction in the PM peak scenario. The proposed development may result in *significant impacts* to the Pearse St (R802) /Grand Canal Quay/ Ringsend St junction in the AM peak scenario, however, this is based on a worst case estimate of traffic generation and will be *short-term* in duration.

Temporary Traffic Management

Works will be required on Grand Canal Quay, Hanover Quay, Asgard Road, and SJRQ. Temporary traffic management will be required along this route for the duration of this work. These measures will include lane and/ or footpath closures. A road closure may be required on Asgard Road however, it is anticipated that vehicular access to the carpark on Asgard Road will be maintained for the duration of the works. It is anticipated that either a stop and go or a temporary traffic signal system will be utilised to maintain two-way traffic flow on SJRQ for the duration of the works. The duration of the impact of these works will be *short term* in nature, with no residual impacts.

11.5.3 Operational Phase

It is not anticipated that the proposed development will result in any trip generation in the operational phase. Additionally, it is intended to reinstate streets impacted by the works to their pre-construction condition with no changes to the road network or permitted directions of travel. Therefore, it can be concluded that the proposed development will have *no impacts* during the operation phase.

11.6 Mitigation Measures

11.6.1 Construction Phase

The following Mitigation measures are proposed for the scheme:

Construction related HGV trips will adhere rigidly to the DCC HGV Management Strategy and associated cordon.

A Preliminary Traffic Management Plan will be drafted by the Project Supervisor Design Process for the works in full consultation with DCC, An Garda Síochána, the Fire Service and the Ambulance service prior to the issuing of tender documents. When the works are awarded to a Contractor, the Preliminary Traffic Management Plan will be developed by the Project Supervisor Construction Phase into a Detailed Traffic Management Plan in full consultation with the same stakeholders. All traffic management plans, including working times, will be agreed with and approved by Dublin City County Council Transportation Department in advance of implementation.

Either a stop and go or a temporary traffic signal system will be utilised to maintain two-way traffic flow on SJRQ where possible.

Delivery vehicles will not utilise Blood Stoney Road to access the works site.

Tracked excavators will be moved to and from the site on low-loaders and will not be permitted to drive on the street pavements.

The Contractor is to arrange for staff parking. Contractor’s, Subcontractor’s or supplier’s vehicles or staff vehicles, or any vehicles associated with the works are not permitted to park, idle or queue on the public road network.

Wheel washers / judder bars will be placed at all site access points to minimise the migration of detritus onto the public roads, where appropriate. The roads will be inspected and cleaned on a regular basis.

Haul vehicles will be covered after loading to ensure there is no risk of construction material falling or to any prevent any nuisance due to dust particles.

Water bowsers will be deployed within the sites during periods of hot weather to damp down potential dust generation from unbound surfaces.

An Application for an Abnormal Load Permit will be made to DCC in advance for any abnormal loads exceeding the thresholds laid out in the Road Traffic (Construction and Use of Vehicles) (S.I. No. 5/2003) Regulations 2003. Where possible abnormal load movements will be restricted to evening or night-time to minimise disruption to local traffic and traffic on strategic routes.

11.6.2 Operational Phase

No mitigation measures are proposed for the operational phase of the Grand Canal Docks Storm Water Outfall Extension.

11.7 Residual Impacts

11.7.1 Construction Phase

The proposed development will result in a *slight negative short-term impact* during construction phase.

11.7.2 Operational Phase

The proposed development will result in *no long-term impacts* during the operation phase.

11.7.3 Interactions

Air Quality and Climate

Construction impacts due to emissions from vehicular traffic and due to earthworks have been assessed in Volume 2, Section 9.

Noise and Vibration

Construction impacts due to noise and vibration from vehicular traffic, most notably HGVs (e.g. transporting earthworks material) have been assessed in Volume 2, Section 10.

Waste Management

Surplus excavated material will be segregated at source and transferred directly from site by a suitably permitted Waste Contractor to suitably licensed facilities. This can lead to temporary additional increase in traffic and HGVs in the areas. However, post mitigation these impacts will be slight negative short-term impact during construction phase. Refer to Volume 2, Section 13.

Material Assets

Impacts will occur as a result of traffic diversions, road closures, and additional traffic due to construction traffic and HGV movements etc. At present there are no public transport routes on Grand Canal Quay, Hanover Quay or SJRQ. The proposed development will result *a short-term slight negative* impact during the construction phase. Refer to Volume 2, Section 14.

Population & Human Health

The construction phase importation of material to the site during the construction phase is detailed in Volume 2, Section 5. All haulage of plant and materials to and from the construction site will be made via M50, Sheriff Street Upper (R101), Guild St, Samuel Beckett Bridge, SJRQ, Forbes Street or Macken Street, Pearse St and Grand Canal Quay.

As a result of the negligible increase in traffic volumes on the surrounding road network, it is not anticipated that the proposed GCSWOE will have any significant impact on the capacity of the local road network and have any significant interaction with Population and Human Health.

11.7.4 Cumulative Impacts

The cumulative impact assessment for Traffic was informed by the scoping exercise undertaken in the development of this EIAR and through consultation with DCC. No major future planned developments which would be constructed concurrently with the proposed GCSWOE were identified. However, it was noted that a number of developments in the Grand Canal Dock area were under construction when the traffic counts were undertaken. Traffic associated with these developments was recorded in the traffic counts and no allowance was made for the reduction in traffic associated with the completion of the construction of these developments. Therefore, the traffic model developed using the traffic counts over-estimates the construction vehicle traffic on the adjoining road network and provides a robust assessment of the cumulative impacts associated with adjoining developments. Additionally, these impacts are based on pre-covid-19 traffic flow conditions, with growth rates applied to determine the future traffic flows on the adjoining road network and as such represent a “Worst-Case” scenario.

11.8 Monitoring

No monitoring is proposed for the operational phase of the Grand Canal Storm Water Outfall Extension.

11.9 References

Dublin City Council. (2018, July). *Map of restricted zone for Heavy Goods Vehicles (HGVs) in Dublin City*. Retrieved from dublincity.ie: https://www.dublincity.ie/sites/default/files/media/file-uploads/2018-07/map_hgv_restricted_zone.pdf

Dublin City Council. (2021, May). *How to Apply for a Heavy Goods Vehicle Permit(s)*. Retrieved from dublincity.ie: https://www.dublincity.ie/residential/transportation/hgv-management/how-apply-heavy-goods-vehicle-permits

Google. (2021, May). *google.com/maps*. Retrieved from googlemaps.com: https://www.google.com/maps/@53.3436207,-6.2406069,15z

IDASO. (2021, April 04). JB Barry - Traffic Data Request. *HDR 21 045 Point Village*.

OpenStreetMap. (2021, May). *openstreetmap.org*. Retrieved from openstreetmap.org: https://www.openstreetmap.org/#map=14/53.3445/-6.2381

Transport Infrastructure Ireland. (2014). *PE-PDV-02045-01 Traffic and Transport Assessment Guidelines.* TII. Retrieved from https://www.tiipublications.ie/library/PE-PDV-02045-01.pdf

Transport Infrastructure Ireland. (2019, May). *PE-PAG-02017 Project Appraisal Guidelines for National Roads Unit 5.3 - Travel Demand Projections.* TII. Retrieved from TII Publications: https://www.tiipublications.ie/library/PE-PAG-02017-02.pdf

Transport Infrastructure Ireland. (2022, 03 30). Retrieved from Traffic Count Data Website: https://trafficdata.tii.ie/publicmultinodemap.asp

SECTION 12: Archaeology and Cultural Heritage

12.1 Introduction

This section has been prepared by Donald Murphy and Magda Lyne, Archaeological Consultancy Services Unit Ltd.

Donald Murphy holds a Master's Degree in Archaeology from University College Dublin (NFQ Level 9) and is excavation licence eligible since 1993. In 2018, he received an NFQ Level 6 award in Co-ordinating Construction Stage Health & Safety. He is a Member of the Institute of Archaeologists of Ireland. Donald is the founder and Managing Director of Archaeological Consultancy Services Unit Ltd. He has over 30 years post-graduation experience carrying out Environmental Impact Assessments, archaeological assessments and excavations. In addition, he is skilled in archaeological and geophysical surveying and has undertaken many magnetic gradiometry and topographic surveys. He has also completed excavations on behalf of the National Monuments Service at Knowth, the Hill of Tara, Clonmacnoise, Mellifont Abbey and Newgrange. As Project Manager/Senior Archaeologist, Donald has led on some of the largest infrastructural schemes undertaken in Ireland, including road projects such as the N52 Nenagh Bypass Link Road (2000); M1 Northern Motorway Project (2001–2002); N22 Ballincollig Bypass (2001); M4 Kinnegad–Enfield–Kilcock Motorway (2001–2004); N25 Waterford Bypass (2003–2007); M3 Clonee to North of Kells Motorway (2005–2010); M7/M8 Motorway (2005–2008) and the N5 Westport to Turlough (2015–2020).

Magda Lyne holds a Master's Degree in Archaeology from the University of Adam Mickiewicz in Poznan, Poland (NFQ Level 9) and is excavation licence eligible since 2019. She is a Member of the Institute of Archaeologists of Ireland. She specialises in archaeological desktop assessments and Environmental Impact Assessments and has over 12 years of post-graduation experience. Magda has worked in Poland, Ireland, Denmark and Norway. She excavated sites for her home University and then worked as a curator's assistant in the Archaeological Museum in Poznan. Her career in Ireland began in 2006 working on a variety of large-scale infrastructure projects (e.g. M3, N9/10, N18 and N22 road projects), as well as with the School of Archaeology in University College Dublin. Between 2011 and 2017 she worked as an archaeologist for governmental institutions in both Denmark and Norway, including works on behalf of the Museum of Copenhagen (Copenhagen Metro Project) and the Norwegian Institute for Cultural Heritage Research (Tonsberg). Magda has worked with ACSU since 2019.

This section presents the findings of an archaeological and cultural heritage impact assessment on the site of the proposed Grand Canal Storm Water Outfall Extension (GCSWOE) at St. Marks, Dublin South City (ITM north part of the proposed works E 717399, N 734316, southern extent E 717287, N 733672; Figure 12.1). Grand Canal Docks Basin, including Grand Canal Docks Quay, Charlotte Quay, Hanover Quay/Britain Quay and the River Dodder is located within a Conservation Area as marked on Map E of the Dublin City Development Plan 2016-2022.

It is proposed to extend the stormwater discharge from the Grand Canal Tunnel from its existing location in the inner basin of the Grand Canal Docks to a discharge point in the River Liffey at SJRQ in order to improve water quality in Grand Canal Docks. The existing stormwater outfall was identified as a source of pollution in the Docks.

The proposed works will commence at the existing Grand Canal Tunnel Outfall located under the Grand Canal Docks Dart Station and the railway bridge at Barrow Street (ITM E 717287, N 733672), traverse underwater through the centre of the southern portion of the Docks and run roughly north within the Grand Canal Docks Basin, pass under MacMahon Bridge (formerly Victoria Bridge), here it will turn northwest and connect to Transition Chamber 2, and run along the Grand Canal Quay as far as Transition Chamber 3 located on Hanover Quay, where the route will take a 90 degree turn to the east and run underground along the Hanover Quay before again turning north towards Asgard Road in order to connect to an existing culvert constructed in 2002 as a part of Phase 1 of the Project. It will exit the Asgard Road culvert at SJRQ. Here a proposed new outfall will exit into the River Liffey through the quay wall (ITM E 717399, N 734316). A full project description is presented in Volume 2, Section 2 above.

An archaeological and cultural heritage impact assessment was carried out for the proposed development to assess the archaeological potential of the project (as outlined on Figure 12.1), including the existence of any as yet unrecorded monuments and cultural heritage features. The purpose of the desk-based assessment is to gain an understanding of the historic environment within and surrounding the proposed development area, in order to assess its significance relative to its hinterland, and ultimately the impact any proposed development of the site would have on these recorded monuments, and protected or historic structures. The mitigation measures also provide strategies to conserve, protect and interpret any significant heritage assets while developing the site.

Consultation with the Department of Culture, Heritage and the Gaeltacht (Ref: G Pre00033/2020) took place in April 2020. The following observations/recommendations were made by the Department:

Underwater Archaeology

It is noted that the development site is located within a zone of archaeological potential established around the historic quays along the Liffey: RMP No DU018-020201-.

It is also noted that the proposed development site is located in an area of high underwater archaeological potential. The Wreck Inventory of Ireland Database (WIID) lists numerous wrecks for the River Liffey and Dublin Bay area, which are subject to statutory protection under section 3 of the 1987 National Monuments (Amendment) Act. The proposed development is located on reclaimed land which previously formed part of the River Liffey Estuary where earlier wrecks may lie. Given the location of the proposed site and the nature of the works, it is possible that monuments or wrecks may be impacted by this development.

The Developer has previously carried out an archaeological Underwater Impact Assessment report. This report should be updated to reflect potential new finds in the development area, any changes to the original plans that may affect archaeology and should include an assessment of any potential impacts on the quay wall which are subject to protection under the National Monuments Act 1930-2004. Having completed the work, it is recommended that the Developer shall submit the updated archaeological report to the Planning Authority and to the Department of Culture, Heritage and the Gaeltacht in advance of the planning decision. Where archaeological material/features are shown to be present, preservation in situ or preservation by record (excavation) may be required and the Department will advise the Applicant/Developer with regard to these matters.

An additional Underwater Survey of the pipeline route was undertaken in 2020 as part of this overall assessment and the results of this survey are integrated into this section. Refer to Volume 3, Appendix 12A for Underwater Archaeological Impact Assessment.

Figure 12.1 Location of the site in relation to; Recorded Monuments; Protected Structures; NIAH structures; Dublin City Zone of Archaeological Potential; previous excavation; extent of underwater assessment (2020)

12.2 Methodology

This assessment was carried out in line with the *Guidelines on the information to be contained in Environmental Impact Assessment Reports* (Environmental Protection Agency, 2022). Cultural heritage incorporates archaeology, architectural heritage, folklore and history. The *EPA* guidelines were consulted and publications by the Department of Housing, Local Government and Heritage (DHLGH), including the *Framework and Principles for the Protection of the Archaeological Heritage* (originally published by the Department of Arts, Heritage, the Gaeltacht and the Islands, 1999);*the Architectural Heritage Protection Guidelines for Planning Authorities* (originally published by the Department of Arts, Heritage, and the Gaeltacht, 2011) and the relevant *Advice Series* publications by DHLGH, including *Paving - The Conservation of Historic Ground Surfaces* (originally published by the Department of Arts, Heritage and the Gaeltacht, 2015).

This impact assessment was carried out involving a literature review and consultation of the Record of Monuments and Places (RMP) and Sites and Monuments Record (SMR) compiled and updated by the National Monuments Service and the National Historic Properties Service of the Department of Culture, Heritage and the Gaeltacht. The RMP is comprised of manuals that list all known archaeological sites and monuments in a county with accompanying maps (based on Ordnance Survey (OS) six-inch maps) locating these sites. All sites included in the RMP are protected under the National Monuments Acts (1930–2004). The SMR consists of all records stored in the Archaeological Survey of Ireland national database and is presented in the Historic Environment Viewer, which also includes sites listed in the National Inventory of Architectural Heritage. The last published RMP for County Dublin is dated 1998 and as such many of the sites listed in the SMR are scheduled for inclusion in the next revision of the RMP.

The Dublin City Development Plan 2016-2022 was consulted, as it contains a record of all Protected Structures and Architectural Conservation Areas for Dublin City. In addition, the Draft Dublin City Development Plan 2022-2028 was also reviewed. Further buildings and features of architectural interest in the area that may not be included on the Record of Protected Structures are detailed in the National Inventory of Architectural Heritage (NIAH) for County Dublin and in the Dublin City Industrial Heritage Record (DCIHR). Both NIAH and DCIHR make recommendations for sites to be added to the list of Protected Structures. In addition to the desk study, a site inspection was conducted which sought to identify current and previous land use and to locate any features of archaeological potential or items of cultural heritage interest on the site.

The Topographical Files of the National Museum of Ireland were also consulted to assess the area's archaeological potential. These files list, on a townland basis, all archaeological artefacts in the care of or known to the museum. Such a record can provide evidence for human settlement or activity in the absence of physical remains or documentary references. The results of previous and ongoing archaeological investigations were also taken into account in order to evaluate the level of archaeological remains coming to light in the area. Historical maps held by the Map Library of Trinity College Dublin and aerial photography from the Geological Survey of Ireland were both consulted. These sources can indicate areas of archaeological potential through features like curving field boundaries, cropmarks and soil marks and can provide information regarding the nature and extent of recorded archaeological sites that have become denuded since the early 19th century. Historical maps are also useful in identifying other features of cultural heritage significance.

The Commons Sessional Papers (CSP) and Wreck Inventory of Ireland Database (WIID), were consulted. The Shipwreck Archive consists of over 18,000 paper files that hold information relating to each individual wreck recorded in the Wreck Inventory of Ireland Database (WIID) with known location. This data set does not define the level of legal protection that might be afforded any individual wreck under the provisions of the National Monuments (Amendment) Acts (1987 and 1994); however all wrecks that are over 100 years old and wrecks subject to an underwater heritage order are protected by Section 3 of the National Monuments (Amendment) Act 1987.

An additional pre-construction Underwater Archaeological Impact Assessment (UAIA) (refer to Volume 3, Appendix 12A) of the proposed extent of the in-water works area associated with the GCSWOE Project was carried out in September 2020 in relation to the requirement of the Department of Culture, Heritage and the Gaeltacht (Ref: G Pre00033/2020). The results of the 2020 assessment along with the results of the previous assessment carried out in 2007/2008 are included in this assessment. It also includes results of a site inspection that was conducted on the 25th September 2020 and the 9th of February 2021 by Donald Murphy of Archaeological Consultancy Services Unit (ACSU). This sought to identify current and previous land use and to locate any features of archaeological potential or items of cultural heritage interest on the site.

The sources listed in the Sections below form the baseline information for the cultural heritage of the area, in order to enable assessment of the impacts that the proposed development may have.

12.3 Receiving Environment

12.3.1 Archaeological and Historical Background

The site is situated within the eastern end of the city quays and is bounded by the River Liffey and SJRQ to the north; the south extent is marked by the southern edge of the Grand Canal Docks Basin, which is crossed by a railway bridge. Refer to Figure 12.2 below.

Figure 12.2 Extract from Brooking's map of the City and Suburbs of Dublin (1728), showing approximate location of the site

The River Liffey played a significant role in the settlement in the Dublin area. The historical development of Dublin is tightly connected economically and geographically with the River Liffey. The development of the urban space along the River Liffey reflects the civic values of local authorities at the time.

In Hammond (1942) the area of the proposed development was described as 'nothing but sand' as far as the Estuary of the Dodder. In the 18th/19th century the city was evolving and growing, and the construction of the quays was a response to the need for land. The expansion of maritime trade in Ireland in the 18th century, as well as the commercial and economic development also caused pressures to improve port facilities. Dublin harbour was at a disadvantage due to a sand bar at its mouth formed by the silt discharged from the Dodder, Liffey and Tolka; quay sides were also shallow. Two large sand banks known as the North and South Bulls formed constantly and were dangerous for ships. As a result, the Ballast Office was created the same year that the Custom House was built at Essex Bridge, and by 1710 was also responsible for activities in relation to port reclamation. It became a department that came under the jurisdiction of 'The Corporation for Preserving and Improving the Port of Dublin' (replaced in 1867 by Dublin Port and Docks Board). This board was the principal institutional framework responsible for the development of the port in Dublin (Branagan 2020) and its responsibilities included development of the port, the quay walls, the bridge structures over the Liffey and overall management and maintenance of these. In 1710 work on the North Wall area started with the South Wall area being reclaimed from 1714. In 1711 a wooden jetty from Ringsend to Pigeon House Fort was constructed with timber caissons that were assembled and floated to the site where they were filled with rubble and sunk. The problem of silting was not fully resolved until 1825 when the North Bull Wall was constructed (this was originally suggested first by Captain William Bligh in 1800). It formed an artificial mouth for the River Liffey, reducing the level of the sand bar and increasing the depth of the breakwater by 3m (Rynne 2015).

Figure 12.3 'A View of Dublin from the Sea' by Gabrielli Ricciardelli (c. 1759)

The 'water and sands of the Liffey' were held by the City under the 1215 charter of King John. The Ballast Office and the Corporation started the construction of the South Wall, as far as Poolbeg Lighthouse. As mentioned previously, the works on the South Wall started in 1714 and were completed in 1796 (Hammond 1942). Sir John Rogerson Senior played a major role in the development of the south quay. He was active in land acquisition in Dublin since 1674 when he was elected Lord Mayor of the city and was knighted. In 1713 he acquired 133 acres of South Strand undeveloped lands described as 'march, stream channels and tidal marsh on the south bank of the Liffey from near Creighton Street where City Quay would end to the Dodder confluence at Ringsend and for some distance along the west bank of the Dodder to the south' (De Courcy, J. 2004). He took on the work to reclaim the land to connect it with the already reclaimed area of City Quay and further to the east towards and as far as Ringsend (Branagan 2020). In 1718 the 'Fountain Tavern' was the first building to be erected in the area. On the 1728 Brooking's map and Pictorial Prospect of the city and Suburbs of Dublin buildings on Rogerson's Quay are shown as far as the gasometer, however, it is unlikely these were built by that time, and the map was likely made with the use of the Corporation plans for the area. This appears to be confirmed by Rocque's map of 1756 and it seems that the easternmost house on Rogerson's Quay in 1789 was the Hibernian Marine School. Refer to Figure 12.3 and Figure 12.4.

Figure 12.4 Extract from Rocque's map of the County of Dublin (1760)

Figure 12.5 'Marine School, Dublin, Looking Up the Liffey' by James Malton 1796

The Hibernian Marine School, Cardiff's Ship Building Yard (Figure 12.5) and the early works of the Dublin Gas Works was set up here, although the area was largely underdeveloped. The Marine school on Rogerson's Quay was erected in 1770 and was in use until 1872 when its interior was destroyed by a fire. It was never reused as a school. Two riverine heads are visible on the brick façade.

By 1729 the Liffey was embanked almost to Ringsend. The 1728 Brooking's map of Dublin depicts the western part of a newly constructed quay as 'Sr John Rogerson's Key', with the area behind it that appears to be wet. Land that was originally called South Lotts was bought by David La Touche from the city. The reclaimed land to the east and behind the Rogerson's Quay including a larger area that incorporated the South Strand was also known as 'South Lotts'. These were leased out in plots for agricultural use. The land reclamation and construction of the quay involved driving three tiers of oaks staves ('The Piles') into the sand by Dutch engine. In 1748 to 1755 the piling was reinforced by kishes of stones between the tiers, to allow for the construction of the road on the top of them. Kish (Ceas) in Irish is a skiff, and the name is used to describe a small boat, also Kis in Arabic is a rock or impediment under water. The embankment of the oak and stones was known locally as 'The Mole'. Ricciardelli's engraving c. 1759 shows SJRQ walls complete and as a roughly surface strip, used by people and horses. Behind the wall an area with water, marshlands, meadow of haycocks is shown at the location of the Grand Canal Docks site. The outline of the Dublin Harbour that was established by 1768 did not change since; however, the width of the Liffey between the south quays and the North Wall changed due to dredging.

Works associated with the Grand Canal commenced in 1756. It took 47 years to build and was finally officially open in April 1804. The Grand Canal not only shortened the length of the journey but also supplied water to the City of Dublin since 1766 (Phillips, 1939). This was the reason why Dublin Corporation took over the Grand Canal works; however, due to insufficient funds a group of noblemen and merchants established and took over the works in 1772. John Smeaton was consulted. He came with William Jessop who became a consulting engineer to the Grand Canal Company. The canal was downscaled due to the anticipated traffic (Delaney, 1980). The Grand Canal was described as an effective water-borne transport facility to and from the west (Hart, 1968) and was used for passenger service and trade. It was threatened first by the railway age and finally could not withstand the development of the road transport network (Delaney, 1980).

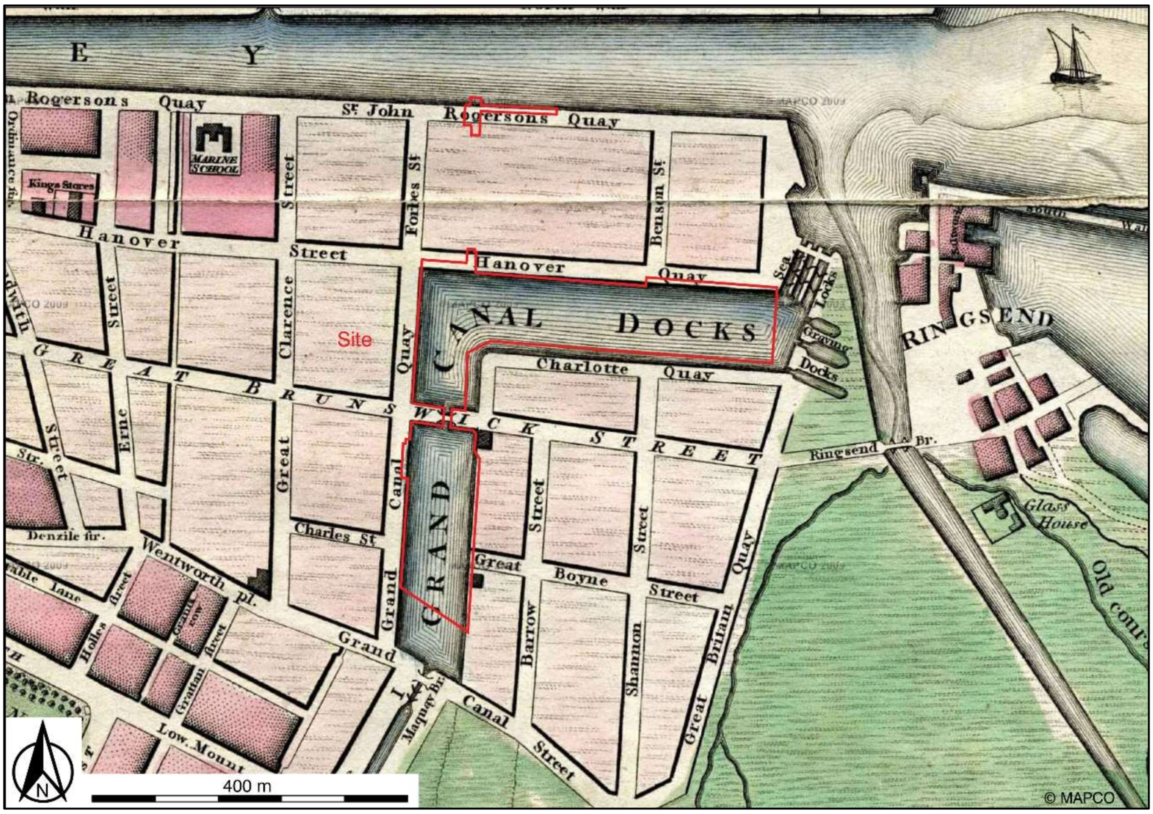


Figure 12.6 Extract from Wilson's map of the City and Environs of Dublin (1798) showing location of the site

Due to intensified traffic on the Liffey associated not only with goods but also with passengers, an additional docking area was required. The works on the Grand Canal Docks started in 1792. It was extended from Portobello Harbour within grounds mentioned earlier as the South Lotts, that were excavated for the Ringsend Basins completed in 1796. Two basins were designed by William Jessop who was the architectural engineer. Edward Chapman was executive engineer, Messrs. Cowan, Gamble and Kirkwood built the graving docks, Messrs. Bergan and Hayes the basin wall, while Alexander Stevens built the sea-locks (Branagan, 2020). Dr Emmet was a large shareholder in the Grand Canal Company. He lived in the vicinity of the Marine School. The basins were equal in extent to the entire dockland at Liverpool at that time. Wilson's Directory of 1798 (Figure 12.6) was the first to show this newly constructed L-shaped dock. When it was built, it was the largest canal dock anywhere in the British Isles, however with the increased width of the steam ships in the early 19th century it'sits limited size meant it could not accommodate these new types of vessels. Its construction is described as 'an important example of 18th-century civil engineering skill and a reminder of an early transport network which provided increased connections throughout the country. The Grand Canal Docks basin is connected with the River Liffey via the mouth of the River Dodder. Three locks – Westmoreland, Buckingham and Camden Lock connect the Grand Canal Dock Basin with the River Dodder. The southern extent of the basin connects to the Grand Canal via the Grand Canal Tunnel with Maquay Bridge and a single canal lock on the Grand Canal side, constructed c. 1790. This section was originally known as the "Circle Line" extending from Portobello to Ringsend and opened in 1796.

It appears that the material removed to allow for the construction of the basins was used to build up banks surrounding the basin as there is no mention of this material being removed off the site and takes into account that the land around the basin is higher than the surrounding area. It was suggested by Branagan (2020) that the Grand Canal Docks could hold 50-100 ships. The opening of the Grand Canal Docks drew a large crowd as shown on a painting by William Ashford and on a sketch by an unknown artist.

In the 18th century, George's Quay and Rogerson's Quay were used by mariners, shipbuilders, shipbrokers, rope and sail makers as well as handlers and outfitters. The area was largely self-sufficient, with its own doctors, grocers, brewers' inns and taverns etc. During the American War of Independence (1775-1783) George's Quay and Rogerson's Quay were places of deportation for city convicts. In 1787 Ringsend was partially demolished by flood and in 1792 it flooded Rogerson's Quay. During the last decade of the 18th century, Rogerson's Quay was considered a pleasant suburb with a panorama of sea and country. Issues abounded with the extent of the 'City Quay' versus 'Rogerson's Quay' and this remained largely undefined throughout the 18th century. In 1774 numbering of the houses in Dublin was enforced by the Act of the Irish Parliament, however due to many vacant sites the area was re numbered, some were overlapping etc. The issue continued up until 1834 when each quay length was defined as a separate street and houses along it were numbered accordingly.

In the 19th century the water traffic intensified; this caused a number of accidents and a number of wrecks within the River Liffey are listed from around that time. The Liffey was levelled and the quay walls were deepened to accommodate steam ships. In 1815 the Dublin Ballast Board, following the advice of engineer George Halpin acquired a steam dredger. The Dredger was built by Anthony Hill's Dublin yard and was named 'Patrick', it operated with an engine supplied by Fenton, Murray and Wood of Leeds. It was later replaced by a new, self-propelled dredger built by a Scottish firm at Leith. In 1896 suction dredgers were used in Dublin and were superior in removing sand and mud (Cox, 1990). The SJRQ has been documented by the 19th-century section drawings, these are in possession of The Dublin Port Company Archive and show details of the construction of the quay walls.

The 1st Edition OS map of 1834 shows the study area with Grand Canal Docks with a railway bridge over it. This was the first Irish railway line from Dublin to Kingstown (currently Dun Laoghaire) that was opened in 1834. The map also shows the 'Drawn Bridge' spanning across the docks. Docks Chemical Works and Docks Mills are depicted and labelled to the east of the docks, and the Gas Works are located just northwest of the Drawn Bridge. The area north of the Grand Canal Docks and south of SJRQ appears to be largely underdeveloped but appears to be divided into plots with minor structures within. Some plots are labelled like 'Queens Timber Yard' and 'Coast Guard Station' also the area south of 'Charlotte Quay' is depicted as 'Rope Walk'. The area is labelled as St. Marks and is part of 'College Ward'. The area to the east of the Grand Canal Basin is labelled as 'South Lots'.

By the time of the 3rd Edition OS Map of 1907 the area is labelled as the 'South Dock Ward', with tram lines marked on streets. The previously mentioned vacant areas had filled up since with industrial buildings that include: to the west of the Canal and along it – Bakery, Dogs Home, Malthouse, Distillery, the Drawn Bridge is now labelled as 'Victoria Bridge', and a large area is occupied by the 'Gas Works', the plots between Hanover Quay and SJRQ are labelled as Coal Depot, Chemical Works, Dublin Granaries, Cattle Pens and Chemical Manure & Oilcake Mills; a Mooring Post is along the Charlotte Quay, with Tram Power Station, and Chemical Works to the south of it; the Travelling Crane to the west and along the Grand Canal Docks Basin. To the east of Barrow

Figure 12.7 South-facing view of SJRQ at proposed impact centre point; discharge outlet to be placed in line with the roadway (ADCO image)

Street and south of Ringsend Road a number of buildings are depicted and labelled, the majority are now listed as protected structures, that relate to Corn Mill, Corn Kiln, Dock Mills (Corn) and Engine Shed. The Grand Canal Tunnel, which runs five kilometres from Dolphin's Barn to Grand Canal Street, is as wide as a London Underground tunnel. Built in the 1970s it consists of two sections, foul and storm. The foul section conveys flows to the Ringsend Treatment Works and the storm section discharges to the inner basin of the Grand Canal Dock.

12.3.2 Record of Monuments and Places (RMP) & Sites and Monuments Record (SMR)

The SMR lists all known archaeological sites and monuments in each county with accompanying maps locating these sites. All sites included in the RMP are protected under the National Monuments Acts (1930–2004). The north part of the study area, at SJRQ, is located within the banks of the River Liffey, that are within the Dublin City Zone of Archaeological Potential (DU018-020), and (DU018-020201-). There are several monuments listed in the RMP and SMR in the environs and within the study area (see Table 12.1).

The following is a list of the recorded monuments located within and in the environs of the site. Where available, these descriptions are derived from the National Monuments Service Archaeological Survey Database (http://maps.archaeology.ie/historicenvironment/).

Table 12.1 Record of Monuments and Places (RMP) and Sites and Monuments Record (SMR)

RMP/SMR No.	Class/ Site Type	Townland	Description
DU018-020201-	SJRQ	Dublin South City	Sir Rogerson's Quay is a part of the historic core of Dublin.
DU018-020	Dublin City Zone Of Archaeological Potential	N/A	Dublin City Zone Of Archaeological Potential.
DU018-020707-	Graveslab	Dublin North City	From SMR file DU018:052: This cross-inscribed slab was dug up in a back garden in Mount Street in 1916 and is now in the National Museum. It was buried c. 3m deep near the back of Sir Patrick Dun's Hospital at a point that as late as the seventeenth century was practically on the seashore. On each face is a Greek cross in raised outline enclosed by a double raised ring; there is a small circle in the centre. Trenches excavated subsequently by Hayden produced no further evidence of archaeological activity.
DU018-053----	Settlement cluster	Dublin South City	From SMR file DU018:053: A small fort to guard Dublin Harbour is shown on two contemporary maps: a map of Dublin by Phillips dating to c. 1685 and a chart of Dublin Bay by Captain Greenville Collins that would have been surveyed after 1681. The Greenville Collins chart shows a square bastioned fort at the end of the peninsula at Ringsend. Phillips's map shows the same structure with a more irregular outline and similar dimensions to the typical Cromwellian period f01t with which it may well be contemporary.
DU018-054----	Settlement cluster	IRISHTOWN (Dublin By.)	From SMR file DU018:054: The royal chapel of St Matthew at Irishtown, built by Dublin Corporation in 1704-06 (with the towers added by Richard Mills in 1713), and Little St George's of Temple Street have rubble towers of quasi-Gothic type. St Matthew's was rebuilt in 1878-79 and St George's was demolished in 1894, but the towers of both survive. In St Matthew's, one can see the last authentic persistence of the Irish Gothic tradition

RMP/SMR No.	Class/ Site Type	Townland	Description
			of stepped battlements. Joyce (1912, 5-18) notes that the 'most conspicuous object in this neighbourhood is the belfry tower of St Matthews church which is still in good preservation and is thickly mantled with ivy.' The city development plan lists the site as No. 82 and describes it as a 'pre-1700 settlement.'

12.3.3 Record of Protected Structures (RPS), Architectural Conservation Areas (ACA), National Inventory of Architectural Heritage (NIAH) and Dublin City Industrial Record (DCIHR)

The Dublin City Development Plan 2016-2022 contains a record of all Protected Structures and the list of Architectural Conservation Areas for the City. Protected Structures are structures that a planning authority considers to be of special interest from an architectural, historical, archaeological, artistic, cultural, scientific, social or technical point of view. These are given statutory protection by the Local Government (Planning and Development) Act 1999 and the Planning and Development Act 2000 (Part IV Architectural Heritage). Architectural Conservation Area (ACA) is a place, area or group of structures that are of special architectural, historical, artistic, cultural, scientific, social or technical interest or that contributes to the appreciation of a protected structure, and whose character it is an objective of a development plan to preserve. The legislation relating to ACA’s is contained in Chapter II of Part IV of the Planning and Development Act 2000.

The National Inventory of Architectural Heritage (NIAH) is a state initiative under the administration of the Department of Housing, Local Government and Heritage and established on a statutory basis under the provisions of the Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act 1999. It contains a record and evaluation of the post-1700 architectural heritage of Ireland, as an aid for the protection and conservation of the built heritage. It provides the basis for recommendations by the Minister for Culture, Heritage, and the Gaeltacht to the planning authorities for the inclusion of particular structures in their Record of Protected Structures (RPS). In November 2019 the Planning & Property Development SPC of Dublin City Council agreed a methodology to expedite the proposed additions/deletions to the RPS in a systematic manner, based on the Architectural Heritage Protection Guidelines 2011 and regionally rated NIAH/Ministerial Recommendations under Section 53(1) of the Planning and Development Act, 2000 (as amended).

The Dublin City Industrial Heritage Record (DCIHR) was developed between 2006 and 2009 as an action of the Dublin City Heritage Plan in conjunction with the city archaeologist with grant support from the Heritage Council’s County Heritage Plan grant scheme. It investigated and mapped sites throughout the city and produced a written record of each site and an extensive photographic record. It highlights structures requiring statutory protection, makes recommendations on conservation of streetscapes, and raises awareness of the industrial heritage of the city.

Figure 12.8 South end of Grand Canal Dock Basin (NIAH 50020499), showing Protected Structures (PRS; 488;484; 483;487; 486; 485 and 7377) along east edge of the basin

The subject site contains a Protected Structure as listed within the Dublin City Development Plan 2016-2022, SJRQ (RPS 7542) that includes Granite ashlar quay walls, stone setts, mooring rings, steps, bollards, lamp standards and machinery. The quay is also located within Architectural Conservation Area.

In addition, the site is located within the Grand Canal Docks Basin (NIAH Reg No. 50020499, Figure 12.8) that is within Architectural Conservation Area and listed in the National Inventory of Architectural Heritage and Dublin City Industrial Heritage Record and also forms a part of Canal Docks/ Britain Quay basin triple sea locks (RPS 987). There are a number of Protected Structures, architectural heritage structures listed in NIAH database (Table 12.2) as well as structures listed in the Dublin City Industrial Record located along the Grand Canal Docks Basin. The only DCIHR asset located within the site is represented by Victoria Draw Bridge/ MacMahon Bridge.

It should be noted, that two additions relevant to the site are listed in the Record of Protected Structures within the Draft Dublin City Development Plan 2022-2028; RPS ID 8844 Grand Canal Quay and RPS ID 8847 Hanover Quay.

The following (see Table 12.2) is a list of the nearby Protected Structures as listed in the Record of Protected Structures in the Dublin City Development Plan 2016-2022; structures listed within the National Inventory of Architectural Heritage that are located within the study area and structures located within and adjacent to the site listed in the Dublin City Industrial Heritage Record. Some entries derive from the National Inventory of Architectural Heritage or Dublin City Industrial Heritage Record; where available. Detailed description is given only for sites and structures located within the site or directly adjacent to it.

Table 12.2 Protected Structures, National Inventory of Architectural Heritage (NIAH) and Dublin City Industrial Heritage Record (DCIHR) sites

RPS ID.	NIAH Reg. No.	DCIHR Y/N	NIAH/RPS/DCIHR Description
7542	50020465	N	SJRQ - Granite ashlar quay walls, stone setts, mooring rings, steps, bollards, lamp standards and machinery.

RPS ID.	NIAH Reg. No.	DCIHR Y/N	NIAH/RPS/DCIHR Description
			From NIAH File: Ashlar granite quay wall, erected c.1870, with ashlar granite coping. Cast-iron mooring hooks and mooring rings. Timber fenders to north of B. J. Marine building. Granite steps with cast-iron railings. Stone setts and inset cast-iron rails to campshire. Raised in height to east and west of Samuel Beckett Bridge as part of recent works. SJRQ was laid out in the early eighteenth century. It consisted of two parallel stone faces, the space in between filled with material dredged from the Liffey. It was the most ambitious of the privately funded quay developments of the period. It runs from Creighton Street towards Ringsend, where it turns at a right angle at the River Dodder. It is depicted on Brooking's map of 1728, showing the quay lined with gable-fronted buildings, with the land behind 'as yet inundated by the tides'. Rocque's map of 1756 depicts a more varied mix of uses with buildings and yards, likely associated with maritime trades such as ship building and provisioning. The end of the eighteenth century saw the completion of the quay, and the start of residential development on streets laid out to its south. The quay walls were rebuilt on two occasions, once in the 1820s and again in 1869, as part of the deepening of the channel along this part of the River Liffey. The quay served an important function, allowing ships to draw alongside for loading and unloading, and is a notable reminder of the maritime heritage of the city. It is well-executed in ashlar granite, attesting to the high level of skill and artisanship employed in its construction and in civil engineering at the time. SJRQ is located at the north extent of the site.
-	50020499	Y	Grand Canal Docks, Hanover Quay/Grand Canal Quay/ Ringsend Road, South Dock Road/Grand Canal Place. From NIAH File: L-plan canal basin, built 1796, as docks for Grand Canal, having trio of sea locks to north-east and dry docks to east end. Roughly coursed Calp limestone walls, with squared Calp coping and tooled granite coping, some replacement coping, having cast-iron bollards and mooring posts. Dressed granite and recent render steps. Recent road bridge, replacing earlier drawbridge, carrying Pearse Street over basin. Situated to east of city centre, south of River Liffey. Canal basin built to design by William Jessop, engineer to the Grand Canal Company. Covering twenty-five acres, it was designed to accommodate 150 ocean-going vessels. At the time of its construction, it was the largest canal dock anywhere in the British Isles. But the increasing width of steamships in the early nineteenth century rendered the limited size of the sea locks problematic, and of insufficient width to accommodate the larger ships by the 1830s. The basin was intended to facilitate the movement of goods between ocean-going vessels and canal boats, which would then be carried inland along the canal. The Grand Canal, which was begun in 1756, originally terminated at Saint James' Gate. These docks terminated a later branch, the Circular Line, which ran from Suir Road Bridge to meet the Liffey. Its construction is an important example of eighteenth century civil engineering skill and a reminder of an early transport network which provided increased connections throughout the country. It continues as an important recreational space for a new residential quarter in the city. From DCIHR File: Materials of construction are largely granite, with some limestone flagging and with original cobble setts surviving in many places. Timber and cast-iron mooring posts as well as a variety of mooring rings, railings etc. survive at many points around the docks and cut-stone steps at strategic locations give access to water level.
987	50020496	Y	The triple sea-locks (Westmoreland, Buckingham and Camden Locks). Located at the river entrance to Grand Canal Dock and outside of the study area.
883	50100333	Y	Railway Bridge. From DCIHR File: Single-arch masonry railway bridge opened in 1834, carrying the Dublin and Kingstown Railway over Grand Canal Quay. Segmental arch with ashlar voussoirs resting on channelled ashlar limestone piers with granite

RPS ID.	NIAH Reg. No.	DCIHR Y/N	NIAH/RPS/DCIHR Description
			opening. Channelled ashlar limestone spandrels and channelled ashlar granite arch barrel. Random squared stone abutment to west. This railway bridge is located adjacent to the south extent of the site.
3277	50100332	Y	Old Malt house. From DCIHR File: Malt House; substantial remains.
-	-	Y	Victoria Draw Bridge/ MacMahon Bridge. From DCIHR File: Concrete bridge currently occupying the site. There is potential for the survival of some fabric from the earlier bridges, particularly as part of the canal walls remain apparently untouched. This bridge is located within the site. The proposed pipeline route will run under this bridge.
-	-	Y	Foot bridge. From DCIHR File: Foot bridge. No trace of bridge identified during inspection.
-	50100342	N	Hanover Quay / Quay/wharf. From NIAH File: Quayside, built c. 1790, lining north side of Grand Canal Docks. Coursed and dressed calp limestone walls with matching coping having rounded upper edge; recessed section having in-built granite steps descending to water. Quay hard standings replaced in recent years, having copings lined to north with cobble-trim and recent masonry paving. Cast-iron mooring posts affixed to coping stones, and modern lighting affixed to recent cobbles. Forms north part of deep-water Grand Canal Docks at south side of River Liffey, to southwest of where it meets River Dodder. Docks enclosed by adjoining Grand Canal Quay to west and Charlotte Quay to east, with McCartney Bridge spanning south end of docks. Recent large-scale developments lining quay; some industrial buildings remaining, including former industrial structures to northeast and northwest.
3513		N	Malt house.
-	50020468	N	Diving Bell. From NIAH File: Cast-iron and riveted plate-iron diving bell, fabricated c.1870, with chamber 23 feet square by 6.5 feet high, accessed by vertical shaft with iron rungs, incorporating air lock. Located to quay side of SJRQ, mounted on modern display structure. An ingenious diving bell designed by Bindon Blood Stoney (1828-1909), Assistant Engineer of the Dublin Port and Docks Board, used from 1872 for the construction of deep-sea quay walls. It was transported on a floating platform, from which it was lowered into position. A crew of six workmen entered the bell through an air-lock in its vertical access shaft which projected above the sea surface. Working in a pressurised chamber, the men levelled the seabed where the new quay walls and docks, made from massive precast concrete blocks, were to be laid. Stoney's diving bell remained in use until the 1950s. Saved from being scrapped in the 1980s, it was moved to SJRQ in 1989. It is striking reminder of the engineering and maritime heritage of Dublin port.
7377	-	Y	Boland's warehouse/mill at lifting bridge, Ringsend Road: six-storey stone warehouse. From DCIHR File: Bolands' Mills represented by Corn Mill; Flour Mill; Ship Builders Yard are recorded at this location, with Corn Mill depicted on the 3rd Edition OS map.
483, 484	-	Y	House/ offices, including railings and steps.

RPS ID.	NIAH Reg. No.	DCIHR Y/N	NIAH/RPS/DCIHR Description
			DCIHR File: Corn Kiln is recorded at this location and shown on the 3rd Edition OS map.
485	-	Y	Two-storey brick gables of warehouses to south of Boland's Mill, see also no.1 Ringsend Road. DCIHR File: Bolands' Mills represented by Corn Mill; Flour Mill; Ship Builders Yard are recorded at this location, with Corn Mill depicted on the 3rd Edition OS map.
486	-	N	Three-storey warehouse with oriel window.
487	-	Y	Five-storey warehouse/mill gable end to quay. DCIHR File: Sack Factory (Lime Kilns) recorded at this location and shown on the 3rd Edition OS map.
488	-	Y	Four-storey brick warehouse/mill parallel to quayside, to rear of 38-40 Barrow Street. DCIHR File: Dock Mills recorded at this location and shown on the 3rd Edition OS map.
-	-	Y	Gas Works; Hibernian Gas Works (DCIHR File).
-	-	Y	City of Dublin Bakery (DCIHR File).
-	-	Y	Cooker and Meter Factory: Coal Depot; Chemical Works (DCIHR file).
3278	-	Y	IDA Enterprise Centre.
8717	50020490	Y	Alliance Gas works Chimneystack. DCIHR File: Alliance Gas Works: Gas Works recorded at this location.
7543	-	N	2 SJRQ Façade.
-	50020495	Y	Dublin Granaries. DCIHR File: Dublin Granaries: Corn Store recorded at this location.

12.3.4 Shipwrecks Inventory

The Shipwreck Archive consists of over 18,000 paper files that hold information relating to each individual wrecks recorded in the Wreck Inventory of Ireland Database (WIID) with known location. This data set does not define the level of legal protection that might be afforded any individual wreck under the provisions of the National Monuments (Amendment) Acts (1987 and 1994); however, all wrecks that are over 100 years old and wrecks subject to an underwater heritage order are protected by Section 3 of the National Monuments (Amendment) Act 1987.

There are no wrecks with known location within the development area as listed within the Wreck Inventory of Ireland Database (WIID), and no wrecks were identified within the study area during the Underwater Archaeological Assessments carried out in relation to the proposed development in 2008 and 2020. There are a number of wrecks whose place of loss is specifically recorded as the River Liffey (see Table 12.3)

The Commons Sessional Papers (CSP) report on the majority of wrecks and though brief in nature include the name of the captain and occasionally the circumstances of the wreck and related information (e.g. whether cargo, crew or passengers were lost) and these are listed below.

Table 12.3 List of Wrecks

Location	Name	Date	Ship Type	Additional Information
Opposite the old coastguard station at Ringsend, River Liffey	Argo	10/12/1892	31-year old, 46- ton, Dublin, wooden fishing smack	Moored in the River Liffey.
Around 20ft from Quay Wall, River Liffey	Argo	1908	Steam ship of Bristol	Stranded and lost.
Between the walls at Dublin	Britannia	6/5/1774	vessel	This vessel was en route from London, under Captain Williams, when she hit an anchor. She went ashore.
River Liffey	Carolina	5/10/1799	Galliot of Oporto	Ran aground and sank.
Dubin River	Commerce	25/10/1811	Vessel	En route from Dublin when sank.
Between the city of Dublin Company's jetty and breakwater head	Edith	8/09/1875	Steamer aboard	En route from the company's wharf to Greenore. She departed at around 1.25am but collided with another London and North-Western Railway Company vessel, the Duchess of Sutherland. This vessel was under the command of Captain Beaumont and was en route from North Wall Dublin. The Edith was violently struck on the starboard bow and sank within a quarter of an hour. A fireman called Jones and his brother who slept in the forecastle were drowned. The weather was clear and calm at the time of the incident. Cargo: 60 to 80 passengers.
Sir John's Quay, Dublin	Emma	17/06/1851	Smack	En route from Liverpool ran aground and listed on her beam ends. She was seriously strained and brought to Eden Quay where she filled. The cargo was damaged. Cargo: Wheat and staves.
South Wall	Henry	23/11/1798	Brig Liverpool	Wrecked.
River Liffey	Hibernia	22/03/1776	Vessel	Burnt.
Pigeon Hole, Dublin River	James and Ann	7/2/1812	ship	En route from Drogheda was hit by a collier brig and sank.
Dublin/ SJRQ	Jessie Maria	1851	Whitehaven vessel	Burnt in 1851.
'Dublin River'	Langston	21/03/1812	Vessel	Portsmouth vessel was reported lost.
River Liffey, Dublin	Leonard	10/01/1853	Ship	Struck by a steamer.

Location	Name	Date	Ship Type	Additional Information
Entrance to Dublin River	Maria Carolina	16/08/1799	Cargo?	En route from Oporto to Dublin when she sank. The cargo was landed.
Abreast of no 2 bouy, River Liffey	Mermeid	16/07/1892	Unregistered wooden yacht/cutter was 5 yrs old and weighed 1 ton.	The master and owner was P. Carolan, Clontarf, Dublin. She was en route from Clontarf to Dublin, in ballast, with 6 crew. She sank in an easterly force 6 wind but was later raised. 4 lives were lost.
The Liffey	Newport	20/05/1851	Montrose schooner	En-route up the Liffey when she came in contact with Hebden from Barbados, which made a hole in her stern.
Dublin River	Nosha Squera de Bonamo	28/06/1798	Brig of Oporto	Ran onto a bank.
Ringsend, R. Liffey	Pelican	08/04/1889	37-ton 32-year old wooden smack of Dublin	At anchor at Ringsend when burnt. Vessel in ballast.
Behind piles at Dublin	Providence	5/02/1771	vessel	En route from London, under Capt. Mayne, when she was lost.
Opposite Halpins Pond, River Liffey	Rat	25/05/1891	10-year old wooden pleasure sailing boat	Capsized and was wrecked during pleasure trip.
River Liffey	Slade	1799	Brig of rye	Lost.
River Liffey	Times	1-2/06/1853	Dublin vessel	En route from Dublin to Liverpool encountered easterly wind. Her boilers burst while in river. Cargo: Passengers.
Off Pigeon House	Times	13/09-29/11/1851	Steamer	Steamer plying to and from Dublin went ashore but got off again after discharging some cargo.
The River Liffey	Thomas	1896	Wooden cutter	Casualty.
Ringsend	Unknown	10.1760	Ship	A severe gale in Dublin Bay wrecked two ships.
Dublin River	Usk	8/10/1856	Vessel	This vessel, en route from Dublin to Wexford, became stranded.
Dublin River	William	10/01/1812	Spit	Went aground.

No wrecks were identified during the Underwater Archaeological Assessments carried out in 2007/2008 and 2020 along the proposed pipeline route. There is however some limited potential that unrecorded vessels, could still lie buried in the silts of the Grand Canal Dock which would not be visible during a Dive Survey. Any such ship remains and associated objects if present, would be legally protected as all wrecks that are over 100 years old and wrecks subject to an underwater heritage order are protected by Section 3 of the National Monuments (Amendment) Act 1987.

12.3.5 National Museum of Ireland Topographical Files

No stray archaeological finds are recorded in the topographical files of the National Museum within the study area. A number of objects are, however, recorded from the environs of the site. These relate to and reflect archaeological activity in the wider area. Among the earliest artefacts encountered were those recovered from excavations located c. 2km to the west of the Grand Canal Basin at Fishamble Street. These included: two flint blades of Larnian style (similar pieces dated to about 3350BC at Sutton and on

Dalkey Island), a Neolithic polished stone axe-head, and a barbed and tanged flint arrowhead of Early Bronze Age type.

Twenty-six (26) artefacts have been listed in the topographical files for the River Liffey and its associated quay structures. Listed artefacts range in date from the early Bronze Age (axe-head, 1922:4) to nineteenth-century material (clay pipe fragments, etc., 1937: 2379-2416). Only eleven artefacts are listed as coming from the River Liffey itself, the rest being recovered during quayside excavation works. One artefact, an iron sword (1964:1) and described as possibly Sudanese was found at Arran Quay and listed as coming directly from riverbed deposits and described as dating from the fourteenth to the nineteenth century. It had a total length of 100cm, with the length of the blade 88cm and the width across the cross-guard 15.5cm. The blade is long tapered and flexible tapering to a blunt rounded point. Glass Beads found in The River Liffey include: 4042:WK428, 4041:WK427, 4034:WK419;WK420, 4031:WK417, these are listed as found with other beads and an iron sword pommel: 4029:WK415 & 4030:WK416. There are no items listed in the Topographical Archives specifically for the Grand Canal Docks.

12.3.6 Previous Archaeological Assessments in relation to the proposed development

There have been a number of archaeological investigations within the surrounding area in the environs of the site, including the dive survey (07D061, 07R249) that was carried out in 2008 and more recently in September 2020 under Licence (20D0039, 20R0144) both carried out in relation to the proposed development. Refer to Volume 3, Appendix 12A.

Listed below (Table 12.4, Figure 12.1) are the investigations located within the study area. Additional sites located in the environs of the study area are also listed and mentioned below if of any relevance in relation to the proposed development. The details are derived from the Summary Accounts of Archaeological Excavations in Ireland (www.excavations.ie).

Table 12.4 Previous archaeological investigations within and in the environs of the study area

Site	Licence No.	RMP/SMR No.	Site Type	Investigation Type
2008:412 - Grand Canal Docks/ Sir John Rogerson's Quay, Dublin, Dublin	07D061; 07R249	N/A	Canal basin/riverine	Underwater Assessment (carried out during earlier stage of this project)
2009:AD5 - EAST WALL TO INCHICORE WORKS, DUBLIN, Dublin	08E915 E3997, E3998, E3999	DU018–020268, DU018–020334	Medieval/post-medieval	Archaeological monitoring
2004:0576 - ALTO VETRO, GRAND CANAL DOCK, PEARSE STREET, DUBLIN, Dublin	04E0887	N/A	No archaeological significance	Archaeological testing
2012:208 - Grand Canal Street District Metered Area, Dublin, Dublin	11E0307	DU018-020 and DU018-052	Urban; no archaeological significance	Archaeological monitoring
2005:445 - 5–7 AND 8 HANOVER QUAY, DUBLIN, Dublin	05E1045	N/A	Urban	Archaeological monitoring

Site	Licence No.	RMP/SMR No.	Site Type	Investigation Type
2002:0577 -Sir John Rogerson's Quay, Dublin, Dublin	02E1625	N/A	Urban	Archaeological testing
2006:642 - 17–19 Sir John Rogerson's Quay, Dublin	05E0617	N/A	Urban/post-medieval	Archaeological testing
2018:180 - Hanover Quay, Dublin, Dublin	15E0372	N/A	No archaeology found	Archaeological monitoring
2015:059 – 76 Sir John Rogerson's Quay, Dublin, Dublin	15E0371	DU018-020	No archaeology found	Archaeological testing
2017:523 - 8 Hanover Quay (former Durabond House), Dublin 2, Dublin	16E0143	N/A	None	Archaeological monitoring
2019:505 - River Liffey, Blood Stoney Pedestrian Bridge Project, Dublin, Dublin	19D0063, 19R0156	Du18-020564, Du18-02021	Riverine	Underwater Archaeological Impact Assessment
2016:015 - Boland's Mill, Dublin 2, Dublin	15E0362	N/A	Works ongoing	Archaeological monitoring
2008:411 - Barrow Street, Grand Canal Dock, Dublin, Dublin	07E0527	N/A	Urban – non archaeological	Archaeological monitoring
2002:0543 - River Liffey, Guild Street/Macken Street, Dublin, Dublin	02E1811	N/A	No archaeological significance	Archaeological monitoring
2014:520 - 1-6 SJRQ / 16-25 Creighton Street, Dublin 2, Dublin	14E0438	DU018-020201	Urban post-medieval	Archaeological testing
2017:150 - Lime Street, Dublin 2, Dublin 2018:837 - Lime Street, Dublin 2, Dublin 2019:629 - Lime Street, Dublin 2, Dublin 2020:312 - Lime Street, Dublin 2, Dublin	16E0620	N/A	Urban post-medieval; land reclamation, early 18th-century houses, river silts	Archaeological testing, monitoring and excavation

The study area was subject to an Archaeological Appraisal by Dr Annaba Kilfeather of Margaret Gowen & Co Ltd in 2006. Subsequently, the study area was the subject of an underwater archaeological assessment undertaken in 2008 within the Grand Canal Docks and Quays, SJRQ, and River Liffey by Niall Brady of The Archaeological Diving Company Ltd (ADCO) under Licence (07D061, 07R249). No archaeologically significant materials/ structures were identified. Both assessments addressed the impact the development will have on SJRQ, as the removal of the granite blocks shall be necessary to insert the stormwater outlet pipe. It concluded that the impact the proposed development will have on a small section of the quay wall will be significant and permanent. It was noted that although the works did not identify any features or deposits of archaeological significance, the possibility of encountering archaeological finds during works should not be dismissed, and recommended:

- Licenced archaeological monitoring should be undertaken during removal of all riverbed/ canal-bed material; and
- Photomosaic/ drawn elevation of the impact area along SJRQ should be made prior to works by a suitably qualified archaeologist and a certified site surveyor.

Consultation with the Department of Housing, Local Government & Heritage took place in 2020. This noted the site lies within the archaeological potential of the historic quays of the River Liffey (DU018-020201), and an area of high underwater archaeological potential, as numerous wrecks are listed within the Wreck Inventory of Ireland database (WIID). The Department recommended that an updated underwater archaeological impact assessment report be prepared for the scheme. This survey was commissioned and carried out by Rex Bangerter of The Archaeological Diving Company Ltd (ADCO) in September 2020 under Licence (20D0039, 20R0144). This confirmed the results of the previous assessment; no archaeologically significant materials/structures were identified. It concluded that while no further archaeological mitigation is required in advance of construction, it recommended the following:

- Archaeological monitoring of all ground/ canal/ riverbed disturbances during construction be undertaken, by a suitably qualified and experienced maritime archaeologist, with the proviso to resolve fully any archaeological material/ features/ deposits observed at that point. In particular, archaeological monitoring of any quayside disturbances is required; allowing a full record of any sections of quayside impacted by the development to be made; and
- Quayside masonry and/ or associated fixtures and fittings that may be removed as part of the development should be retained and subject to additional recording.

In the majority of occasions where archaeological investigations have taken place in the environs of the site, no archaeological material was identified as was the case with the Phase 1 construction of the pipeline under Asgard Road between Hanover Quay and SJRQ in 2002. During excavation at 17–19 SJRQ (05E0617) following demolition of a building, post-medieval land reclamation deposits with associated wooden posts or planks were noted at the eastern end of one of the trenches. Also, during the investigations at the west side of the junction with Hanover Quay and Benson Street (05E1045) a substantial stone wall was encountered along the Hanover Quay frontage. The wall was of mortared stone construction, c. 1m wide and up to 5m below street level, it extended the length of the Hanover Quay frontage (c.80m) continuing both east and west. This wall does not appear on any cartographic or historic record and is likely associated with the construction of the Grand Canal Dock.

Significant discoveries were also made in 2003/2004 (03E0654) and 2006-2007 (06E0668), outside of the study area on the north shoreline of the River Liffey when previously unknown, Mesolithic material was identified consisting of Six Late Mesolithic wicker fish traps (6100-5700 BC) as well as wooden stake rows and the remains of a Mid-Neolithic wicker fish trap (3630-3370 BC) that were preserved in the waterlogged silts. These were found c. 6-7m below sea level.

Figure 12.9 West-facing view of northwest limit of Grand Canal Docks. Grand Canal Quay to left and Hanover to right of picture (ADCO image).

Furthermore, extensive post-medieval deposits were exposed at a site located at 20-24 SJRQ, as part of archaeological works carried out under licence 16E0620, on a site located c. 440m to the west of the proposed development and outside of the study area. Archaeological excavations were carried out on site since 2017, these included the initial test trenching that resulted in identification of brick and limestone walls north-south and east-west aligned at a depth of c. 0.2m-1.5m below present ground level. The walls fronting onto SJRQ were identified as associated with four early 18th century Dutch Billy houses depicted by Rocque in 1756 (Figure 12.4) and by Scale in 1773. Subsequently during monitoring in 2018 a substantial north-south wall was uncovered in the east portion of the site. It was interpreted as a wall constructed by Rogerson and representing a slip or berth running off perpendicular to the river. This wall was depicted by Brooking in 1728 (Figure 12.2), marking the eastern limit of the development on the polder and representing the extent of strand 'taken in' by Rogerson from the unreclaimed area further east where the proposed development site is located. In 2019 during monitoring nothing of archaeological significance was encountered. However, in 2020 excavations of an early 18th century north-south river/dike wall took place. The wall was identified as a part of Sir John Rogerson reclamation works carried out in the 1710's and at that time it formed the end of the quays in Dublin City. The river wall exceeded 2.6m in height and was 1.3m wide, with rubble core and square-cut stone faces. The wall was depicted by Brooking in 1728, at which time land further east is shown as being reclaimed.

12.3.7 Cartographic Review

Examination of pre-Ordnance Survey maps included John Speed's map (1610), 1654 Dublin Civil Survey, De Gomme's map of 1673, Brooking's map of the City and Suburbs of Dublin (1728), Rocques Map of Dublin 1756-60, Pool and Cash maps of 1780 and 1787, John Rocque & Bernard Scale map and Wilson's map of the city and Environs of Dublin (1798).

John Speed's map (1610) is the earliest map and shows Dublin City that is centred around Dublin Castle and Trinity College. The 1654 Dublin Civil Survey map depicts the current site as located between Dublin and Ringsend and labels them as 'Liberties of Dublin'. The Grand Canal Docks area was named 'South Strand' on De Gomme's map of 1673, as it was an area affected by the tide. The map also shows the River Dodder flowing into the Liffey with no buildings depicted. Brooking's map of the City and Suburbs of Dublin (1728) (Figure 12.2) shows Sir Rogerson's Quay with tall townhouses shown along the river and a road shown along it with ships moored along the quay wall between the SJRQ and Ringsend. On Rocque's Map of Dublin (1756-60) (Figure 12.4) a road is depicted and labelled as 'Horse Road to Ringsted' along the river, currently SJRQ; the quay and the wall were built by 1729. 'Foot Rd to Ring' is also depicted to the south and within an area called 'The South Lots' that is now part of the Grand Canal Docks Basin and to the east of the River Dodder, also depicted. The 1780 Pool and Cash maps depict and label 'Sir Rogerson's Quay' and John Rocque & Bernard Scale's map of 1787 depicts 'Rogersons Quay'. Wilson's map of the City and Environs of Dublin (1798) (Figure 12.6) depicts the Grand Canal Docks for the first time. Great Brunswick Street is depicted running roughly east-west with a bridge over the Grand Canal Docks. The Grand Canal Quay is depicted as a road running along the full length of the

Grand Canal Docks to the west, with Hanover Quay along its north extent and Charlotte Quay opposite. SJRQ is also depicted along the River Liffey. Sea Locks and Graving Docks are depicted with Ringsend to the east and accessed by Ringsend Bridge.

The cartographic review of the Ordnance Survey maps of 1834 and 1907 shows rapid urbanisation of the area. The 1st Edition OS map of 1834 shows the study area with the Grand Canal Docks with a railway bridge over it. This was the first Irish railway line - the Dublin to Kingstown (currently Dun Laoghaire) that was opened in 1834. The map also shows the 'Drawn Bridge' spanning across the docks. The Docks Chemical Works and Docks Mills are depicted and labelled to the east of the docks and Gas Works are located just northwest of the Drawn Bridge. The area north of the Grand Canal Docks and south of SJRQ appears to be largely underdeveloped but appears to be divided into plots with minor structures within. Some plots are labelled like 'Queens Timber Yard' and 'Coast Guard Station'; also the area south of the 'Charlotte Quay' is depicted as 'Rope Walk'. The area is labelled as St. Marks and is part of 'College Ward'. The area to the east of the Grand Canal Basin is labelled as 'South Lots'.

Figure 12.10 North extent of the Grand Canal Dock basin, facing Hanover Quay. North extent of Grand Canal Docks to the left.

By the time of the 3rd Edition 1907 map the area is labelled as the 'South Dock Ward', with tram lines marked on streets. The previously mentioned vacant areas had filled up since with industrial buildings that include: to the west of the canal and along it – Bakery, Dogs Home, Malthouse, Distillery, the Drawn Bridge is now labelled as 'Victoria Bridge', and a large area is occupied by the 'Gas Works', the plots between Hanover Quay and SJRQ are labelled as Coal Depot, Chemical Works, Dublin Granaries, Cattle Pens and Chemical Manure & Oilcake Mills; a Mooring Post is along the Charlotte Quay, with Tram Power Station, and Chemical Works to the south of it; the Travelling Crane to the west and along the Grand Canal Docks Basin. To the east of Barrow Street and south of Ringsend Road a number of buildings are depicted and labelled, the majority are now listed as protected structures, that relate to Corn Mill, Corn Kiln, Dock Mills (Corn) and Engine Shed.

12.3.8 Aerial Photography Review

In addition to examining the various editions of the OS maps, aerial photographs from the Geological Survey of Ireland, dating from between 1995 and 2013, and the google aerial imagery dating between 1995 and 2019 were consulted.

No features of archaeological interest are apparent from an examination of these.

12.3.9 Field Survey

The purpose of this survey was to assess whether or not the site contained any evidence for the presence of any previously unrecorded areas or features of historical, built heritage or archaeological significance.

The field survey of the site was conducted by Donald Murphy of ACSU on two occasions, on the 25th of September 2020 and on the 9th of February 2021. The majority of the study area is located in the central underwater part of the Grand Canal Docks Basin. The proposed development will connect to the existing Grand Canal Tunnel Outfall, and run under MacMahon Bridge (former Victoria Bridge) (Figure 2.3) before turning to the northwest and connecting to Transition Chamber 2, continuing adjacent to Gallery Quay/north extent of Grand Canal Quay before reaching the Hanover Quay and connecting to Transition Chamber 3, here it will take a 90 degree turn and leave the basin to continue along the south side of Hanover Quay Street (Figure 2.3) before turning north towards Asgard Road and connect to an existing culvert constructed in 2002 during Phase 1 of the Project. The northern part will connect to the north end of the Asgard Road culvert and run north terminating at SJRQ. Here an outfall will exit into the River Liffey through the quay wall (Figure 12.7). The proposed location of two temporary construction compounds along Grand Canal Quay and Hanover Quay were also inspected. It was noted that several cast-iron mooring posts affixed to the capping stones of the quay wall are present on Hanover Quay and will require adequate protection during the construction phase (Figure 12.11). No ground disturbance is proposed at either compound location.Hanover Quay delineates the northern side of the dock/ basin area, extending at right angles from the north terminus of Grand Canal Quay for a distance of *c*. 480m (ITM E 717312, N 734105 - ITM E 717795, N 734047). Two (2) courses of rough-cut, limestone, masonry are visible above the waterline; measuring in size between 500mm length x 400mm height and 1m length x 400mm height. Above this, large capping stones are present, measuring up to 750mm length x 400mm height x 650mm depth. A series of small, forged-iron, mooring bollards adorn the top of the quay structure; these being marked '*Athy CO OP Foundry*'. The quay has undergone frequent modern intervention/ remedial works along its extent. This includes repair and re-pointing (cement) of the quay wall and in places replacement of its original, limestone, capping with granite and/or modern-cut limestone. A set of river-access steps are positioned near (*c.* 6m) the quay's western terminus. The Grand Canal Dock including Hanover Quay is listed in the National Inventory of Architectural Heritage. The proposed pipeline will impact a section of the quay wall here at Transition Chamber 3.

Figure 12.11 Cast iron mooring on Hanover Quay, at the location of the proposed main compound.

The only Protected Structure within the works area itself is RPS ID. 7542 SJRQ- Granite ashlar quay walls, stone setts, mooring rings, steps, bollards, lamp standards and machinery. In addition, a number of protected structures are located in the immediate environs of the site (Table 12.2). SJRQ is composed of neatly-cut/faced, regularly coursed, granite blocks measuring a uniform 1.20m in length x 300mm in height and 950mm in length x 300mm in height. This uniformity of construction is evident from the base of the capping stones to the base of the structure; the capping stones being of greater height at 400mm. A chamfer in the quay wall is located *c.* 2.5m from the top of the structure. A set of river-access steps are located *c.* 25m to the east of the identified location of the proposed outfall. A recessed mooring-hoop

(250mm recess) is located *c*. 9m east of the outfall centre-point. In addition, two (2) rectangular recesses measuring 250mmm (length) x 150mm (width) x 0.25m (depth) are located at the point of impact. These rectangular recesses are likely to represent fixtures for a wooden access ladder or wooden buffer-posts to protect the quayside. No fixtures or fittings were visible below the water-line, the only noteworthy feature being the masonry chamfer detail present along the quay wall.

Figure 12.12 Hanover Quay

As set out in the draft Development Plan 2022-2028, under the proposed Policy BHA 18(a), the extant historic and traditionally laid stone setts to Sir John Rogerson's Quay (campshires) are to be protected, conserved and reintroduced; together with any associated gutter row(s) of setts; gutter flags or flat diorite gutters; diorite strip between central and side paving and traditional gullies, gratings and covers etc.

Moreover, should extant historic and traditionally laid stone sets or historic (antique) granite kerbing and pavers/flags, historic milestones, boundary markers, bollards, boot scrapers, troughs, guard or jostle stones, cast iron basement lights, street skylights and prisms, historic and traditional gratings, historic gutter setts, decorative manholes, coal hole and other covers or historic (antique) granite kerbing etc. be found elsewhere within the scheme, these are all to be protected, conserved and reintroduced under the programme for areas with historic ground/street surfaces, together with any associated historic features.

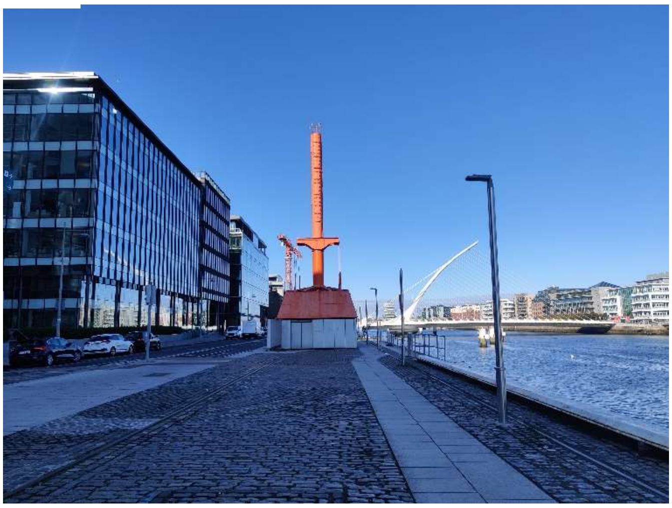


Figure 12.13 Traditionally laid stone setts at SJRQ

It should be noted, that such settings can only be impacted upon in two locations; at Hanover Quay (Figure 12.12) and at Sir John Rogerson's Quay (Figure 12.13). However, only on SJRQ such surface was evident. Furthermore, stone setts at SJRQ are detailed as a part of PRS ID 7542. The existing surfaces at Hanover Quay should be reinstated upon completion.

No additional structures or features of a built heritage or archaeological nature were identified within the scheme. The features highlighted and photographed in the ADCO underwater survey have also been included. These consist of the quay walls and two elements located at SJRQ wall - two rectangular recesses, possibly for a ladder and a recessed iron mooring hoop (Figure 12.7).

12.4 Characteristics of the Development

The proposed development by its very nature will involve ground disturbance in a number of areas. The first of these will occur within the Grand Canal Basin. The pipeline here will be laid on the existing bed with silts being pushed to either side to create a level bed. At Hanover Quay the pipeline will involve the removal of a small section of the quay wall before turning east along the quay and then north towards Asgard Road where it will join an existing pipeline. Ground disturbance will occur along Hanover Quay as the pipeline will be laid in an open cut trench. The final area of ground disturbance will occur SJRQ where the pipeline will cross the road and result in the removal of a small section of the quay wall where the proposed storm outfall will exit into the Liffey.

12.5 Potential Impacts

The potential for direct impacts on known archaeology and cultural heritage is considered low even though the northern part of the application area is within the Dublin City Zone Of Archaeological Potential (DU018-020). The outfall extension that will discharge into the River Liffey at the very north portion of the scheme, will impact a small section of SJRQ Sir John Rogerson's Quay (DU018-020201) which is a Recorded Monument, within Architectural Conservation Area as marked on Map E of the Dublin City Development Plan 2016-2022 and is also listed in the National Inventory of Architectural Heritage structure (NIAH Reg. No 50020465). The Granite ashlar quay walls, stone setts, mooring rings, steps, bollards, lamp standards, and machinery along Sir John Rogerson’s Quay is also a Protected Structure (RPS 7542).

The Grand Canal Docks Basin (NIAH Reg. No. 50020499), including Grand Canal Docks Quay, Charlotte Quay, Hanover Quay (NIAH Reg. No. 50100342), Britain Quay, and the River Dodder are located within a Conservation Area as marked on Map E of the Dublin City Development Plan 2016-2022. There will be an impact on the Quay wall at the north end of the Grand Canal Docks/ Hanover Quay where Transition Chamber 3 will be constructed. The proposed development also has the potential to have a direct impact on a substantial possibly late 18th century stone wall exposed along the north side of Hanover Quay should it extend into the site. The pipeline running northwards through the Basin will be inserted and pass through a section of Hanover Quay, and link with existing culvert on Asgard Road built in 2002. Should the late 18th century stone wall extend into the area to be impacted by groundworks associated with the proposed development, the wall will be perforated. Monitoring including preservation by record (excavation) will be necessary in order to mitigate this impact. The wall was identified as a result of investigations carried out under Licence 05E1045 on a site to the east of the proposed development. As it does not appear on any cartographic or historic record, it is likely associated with the construction of the Grand Canal Dock. If the wall were to be continued into the proposed development site it would be likely to be exposed at or near the junction of Hanover Quay and Asgard Road.

While it appears that before the 18th century, the area was part of the estuary of the River Dodder where it joined the River Liffey, it is possible an earlier 18th-century quayside might be located behind the extant wall on SJRQ, and should it be present it may be impacted as a result of the proposed development. Sources indicate however, that in the early 18th century this area was reclaimed, and the ground level was raised which allowed for the construction of a quay road and buildings along the quay, fronting the River Liffey. The reclamation deposits themselves have the potential to contain cultural heritage material such as artefacts and the underlying silts have the potential to contain archaeological features that pre-date the construction of the Grand Canal Dock. The underwater survey confirmed the absence of any visible wrecks or other archaeological features along the proposed pipeline route and there is limited potential for vessels or archaeological features to lie buried in the underlying silts but the possibility cannot be entirely dismissed.

12.5.1 Do-Nothing Impacts

In the event that the project does not progress there will be no impact on Archaeology or Cultural Heritage features as a result.

12.5.2 Construction Phase

There are two direct impacts on sites of known archaeological and cultural heritage significance. The first is the proposed storm water outfall to the River Liffey which will have a *direct negative impact, moderate and permanent in nature* on a small section of SJRQ, which is within the Dublin City Zone Of Archaeological Potential: DU018-020, and is a recorded monument listed in the Record of Monuments and Places for County Dublin (DU018-020201-). It is also a Protected Structure (RPS 7542) in the Dublin City Development Plan 2016-2022, that includes granite ashlar quay walls, stone setts, mooring rings, steps, bollards, lamp standards and machinery and is also recorded in the National Inventory of Architectural Heritage (NIAH Reg. No 50020465). Works relating to Sir Rogerson's Quay date as early as 1714. The proposed outfall will necessitate the removal of a small section (c. 13m) of the granite ashlar quay walls directly opposite Asgard Road. The wall at this location includes two rectangular recesses likely to have supported a wooden access ladder or buffering posts along the quay wall.

The second direct impact on a site of known cultural heritage significance is located along the north end of the Grand Canal Docks at Hanover Quay where the construction of the pipeline will require the removal of a small section (c. 7.3m) of the quay wall where it will have a *direct negative impact, moderate and permanent in nature*. The wall at this location consists of two courses of rough-cut limestone above the water level with large capping stones above. A set of access steps are located 6m from the western edge of the quay wall.

There is also some limited potential that construction works could directly impact previously unknown features or deposits of an archaeological nature should they be discovered during the course of the works. Excavations of estuarine deposits in the Grand Canal Docks and possibly along Hanover Quay and SJRQ have the potential to expose fish traps, trackways, canoes, boats or objects related to fishing and hunting due to good preservation in waterlogged deposits. This could also include remains of ships that pre-date the 18th century reclamation works that got stranded in the silts and buried during reclamation works. During reclamation in the 18th century a series of fills would have been deposited in order to reclaim the ground. The proposed development will impact upon these 18th century reclamation deposits. This could be material representing waste from the city as well as silts dredged from the river and basin. Both types of materials have potential to contain archaeological objects. Deeper excavations could expose estuarine deposits that might contain 'in situ' pre 18th century material.

In order to facilitate the works three temporary compound locations are also proposed; a small compound located at Grand Canal Quay Inner Basin (ITM E 717278, N 733832), temporary works compound located at the SJRQ at the end of Asgard Road towards the River Liffey(ITM E 717412, N 734309) and a main compound located at Hanover Quay (ITM E 717552, N 734080). While no ground works are anticipated in relation to these and therefore no direct impact is expected, any vulnerable historic surfaces at compound locations will need to be protected. The site visit identified cast iron moorings along Hanover Quay (NIAH Reg. No. 50100342) that will require appropriate protection during the construction phase.

12.5.3 Operational Phase

There will be no operational phase impacts on archaeology or cultural heritage features from the proposed development.

12.6 Mitigation Measures

12.6.1 Pre - Construction Phase

The following mitigation measures will be carried out before Construction Works commence:

- A conservation expert (Grade 1 Conservation Architect preferably) with proven and appropriate expertise shall be employed to design, manage, monitor and implement all proposed new work from initial concept design stage through to construction stage and to ensure adequate protection of the historic fabric during the work. In this regard, all permitted works shall be designed to cause minimum interference to the structures and/or fabric. All works to the historic fabric shall be carried out in accordance with best conservation practice and the Architectural Heritage Protection Guidelines for Planning Authorities (2011) and Advice Series issued by the Department of the Environment, Heritage and Local Government. Any repair works shall retain the maximum amount of surviving historic fabric in situ. Items to be removed for repair off-site shall be recorded prior to removal, catalogued and numbered to allow for authentic re-instatement. All existing original features, in the vicinity of the works shall be protected during the course of the refurbishment works. All repair of original fabric shall be scheduled and carried out by appropriately experienced conservators of historic fabric. The architectural detailing and materials in the new work shall be executed to the highest standards so as to complement the setting of the protected structure and the historic area;
- Prior to the commencement of works a detailed pre-construction survey of the location of the outfall at SJRQ will be carried out and elements of SJRQ to be impacted upon will be recorded. This will

include features within the works area such as cobbling, metal tracks, stone setts (also identified as historic street surfaces in Appendix 6 of the Draft Dublin City Development Plan 2022-2028 and protected in accordance with Policy BHA 18(a))and bollards that are part of the quays and any features that are deemed of archaeological or architectural importance that might be impacted upon by the proposed works., The survey will include detailed plans and elevations of the quay wall at the outfall exit location crossed referenced against detailed photographic record; detailed set of drawings will be prepared, cross-referenced against marked-up photographs (to-scale photogrammetric survey)of the historic vertical and horizontal surfaces of the area to record the condition of the historic surfaces and to inform any repairs required. This will be carried out using a drone photographic survey, superimposed / cross referenced at scale on a set of CAD drawings so as to identify the presence of such features and to calculate the area of historic surfaces that may be impacted by the development and to identify the necessary repairs;

- Prior to the commencement of works a detailed pre-construction survey of the location of Transitional Chamber 3 at the junction of Grand Canal Docks and Hanover Quay will be carried out and elements of the north wall of the Grand Canal Docks along Hanover Quay to be impacted upon will be recorded. This will include any features within the works area such as the iron mooring points and stone steps and any other features that are deemed of archaeological, cultural heritage or architectural importance that might be impacted upon by the proposed works. The survey will include detailed plans and elevations of the quay wall at the outfall exit location; detailed set of drawings will be prepared, cross-referenced against marked-up photographs (to-scale photogrammetric survey) of the historic vertical and horizontal surfaces of the area to record the condition of the historic surfaces and to inform any repairs required. This will be carried out using a drone photographic survey, superimposed / cross referenced at scale on a set of CAD drawings so as to identify the presence of such features and to calculate the area of historic surfaces that may be impacted by the development and to identify the necessary repairs; and
- Prior to the commencement of works the removal of sections of wall (including as of yet unidentified sections) will be agreed in writing with both the City Archaeologist and Conservation Officer. The removal of quayside fixtures will also be agreed in writing with the City Archaeologist/Conservation Officer prior to removal.

12.6.2 Construction Phase

The following mitigation measures will be carried out during the construction phase:

- The perimeter of the temporary construction compound at Hanover Quay will be placed at 1m distance from the edge of the quay wall. This will ensure that the cast iron moorings are outside the compound and will not be impacted. If for any reason this is not possible then the moorings will be removed for the duration of the works, stored safely and re-instated on completion. Any historic surfaces deemed vulnerable will be protected. A conservation specification and methodology for this aspect of the work shall be prepared by the conservation professional and submitted to the Conservation Officer for their written agreement in advance of works commencing. This will fully mitigate any impact on this part of Hanover Quay. No ground works are proposed within either compound area;
- As pre-development test excavation of areas to be impacted is not feasible due to the nature of works and location, monitoring of all groundworks will be necessary. Therefore it is recommended that prior to groundworks/excavation a conservation specification and methodology for the careful lifting, protecting, and setting aside of the historic surfaces shall be prepared by the conservation professional and submitted to the Conservation Officer for their written agreement in advance of works commencing. Subsequently, following lifting of these historic surfaces in line with the agreed specification and methodology, breaking and removal of the deposits will be carried out by a suitably qualified archaeologist in line with a method statement prepared and approved by the City Archaeologist, and under Licence from the Department of Housing, Local Government & Heritage in consultation with the National Museum of Ireland. Should significant archaeological material be identified during works, preservation in situ where possible or preservation by record is recommended where other mitigation measures are not possible. This will require strategies to be implemented that will require consultation with the Department of Housing, Local Government & Heritage and the Dublin City Archaeologist and Conservation Officer of Dublin City Council;

- In the underwater areas (the area of the Grand Canal Basin and the River Liffey) archaeological monitoring during excavation/ moving of silts will be required by a suitably qualified archaeologist with maritime experience who will monitor the material being disturbed from the basin and riverbed. Provisions will be made to fully resolve any archaeological material/ features/ deposits observed during the monitoring;
- Any quayside masonry and/or associated fixtures and fittings that require removal as part of the development will be recorded in advance, retained and every attempt will be made that these are re-instated. Where re-instatement is not possible suitable long-term storage or re-use options will be agreed in advance with the Dublin City Archaeologist and Conservation Officer; and
- Should any previously unknown, concealed historic fabric is discovered / uncovered in the course of opening up / excavation / construction work, the Conservation Officer shall be contacted and informed so as agree in writing a preferred methodology for its careful and authentic reinstatement.

If these recommendations are implemented the potential impact on archaeological and built heritage material will be sufficiently mitigated.

12.6.3 Operational Phase

No mitigation measures relating to the archaeological, architectural and cultural heritage resource are deemed to be necessary during the operational phase of the proposed development.

12.7 Residual Impacts

12.7.1 Construction Phase

If the mitigation measures above are fully implemented there will be no residual impacts on the archaeological, architectural or cultural heritage resource as any features of significance would be preserved either in situ or by record.

12.7.2 Operational Phase

There will be no residual impacts during the Operational phase as there are no Impacts or Mitigation proposed for this phase.

12.7.3 Interactions

There will be no direct interactions between Archaeology & Cultural Heritage and other environmental factors being considered as part of this project. However, there may be an indirect interaction of Archaeology and Cultural Heritage with the Landscape and Visual Impact, Noise and Vibration and Lands, Soils, Geology and Hydrogeology. These are detailed in Volume 2, Section 16.

12.7.4 Cumulative impacts

Cumulative impacts are those that through the addition of many minor or significant effects, including the effects from other projects, add up to larger more significant impacts. In terms of the identified archaeological, architectural and cultural heritage features on the site, there are no additional cumulative impacts.

12.8 Monitoring

A CEMP has been prepared and is included in Volume 3, Appendix 17A to the EIAR which will be updated and finalised by the Contractor prior to construction commencing. The CEMP contains the archaeological mitigation measures outlined above.

Archaeological monitoring of all ground disturbance associated with the proposed development with the provision for recording and excavation (if required) will mitigate any potential impact and preserve any archaeological, architectural and cultural heritage features identified by record.

The full implementation of the archaeological monitoring and excavation measures will ensure that there will be no residual impacts on any further features of archaeological potential not previously identified on site.

12.9 References

The following sources have been consulted in the preparation of this EIAR:

Brady, N., 2008, *Underwater Archaeological Assessment, Grand Canal Quay, Grand Canal Docks, Sir John Rogerson's Quay, River Liffey, Dublin city, Co. Dublin (07D061, 07R249),* unpublished report.

Branagan, M., 2020. Dublin moving east 1708-1844. How the city took over the sea. Wordwell, Dublin.

Bangerter, R., 2020*, Underwater Archaeological Impact Assessment (UAIA). Grand Canal Surface Water Outfall Project. Grand Canal Docks and River Liffey, Dublin City (20D0039, 20R0144),* unpublished report.

Cox, R. 1990, *Bindon Blood Stoney. Biography of a port engineer* (Dublin).

De Courcy, J. (2004). *The Liffey Banks in Dublin: The Early Works of the Private Developers. Dublin Historical Record, 57(2), 146-151.*

Delaney, R. (1980). *The Grand Canal. Dublin Historical Record, 33(2), 73-76.*

Dublin City Development Plan 2016-2022 (https://www.dublincity.ie/dublin-city-development-plan-2016-2022).

Draft Dublin City Development Plan 2022-2028 (https://www.dublincity.ie/residential/planning/strategic-planning/dublin-city-development-plan/development-plan-2022-2028)

GeoHive by Ordnance Survey Ireland (https://geohive.ie/).

Hammond, J. (1942). *George's Quay and Rogerson's Quay in the Eighteenth Century. Dublin Historical Record, 5(2), 41-54.*

Hammond, J. (1944). *George's Quay and Rogerson's Quay in the XVIII Century. Dublin Historical Record, 6(4), 155-156.*

Hart, H. (1968). *The Passage Boats of the Grand Canal. Dublin Historical Record, 22(1), 176-186.*

Kilfeather A., 2006. *Archaeological Appraisal. Grand Canal Storm Outfall Grand Canal Docks, Dublin 2,* unpublished report.

Lewis, S (1837) *A Topographical Dictionary of Ireland*. Lewis & Co. London.

National Inventory of Architectural Heritage (http://www.buildingsofireland.ie/).

National Library of Ireland, 7–8 Kildare Street, Dublin 2.

Phillips, H. (1939). *Early History of the Grand Canal. Dublin Historical Record, 1(4), 108-119.*

Placenames Database of Ireland, developed by Fiontar & Scoil na Gaeilge (DCU) and The Placenames Branch (Department of Culture, Heritage and the Gaeltacht) (www.logainm.ie).

Record of Protected Structures (https://www.dublincity.ie/sites/default/files/2020-08/dublin-city-development-plan-2016-2022-volume-4.pdf)

Record of Monuments and Places (RMP), the Heritage Service, 7 Ely Place, Dublin 2 (https://maps.archaeology.ie/historicenvironment/).

Rynne, C., (2015) Industrial Ireland 1750-1930. The Collins Press.

Summary Accounts of Archaeological Excavations in Ireland (www.excavations.ie).

The Commons Sessional Papers (CSP).

The Schools Collection, national Folklore Collection, UCD (https://www.duchas.ie/en/cbes).

Topographical Files of the National Museum of Ireland, Kildare Street, Dublin 2.

Woodman, P.C. 1978. *The Mesolithic in Ireland. British Archaeological Reports, Series 58. Oxford*.

Wreck Inventory of Ireland Database (WIID).

https://dahg.maps.arcgis.com/apps/webappviewer/index.html?id=89e50518e5f4437abfa6284ff39fd640

Cartographic Sources:

Dublin Civil Survey map 1654.

De Gomme's map of 1673.

John Rocque & Bernard Scale map 1787.

John Speed map 1610.

Pool and Cash map of 1780.

Ordnance Survey maps of County Dublin (6inch & 25inch) 1834, 1907.

Rocque Map of Dublin 1756-60.

SECTION 13: Waste Management

13.1 Introduction

This assessment was drafted by Namrata Kaile who is an Environmental Specialist with J. B. Barry and Partners for the past 2.5 years. She holds a Bachelors Degree (BSc) in Life Sciences and a Masters Degree (MSc) with distinction in Environmental Sciences from Trinity College Dublin. She is a Qualifying member of Chartered Institute of Ecology and Environmental Management (CIEEM) and has experience in drafting EIA Screening reports, AA Screening reports and Construction Environmental Management Plan.

This assessment was reviewed by Kieran O'Dwyer who is a Technical Director with J. B. Barry and Partners and has over 40 years' experience in the field of environmental consultancy. He holds a BE from UCD and is Member of the Institution of Engineers Ireland (MIEI) and International Association of Hydrogeologists (IAH). He is the overall project manager responsible for the coordination of this EIAR. He was formerly a director with K. T. Cullen and Co. Ltd (Environmental Consultants) and a Regional Director with WYG Ireland. Kieran has been responsible for specialist inputs to numerous Environmental Impact Assessments and has presented specialist evidence at numerous planning oral hearings.

This section of the EIAR will address the potential for likely significant impacts relating to the planned avoidance, necessary generation of wastes and their management during the construction and operation phases of the proposed development. This includes the potential waste generated from excavation, temporary and permanent construction works, and operation of the proposed development.

Throughout the design development of the proposed scheme consideration has been given for the minimisation of resource usage and avoidance or minimisation of waste through the planned retention of material on site and material use and reuse where possible. However, it is inevitable that during the construction of the proposed development there will be some wastes generated from certain aspects of the proposed Grand Canal Storm Water Outfall Extension (GCSWOE) project. This will include waste generated from site clearance, demolition and excavation along with general construction wastes.

The aims of this assessment are:

- To set out the methodology to examine the use of resources and the potential avoidance or minimisation of waste and generated surplus material and any associated waste management;
- To establish a baseline for the receiving environment and assess the probability of encountering industrial and domestic waste during excavation works;
- To identify the likely potential impacts of the use of resources and the generation and management of waste from the proposed activities;
- To identify mitigation measures to avoid, or reduce significant negative impacts arising from the waste generated as a result of the proposed development;
- To identify residual impacts post mitigation and the significance of their effects;
- To assess cumulative impacts of the proposed activities and waste generated along with other nearby development projects in the area; and
- To set out measures for monitoring of the waste management during the construction phase of the project.

A Construction Environmental Management Plan (CEMP) and Resource and Waste Management Plan (RWMP) has been prepared as part of the planning application submission and is attached as Volume 3, Appendix 17A and Appendix 13A, respectively, to this report. The CEMP and RWMP will be further updated by the Contractor during the pre-construction phase of the proposed development. These documents are prepared as per the plans and guidance documents listed in Section 13.2 and will ensure sustainable management of wastes arising at the development is in accordance with legislative requirements and best practice standards.

A detailed review of the existing ground conditions and contaminated land are presented in Volume 2, Section 8 Land, Soils, Geology and Hydrogeology, of this report.

13.2 Methodology

The assessment of the impacts of the proposed development arising from the consumption of resources and the generation of waste materials was carried out taking into account the methodology specified in relevant guidance documents. Desktop studies, site visits and site-specific investigations were conducted in the area of the proposed development. The desktop study included a review of applicable policy and legislation which creates the legal framework for resource and waste management in Ireland. The proposed construction methodology, design, and drawings for the proposed development were considered in the course of this assessment. The section also discusses the management and disposal of contaminated waste soils.

The volume of surplus material expected to be removed during the course of construction was considered as part of this assessment, including the various sources of waste, potential haulage routes, disposal facilities, and necessary licences etc. Mitigation measures are proposed to minimise the effect of the proposed scheme on the environment, to promote efficient waste segregation, reduce the quantity of waste removed or sent for disposal in so far as feasible and to promote sustainable waste management practices. Where residual waste was identified it shall be dealt in accordance with the waste hierarchy set out in the European Communities (Waste Directive) Regulations 2011 (as amended).

13.2.1 Policy, Plan and Guidelines

Waste Framework Directive 2008/98/EC of the European Parliament amended by Directive 2018/851 is transposed into the national law by European Communities (Waste Directive) Regulations 2011 (as amended). The Directive outlines a five-step hierarchy of waste management options, waste prevention, re-use, recycling, recovery, and safe disposal. The Waste Management Acts 1996 (as amended) which provide for holding, transportation, recovery, and disposal of waste in such a manner that does not result in environmental pollution in an Irish context are observed herein. Furthermore, all material requiring disposal shall be handled in accordance with all local regulations and only permitted Contractors will be allowed remove specifically consented wastes to licenced or permitted facilities in accordance with legislation referred to below.

The following policy, plans and guidance documents were utilised in the preparation of this assessment:

- European Communities (Waste Directive) Regulations, 2011 (as amended);
- The Waste Management (Permit) Regulations, 1988 (S.I. No. 165 of 1998);
- The Waste Management (Collection Permit) Regulations, 2001 (S.I. No. 402 of 2001);
- The Local Government (Water Pollution) Acts, 1977 & 1990;
- The Waste Management Act, 1996 and amendments;
- Waste Management (Movement of Hazardous Waste) Regulations, 1998 (S.I. No. 147 of 1998);
- Waste Management (Transfrontier Shipment of Waste) Regulations, 1998 (S.I. No. 149 of 1998)
- A Resource Opportunity – Waste Management Policy in Ireland (Department of the Environmental, Climate and Communications, 2012);
- Best Practice Guidelines for the Preparation of Resource and Waste Management Plans for Construction and Demolition Projects (EPA 2021);
- National Hazardous Waste Management Plan 2021 – 2027 (EPA 2021);
- Eastern – Midlands Region Waste Management Plan 2015 – 2021 (DCC 2015);
- Guidance on Soil and Stone By-products in the context of article 27 of the European Communities (Waste Directive) Regulations 2011, Version 3 (EPA 2019);
- By-Product Guidance Note, A Guide to by-products and submitting a by-product notification under Article 27 of the European Communities (Waste Directive) Regulations 2011 (S.I. No. 126 of 2011) (EPA, 2020);
- A Waste Action Plan for a Circular Economy, Ireland's National Waste Policy 2020 – 2025, Department of Communications, Climate Action and Environment, 2020;
- Waste Minimisation in Construction (SPU SP 133), Construction Industry Research and Information Association (CIRIA) 1997;
- Waste Classification, List of Waste and Determining if Waste is Hazardous or Non-hazardous, (EPA 2018); and

- Guidance on the Management of Contaminated Land and Groundwater at EPA Licensed Sites (EPA 2013).

Waste classification in Ireland is based on:

- Commission Decision of 18 December 2014, amending Decision 2000/532/EC on the list of waste pursuant to Directive 2008/98/EC of the European parliament and of the Council (2014/955/EEC);
- Commission Regulation (EU) No. 1357/2014 of 18 December 2014, replacing Annex III to Directive 2008/98/EC of the European Parliament and of the Council on waste and repealing certain Directives; and
- Council Regulation (EU) 2017/997 of 8 June 2017 amending Annex III to Directive 2008/98//EC of the European parliament and of the Council as regards the hazardous property HP 14 'Ecotoxic'.

Within the basin, waste will be minimised by the redistribution of displaced soil and silts. Redistribution of suitable displaced material will not extend more than 10 metres from the pipeline structure and will not raise the bed level above the top of the structure (0.8 mOD) on the Basin bed thus maintaining the minimum draught for boat traffic within the basin.

Disposal of waste to waste management facilities is governed by the Landfill Directive Council Directive 1999/31/EC on the landfill of waste, which classifies landfills by waste type including Inert; Non-Hazardous; and Hazardous.

13.2.2 Assessment Criteria

The criteria used to assess the potential impacts of the waste generation and management arising from the proposed development has been adopted from the EIAR Guideline Document by EPA and is outlined below. Refer to Table 13.1.

Table 13.1 Adapted from Table 3.3 Description of Effects from the EPA Guidelines (EPA 2022)

Assessment Criteria	Description of Effects
Quality of Effects It is important to inform the non-specialist reader whether an effect is positive, negative or neutral	**Positive Effects** A change which improves the quality of the environment (for e.g., by increasing species diversity; or the improving reproductive capacity of an ecosystem, or by removing nuisances or improving amenities).
	Neutral Effects No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error.
	Negative/ Adverse Effects A change which reduces the quality of the environment (for e.g., lessening species diversity or diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing nuisance).
Describing the Significance of Effects ''Significance' is a concept that can have different meanings for different topics – in the absence of specific definitions for different topics the following definitions may be useful (also see Determining Significance below.).	**Imperceptible** An effect capable of measurement but without significant consequences.
	Not significant An effect which causes noticeable2 changes in the character of the environment but without significant consequences.
	Slight Effects

Assessment Criteria	Description of Effects
	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
	Moderate Effects An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
	Significant Effects An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
	Very Significant An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
	Profound Effects An effect which obliterates sensitive characteristics
Describing the Duration and Frequency of Effects 'Duration' is a concept that can have different meanings for different topics – in the absence of specific definitions for different topics the following definitions may be useful.	**Momentary Effects** Effects lasting from seconds to minutes
	Brief Effects Effects lasting less than a day
	Temporary Effects Effects lasting less than a year
	Short-term Effects Effects lasting one to seven years.
	Medium-term Effects Effects lasting seven to fifteen years.
	Long-term Effects Effects lasting fifteen to sixty years.
	Permanent Effects Effects lasting over sixty years
	Reversible Effects Effects that can be undone, for e.g., through remediation or restoration
	Frequency of Effects Describe how often the effect will occur. (once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, monthly, annually)

13.3 Receiving Environment

The receiving environment for the proposed development entails the Grand Canal Docks, including the Grand Canal Basin, Hanover Quay, Asgard Road, SJRQ and the River Liffey.

DCC is the local authority responsible for setting and administering waste management activities in the area of the proposed works. This is governed by the requirements set out in the Eastern- Midlands Region Waste Management Plan 2015-2021. The waste management plan sets out the following goals for 2030 for waste management in the region to '*Reduce and where possible, eliminate the landfilling of all major* *waste streams including municipal, industrial and construction and demolition wastes in favour of the recovery of residual wastes'.*

The Regional Plan sets out the strategic targets for waste management in the region and sets a specific target for C&D waste of '*70% reuse, recycling and materials recovery rate target of non-soil and stone construction and waste demolition to be achieved by 2020.'* The National Waste Statistics Summary Report for 2019, published by EPA in 2021 identifies that Ireland's current progress against construction and demolition waste recovery rate is 84% which is above the 2020 EU target of 70%. The Dublin City Development Plan 2016-2022 and draft Dublin City Development Plan 2022-2028 also sets out policies and objectives or the DCC area which reflect those set out in the regional waste management plan.

In terms of physical waste infrastructure, there are numerous wastes permitted and licensed facilities located in the Eastern-Midlands Waste Region for management of wastes from the construction industry as well as municipal sources. These include soil recovery facilities, inert C&D waste facilities, hazardous waste treatment facilities, municipal waste landfills, material recovery facilities, waste transfer stations and two waste-to-energy facilities. The soils and stone wastes collected within the East Midlands Region are primarily managed at local authority permitted infill sites with the other construction and demolition waste types primarily managed at EPA licensed facilities. However, a conservative approach has been adopted for this assessment with waste soils being considered as contaminated (either non-hazardous or hazardous). Contaminated soils are treated at appropriately licensed hazardous waste sites in the region. For materials arising close to Dublin Port there is a viable commercial option for them to be exported to permitted facilities abroad in compliance with relevant waste export legislation.

13.3.1 Site Specific Ground Investigation

A geotechnical site investigation campaign carried out in 2002 (Geotechnical Specialists Ltd) identified materials with a strong hydrocarbon smell in a number of boreholes (BH1, BH2C, BH3, BHR3, BH6, and BH9) between 0mOD and -16.2mOD. Samples were taken for contaminant analysis (Halcrow Geotech, 2002) from boreholes on SJRQ, Hanover Quay, the Outer Basin, and at the location of the existing outfall in the Inner Basin. High levels of Total Petroleum Hydrocarbon (TPH), Polycyclic Aromatic Hydrocarbon (PAH), and lead have been identified in terrestrial exploratory locations, BH1, BH2, and BH3. High levels of TPH, PAH, Lead, and Mercury have been identified in aquatic exploratory locations within the upper silt layer (depths of 1 to 2m below ground level) of the Basin in BH6, BH7, and BH9. The borehole locations as part of site investigations undertaken in 2002 are shown in Figure 13.1 and the borehole logs are in Volume 3, Appendix 8B.

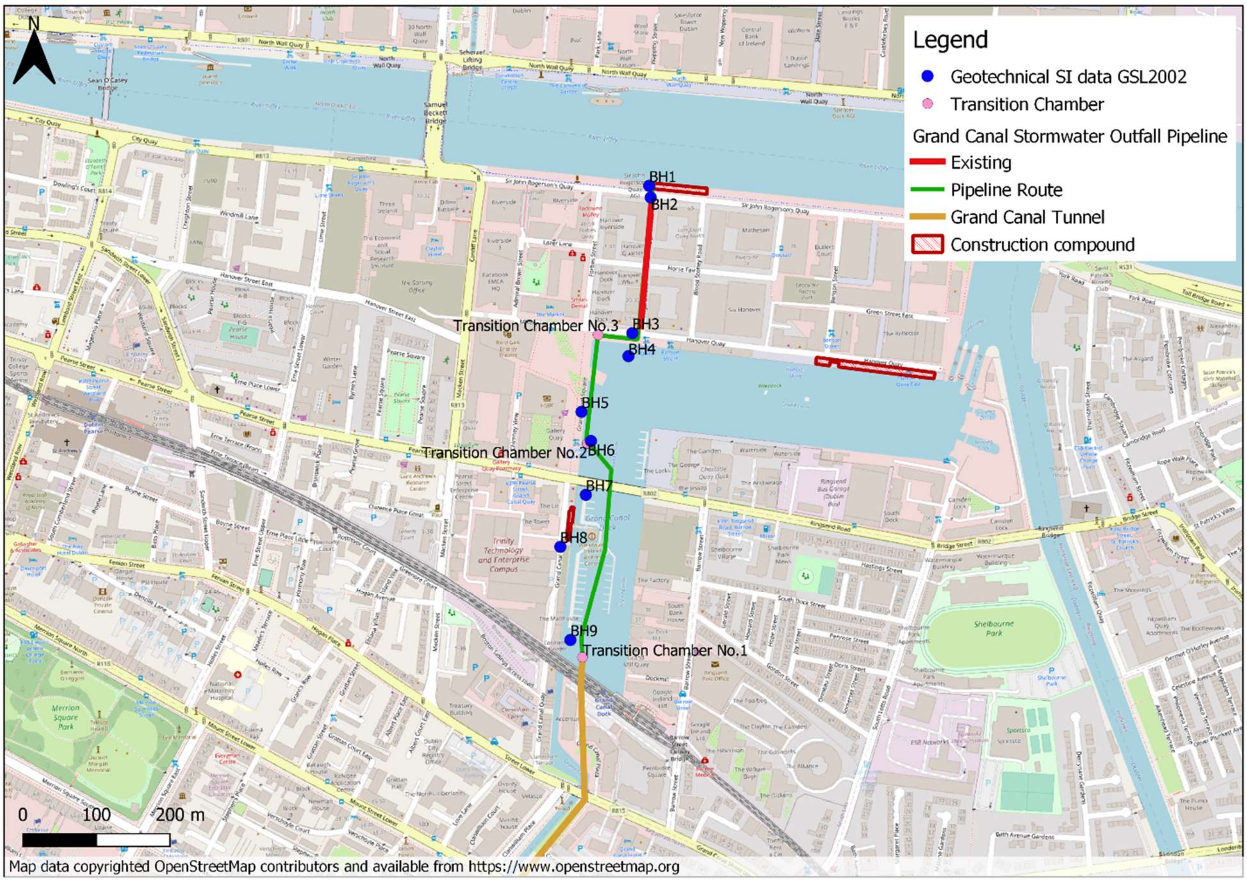


Figure 13.1 Borehole locations for geotechnical site investigation undertaken in 2002 by Geotechnical Specialists Ltd.

Based upon Limit Values by Inert Waste Landfills in the Dublin area, it is likely that excavated material will not be classified as "inert waste". However, it was determined that the sample material tested from the proposed terrestrial excavation areas and dredging areas within the Basin contain low to moderate concentrations of metal and organic contaminants. Contaminants tested for include Iron, COD, PAH, Arsenic, Phenol, PAH, and Ammoniacal N. From leachability tests it was found that the materials analysed generally have low leaching potential. However, these materials do appear capable of leaching relatively low concentration of organic species particularly PAH and to a lesser extent phenols. The groundwater analysis results indicate elevated levels of conductivity, chloride, ammoniacal nitrogen, total petroleum hydrocarbons and phenols. The results of soil analysis do not indicate that the soils sampled are particularly heavily contaminated. However, ground materials and the distribution of contamination within these materials can be highly variable between locations and strata.

Owing to the history of the area and from the geotechnical investigation campaign results there is a high probability of encountering contaminated soil during excavation works. As such, all excavated soil materials will conservatively be treated as contaminated material that will require disposal to a licenced waste facility.

13.4 Characteristics of the Development

13.4.1 Proposed Development

As described in further detail in Volume 2, Section 2, a pipeline will be laid within the Basin with the installation of three transition chambers. Transition Chamber 1 will be constructed at the existing Grand Canal Tunnel outfall location within the Inner Basin; Transition Chamber 2 will be constructed at the junction of the 5 no. 1.5m diameter pipes and twin 2.4m dimeter pipes within the Basin; and Transition Chamber 3 will be constructed at Hanover Quay where the pipeline traverses from the Basin to quayside. Excavation works and some tunnelling will take place on Hanover Quay where the proposed pipeline will connect to the existing culvert underneath Asgard Road. Excavation will also take place on SJRQ between the existing culvert underneath Asgard Road and the River Liffey quay wall. Finally, a new outfall structure will be constructed in the River Liffey.

There is potential for waste to be generated in the vicinity of the following locations:

- The Inner Basin; invert level of pipeline = -1.2 to -1.3mOD (average depth = 0.3m);
- The Outer Basin; invert level of pipeline = -1.3 to -1.5mOD (average depth = 0.5m);
- Hanover Quay; Construction of 4x2.7m culvert from Ch.0+450m to Ch.0+526.70, where invert level of pipeline = -1.59 to -1.65mOD (average depth = 6m); and
- SJRQ; invert level of pipeline and outfall structure = -4.38 to -4.8mOD (average depth = 7.6m).

An estimation of the surplus soil material that will be removed from the works area is presented in Table 13.2. Approximately ***5,550m³*** of surplus soil will be removed. It is estimated that 3,400m³ of this waste will be treated as hazardous waste and will be disposed of accordingly.

Table 13.2 Waste generation volumes

Location	**Volume of material to be removed (m³)**	
	Hazardous	Non-Hazardous
Hanover Quay	1,875	1250
SJRQ	460	307
Transition Chamber 1	31	100
Transition Chamber 2	50	117
Transition Chamber 3 at Hanover Quay	375	273
Outfall Structure – River Liffey	600	100
	3,391	**2,147**

As detailed in Volume 2, Section 8 Lands, Soils, Geology and Hydrogeology previous site investigations have indicated the presence of contaminated soils close to the proposed development. In order to establish the appropriate reuse, recovery and/or disposal route for the material to be removed off-site, waste will initially need to be classified as hazardous or non-hazardous in accordance with the '*Waste Classification- List of Waste and Determining if Waste is Hazardous or Non-hazardous*', EPA 2018.

Excavation works will be required to be carefully monitored by a suitably qualified person to ensure hazardous soil is identified and segregated from any potentially non-hazardous soil, where encountered. Additional soil testing may be required in order to reclassify soil and the waste material generated will be required to be classified as inert, non-hazardous or hazardous in accordance with the EC Council Decision 2003/33/EC for acceptance of waste at landfills.

Other waste will also be generated from construction workers e.g. organic/food waste, dry mixed recyclables (waste paper, newspaper, plastic bottles, packaging, aluminium cans, tins and Tetra Pak cartons), mixed non-recyclables and potentially sewage sludge from temporary welfare facilities provided onsite during the construction phase. Waste printer/toner cartridges, waste electrical and electronic equipment (WEEE) and waste batteries may also be generated infrequently from site offices. Individual waste streams will be segregated through the use of separate bins, storage containers or clearly defined areas for stockpiling. Reusable and recyclable waste streams will be stored separately to residual wastes to avoid contamination and maximize their reuse potential. The Contractor will identify and engage hauliers with the relevant Waste Collection Permit to transport all resources and waste off-site.

It should be noted that until final materials and detailed construction methodologies have been confirmed it is difficult to predict with a high level of accuracy the construction waste that will be generated from the construction of the proposed development as the exact materials and quantities may be subject to some degree of change and variation during the construction process. Further detail on the waste materials likely to be generated during the excavation and construction works are presented in the

Resource and Waste Management Plan, included as Volume 3, Appendix 13A, which will be updated and finalised by the Contractor prior to construction commencing. A CEMP has been prepared and is included in Volume 3, Appendix 17A to the EIAR which will be updated and finalised by the Contractor prior to construction commencing which may refine the waste estimates.

There will be no waste generated from the development once it becomes operational apart from the waste arising during periodic maintenance cleaning.

13.4.2 Waste Facilities for Excavated Soil

All waste will be disposed of in suitably licensed facilities. The decisions to treat material at certain facilities will depend on capacity of receiving plants and ability to remove the material in quick order to suit construction, these will combine both environmental and economic decisions prior to construction.

It is acknowledged that there are currently no hazardous waste facilities in operation in Ireland and hazardous waste will likely require export and disposal at a licensed hazardous waste facility abroad.

A conservative approach will be adopted for waste disposal and the soil to be disposed of will be treated as either hazardous or non-hazardous. The Table 13.3 below includes the List of Waste (LoW) codes as per Waste Classification by EPA (2018).

Table 13.3 Waste Classification Summary for Excavated Soil

Classification	LoW Code	LoW Code description
Hazardous soil	17 05 03	soil and stones containing hazardous substances
	17 05 05	dredging spoil containing hazardous substances
Non- hazardous soil	17 05 04	soil and stones other than those mentioned in 17 05 03
	17 05 06	dredging spoil other than those mentioned in 17 05 05

13.5 Potential Impacts

13.5.1 Do-Nothing Impacts

The do nothing impacts involve continual discharge from the Grand Canal Tunnel into the Basin. There will be no construction and no waste generated. Consequently, there will be no waste impacts associated with the "Do Nothing" scenario.

13.5.2 Construction Phase

As detailed in the previous sections, the proposed development will generate surplus excavated material. Previous ground investigation reports have highlighted the presence of contaminated soils in the area. There will be minor demolition required as part of the proposed project (creation of openings in quay walls at Hanover Quay and SJRQ). Excavation works, site compounds and temporary works facilities are likely to generate construction waste.

Surplus excavated material will then be segregated at source and transferred directly from site by a suitably permitted Waste Contractor to suitably licensed facilities. Waste materials generated at the site compound from welfare facilities and site compounds will be temporarily stored at the site compound and will be collected by a suitably permitted Waste Contractor. The waste storage area will need to be easily accessible to waste collection vehicles.

The potential impacts associated with construction phase include:

- Spillage of contaminated material arising from minor dredging works and piling works in the Basin. This is considered a *temporary moderate negative impact*;
- Spillage of hydrocarbons and construction materials during works in the Basin and in the River Liffey. This is considered a *temporary moderate negative impact*;
- Spillage of contaminated material arising from terrestrial excavations on Hanover Quay, and SJRQ into the waters of River Liffey. This is considered a *temporary moderate negative impact*;
- Spillage of contaminated material arising from minor dredging works and piling works in the River Liffey during the construction of the new outfall structure. This is considered a *temporary moderate negative impact*;
- The waste generation and transport of waste from site may cause a number of direct and indirect impacts on other environmental aspects such as air quality (dust, odour), traffic, noise, water and human health; and
- The use of non-permitted Waste Contractors or unlicensed facilities could give rise to inappropriate management of waste and result in environmental impacts/pollution. Any waste generated on site during the construction phase will be segregated and removed by a licensed waste collector(s).

Waste generated from the works is not likely to result in a significant impact on the receiving environment given that standard best practice guidelines and procedures will be followed. Any material arisings on site will not be reused due to its nature as contaminated material.

The potential effect of construction waste generated from the proposed development is considered to be *moderate, negative,* but *temporary.*

13.5.3 Operational Phase

Standard maintenance measures will be carried out on the pipeline to remove the build-up of solid wastes and siltation. These measures include CCTV, jetting, and cleaning which will be carried out regularly to prevent large build ups and the need for removing significant volumes of debris. The maintenance Contractor will be responsible for disposing off the waste generated during cleaning in accordance with the relevant legislation and regulations.

There are no identified potential impacts associated with the operation phase of the proposed development other than those outlined in Volume 2, Section 7 Water Quality and Hydrology relating to normal operating stormwater discharges into the River Liffey.

13.6 Mitigation Measures

13.6.1 Construction Phase

The surplus material arising from piling works and from excavated soil from open trench works on Hanover Quay and SJRQ will not be reused on site and will be transported offsite to a suitably licenced acceptance facility.

The Contractor will be responsible for ensuring compliance with statutory obligations for the collection and transport of waste. All material will be treated as contaminated material and will be disposed of at suitably licenced facilities. Actions regarding waste material and removal will be undertaken as per the Guidelines for the Management of Waste from National Road Construction Projects, Transport Infrastructure Ireland, 2017.

Within the basin, waste will be minimised by the redistribution of displaced soil and silts. Redistribution of displaced material will not extend more than 10 metres from the pipeline structure and will not raise the bed level above the top of the structure (0.8 mOD) on the basin bed thus maintaining the minimum draught for boat traffic within the basin. Resuspension of sediments will be confined within silt curtains during the construction stage in the basin.

Management Plans including method statements will be developed for excavations and construction activities that may encounter contaminated or hazardous material.

In order to mitigate potential impacts associated with contaminated material and silt/ soil disposal, the contract documents for the proposed development will include the following provisions:

- The Contractor will be required to update and finalise the CEMP during the pre-construction phase of the proposed development;
- The Contractor will be required to update and finalise the RWMP addressing inter alia the treatment, storage, and disposal of contaminated material;
- A Project Waste Manager will be appointed by the Contractor to oversee the implementation and adherence to the Waste Management Plan during the construction phase of the proposed development;
- All contaminated material will be disposed of in accordance with all relevant legislation including the Department of the Environment and Local Government (DoELG) (1996 to 2008) Waste Management Acts, the DoELG (1998) Waste Management (Permit) Regulations, the Guidelines for the Management of Waste from National Road Construction Projects (TII, 2017), East-Midland Region Waste Management Plan (2015-2021), and the Landfill Directive (2003/33/EC);
- All waste will only be removed by Waste Contractors authorised under the Waste Management (Collection Permit) (Amendment) Regulations (2008); and
- Waste will be delivered to authorised waste facilities in accordance with the Waste Management Acts 1996-2010.

Other mitigation measures include:

- Fuels, waste fuels, and waste materials will be stored temporarily in designated areas that are isolated from surface water features. Skips will be closed over/ covered to prevent materials being blown or washed away and to reduce the likelihood of contaminated water leakage;
- All hazardous materials including waste oil, solvents, paints, and soil etc. will be stored in sealed containers and kept separate from inert waste materials while awaiting collection from the appropriate waste carrier;
- Re-fuelling, lubrication, storage areas and site offices will follow best practice procedures when setting up, operating, and taking down near surface water bodies;
- Contaminated soils will be removed as soon as possible from active working areas;
- Any potential hydrocarbon or hazardous material spills will be reported immediately to the following authorities, EPA, DCC, and the Eastern Regional Fisheries Board;
- A separate container will be located in the Contractors compound to store absorbents used to contain spillages of hazardous materials. The container will be clearly labelled and the contents of the container will be disposed of by a licenced Waste Contractor at a licenced site. Records will be maintained of material taken off site for disposal;
- All spills will be recorded on an Incident Report Form;
- On site segregation of waste materials will be carried out to increase opportunities for off-site recycling and disposal especially for waste generated at site compounds such as organic waste, packaging waste, mixed dry recyclables and mixed dry non-recyclable;
- A maintenance programme for the bunded areas will be managed by the site environmental manager. The removal of rainwater from the bunded areas will be their responsibility. Records will be maintained of materials taken off site for disposal; and
- Drainage collection system for washing area to prevent run-off into surface water system.

13.6.2 Operational Phase

The maintenance activities for the pipeline and the disposal of any waste arising as part of these activities will be done in accordance with relevant guidance documents and policies. No other mitigation measures are proposed for the operational phase of the project.

13.7 Residual Impacts

13.7.1 Construction Phase

The potential impacts associated with construction phase include the risk of spillage of contaminated material and hydrocarbons as previously mentioned. However, the risk of this is low given that best practice guidelines (mitigation measures) will be followed.

As previously mentioned, waste generated from the works is not likely to result in a significant impact on the receiving environment given that standard best practice guidelines and procedures will be followed.

Consequently, the resultant impact from the proposed development in relation to waste is *short term, neutral and imperceptible*.

13.7.2 Operational Phase

In terms of waste management there are no identified potential impacts associated with the operational phase of the proposed development.

13.7.3 Interactions

The interactions between Waste Management and other Sections within this Volume 2 of the EIAR as discussed in this section include, Section 5 Population and Human Health, Section 7 Water Quality and Hydrology, Section 8 Land, Soils, Geology and Hydrogeology, Section 9 Air Quality and Climate, Section 10 Noise and Vibration and Section 11 Traffic and Transport. Refer to detailed assessment in Section 16 Interactions.

The mitigation measures presented in this section are consistent with measures outlined in these individual sections.

13.7.4 Cumulative Impacts

There are a number of other projects proposed for the area and there will be a potential cumulative impact resulting from the construction stage if the projects are constructed simultaneously. However, in terms of Waste Management there will be no significant cumulative impacts from the operation of proposed development.

13.8 Monitoring

All excavation will be monitored by a competent person during earthworks to ensure that the soils excavated for disposal are consistent with the descriptions and classifications according to the waste acceptance criteria testing carried out as part of the site investigations.

No monitoring is proposed for the operational phase of the Grand Canal Storm Water Outfall Extension.

13.9 References

Construction Industry Research and Information Association (CIRIA) 1997. *Waste Minimisation in Construction (SPU SP 133).*

Department of the Environmental, Climate and Communications, 2012. *A Resource Opportunity – Waste Management Policy in Ireland.*

Department of Environment, Heritage and Local Government, 2006. *Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects.*

Department of Communications, Climate Action and Environment, 2020. *A Waste Action Plan for a Circular Economy, Ireland's National Waste Policy 2020 – 2025.*

Eastern-Midlands Regional Waste Office, 2015. *Eastern – Midlands Region Waste Management Plan 2015 – 2021.*

European Communities (Waste Directive) Regulations, 2011 (as amended).

Environment Protection Agency (EPA), 2021. *Best Practice Guidelines for the Preparation of Resource and Waste Management Plans for Construction and Demolition Projects.*

Environment Protection Agency (EPA), 2014. *National Hazardous Waste Management Plan 2014 – 2020.*

Environment Protection Agency (EPA), 2021. *Draft National Hazardous Wase Management Plan 2021 – 2027.*

Environment Protection Agency (EPA), 2019. *Guidance on Soil and Stone By-products in the context of article 27 of the European Communities (Waste Directive) Regulations 2011, Version 3.*

Environment Protection Agency (EPA), 2020. *By-Product Guidance Note, A Guide to by-products and submitting a by-product notification under Article 27 of the European Communities (Waste Directive) Regulations 2011 (S.I. No. 126 of 2011).*

Environment Protection Agency (EPA), 2018. *Waste Classification, List of Waste and Determining if Waste is Hazardous or Non-hazardous.*

Environment Protection Agency (EPA), 2013. *Guidance on the Management of Contaminated Land and Groundwater at EPA Licensed Sites.*

Environmental Protection Agency (Ireland) (EPA), (2022). *Guidelines on the information to be contained in Environmental Impact Assessment Reports.*

Environmental Protection Agency (Ireland) (EPA), (2017). *Guidelines on the information to be contained in Environmental Impact Assessment Reports, Draft.*

The Waste Management (Permit) Regulations, 1988 (S.I. No. 165 of 1998).

The Waste Management (Collection Permit) Regulations, 2001 (S.I. No. 402 of 2001).

The Local Government (Water Pollution) Acts, 1977 & 1990.

The Waste Management Act, 1996 and amendments.

Waste Management (Movement of Hazardous Waste) Regulations, 1998 (S.I. No. 147 of 1998).

Waste Management (Transfrontier Shipment of Waste) Regulations, 1998 (S.I. No. 149 of 1998).

SECTION 14: Material Assets

14.1 Introduction

This assessment was drafted by Namrata Kaile who is an Environmental Specialist with J. B. Barry and Partners for the past 2.5 years. She holds a Bachelors Degree (BSc) in Life Sciences and a Masters Degree (MSc) with distinction in Environmental Sciences from Trinity College Dublin. She is a Qualifying member of Chartered Institute of Ecology and Environmental Management (CIEEM) and has experience in drafting EIA Screening report, AA Screening reports and Construction Environmental Management Plan.

This assessment was reviewed by Kieran O'Dwyer who is a Technical Director with J. B. Barry and Partners and has over 40 years' experience in the field of environmental consultancy. He holds a BE from UCD and is Member of the Institution of Engineers Ireland (MIEI) and International Association of Hydrogeologists (IAH). He is the overall project manager responsible for the coordination of this EIAR. He was formerly a director with K. T. Cullen and Co. Ltd (Environmental Consultants) and a Regional Director with WYG Ireland. Kieran has been responsible for specialist inputs to numerous Environmental Impact Assessments and has presented specialist evidence at numerous planning oral hearings.

This section of the EIAR assesses the potential impacts on Material Assets in the vicinity of the proposed development. The EPA Guidelines (EPA, 2022) state *"Material assets can now be taken to mean built services and infrastructure".* Directive 2014/52/EU includes those heritage aspects as components of cultural heritage. Traffic is included because in effect traffic consumes roads infrastructure.

For the purposes of this assessment, the focus will be on built-services. Potential impacts on sensitive receptors adjacent to or in the vicinity of the site will be assessed. There will also be focus on existing utilities and residential and commercial property including:

- Commercial and residential properties;
- Electricity infrastructure;
- Gas Services infrastructure;
- Telecommunications infrastructure;
- Water supply infrastructure; and
- Sewer and drainage infrastructure.

The main objectives of this assessment are to:

- Establish the existing material assets in the vicinity of the proposed development;
- Assess the potential impacts of the proposed development on these material assets; and
- Recommend mitigation measures, if any and where appropriate, in relation to the proposed development.

Other sections which cover relevant aspects of Material Assets include Section 9 Air Quality and Climate Section 11 Traffic and Transport, Section 12 Archaeology and Cultural Heritage, Section 6 Biodiversity, Section 7 Water Quality and Hydrology, Section 8 Land, Soils, Geology and Hydrogeology and Section 15 Landscape and Visual Impact.

An Environmental Scoping Report was prepared for the proposed development (J. B. Barry, 2020) and has been taken account of in the preparation of this assessment.

14.2 Methodology

This assessment was carried out by a desktop study and site walkovers, along with information from other sections from this EIAR. This section was prepared in accordance with EIA Directive 2014/52/EC (as amended) with regard to the following guidance documents:

- EPA. (2022). Guidelines on the Information to be contained in Environmental Impact Assessment Reports;
- EPA. (2017). Draft Guidelines on the Information to be contained in Environmental Impact Assessment Reports; and
- EPA. (2015). Draft Advice Notes for preparing Environmental Impact Statements.

Consultation has been made with various utility providers that may have services within the area. Utilities that may be impacted upon by the proposed development have been mapped and their providers informed of the project details.

Consultation has also been made with key stakeholders present in the local vicinity including community groups, statutory and non-statutory bodies, environmental groups, resident's associations, and local businesses etc.

Documents, plans and resources reviewed in the preparation of this section include:

- Dublin City Development Plan 2016 – 2022, (DCC, 2016);
- Draft Dublin City Development Plan 2022-2028 (DCC, 2021);
- Dublin Port Masterplan 2012 – 2040 (reviewed 2018), (Dublin Port Company, 2012);
- Geological Survey of Ireland (GSI) Online Map Viewer (https://www.gsi.ie/en-ie/data-and-maps/Pages/default.aspx), (GSI, accessed May 2021);
- Google Maps Imagery (www.google.com/maps/), (Google, accessed May 2021);
- North Lotts and Grand Canal Dock Planning Scheme (and interim publications/ amendments), (DCC, 2014); and
- Correspondence with DCC and utility providers including:
  - BT Ireland;
  - E Net;
  - Eir;
  - ESB;
  - Gas Networks Ireland;
  - IW; and
  - Virgin Media.

14.2.1 Assessment Criteria

The criteria used to assess the potential impacts of the proposal on Material Assets in the vicinity of the site is outlined in Table 14.1. The criteria is based on the quality, significance and duration of the impacts.

Table 14.1 Impact Classification Terminology taken from Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA, 2022)

IMPACT CHARECTERISTICS	TERM	DESCRIPTION
Quality of Effects	Positive	A change that improves the quality of the environment.
	Neutral	No effects or effects that are imperceptible, within normal bounds of variation within the margin of forecasting error.
	Negative/ Adverse	A change that reduces the quality of the environment.
Significance of Effects	Imperceptible	An effect capable of measurement, but without significant consequences.
	Not significant	An effect which causes noticeable changes in the character of the environment, but without significant consequences.
	Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.

IMPACT CHARECTERISTICS	TERM	DESCRIPTION
	Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
	Significant	An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
	Very significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
	Profound	An effect which obliterates sensitive characteristics.
Duration and Frequency of Effects	Momentary	Effects lasting from seconds to minutes.
	Brief	Effects lasting less than a day.
	Temporary	Effects lasting less than a year.
	Short-term	Effects lasting one to seven years.
	Medium-term	Effects lasting seven to fifteen years.
	Long-term	Effects lasting fifteen to sixty years.
	Permanent	Effects lasting over sixty years.
	Reversible	Effects that can be undone, for e.g., through remediation or restoration
	Frequency	Describe how often the effect will occur. (once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, monthly, annually)

14.3 Receiving Environment

As previously mentioned, the development is located in the Grand Canal Docks which is a hub of modern apartment buildings and office and retail spaces, which has been zoned as a Strategic Development Regeneration Area (SDRA) in the Dublin City Council Development Plan, 2016 – 2022. The area is also a Strategic Development Zone (SDZ) within the North Lotts and Grand Canal Dock Planning Scheme, 2014. There is a high amenity value to the Grand Canal Docks. The Grand Canal Basin is under the ownership of Waterways Ireland.

14.3.1 Public Amenity

The Grand Canal Basin itself is a valuable amenity as a visual attraction, and as a waterbody for houseboats, transportation, and water-based recreation including boating, kayaking, water skiing, paddle boarding and the Viking Splash Tour. Due to water quality issues, immersive water sports are currently not permitted in the basin.

Grand Canal Square is located within the Docks and adjacent to the proposed development. There are a number of public open spaces located in the nearby vicinity including Capital Dock Park, South Dock Street Park, Pearse Square Park and Chimney Park (children’s play park). These will not be impacted by the proposed development.

Grand Canal Quay at the Waterways Ireland Visitor Centre, in the vicinity of the Inner Basin Construction Compound, has street furniture in the form of benches, trees with metal guards, lampposts, and bollards.

Hanover Quay, in the vicinity of the proposed Transition Chamber 3 and the buried culvert, has street furniture in the form of signs with tourist information and maps, bins, benches, trees with metal guards, lampposts, and bollards. There are cast iron moorings on top of the quay walls as well as metal ladders allowing access/ egress into the Docks. There is also a Dublin Bikes stand opposite Asgard Road, and a taxi rank between Asgard Road and Forbes Street.

Hanover Quay, in the vicinity of the proposed main construction compound has little street furniture in the form of bins, bollards, and lampposts. There are cast iron moorings on top of the quay walls as well as metal ladders allowing access/ egress into the Docks. There is also a Dublin Bikes stand near the end of Hanover Quay east of Hanover Walk.

SJRQ , in the vicinity of the proposed outfall structure and the SJRQ Construction Compound, is partially cobble-surfaced with street furniture in the form of lampposts, benches, bins, bollards, and a cycle path. There are cast iron moorings on top of the quay walls

The Grand Canal Docks Basin, including Grand Canal Docks Quay, Charlotte Quay, Hanover Quay/ Britain Quay and the River Dodder are located within a Conservation Area as described in further detail Volume 2, Section 12 Archaeology and Cultural Heritage.

Public amenities, social patterns and land use are described in more detail in Volume 2, Section 5 Population and Human Health.

14.3.2 Recreation

Notable recreational facilities in the area include the Bord Gáis Energy Theatre, Flyefit, Freeman's Quay Leisure Centre, Lir Academy, Wakedock, Waterways Ireland Visitor Centre and the Diving Bell. Further afield there is the Aviva Stadium, Shelbourne Park Greyhound Stadium, Ringsend Park, South Dock Street Park, Irishtown Stadium, and Irishtown Nature Park/ Reserve.

The Basin itself is used for recreational water sports by the general public as well as Dublin University Kayaking Club, Surfdock, and Wakedock. The Viking Splash Tour used to enter the Basin in an amphibious vehicle, however, the service closed prior to COVID-19 and it is unclear whether it will re-open in the future.

The Grand Canal itself is 132km long beginning at the Shannon Harbour in Co. Offaly in the West and terminating at the Grand Canal Docks in Dublin. Barges may freely travel along the Grand Canal passing through locks along the way.

The River Liffey is used for sailing, with Poolbeg Yacht Club located 1.4km downstream towards Dublin Bay. The Liffey is also used by anglers from both the shore and by boat. The Great South Wall is a popular angling spot and is located approximately 4km downstream from the proposed outfall location via the River Liffey. Among others. St. Patrick's Rowing Club make use of the River Liffey for rowing and are located approximately 600m downstream via the River Liffey.

The nearest designated bathing waters are located at Dollymount Strand and Sandymount Beach.

Further details on recreational users are included in Volume 2, Section 5 Population and Human Health.

14.3.3 Commercial

There are many businesses, shops, cafes, offices, and restaurants located within Grand Canal Docks along the quayside, on SJRQ, and in the immediate vicinity of the Docks.

Larger commercial units in the area include:

Google headquarters, the Bloodstone Building offices which include Equifax Ireland; Kennedys Law Firm; and TripAdvisor Ireland, 70 SJRQ offices which include Goldman Sachs and Matheson, Accenture, AIB, Bank of Ireland, Clayton Hotel Cardiff Lane, Facebook, Grand Canal Hotel, Indeed, and The Marker Hotel.

Retail and smaller business units include:

Alan Ardiff, Amethyst Dublin, Anne O'Mahony Bespoke Clothing, CIPD, Cycle Clinic, DocuSign, Grand barbers, JP Morgan, Jule Beauty Salon, Macken Motors, MCA Michael Collins Associates, Minima, My Virtual Office Spaces, Simmons and Simmons, and Spar.

Food and drink units include:

Á Table, The Art of Coffee (Grand Canal Dock), The Art of Coffee (Capital Dock), Basil Pizza, Boojum, BrewDog, Café Bar H, Charlotte Quay, Fresh, Freshii, The Grafton Barber, Herbstreet, Insomnia Coffee Company, Lolly and Cooks, Mackenzie's, Milano, Nutbutter, Osteria Lucio, Pause Café, Tadka House, and Starry Night.

Commercial receptors are described in more detail in Volume 2, Section 5 Population and Human Health.

14.3.4 Residential

Grand Canal Docks is home to many residential apartments both new and old. Many of the residential apartment blocks along the Grand Canal Docks waterfront have commercial units at ground level. Most of the quayside residential buildings are relatively new and high rise. Older apartment buildings are located on the eastern side of the River Dodder to the east of the Docks. Houseboats are located in the Inner Basin. Residential receptors are described in more detail in Volume 2, Section 5 Population and Human Health.

14.3.5 Transport

The road network immediately adjacent Grand Canal Docks includes Grand Canal Quay, Hanover Quay, Misery Hill, Blood Stoney Road, Asgard Road, Forbes Street, Benson Street, MacMahon Bridge, and Ringsend Road. The Grand Canal Dart Station is located immediately south of the proposed development.

A number of buses serve the area alighting at stops along Pearse Street (R802) including the 1, 15A, 15B, 15D, 27, 47, 56A, 77A. At present there are no bus routes along Grand Canal Quay, Hanover Quay or SJRQ along the proposed pipeline route.

The Grand Canal DART Station is located immediately south of the proposed development. From Grand Canal DART Station, the following stations are served northbound, Dublin Pearse, Tara Street, Dublin Conolly, Clontarf Road, Killester, Harmonstown, Raheny, Kilbarrack Howth Junction, CLongriffin, Portmarnock, and Malahide. The following stations are served southbound, Lansdowne Road, Sandymount, Sydney Parade, Booterstown, Blackrock, Seapoint, Salthill and Monkstown, Dun Laoghaire, Sandycove, Glenageary, Dalkey, Killiney, Shankill, and Bray. There are a number of connections at various stations from this DART line to other lines, local rail services, and the Luas.

The road network is described in more detail in Volume 2, Section 11 Traffic and Transport.

14.3.6 Land Take and Compulsory Purchase Orders

The landownership along the entire route of the pipeline and the proposed construction compounds is under the ownership of either DCC or Waterways Ireland. Letters of consent to the planning application have been received from both Waterways Ireland and DCC. No compulsory purchase orders from third parties will be required to complete the project. Dublin Port have also provided letters of no objection. Refer to Volume 3, Appendix 2A.

14.3.7 Utilities

Consultation has been undertaken with utility providers to determine the extent and location of services within the project area. Utility providers contacted include:

- BT Ireland;
- E Net;
- Eir;
- ESB;
- Gas Networks Ireland;

- IW; and
- Virgin Media.

The following utilities and services were identified in the project area:

BT have network services along Grand Canal Quay, in the vicinity of the WI Visitor Centre, the Inner Basin Construction Compound, Hanover Quay, Asgard Road, and SJRQ .

E-Net have ducts along Grand Canal Quay, Hanover Quay, the Main Construction Compound, Asgard Road, and SJRQ.

Eir Network have services on Grand Canal Quay, the Inner Basin Construction Compound, MacMahon Bridge, Hanover Quay, the Main Construction Compound, a portion of Asgard Road, SJRQ, and the SJRQ Construction Compound as well as most adjoining roads.

ESB have MV/LV underground cables on Grand Canal Quay, the Inner Basin Construction Compound, MacMahon Bridge, Hanover Quay, the Main Construction Compound, Asgard Road, and SJRQ. They also have 38KV and higher voltage underground cables on Hanover Quay.

Gas Network Ireland have a low-pressure distribution pipe along Grand Canal Quay, the Inner Basin Construction Compound, Hanover Quay, the Main Construction Compound, and SJRQ. They also have a high-pressure distribution gas main on SJRQ. There are also Aurora Telecom ducts and subducts along Grand Canal Quay, Hanover Quay, and Asgard Road.

IW services are located along Grand Canal Quay, MacMahon Bridge, Hanover Quay, the Main Construction Compound, Asgard Road, and SJRQ.

Within the basin the expected utility that could potentially be impacted is a large 8ft diameter trunk sewer heading to Ringsend installed in an east west direction in the bed of the basin underneath MacMahon Bridge.

Virgin Media have critical live fibre cabling along Grand Canal Quay, Hanover Quay, Asgard Road, and some parts of SJRQ.

Public street lighting is present on Grand Canal Quay, Hanover Quay, Asgard Road, and SJRQ.

Figure 14.1 to Figure 14.4 present the extent of utilities in the works area. Figure 14.4Figure 14.5 to Figure 14.6 present the extent of utilities in the areas of the construction compounds. It should be noted that the location of these utilities is approximate and is inferred from drawings provided by the respective service provider. Focus was made on services in the immediate vicinity of the proposed works. The exact location of services will be verified by in situ investigation prior to any excavation or construction works.

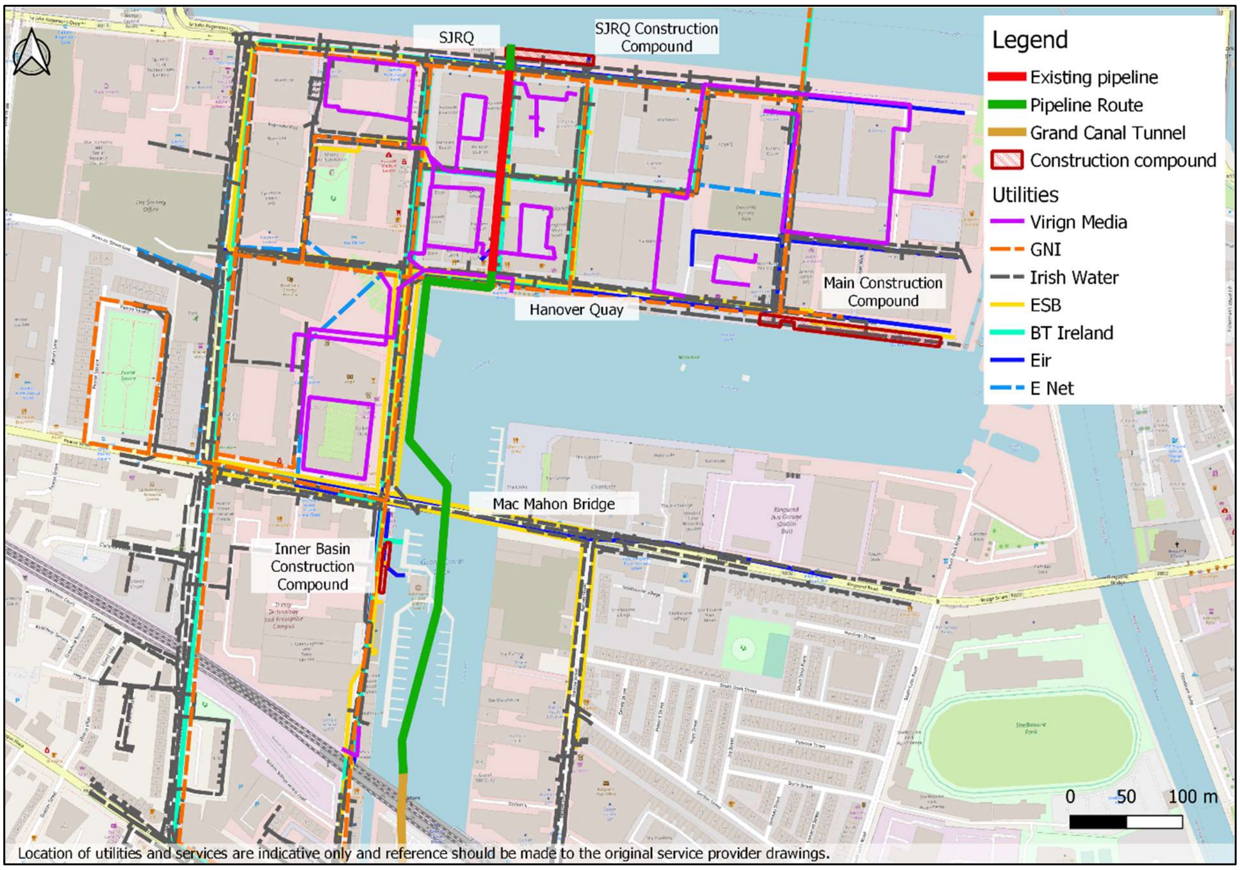


Figure 14.1 Overview of utilities in the vicinity of the GCSWOE project

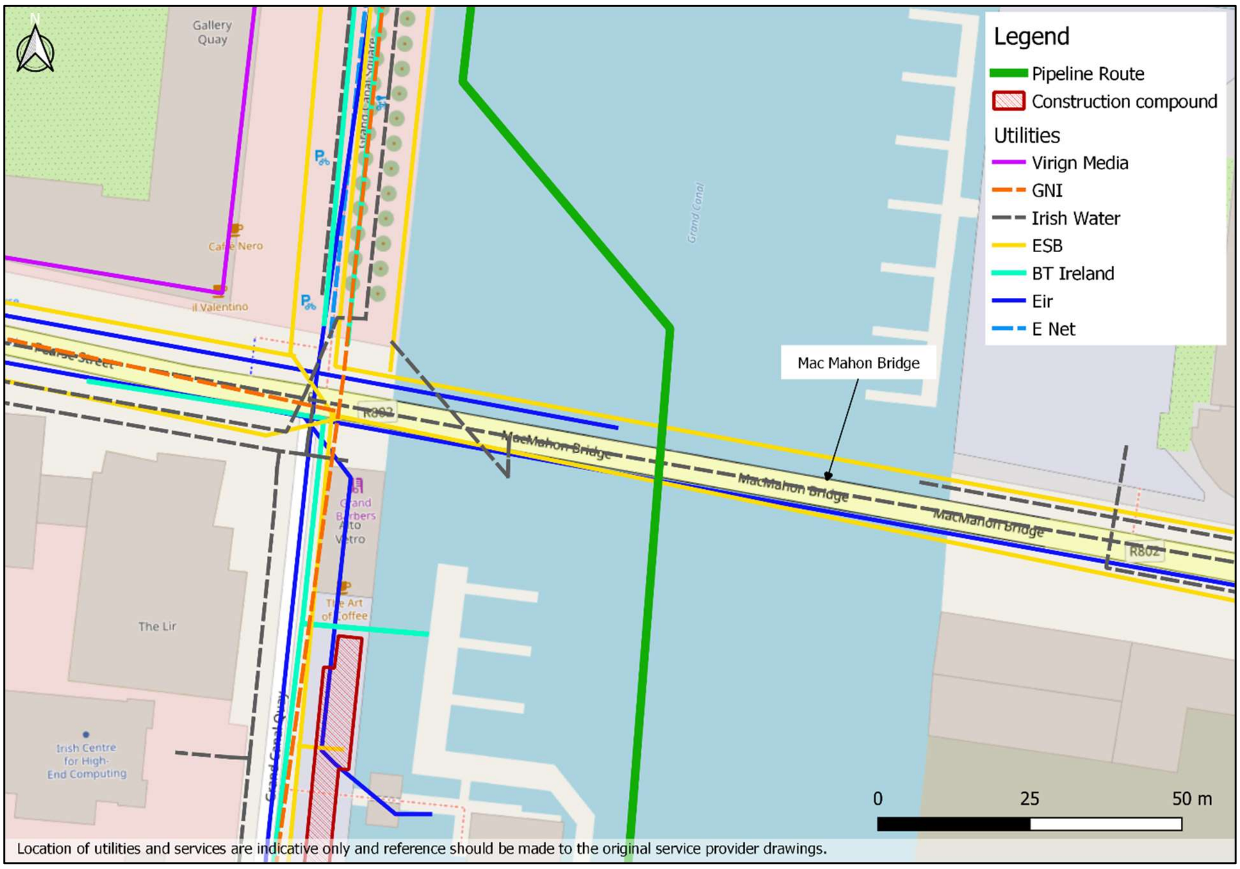


Figure 14.2 Utilities in the vicinity of the MacMahon Bridge

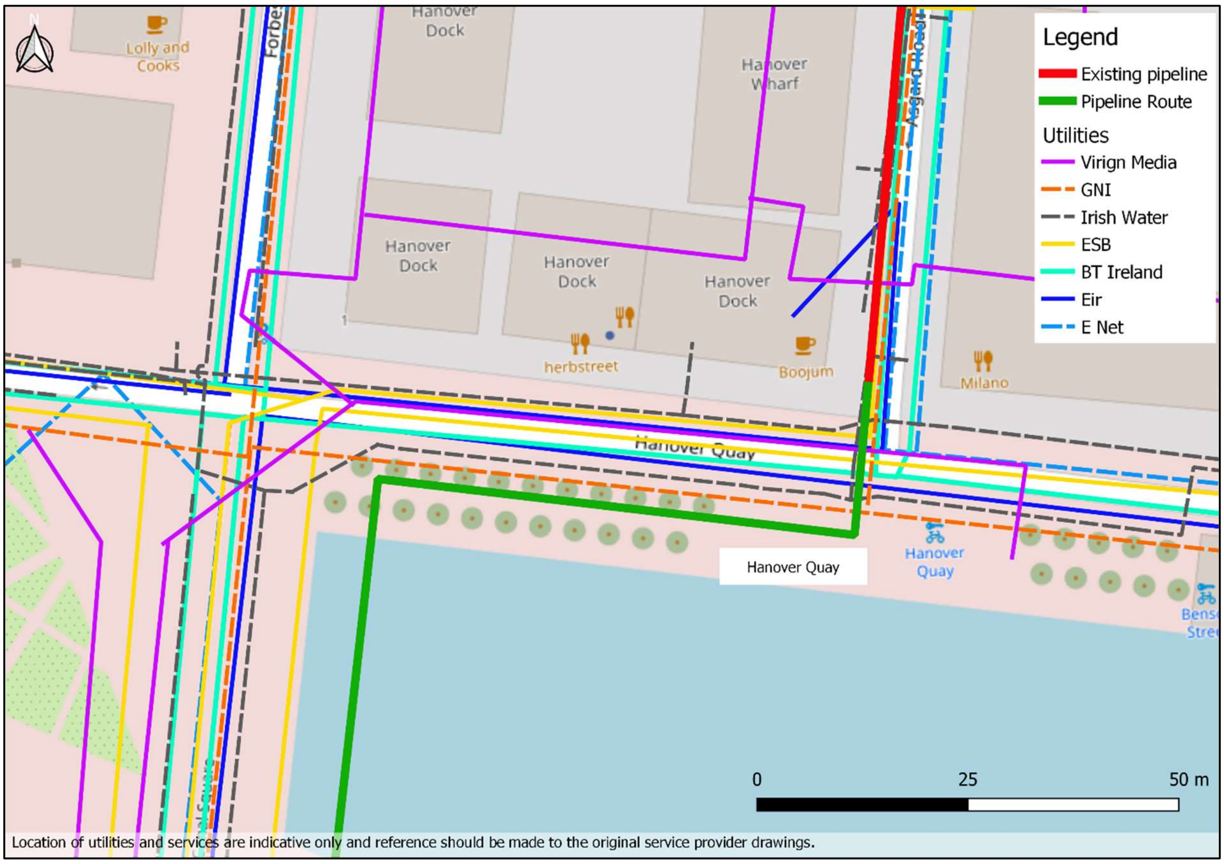


Figure 14.3 Utilities in the vicinity of works area at Hanover Quay

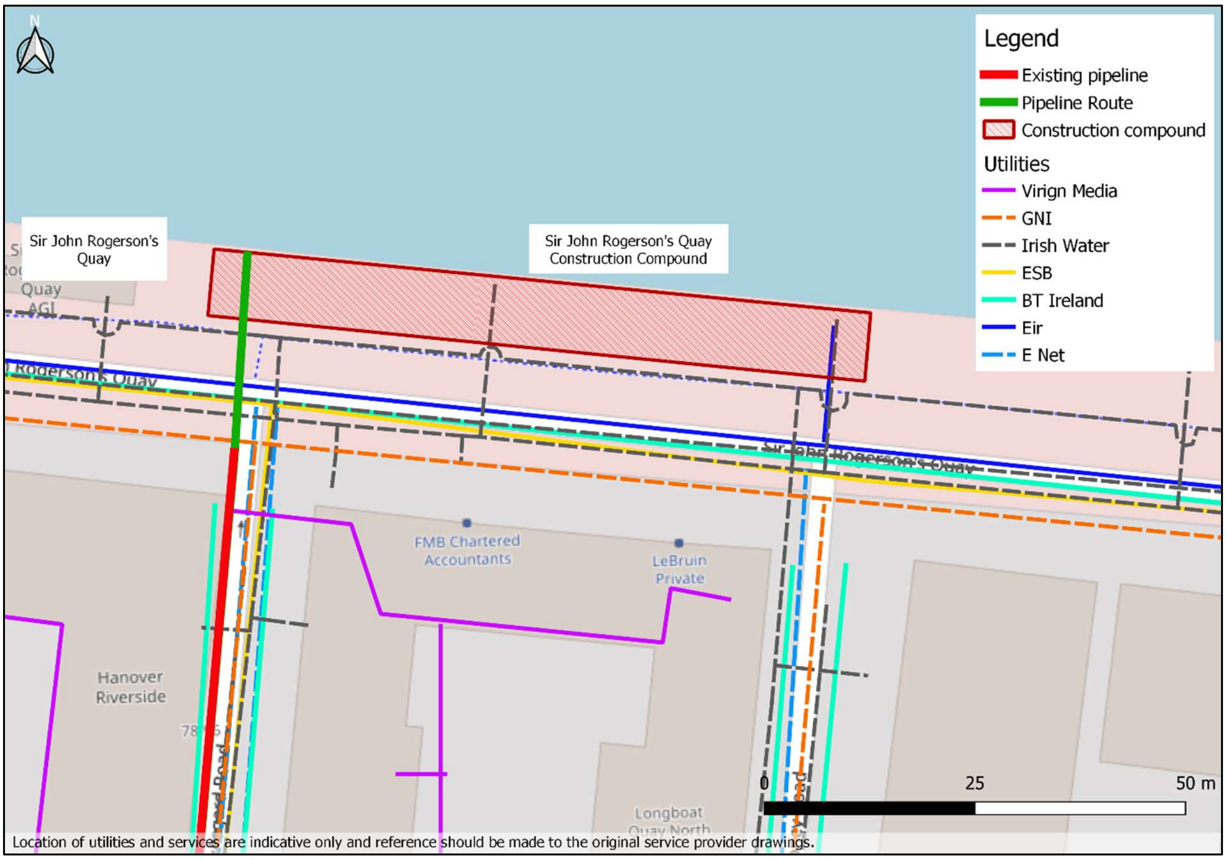


Figure 14.4 Utilities in the area of the SJRQ works area and construction compound

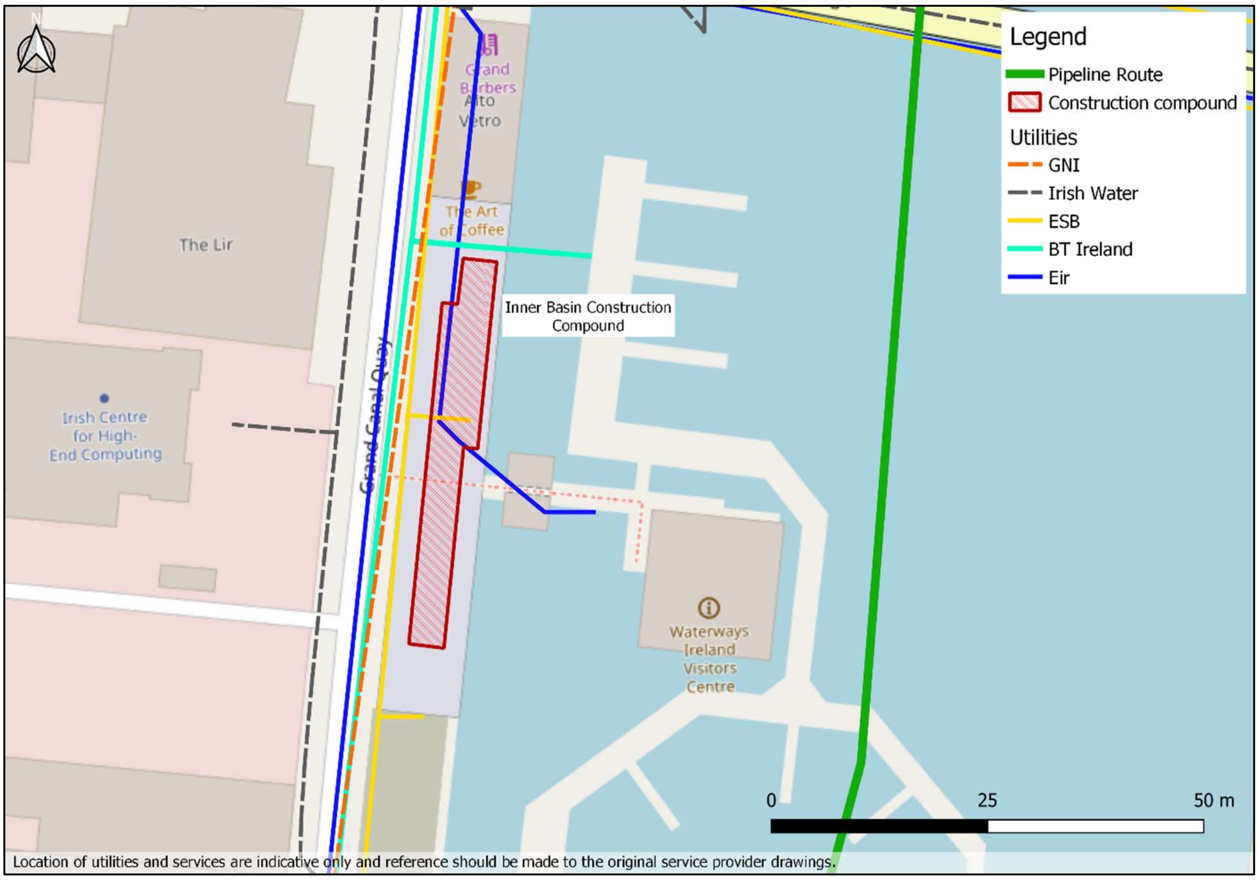


Figure 14.5 Utilities in the area of the Inner Basin Construction Compound

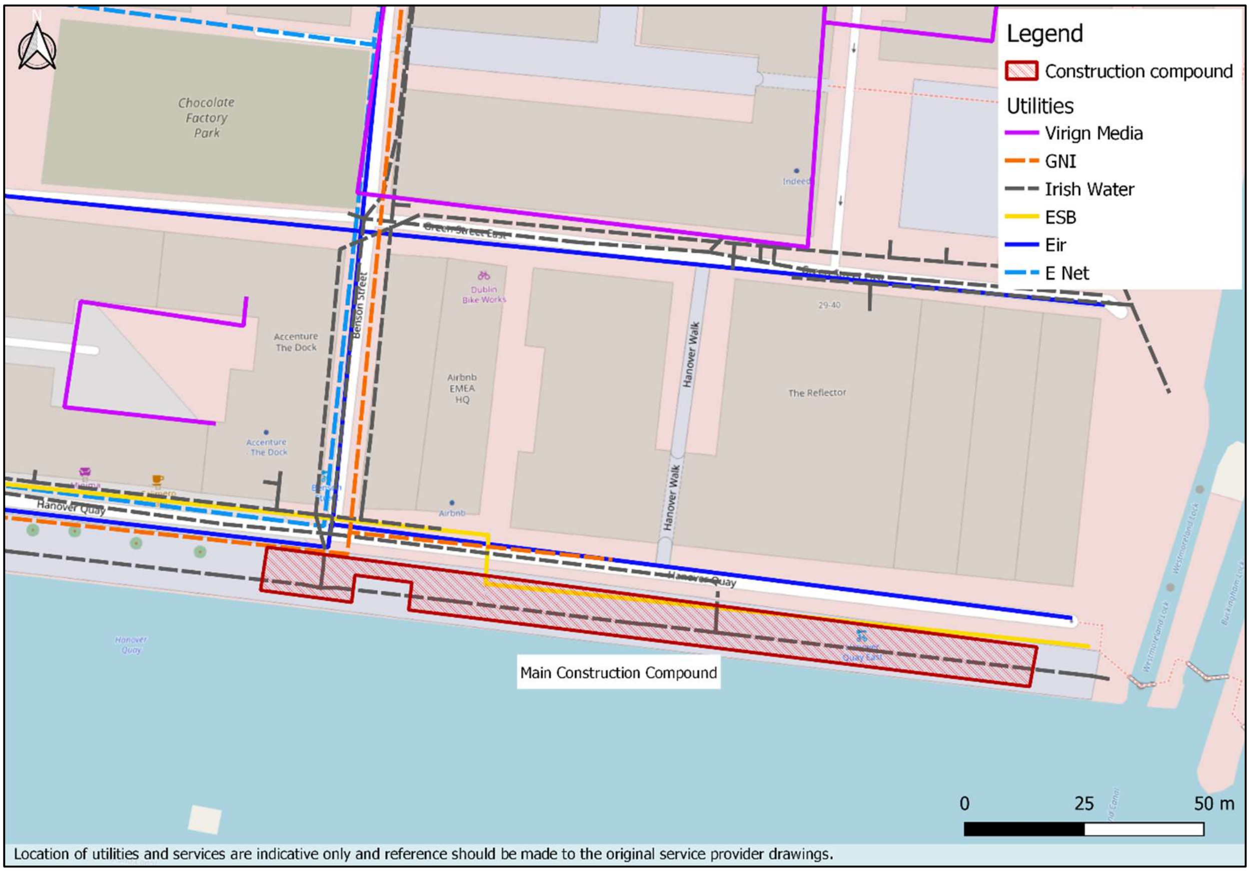


Figure 14.6 Utilities in the area of the Main Construction Compound

14.3.8 Geological Heritage

As mentioned in Volume 2, Section 8 Land, Soils, Geology, and Hydrogeology, there are no designated Geological Heritage Sites within or near the proposed development area. The nearest site is The River Poddle (Site Code: DC011), which is located 1.8km west of the proposed development. This will not be impacted by the proposed development.

14.3.9 Archaeological and Cultural Heritage

As mentioned in Volume 2, Section 12 Archaeology and Cultural Heritage, there are a number of assets of value to the public in the vicinity of the Grand Canal Docks. These include quay walls, local buildings, cast iron mooring rings, cobblestone pavements etc. These sites are considered within Section 12.

14.3.10 Natural Amenities

As mentioned in Volume 2, Section 6 Biodiversity, there are eleven internationally designated sites located within the identified Zone of Influence of the proposed development including:

- South Dublin Bay and River Tolka SPA (Site code 004024);
- North Dublin Bay SAC (Site code 000206);
- North Bull Island SPA (Site code 004006);
- South Dublin Bay SAC (Site code 000210);
- Rockabill to Dalkey Island SAC (Site code 003000);
- Howth Head SAC (Site code 000202);
- Howth Head Coast SPA (Site code 004113);
- Ireland's Eye SPA (Site code 004117);
- Ireland's Eye SAC (Site code 002193);
- Baldoyle Bay SAC (Site code 000199); and
- Baldoyle Bay SPA (Site code 004016).

A further four-non statutory nationally designated sites are located within the nearby vicinity of the proposed development including:

- Grand Canal pNHA (Site code 002104);
- Dolphins Dublin Docks pNHA (Site code 000201);
- North Dublin Bay pNHA (Site code 000206); and
- South Dublin Bay pNHA (Site code 000210).

The proposed works involve 450m of pipeline to be laid within the Basin. The proposed outfall of the development is located at the River Liffey. The Liffey will be receiving stormwater overflow as a result of the proposed development. An ecological survey was carried out in July 2020 (BEC, 2020) for the proposed development.

Dublin Bay is located approximately 2km downstream of the proposed development.

Irishtown Nature Reserve is located approximately 2.6km east of the proposed development. Morehampton Road Wildlife Sanctuary is located approximately 1.4km south.

These natural amenities will be considered in terms of their ecological value within Volume 2, Section 6 Biodiversity. Natura 2000 sites will be addressed in the Natura Impact Statement.

14.4 Characteristics of the Development

A description of the proposed development and construction methodology is given in Volume 2, Section 2. The works will interact with Material Assets during the construction and operational phases.

Potential impacts on Material Assets will be principally associated with excavation during the construction stage. Excavation and contaminated soils are also addressed in Volume 2, Section 8 Land, Soils, Geology and Hydrogeology and Section 13 Waste Management.

During the construction phase bed material will be moved/displaced within the basin. This involves dredging and pushing aside silt from the bed of the basin. A 200mm gravel bed will be laid down on the footprint of the pipeline, with deeper areas on soft spots where required. As much of the material as possible will be left within the basin and placed around the pipeline. Material that will be removed will be treated as contaminated material and transported to a suitably licensed facility.

Ground disturbance will occur along Hanover Quay as the pipeline will be laid in an open cut trench. The final area of ground disturbance will occur at SJRQ where the pipeline will cross the road and result in the removal and subsequent restoration of a small section of the quay wall where the proposed storm outfall will exit into the Liffey.

The cofferdams for Transition Chambers 1 and 2 within the basin will be constructed using conventional sheet piling. Excavations along Hanover Quay to allow for the new pipeline will be at a depth of 6.55m. Sheet piles will not be permitted along the back of Hanover Quay wall i.e. in the Campshire itself.

It is anticipated that Transition Chamber 3 and the Hanover Quay culvert will be constructed within a secant piled wall. This secant piled wall will be required to minimise working width, to contain the existing contaminated material and to limit any water ingress from the dock and surrounding ground. This will tie into the cofferdam or other temporary works provided by the Contractor in the dock to ensure a watertight seal.

The Contractor will provide a cofferdam or other temporary works to ensure a watertight seal around the excavation/works in SJRQ and the River Liffey. For the works in SJRQ, low vibration, CFA piles are required, as a condition specified by the Bord Gáis Transmission Main Department.

The works will involve short term disturbance to Campshire surfaces, quay wall, bike stand, bollards, street lighting and street furniture during construction.

14.5 Potential Impacts

14.5.1 Do-Nothing Impacts

The "Do Nothing" scenario involves no change in impacts upon Material Assets. This means that there will be no improvement to the amenity of the Grand Canal Docks during the operational phase by way of improving water quality within the Basin. There will also be no disruption of material assets in the construction phase. Impacts on Material Assets as a result of the "Do Nothing" scenario will be neutral.

14.5.2 Construction Phase

The potential impacts on material assets associated with construction phase include:

- Temporary reduction of amenity value of the Grand Canal Docks for the general public and local residents during the construction phase due to construction movements, noise, road diversions, hoarding;
- Temporary reduction of amenity value of SJRQ during construction works;
- Temporary reduction of recreational amenity use of the Basin during construction works;
- Temporary slight negative impact on traffic in the vicinity of the Docks during construction works due to HGV and construction traffic movements;
- Risk of reduction of water quality of the Basin and the River Liffey due to hydrocarbon and material spillage;
- Risk of damage to utilities during digging on Hanover Quay and SJRQ;
- Risk of damage to the MacMahon Bridge services and services that cross beneath it; and
- Permanent slight negative impact upon the cultural heritage of the area through digging on SJRQ and Hanover Quay, the quay walls of the Dock and SJRQ, and at the proposed outfall location in the River Liffey.

Public Amenity

The proposed development will cause *short term moderate negative impacts* on the public amenity of the Basin itself, the Grand Canal Docks, and SJRQ during the construction phase. This will be due to visual impact, removal of available public space, construction noise, and traffic diversions.

Three temporary construction compounds will be erected, one on Grand Canal Quay, one Hanover Quay, and one on SJRQ as shown in Volume 4, Project Drawings. At these proposed compound locations there will be less available public space for people to walk around, eat lunch, and drink coffee etc. These impacts will be *short term moderate negative and temporary.*

The impact on the visual amenity of the Grand Canal Basin and SJRQ during construction will be *short term and temporary*. Landscape and visual impacts discussed in further detail in Volume 2, Section 15 Landscape and Visual Impact.

Recreation

During construction, water-based recreation activities will not be permitted in the vicinity of the works within the Basin. A number of house boats adjacent the Waterways Ireland Visitor Centre will be removed from the Inner Basin, as well as a number of their floating moorings

Boats will be kept to a safe distance from the works within the River Liffey at the location of the proposed outfall structure during construction. Floating buoys or similar safety equipment will be used to keep water vessels at a safe distance from construction works.

This will result in a *short-term moderate negative impact* on the recreational activities in the area.

Commercial

No compulsory purchase of commercial property is required as part of this project.

Traffic diversions during the construction phase may indirectly negatively impact upon local businesses by limiting access by vehicles and reducing the attractiveness of the Docks for shoppers, tourists, and potential patrons. However, this impact will be *short-term and slight negative.*

During the construction phase there may be *short-term not significant negative* impact on the commercial receptors within immediate vicinity of the construction compounds due to ambient dust and noise levels.

These individual impacts are discussed in further detail in Volume 2, Section 9 Air Quality and Climate Volume 2, Section 11 Traffic and Transport.

Residential

No compulsory purchases of residential property is required to as part of the project.

There will be *short-term impacts* on residents in the immediate vicinity of the Docks from construction activities as a result of noise, dust, vibration, visual impact, and traffic disruptions.

These individual impacts are discussed in further detail in their respective sections.

Transport

Impacts will occur as a result of traffic diversions, road closures, and additional traffic due to construction traffic and HGV movements etc. At present there are no public transport routes on Grand Canal Quay, Hanover Quay or SJRQ. The proposed development will result *a short-term slight negative* impact during the construction phase.

This is discussed in more detail in Volume 2, Section 11 Traffic and transport.

Utilities

There is a risk of damage upon services and utilities in the area of the proposed works. This may occur during excavation works. Excavations in the vicinity of services such as the high-pressure gas distribution line on SJRQ have the potential to result in a *very significant temporary negative* impact upon Gas Network Ireland service users and built heritage and infrastructure in the local area.

Similarly, construction in the vicinity of the 8ft city sewer under the basin bed at MacMahon Bridge has the potential to result in a *very significant temporary negative* impact in the event that the sewer is damaged during construction.

Existing utilities on the inner dock, quays, near the construction compounds will be monitored to ensure protection to infrastructure and minimisation of potential disruption to services. Potential impacts could arise as a result of necessary re-routing of infrastructure. At the time of any re-routing of services there may be a brief disruption to service in the local area. Hence, construction works may result in *a temporary/short-term slight adverse impact* on services.

Water mains may require to be temporarily diverted or supported during the construction works, however the access to the existing fire hydrants along the Grand Canal Quay, Hanover Quay and SJRQ will not be hindered.

There are no impacts on underground utilities predicted associated with the temporary construction compounds as no excavation will be undertaken in these areas.

Geological Heritage

The proposed project will not impact the existing geological heritage sites as here are no material assets of a geological heritage nature within the project boundary or in the immediate vicinity.

Archaeological and Cultural Heritage

There is a potential *permanent slight negative* impact upon the cultural heritage of the area through digging on SJRQ and Hanover Quay, the quay walls of the Dock and SJRQ, and at the proposed outfall location in the River Liffey.

Cultural heritage impacts are discussed in more detail in Volume 2, Section 12 Archaeology and Cultural Heritage.

Natural Amenities

Impacts on natural amenities are discussed in Volume 2, Section 6 Biodiversity and within the Natura Impact Statement.

14.5.3 Operational Phase

Public Amenity

The public amenity value of the Docks will experience a *significant permanent positive* impact due to the improvement in the water quality in the Basin. This will greatly improve the safe use of the waters and therefore the recreation value of the Basin.

Recreation

The recreation value of the Docks will experience a *significant permanent positive* impact as water quality will be improved within the Basin. This will make water-based recreational activities more attractive and safer for the public.

Natural Amenities

The removal of the stormwater outfall in the Grand Canal Basin will lead to a reduction in input of polluted water. This would have a *permanent positive* effect and will improve the water quality within the basin and the overall WFD status of the waterbody. Due to the higher assimilative capacity of the River Liffey, changes in water quality there will be *not significant*. This is discussed in more detail in Volume 2, Section 6 Biodiversity and Section 7 Water Quality and Hydrology.

Other Material Assets

The Dublin Port Company have indicated that berthing at the SJRQ may be restricted in the vicinity of the outfall. This will result in *slight negative long-term effect* during the operational phase. There are no other direct or indirect impacts on commercial, residential, transport, utilities, geological heritage, archaeological and cultural heritage during the operational phase of the project.

14.6 Mitigation Measures

14.6.1 Construction Phase

Mitigation by avoidance will be the primary mitigation measure implemented during the proposed development. This will be applied during the construction phase in the avoidance of utilities such as underground services.

Consultation has been undertaken with utility providers to determine the location of services prior to commencement of works. Management plans including method statements and risk assessments will be developed for excavations in proximity to underground utilities. Where excavations of intrusive works are located nearby utilities it may be necessary to have a plant protection officer/ representative from the respective utility provider on site during the works. Any required supervision of excavation works nearby utilities will be agreed with the respective utility provider.

In particular detailed individual method statements will be provided by the Contractor and developed in consultation with respective utility owner with respect to the 8ft city sewer under MacMahon Bridge and the high-pressure gas mains on SJRQ.

Any necessary re-routing of utilities will be identified, agreed with the relevant utility provider and carried out in advance of the main works. A record of the position, size and type of all services encountered or affected by the works will be documented. Access to the existing fire hydrants along the Grand Canal Quay, Hanover Quay and SJRQ will not be hindered.

As discussed in Volume 2, Section 15 Landscape and visual impact, sensitive design in temporary works will be undertaken. Temporary hoardings will be put in place around land-based works along Hanover Quay and SJRQ and around the construction compounds. Also, temporary hoarding may be put in place to the edge of the construction zones on Grand Canal Quay and Grand Canal Square for works in the outer basin.

Any existing street furniture, surfaces, and historic features such as the granite ashlar quay walls, stone setts, mooring rings, steps, bollards, lamp standards and crane tracks, which are to be temporarily removed for construction, will be done so under supervision of a qualified archaeologist and catalogued Following the construction phase, the Campshires will be reinstated as existing.

The extent of the existing quay wall requiring demolition to allow for the installation of the culvert will be minimised. Care will be taken not to damage the existing stone as they will be reinstated around the culvert structure.

All construction works will be temporary and carried out in accordance with best practice guidelines to minimise impacts upon receiving communities. The relevant guidelines are discussed in each respective section elsewhere in this report.

A CEMP has been prepared and is included in Volume 3, Appendix 17A to the EIAR which will be updated and finalised by the Contractor prior to construction commencing. Method statements will be provided by the Contractor for the works in the vicinity of utilities and underground services.

14.6.2 Operational Phase

There are no specific mitigation measures to reduce impacts on services and the built environment required as part of the operational phase.

14.7 Residual Impacts

There will be no significant impacts to material assets as a result of the construction phase of the proposed development. However, adherence to best construction practice and the mitigation measures outlined in the relevant EIAR sections herein will be implemented.

There will be a *short term moderate negative* impact on the public amenity of the Basin itself, the Grand Canal Docks, and SJRQ during the construction phase. This will be due to visual impact, recreation, removal of available public space, construction noise, and traffic diversions.

There will be a *short-term moderate negative* impact on residents in the immediate vicinity of the Grand Canal Docks and SJRQ from construction activities, most notably, noise, dust, vibration, visual impact, and traffic disruptions.

There will be a *slight negative* impact on traffic during the construction phase due to diversions, road closures, and additional traffic due to construction traffic and HGV movements etc.

There will be a *significant permanent positive* impact on the amenity of the Grand Canal Basin during the operational phase for recreational users and the public as a result of the proposed development moving the Storm Water Outfall to the River Liffey where its discharge will be better assimilated.

There will be a '*not significant' temporary negative* impact on the receiving waters of the River Liffey during the operational phase of the proposed development. This will occur when there are CSO spills to the Storm Water section of the Grand Canal Tunnel. This is not anticipated to significantly reduce the amenity value of the River Liffey or to impact upon its users as demonstrated by the water quality model.

The Dublin Port Company have indicated that berthing at the SJRQ may be restricted in the vicinity of the outfall. This will result in *slight negative long-term effect* during the operational phase.

Following reinstatement there will be no other negative impacts on material assets during the operational stage.

14.7.1 Interactions

The interactions between Material Assets and other Sections within this Volume 2 of the EIAR as discussed in this section include, Section 7 Water Quality and Hydrology, Section 8 Land, Soils, Geology and Hydrogeology and Section 11 Traffic and Transport. Refer to detailed assessment in Section 16 Interactions.

The mitigation measures presented in this section are consistent with measures outlined in these individual sections.

14.7.2 Cumulative Impacts

As described previously there are a number of concurrent developments in the vicinity of the proposed development. Due to the location of the project within Dublin City Centre, and the fact that the location is zoned as an SDRA, there is continuous development in the area. As such, the developments which have been identified as having potential cumulative impacts include:

- Alexandra Basin Redevelopment;
- Barrow Street Improvements;
- Inner Basin Boardwalk;
- Boland's Mill;
- Bus Connects;
- Canal Loop Greenway;
- Campshires Public Realm;

- Dart Underground;
- Dodder Greenway;
- Dodder Public Transportation Opening Bridge;
- Dublin District Heating System;
- Dublin Eastern Bypass project;
- Extension of Luas Red Line across the River Liffey;
- Grand Canal Greenway- Grand Canal Dock Section;
- Grand Canal Quay East;
- Liffey Cycle Route;
- Liffey-Tolka Project;
- Maintenance dredging in Dublin Port;
- Malthouse;
- Metrolink;
- MP2 Project, Dublin Port Company;
- North Lotts and Grand Canal Dock SDZ Water Animation Strategy 2018;
- Point Pedestrian Bridge;
- Refurbishment of Camden Lock Gates;
- Ringsend Wastewater Treatment Plant Upgrade;
- South Campshire Flood Defence Wall project;
- Southern Port Access Route;
- Treasury Building; and
- Trinity East Innovation Hub.

When in cumulation with the proposed development, impacts from other developments in the area of the proposed development have the potential to generate excessive traffic disruptions, visual amenity impacts, and noise emissions.

No cumulative impacts are predicted on built services and infrastructure.

14.8 Monitoring

Monitoring of material assets will involve supervision of buried utilities where open trench excavation is scheduled. Other material asset monitoring measures for transport, visual amenity, and cultural heritage are covered Volume 2, Sections 11, 15 and 12 respectively. This will occur, at the discretion of the relevant utility provider, at Hanover Quay, and SJRQ. The present utilities here include:

- Hanover Quay:
  - BT Ireland;
  - E-Net;
  - ESB;
  - Gas Networks Ireland;
  - IW (road drainage, foul and storm sewers); and
  - Virgin Media.
- SJRQ:
  - BT Ireland;
  - E-Net;
  - ESB;
  - Eir;
  - Gas Networks Ireland;
  - IW (road drainage, foul and storm sewers); and
  - Virgin Media.

14.9 References

Correspondence with DCC and utility providers.

Dublin City Council, (2016). *Dublin City Draft Development Plan 2016 – 2022.*

Dublin Port Company, (2012). *Dublin Port Development Plan 2012 – 2040.*

Dublin City Council, (2014). *North Lotts and Grand Canal Dock Planning Scheme (and interim publications/ amendments).*

Dublin City Council, (2013). *SDRA 6 – Docklands (SDZ & Wider Docklands Area).* Available at: http://www.dublindocklands.ie/planning/dublin-docklands-sdz/sdz-scheme

Environmental Protection Agency (Ireland) (EPA), (2022). *Guidelines on the information to be contained in Environmental Impact Assessment Reports.*

Environmental Protection Agency (Ireland) (EPA), (2017). *Guidelines on the information to be contained in Environmental Impact Assessment Reports, Draft.*

SECTION 15: Landscape and Visual Impact

15.1 Introduction

This Landscape and Visual Impact Assessment (LVIA) aims to identify and assess the potential impacts on landscape character and visual amenity of the proposed development. Its purpose is to provide the relevant information to enable the interested parties determine the best approach to mitigate any arising impacts.

The LVIA was drafted by Alex Craven, senior landscape architect with six years' experience on infrastructure related LVIAs. Amendments to the report were implemented by Christos Papachristou, senior landscape architect with five years' experience on infrastructure related projects. The review of the report was carried out by Bernadette O'Connell, CMLI with over twenty years of experience on infrastructure related projects.

The work was commissioned to JBA by JBB on behalf of DCC and IW.

15.2 Methodology

15.2.1 Assessment Methodology

The assessment is based on the recommendations in the *Guidelines for Landscape and Visual Impact Assessment* (GLVIA) as published by the Landscape Institute (UK) and the Institute of Environmental Management and Assessment (3rd Edition, 2013). The assessment also considers the landscape character assessment within the Dublin City Development Plan 2016-2022.

The LVIA, which was carried out during the Winter of 2020, was undertaken through a combination of desk studies and field surveys. The desk studies involved assessment of satellite imagery, Google Street View, historic and ordnance survey mapping, background search of the relevant policies from the local council and analysis of the Zone of Theoretical Visibility (ZTV). The site-work stage involved the verification of nearby views from the initial desk-based study. Field notes were recorded in relation to the likes of topography, land use, significant landscape features and overall landscape character.

15.2.2 Landscape Impact Assessment Criteria

When assessing the potential impacts on the landscape resulting from a proposed project, the following criteria are considered:

- Landscape character sensitivity;
- Magnitude of likely impacts; and
- Significance of landscape effects.

15.2.3 Sensitivity of the Landscape

The sensitivity of the landscape to change is the degree to which a particular Landscape Character Area (LCA) can accommodate changes or new elements without unacceptable detrimental effects to its essential characteristics.

Landscape Sensitivity, often referred to as 'value', is classified using the following criteria which have been derived from a combination of industry guidelines from the Landscape Institute for Landscape and Visual Impact Assessment and professional judgement.

- Very high - Areas where the landscape character exhibits a very low capacity for change in the form of development. Examples of which are very high value landscapes, protected at an international level e.g. World Heritage Site, where the principal management objectives are likely to be protection of the existing character;
- High - Areas where the landscape character exhibits a low capacity for change in the form of development. Examples of which are high value landscapes, protected at a national level e.g.

National Park, where the principal management objectives are likely to be protection of the existing character;

- Medium - Areas where the landscape character exhibits a medium capacity for change in the form of development. Examples of which are medium value landscapes, protected at a Local or Regional level e.g. Open space areas mentioned within a County Development Plan, where the principal management objectives are likely to be protection of the existing character;
- Low - Areas where the landscape character exhibits a high capacity for change and has very few or no designated landscapes or open space areas; and
- Negligible - Areas of landscape character that include derelict, mining, industrial land or are part of the urban fringe where there would be a reasonable capacity to embrace change or the capacity to include the development proposals. Management objectives in such areas could be focused on change, creation of landscape improvements and/or restoration to realise a higher landscape value.

15.2.4 Magnitude of Likely Landscape Impacts

The magnitude of a predicted landscape impact is a product of the scale, extent or degree of change that is likely to be experienced as a result of the proposed project. The magnitude takes into account whether there is a direct physical impact resulting from the loss of landscape components and/or a change that extends beyond the boundary of the proposed project that may have an effect on the landscape character of the area.

- Very high - Change that would be large in extent and scale with the loss of critically important landscape elements and features, that may also involve the introduction of new uncharacteristic elements or features that contribute to an overall change of the landscape in terms of character, value and quality;
- High - Change that would be more limited in extent and scale with the loss of important landscape elements and features, that may also involve the introduction of new uncharacteristic elements or features that contribute to an overall change of the landscape in terms of character, value and quality;
- Medium - Changes that are modest in extent and scale involving the loss of landscape characteristics or elements that may also involve the introduction of new uncharacteristic elements or features that would lead to changes in landscape character, and quality;
- Low - Changes affecting small areas of landscape character and quality, together with the loss of some less characteristic landscape elements or the addition of new features or elements;
- Negligible - Changes affecting small or very restricted areas of landscape character. This may include the limited loss of some elements or the addition of some new features or elements that are characteristic of the existing landscape or are hardly perceivable;
- Neutral - Changes that do not involve the loss of any landscape characteristics or elements and will not result in noticeable changes to the prevailing landscape character; and
- Positive - Changes that restore a degraded landscape or reinforce characteristic landscape elements.

15.2.5 Significance of Landscape Impacts

The significance of the landscape impact will be the combination of the sensitivity of the landscape against the magnitude of the change. It is summarised in Table 15.1 below.

Table 15.1 Significance of Landscape and Visual effects based on Magnitude and Sensitivity

Significance of Landscape and Visual effects					
MAGNITUDE	**SENSITIVITY**				
	Very high	High	Medium	Low	Negligible
Very high		Very significant	Significant	Moderate	Slight
High	Very significant	Significant	Moderate	Slight	Slight
Medium	Significant	Moderate	Slight	Slight	Imperceptible
Low	Moderate	Slight	Slight	Imperceptible	Imperceptible

Negligible	Slight	Slight	Imperceptible	Imperceptible	Imperceptible
Neutral	Imperceptible	Imperceptible	Imperceptible	Imperceptible	Imperceptible
Positive	Positive	Positive	Positive	Positive	Imperceptible

15.2.6 Sensitivity of Visual Receptors

Unlike landscape sensitivity, the sensitivity of visual receptors has an anthropocentric (or human-centric) basis. It considers factors such as the perceived quality and values associated with the view, the landscape context of the viewer, the likely activity they are engaged in and whether this heightens their awareness of the surrounding landscape.

Visual receptors most susceptible to changes in views and visual amenity are:

- Very high - Residents in properties within protected landscapes and travellers on a scenic route where awareness of views is likely to be heightened;
- High – Residents in properties with predominantly open views from windows, gardens or curtilage. People, whether residents or visitors, who are engaged in outdoor recreation including use of public rights of way, whose attention or interest is likely to be focused on the landscape and on particular views, and those on a scenic route where the view is not specifically in the direction of the proposed development;
- Medium - Visitors to heritage assets, or to other attractions, where views of the surroundings are an important contributor to the experience, and communities where views contribute to the landscape setting enjoyed by residents in the area;
- Low - People engaged in outdoor sport or active recreation on a local scale, which does not involve or depend upon appreciation of views of the landscape; and people at their place of work whose attention may be focussed on their work or activity, not their surroundings and where the setting is not important to the quality of working life, and people travelling in vehicles where their view is limited to a few minutes at any view point; and
- Negligible - Changes affecting restricted viewpoints.

15.2.7 Magnitude of Visual Impact

The magnitude of a visual effect is determined on the basis of several factors: the relative numbers of viewers, the distance from the viewpoint, the visual dominance of the proposed development within a view and its effect on visual amenity, as follows:

- Very high - The proposal intrudes into a large proportion or critical part of the available vista and is without question the most noticeable element. A high degree of visual clutter or disharmony is also generated, strongly reducing the visual amenity of the scene;
- High - The proposal intrudes into a significant proportion or important part of the available vista and is one of the most noticeable elements. A considerable degree of visual clutter or disharmony is also likely to be generated, appreciably reducing the visual amenity of the scene;
- Medium - The proposal represents a moderate intrusion into the available vista, is a readily noticeable element and/or it may generate a degree of visual clutter or disharmony, thereby reducing the visual amenity of the scene. Alternatively, it may represent a balance of higher and lower order estimates in relation to visual presence and visual amenity;
- Low - The proposal intrudes to a minor extent into the available vista and may not be noticed by a casual observer and/or the proposal would not have a marked effect on the visual amenity of the scene; and
- Negligible - The proposal would be barely discernible within the available vista and/or it would not detract from, and may even enhance, the visual amenity of the scene.

Magnitude can also be described as:

- Neutral - Changes that are not discernible within the available vista and have no bearing on the visual amenity of the scene; and

- Positive - Changes that enhance the available vista by reducing visual clutter or restoring degraded features.

15.2.8 Significance of Visual Impacts

As stated above, the significance of visual impacts is a function of visual receptor sensitivity and visual impact magnitude. This relationship is expressed in the same significance matrix as used earlier in respect of landscape impacts, see Table 15.1.

Impact Classification Terminology

Table 15.2 below presents the Impact Classification Terminology as published in the EPA guidance document (Environmental Protection Agency (May 2022) *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports*). Standard definitions are provided in this glossary, which permit the evaluation and classification of the quality, significance, duration and type of impacts associated with a proposed development on the receiving environment.

Each impact is described in terms of its quality, significance, extent, duration & frequency and type, where possible.

Table 15.2 Impact Classification Terminology taken from Environmental Protection Agency (May 2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports

IMPACT CHARECTERISTICS	TERM	DESCRIPTION
Quality of Effects	Positive	A change that improves the quality of the environment.
	Neutral	No effects or effects that are imperceptible, within normal bounds of variation within the margin of forecasting error.
	Negative/ Adverse	A change that reduces the quality of the environment.
Significance of Effects	Imperceptible	An effect capable of measurement, but without significant consequences.
	Not significant	An effect which causes noticeable changes in the character of the environment, but without significant consequences.
	Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
	Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
	Significant	An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
	Very significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
	Profound	An effect which obliterates sensitive characteristics.
Extent and Context of Effects	Extent	Describe the size of the area, the number of sites, and the proportion of a population affected by an effect.
	Context	Describe whether the extent, duration, or frequency will conform or contrast with established (baseline) conditions.

IMPACT CHARECTERISTICS	TERM	DESCRIPTION
Probability of Effects	Likely	The effects that can reasonably be expected to occur because of the planned project, if all mitigation measures are properly implemented.
	Unlikely	The effects that can reasonably be expected not to occur because of the planned project, if all mitigation measures are properly implemented.
Duration and Frequency of Effects	Momentary	Effects lasting from seconds to minutes.
	Brief	Effects lasting less than a day.
	Temporary	Effects lasting less than a year.
	Short-term	Effects lasting one to seven years.
	Medium-term	Effects lasting seven to fifteen years.
	Long-term	Effects lasting fifteen to sixty years.
	Permanent	Effects lasting over sixty years.
	Reversible	Effects that can be undone, for e.g., through remediation or restoration
	Frequency	Describe how often the effect will occur. (once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, monthly, annually)
Types of Effects	Indirect/ Secondary)	Impacts on the environment, which are not a direct result of the project, often produced away from the project site or because of a complex pathway.
	Cumulative	The addition of many minor or significant effects, including effects of other projects, to create larger, more significant effects.
	'Do-Nothing'	The environment as it would be in the future should the subject project not be carried out.
	`Worst case'	The effects arising from a project in the case where mitigation measures substantially fail.
	Indeterminable	When the full consequences of a change in the environment cannot be described.
	Irreversible	When the character, distinctiveness, diversity or reproductive capacity of an environment is permanently lost.
	Residual	The degree of environmental change that will occur after the proposed mitigation measures have taken effect.
	Synergistic	Where the resultant effect is of greater significance than the sum of its constituents.

15.3 Receiving Environment

15.3.1 Site Fabric

The Site comprises an area of open water, referred to in this report as the Basin, which forms part of Grand Canal Docks, a historic dock on the eastern side of Dublin city centre. The basin is an inverted L-shaped formed by two rectangular arms aligned approximately north-south (the Inner dock/Basin) and east-west (the Outer Dock/Basin). The basin is bounded to the north by Hanover Quay, to the south by a viaduct carrying the Dublin Area Rapid Transport (DART) line, and to the west by a Grand Canal Quay.

To the eastern end of the dock are two disused graving docks and three lock gates which connect the dock to the river Liffey. The dock is transected by a modern road bridge, MacMahon Bridge, which connects Pearse Street to Ringsend Road west to east across the centre of the basin. The walls of the basin are constructed of roughly coursed calp limestone masonry, with squared calp coping and tooled granite coping, some replacement coping. Cast-iron bollards and mooring posts are regular features.

A Waterways Ireland Visitor centre and 20 associated barge moorings are present within the dock. There is provision for recreational use of the eastern stretch of the docks in the form of a cable skiing system for use for water-skiing and wakeboarding. A slipway on the eastern edge of the dock allows regular use by the semi-aquatic vehicle of Viking Splash Tours.

The site also includes a small area of Asgard Road and a section SJRQ. These are composed of road carriageways in bitmac and pedestrian areas which are largely paved in natural stone flags and setts. Some historic elements of landscape on SJRQ including granite ashlar quay walls, stone setts, mooring rings, steps, bollards, lamp standards and inlaid crane tracks are listed in the Record of Protected Structures (RPS). The site has high heritage value due to its inclusion within the Grand Canal Conservation Area and the archaeological significance of key features of the landscape including the basin, quay walls and adjacent quays.

The sensitivity of the site fabric to infrastructural development is *high*.

15.3.2 Site Context

The area surrounding the dock is urban and composed of a range of mainly high and medium rise buildings. The street pattern in the site context is largely arranged in a grid pattern, and this is particularly obvious to the northern side of the docks where block size is most regular. Towards the south the street pattern becomes more irregular, and blocks become less legible. There are 6 key streets that adjoin the docks; To the west are Pearse Street and Misery Hill, to the north are Asgard Road, Blood Stoney Road and Benson Street, and to the west is Ringsend Road. These provide vistas down to the docks. There are also several smaller unnamed streets and inter-building accesses which lead to the docks.

The surrounding area accommodates largely residential and commercial uses. The area has become known as Silicon Docks due to its high concentration of international technology companies. Trinity Technology and Enterprise Campus is located to the west of the docks. At the time of writing there are also a number of buildings undergoing renovation and buildings in the process of being constructed.

Following their opening in 1796, the docks were one of the biggest and the busiest in the world. The whole of the site area is designated as the Grand Canal Conservation Area. Several historic buildings listed in the Record of Protected Structures (DCC, 2018) are in existence around the dock and shown in Figure 15.1 overpage; Boland's Flour Mills, The Malthouse, and other protected structures are clustered closely to the edges of the Inner Basin. These are unified by their consistent use of brick and local stone, and similar style and massing. A listed former warehouse is present on the north-east corner of the basin adjacent to Hanover Quay. The three sea-locks that act as an entrance to the docks (Westmoreland Lock, Buckingham Lock, Camden Lock) are listed in the National Inventory of Architectural Heritage and the RPS. Along SJRQ, the granite ashlar quay walls, stone setts, mooring rings, steps, bollards, lamp standards and machinery are also listed historic elements. All these elements of built heritage combine to help retain much of the historic character of the docks.

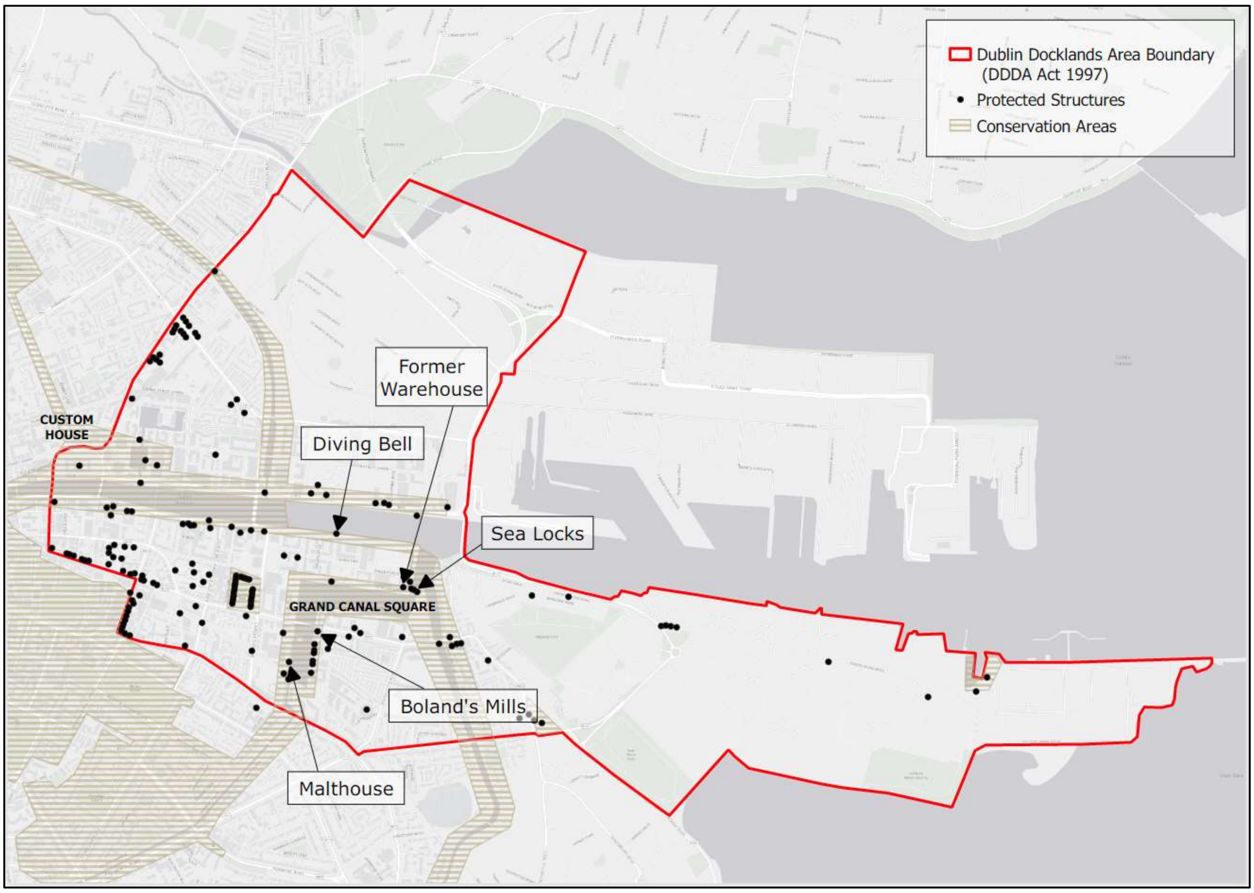


Figure 15.1 Cultural Heritage features within Study area

Many taller modern buildings rise over the historic buildings of the docks in a medley of different forms and materials. The Bord Gáis Energy Theatre is a prominent feature in the landscape. Overall, the development surrounding the docks lacks unity of form, massing or choice of materials, although some harmony is provided by the street pattern which determines the block size. Overall, the built form creates a character of balance between modern development and heritage buildings and features. The heritage elements are closely spatially associated to the basin and have a close visual link though a similar use of materials to the quay walls and surfaces, however, the modern development is more prominent due to its significantly larger massing.

Adjacent to the basin, the visually striking landscape of Grand Canal Square, designed by renowned landscape architect Martha Swartz, is a prominent focal point. This space includes numerous large sculptural poles in bright red, and a public jetty extends out into the basin and site area. This landscape has areas of seating and is well used for passive recreation and is an attractor for visitors to the area. Areas of public space for wrap around the dock. Grand Canal Quay is pedestrianised north of Pearse Street, and there is a strip of public space warping around the basin to the north, providing space for seating and enjoyment of views over the water.

At the time of writing, construction activity can be perceived from the docks and surrounding areas, the development of tall buildings at Boland's Mill being particularly prominent. Noise, visual activity, and visual clutter from construction is common in this rapidly developing corner of the city.

Asgard road is a narrow street between medium-rise blocks of mainly residential and commercial development. A row of small-scale residences faces the street on the western side. Generally, the buildings have active frontages of good architectural quality, and the street has a pleasant, secluded character in contrast to the larger scale open landscape of the docks and the Liffey. Regular street trees soften the street and screen views down to the basin and to the north to the Liffey.

The landscape of SJRQ is defined by its boundary with the River Liffey and views over to the North Lotts on the adjacent bank. Adjacent buildings are relatively bland, large scale and corporate in feel. There is lack of active frontages to buildings and activity on the quay. The lack of established trees lends the area a windswept character. A double width cycle path runs parallel to the road for the length of the quay. Key landscape features include the historic features such as the boat moorings, crane tracks and setts as mentioned in the previous section. The Diving Bell, used for nearly a century for constructing the quay walls of the docks, is located to the west of the site. This is a significant piece of industrial heritage which has been converted into a small museum. This is of high landscape value as a landmark and feature of interest. A small building functioning as a 'Pig Trap' for an underground gas pipeline is located adjacent to where the outfall is to be constructed. This is marked by the words 'Pig Trap' outlined in metal strips embedded into the bitmac cycle path which is in itself an interesting feature.

The basin and the areas of surrounding public open space in Grand Canal Docks are sensitive to infrastructure development due to their historic significance, designation as a conservation area and their high value for recreation and as a landmark destination for the city. Sensitivity is *high*. Sensitivity of Asgard Road and SJRQ is *medium* due to the presence of landscape features of historical importance but its overall lesser landscape amenity value.

The surrounding urban areas have a much greater capacity to absorb change from infrastructure developments and an overall lower landscape value, they are therefore of lower sensitivity. Sensitivity is *low.*

15.3.3 Visual Baseline

Due to the position of the site in a highly developed urban location the quantity of receptors in the receiving environment is very high. The area surrounding the site contains many medium and high rise residential and commercial developments, which overlook the basin and SJRQ and these are likely to be designed to make the most of these views.

Public open spaces form the majority of the areas adjacent to the basin and these are well used due to their clear views over the basin. Grand Canal Square is a key location for visitors to the city due to the interesting landscape design and proximity to Bord Gáis Energy Theatre. SJRQ has appealing views over the Liffey over to buildings in the North Lotts area on the north bank, and to Samuel Beckett Bridge. There are views along from the site area to the Diving Bell further up the quay.

The adjoining streets provide a selection of vistas and viewpoints over the basin; however, these are generally limited in range due to the low level of the basin, and visually constricted character of the streets. Views of the buildings surrounding the basin are much more wide ranging.

Asgard Road is a narrow street between large blocks of development. Views down the street are limited by the narrow nature of the street and by frequent street trees.

Dublin City Development Plan 2016-2022 (DCC, 2016) seeks to protect views and landmarks. Policy SC7 aims to protect and enhance important views and view corridors into, out of and within the city, and to protect existing landmarks and their prominence.

The North Lotts and Grand Canal Dock SDZ Planning Scheme (DCC, 2014) identifies key landmark features within the site context and identifies important Views and Vistas DZP-JBAI-XX-DR-L-0001 (Volume 3, Appendix 15A). Those that are either in close proximity to the site, or form backdrops to views across the site, are as follows:

- Alto Vetro Tower;
- Boland's Mills;
- Old North Wall Railway Station Complex;
- Poolbeg Generating Station Chimneys;
- St. Patrick's Church Spire (Ringsend); and
- The Gasworks.

Of these noted landmarks, the Alto Vetro Tower and Boland's Mills, are the most prominent in the site context. This prominence is due to their height and their location adjacent to the central part of the basin.

There are a number of Designated Views & Prospects described within the North Lotts and Grand Canal Dock SDZ Planning Scheme (DCC, 2014) (refer to Volume 3, Appendix 15A). Some of these cross the site; Vistas from Viewpoints Nos. 1, 7, 8, and 14 cross the southern section of the basin focusing on the Alto Vetro Tower, which is located adjacent to the dock. Three vistas originate from Grand Canal Square and cross the northern part of the site; Vistas from Viewpoints No. 4 and 9 look towards the chimneys of Poolbeg Generating Station and Viewpoint No. 4 looks towards St. Patrick's Church in Ringsend. Viewpoint 15 looks east from Hanover Quay towards Poolbeg Generating Station chimneys, crossing the location of the proposed Main Works Compound.

There are also vistas that pass through the site context, those closest to the site are: Viewpoint No. 16 looks over to the Alto Vetro Tower from the west; Viewpoint No. 12 looks towards the Boland's Mills site, to the landmark buildings which are currently under construction there; Viewpoint 1 looks from Sheriff Street Upper, over the old North Wall railway station building towards The Alto Vetro tower. These viewpoints are generally aimed at landmarks of high elevation and therefore are of generally low susceptibility to changes at ground level.

At the time of writing, construction activity is visible from viewpoints around the docks, the development of tall buildings at Boland's Mill being particularly prominent.

15.3.4 Dublin City Development Plan 2016-2022

Dublin City Development Plan 2016-2022 (DCC, 2016) has the following designations relevant to the landscape and visual aspects of the site and surroundings:

- The basin is designated as Zone Z11, the aim of which is to protect and improve canal, coastal and river amenities;
- The basin and surrounding dock areas are designated as part of the Grand Canal Conservation Area;
- Grand Canal Square; the northern part of Grand Canal Quay; and public open spaces surrounding the basin to the north and east are designated as Zone Z9. The aim of this is to preserve, provide and improve recreational amenity and open space and green networks;
- SDRA6. The designation of the Docklands, including the Docklands SDZ, as a strategic development and regeneration area (SDRA) provides for the continued physical and social regeneration of this part of the city; and
- Z15 "to seek the social, economic and physical development and/or rejuvenation of an area with mixed use of which residential and "Z6" would be the predominant uses".

15.3.5 The North Lotts and Grand Canal Dock SDZ Planning Scheme

The site is included within The North Lotts and Grand Canal Dock Special Development Area. Planning policy for this area is covered in The North Lotts and Grand Canal SDZ Planning Scheme (DCC, 2014)

15.4 Characteristics of the Development

15.4.1 Proposals

The proposed works for the scheme consists of the following:

- Construction of temporary coffer dams and dewatering of areas of the basin to enable construction of 3no. transition chambers;
- Construction of Transition Chamber 1 at chainage Ch.+0m (Starting at southernmost point of development at existing storm water outfall;
- Construction of 5.0 no. 1.5m diameter pipes from chainage Ch.+7.26 – Ch.+310.00m;
- Construction of Transition Chamber 2 at chainage Ch.+310.00 – Ch.+320.00m;
- Construction of Twin 2.4m dimeter pipes from chainage Ch.+320.00 – Ch.+490.00m;
- Construction of Transition Chamber 3 at chainage Ch.+490.00m;
- Construction of 4m wide 2.7m high (internal diameter) pipe on Hanover Quay;

- Construction of new outfall structure at SJRQ on the River Liffey; and
- Construction of permanent floating platform along Grand Canal Quay.

The total length of the pipeline to be constructed is 550m. The proposed works involve 450m of development on the silt bed of the Grand Canal Basin, and 100m along existing road and pedestrian infrastructure, see Figure 2.3 to Figure 2.1 in Section 2 of Volume 2 of this EIAR.

Three temporary cofferdams will be built at each of the transition chambers including:

- Transition Chamber 1 at the existing Grand Canal Tunnel Outfall;
- Transition Chamber 2 at the transition point from the 5 no. 1.5m diameter pipeline to the 2 no. 2.4m diameter pipeline; and
- Transition Chamber 3 at Hanover Quay.

The route is proposed to traverse underwater through the centre of the southern portion of the Basin, pass underneath the MacMahon Bridge, then bear close to the western wall of the Basin. The pipeline will enter Transition Chamber 3 at Hanover Quay and will run underground along the quay before adjoining with the existing pipeline on Asgard Road (see Figure 2.3).

15.4.2 Construction Phase

There will be three construction compounds set up as part of the construction phase. The first compound (Main Works Compound/ Main Compound) will be located at the eastern end of Hanover Quay (drawing 19708-JBB-00-XX-DR-Z-00100, Volume 4, Project Drawings). The second compound (Compound for Inner Basin Works/ Inner Basin Compound) will be located at Grand Canal Quay adjacent to the Irish Waterways Visitors Centre (drawing 19708-JBB-00-XX-DR-Z-00101, Volume 4, Project Drawings). The third compound (SJRQ Compound) will be located at SJRQ, from Asgard Road to Blood Stoney Road (Drawing 19708-JBB-00-XX-DR-Z-00118, Volume 4, Project Drawings).

The Main Compound will be used for the duration of the works, whereas the Inner Basin Compound and SJRQ Compound will be used for a shorter duration during the works in the Inner Basin and SJRQ respectively. There will be temporary road closures and diversions to divert traffic away from working areas. It is not expected that there will be any long-term full closures of any roads. The construction compounds will be accessed by road.

Temporary hoardings will be put in place around land-based works along Hanover Quay and SJRQ and around the construction compounds. Also, temporary hoarding may be put in place to the edge of the construction zones on Grand Canal Quay and Grand Canal Square for works in the outer basin.

The construction phase will entail construction of temporary coffer dams and draining of areas of the basin to allow construction of three transition chambers: a transition chamber between the existing outfall from grand canal tunnel and the proposed pipeline; a transition chamber north of MacMahon Bridge; and the transition chamber between the proposed pipeline and the existing pipeline under Asgard Road. The pipeline between the transition chambers will be laid by crane onto the bed of the basin and will not require draining of these areas of the basin.

Areas of excavation will be carried out on Hanover Quay, Asgard Road and SJRQ. Existing landscape surfacing and street furniture will be reinstated. The wall of the basin will be broken out adjacent to Grand Canal Square to construct the proposed culvert under Hanover Quay that will connect to the existing section of culvert under Asgard Road. A section of the Liffey quay wall will also be broken out for the proposed outfall. This will be reinstated to match the pre-existing as per the advice from DCC City Architects' (Team 9). The requirements include the need for input/ engagement with the DCC Conservation Officer and the DCC Archaeologist prior to the works and a suitably qualified conservation expert to advise on and supervise the works to the Protected Structures.

15.4.3 Operational Phase

The majority of the proposals will be located either underwater or underground. During the operational phase visibility of the proposals will be limited to only the above water sections of Transition Chambers

1 and 2, the proposed floating mooring to Grand Canal Quay, street level access points to inspection chambers i.e. manholes on Hanover and SJRQ, and the outlet to the Liffey at SJRQ.

Transition Chamber 1 will be located adjacent to the existing outfall structure and will be visually similar. A lifting davit will be the most noticeable feature. The floating platforms will stretch along much of the edge of Grand Canal Square and they form the largest visible change to the landscape. Transition Chamber 2 will form part of the ramped access route onto the floating platforms from Grand Canal Quay.

15.5 Potential Impacts

15.5.1 Do-Nothing Impacts

Landscape Impacts

The do-nothing scenario will result in a continuation of the periodic outfall of effluent into the basin and the subsequent decrease in water quality. This has an impact on the suitability of the basin for recreation. The basin is currently used for tourism, water sports and is a central focal point for public open spaces in the surrounding area. Poor water quality due to effluent entering the basin may occasionally make the water hazardous for users, and unpleasant odours may be experienced by users of adjacent areas. There would be a benefit in the short-term due to construction stage effects not occurring. Effects in the operational phase would be *negative, moderate, long-term and intermittent*.

Visual Impacts

Visual impacts are likely to be extremely limited in this scenario. The issues with water quality may affect the appearance of the water in the basin due to eutrophic algae blooms or increase in sediment however this is likely to be low in magnitude. The existing outfall structure would continue to be used which is unsightly but already an established part of the landscape. There would be a positive impact in the short-term due to construction stage effects not occurring. Effects in the operational phase would be *negative, slight, long-term and intermittent.*

15.5.2 Construction Phase

Landscape Impacts in Construction Phase

Temporary hoardings will be put in place around land-based works along Hanover Quay and SJRQ and around the construction compounds. Also, temporary hoarding may be put in place to the edge of the construction zones on Grand Canal Quay and Grand Canal Square for works in the outer basin.

Construction traffic, machinery, materials personnel will form new temporary elements in the landscape. There will be temporary loss of important historical landscape features on site; historic elements such as the quay wall, mooring rings, stone paving, mooring post etc. will be temporarily removed where necessary and reinstated upon completion of the works.

The three site compounds will result in a loss of public open space for the duration of their use throughout the construction phase. Construction access routes will reduce the amount of public space on some areas of Hanover Quay, Grand Canal Quay and SJRQ.

The construction phase will result in a partial, localised and temporary change in the landscape character of some areas of the basin and surroundings area. There would be a partial temporary physical change from areas of public space, including the basin itself, with mainly recreational and boating associated uses, to a series of construction sites. The construction sites would occupy a minority of the basin as a whole but would be on a large enough scale to be a significant proportion of the basin. The construction and compound areas would be spread out across various areas of the basin and would have a temporary, cumulative impact on the basin and surrounding landscape character as a whole.

The construction process would result in an increase in activity and visual clutter, which would have a temporary perceptual impact on the basin and surrounding areas. However, the sequential nature of the construction process will reduce the amount and extents of construction areas that would be in use at any one time thus helping to mitigate the effect.

The docklands have been in nearly constant development over the past two decades. Construction activity is currently clearly evident in the area at the time of writing (the prominent Boland's Mill site) and is likely to continue well into following years for approved applications. The proposals will represent an increase in construction activity however this is arguably characteristic of the area.

The magnitude of change would be locally *high* and the effect would be *temporary, significant, adverse* within the western side of the basin and the landscape of the surrounding public open spaces Grand Canal Quay, Grand Canal Square and Hanover Quay, which are included or adjacent to the proposed works. Beyond these areas the effect on landscape character would be lessened and there would be a gradual reduction of impact towards the eastern side of the basin where the landscape effect would be reduced to *moderate*.

The magnitude of change for the landscape of Asgard Road would be *medium* and the effect would be *temporary, slight adverse*.

For the landscape of SJRQ the magnitude of change would be locally *high* and the effect would be *temporary*, *moderate adverse.* There would be temporary loss of valued features such as a section of quay wall, mooring posts and stone paving. These will be reinstated upon completion of the works. This effect would reduce gradually with distance and beyond 30m would reduce to a *low* magnitude of change and a *slight adverse* effect*.* The effect for the quay as a whole would be *temporary*, *slight adverse*. These spaces would experience a smaller volume of construction and have a lower landscape value than the basin and surroundings. The landscape of SJRQ has a greater capacity to accommodate change due to its larger urban grain and position next to the large expanse of the Liffey. The construction activity will appear relatively insignificant in comparison to the large scale of the surrounding landscape.

The perceptual influence of the works on areas beyond the site and adjacent public open spaces is limited due to the nature of the urban environment. The visual clutter and noise of nearby urban areas, plus awareness of existing construction activity lessens the sensitivity to change from the construction proposals.

Although there would be *adverse significant* landscape effects experienced during the construction phase these will all be *temporary* to *short-term and reversible.*

Visual Impacts in Construction Phase

The construction will result in a change in views from surrounding residential and commercial receptors and those experienced by receptors using adjacent public open spaces. Views from adjacent public open spaces will be changed by the presence of construction machinery, coffer dams, hoarding, construction traffic and activity. Receptors have been given reference numbers for clarity, refer to drawing DZP-JBAI-XX-DR-L-0002 (Volume 3, Appendix 15A). Receptors have been grouped where similar effects are expected.

PUBLIC OPEN SPACE RECEPTORS

POS1 Grand Canal Square (adjacent) This public open space is located adjacent to the west of the basin and benefits from views over the water. It is a landmark attraction close to Dublin City Centre due to its striking landscape design and location next to the docks and the Bord Gáis Energy Theatre.

Sensitivity Receptors would be pedestrian users of the outdoor public space, either visitors or people passing through, whose attention is likely to be focused on the views over the basin. Sensitivity is *high.*

Magnitude The construction of hoarding along the edge of the quay would result in a loss of valued open views across the Liffey to the north and from the north to the south. Views out onto the Liffey will be disrupted by the presence of hoarding (height to be confirmed; expected indicative 2.3m).

There would be an increase in visual clutter and activity within the scene primarily caused by machinery visible over the hoarding. Some internal views through the space would be seen against this backdrop. The magnitude of change would be *high* but temporary.

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *significant, negative, temporary* to *short-term.*

POS2a, POS2b Grand Canal Quay (adjacent and inclusive of site compound) This public open space located adjacent to the west of the basin and benefits from views over the water. It forms part of a wider network of public open space that borders the basin. The northern section north of Pearse Street (POS2a) forms the main pedestrian connection along the western side of the docks. The southern section (POS2b) has vehicular access. The Inner Basin Works Compound would be present within the central portion of the quay, adjacent to the Waterways Ireland Visitor Centre.

Sensitivity Receptors would be pedestrian users of the outdoor public space, either visitors or people passing through, whose attention is likely to be focused on the views over the basin. Motorists would be receptors for the southern section. Sensitivity is *high* for the northern section (POS2a) gradually reducing to *medium* for the southern section (POS2b).

Magnitude The construction of hoarding along the edge of the quay would result in a loss of valued open views across the Liffey to the north and from the north to the south. Views out onto the Liffey will be disrupted by the presence of hoarding (height to be confirmed; expected indicative 2.3m).

There would be an increase in visual clutter and activity within the scene primarily caused by machinery visible over the hoarding and the presence of the Inner Basin Works Compound within the quay. The magnitude of change would be *high* for POS2a gradually reducing to *low* for POS2b and *negligible* south of the DART viaduct.

Effect In accordance with the visual effect would therefore be *significant, negative, temporary* gradually reducing with distance to *imperceptible* towards south of the DART viaduct.

POS3 Hanover Quay (adjacent) This public open space is located adjacent to the north side of the basin and benefits from views over the water. It is a popular and well used due to its valued views, shaded seating areas and city centre location.

Sensitivity Receptors would be pedestrian users of the outdoor public space, either visitors or people passing through, whose attention is likely to be focused on the views over the basin. Motorists would also be a receptor. Sensitivity is *high.*

Magnitude The proposed works would intrude into a significant proportion of the available vistas and would be one of the most noticeable elements. A considerable degree of visual clutter or disharmony is also likely to be generated by the presence of machinery and construction activity, appreciably reducing the visual amenity of the scene. This will be mainly evident towards the western end of the quay where it is closest to the works. The impact would reduce towards the middle of the quay where views of the middle of the Outer Basin would remain largely unchanged. The impact would increase towards the eastern end of the quay, where the Main Works Compound would be located. The magnitude of change would be *high* reducing to *medium* towards the centre of the quay.

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *significant, negative, temporary.*

POS4 Grand Canal Basin (inclusive of site) The basin is a key attraction and highly valued amenity space which is popular due to its use for water sports and other water-based activities.

Sensitivity Receptors would be users of the water whose attention is likely to be focused on the views over the basin. Sensitivity is high.

Magnitude The proposed works would intrude into a significant proportion of the available vistas and would be one of the most noticeable elements. A considerable degree of visual clutter or disharmony is also likely to be generated by the presence of machinery and construction activity, appreciably reducing the visual amenity of the scene. This will be mainly evident towards the western end of the basin where the majority of the works will be carried out. The impact would reduce towards the middle of the Outer

Basin where views would remain largely unchanged. The impact would increase towards the eastern end of the quay, where the Main Works Compound would be located. There would be an overall reduction in the area available for public access and this would have a negative effect on the amount of views able to be experienced by users. The magnitude of change would be *high* reducing to *medium* towards the centre of the Outer Basin.

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *significant, negative, temporary* to *short-term* reducing to *moderate* towards the centre of the Outer Basin.

POS5 SJRQ (adjacent and inclusive of site compound) This public open space includes areas of pedestrianised space and a cycle path. A road runs along its length. There are wide expansive views over the Liffey over to North Lotts on the opposite bank. Views of the Diving Bell and Samuel Beckett Bridge are important vistas.

Sensitivity Receptors would be pedestrian users of the outdoor public space, either visitors or people passing through, whose attention is likely to be focused on the views over the Liffey. Motorists would also be a receptor. The space has features of interest and good views but is a less valued space than Grand Canal Dock and is less unique on a city-wide level. Sensitivity is *medium.*

Magnitude The construction of hoarding along the edge of the quay would result in a loss of valued open views across the Liffey to the north and from the north to the south. Views out onto the Liffey will be disrupted by the presence of hoarding (height to be confirmed; expected indicative 2.3m).

There would be an increase in visual clutter and activity within the scene primarily caused by machinery visible over the hoarding within the quay. These effects would rapidly reduce with distance from the works. For receptors further than 30m from the works, the negative impact in the visual amenity of the scene would be much reduced. From most viewpoints on the quay the proposed works would be a minor element in an expansive landscape. The attention of most receptors would be focused on views of the river, nearby architecture, the Diving Bell or the Samuel Beckett Bridge. The magnitude of change would be *locally high* (within 30m) reducing to *negligible* with distance for viewpoints beyond around 150m.

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *moderate, negative, temporary,* reducing to *imperceptible* with distance for viewpoints beyond around 150m.

POS6 North Wall Quay (inclusive of the site) This public open space includes areas of pedestrianised space with seating along the boundary with the Liffey. A road runs along its length. There are wide expansive views over the Liffey over SJRQ on the opposite bank. Views of the Diving Bell and Samuel Beckett Bridge are important vistas.

Sensitivity Receptors would be pedestrian users of the outdoor public space, either visitors or people passing through, whose attention is likely to be focused on the views over the Liffey. Motorists would also be a receptor. The space has features of interest and good views but is a less valued space than Grand Canal Dock and is less unique on a city-wide level. Sensitivity is *medium.*

Magnitude. From viewpoints on the quay the proposed works compound would be a proportionally minor, yet noticeable element in an expansive landscape. The attention of most receptors would be focused on views of the river, nearby architecture, the Diving Bell or the Samuel Beckett Bridge. The magnitude of change to direct views would be *medium* (directly opposite the compound) reducing to *negligible* as views towards it become more angled.

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *moderate, negative, temporary,* reducing to *imperceptible* for angled views.

<u>RESIDENTIAL RECEPTORS</u>

R1, R02 (80m west) A medium rise block of mixed-use development on SJRQ with largely commercial uses to the northern side (R01) and residential uses to the western side with commercial units on the ground floor (R02). The residences have open views out across the Liffey and to a lesser extent along SJRQ.

Sensitivity Receptors would be residents at home. Sensitivity is *high*.

Magnitude There would be oblique views down SJRQ towards the site. But these would be mainly limited to views from the corner balconies. Internal views would be focused out over the Liffey. The Proposals would form a small proportion of the available views which are expansive. The magnitude of change would be *low.*

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *slight, negative, temporary* to *short-term.*

R03 (110m north) A medium rise block of mixed-use development on Forbes Street, composed of residential development with commercial uses on the ground floor.

Sensitivity Receptors would be residents at home. Sensitivity is *high*.

Magnitude There would be oblique views down Forbes Street to the south towards the edge of the site at Grand Canal Square and north to the works at SJRQ. Views would be very oblique and limited by adjacent buildings. Internal views would be mainly focused out over the street in front of the building. The Proposals would form a very small proportion of the available views which are urban in nature. The magnitude of change would be *low.*

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *slight, negative, temporary* to *short-term.*

R04, R05 (15m south) A medium rise block of mixed-use development on SJRQ, composed of residential development with commercial uses on the ground floor. The development has expansive views out across the Liffey.

Sensitivity Receptors would be mix of commercial staff and residents at home. Sensitivity is *high*.

Magnitude There would be views across the road to the works which would be close to the corner of the buildings at the junction of the quay and Asgard Road. Views would be very clear and not screened and would be experienced from both balconies and from internally within the building. The Proposals would form a very small proportion of the available views which are expansive in nature and focused on the Liffey. The magnitude of change would be *medium.*

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *moderate, negative, temporary to short-term.*

R06 (adjacent to north) This is an area of residential development situated between Forbes Street to the west and Blood Stoney Road to the east. It is situated to the south of blocks adjoining SJRQ (R04 and R05 receptors) to the north, and to the north of blocks adjoining Hanover Quay (R07 and R08 receptors) to the south.

Sensitivity Receptors would be residents at home. Sensitivity is *high*.

Magnitude Views of the proposals would be extremely limited. Views towards the southern end of Asgard Road would be the most affected due to the proximity of works there. There would be oblique views down Forbes street to the south towards the edge of the site at Grand Canal Square and possibly some restricted views north along Asgard Road to the works at SJRQ. Views would be very oblique and limited by buildings bordering the streets. Views would be mainly focused out over the street in front of the buildings or internally into the courtyard spaces present within each block. The proposals would form a very small proportion of the available views which are urban in nature and generally internally focused. The presence of street trees within the area, particularly on Asgard Road, helps mitigate against views. The magnitude of change would be *low.*

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *slight, negative, temporary to short-term.*

R07, R08 (adjacent to north) A medium rise block of mixed-use development on Hanover Quay, composed of residential development with commercial uses on the ground floor. These have clear, uninterrupted, and expansive views over the basin from the southern elevations.

Sensitivity Receptors would be mix of commercial staff and residents at home. Sensitivity is *high*.

Magnitude There would be direct views onto the adjacent works at the southern end of Asgard Road to the south. The majority of the construction site in the basin would be visible from windows and balconies on the southern side of the buildings. There may be glimpsed views of the works on SJRQ for windows on the north side. The Main Works Compound on Hanover Quay would be screened by intervening buildings to the east. The Proposals would form a significant proportion of the available views over the basin, and the works are in close proximity. The magnitude of change would be *high.*

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *significant, negative, temporary to short-term.*

R09 (80m east) A medium rise block of mixed-use development on Hanover Quay, composed of a commercial office block development to the western half and residential development with commercial uses on the ground floor to the eastern half. There are clear, uninterrupted views over the basin from the upper floors; the ground floor views are mainly screened by low dock buildings along the southern edge of the basin.

Sensitivity Receptors would be mix of commercial staff and residents at home. Sensitivity is *high*.

Magnitude There would be direct views onto the works in the basin. The majority of the construction site in the basin would be visible from windows and balconies on the southern side of the buildings that are above the ground floor. There would be oblique views to the west to the works on Hanover Quay/Asgard Road and to the east to the Main Works Compound on Hanover Quay. The Proposals would form a noticeable intrusion into the available views over the basin, however these views are more focused towards the centre of the Outer Basin where no works are taking place. Construction traffic is likely to pass close to the receptors. The magnitude of change would be *medium.*

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *moderate, negative, temporary to short-term.*

R10 (50m north) A medium rise block of largely residential development to the rear of other development on Hanover Quay, composed of residential development with commercial uses on the ground floor. Views are restricted by surrounding buildings, views of the basin are screened by R11.

Sensitivity Receptors would be mix of commercial staff and residents at home. Sensitivity is *high*.

Magnitude Views of the site are restricted by buildings along Hanover Quay. There may be minor glimpsed views of a section of the basin and Hanover Quay where works will not occur but may accommodate occasional construction traffic. The magnitude of change would be *negligible.*

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *slight, negative, temporary to short-term.*

R11 (adjacent to north) A medium rise block of largely residential development on Hanover Quay, composed of residential development with commercial uses on the ground floor. There are expansive, open views onto the basin from the southern elevations with views focused on the Outer Basin nearby to the south.

Sensitivity Receptors would be mix of commercial staff and residents at home. Sensitivity is *high*.

Magnitude There would be views south-west over the works adjacent to Grand Canal Square and Grand Canal Quay. Views would be open but oblique. Views of works in the Inner Basin would be mainly screened. There would be oblique views of the Main Works Compound to the east along Hanover Quay. The Proposals would form a noticeable intrusion into the available views over the basin, however these views are more focused towards the centre of the Outer Basin where no works are taking place. Construction traffic is likely to pass close to the receptors. The magnitude of change would be *medium.*

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *moderate, negative, temporary to short-term.*

R12 (120m south) A medium rise block of residential development on South Dock Road. There are clear expansive views over the Outer Basin.

Sensitivity Receptors would be residents at home. Sensitivity is *high*.

Magnitude Views from the northern elevation of the building are focused to the north over the Outer Basin and towards the location of the Main Works Compound. The works in the Outer Basin would be visible in the distance at the far western end of the basin. The works in the Inner Basin would be screened by intervening buildings. Construction traffic would be visible in the basin and along Hanover Quay. The magnitude of change would be *medium.*

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *moderate, negative, temporary to short-term.*

R13, R16 (120m south-west) Two medium rise blocks of residential development on Charlotte Quay Dock. There are clear expansive views over the Outer Basin from northern elevations.

Sensitivity Receptors would be residents at home. Sensitivity is *high*.

Magnitude Views from the northern elevations of the buildings are focused to the north over the Outer Basin. The works in the outer basin would be visible obliquely at the western end of the basin. The works would be partially screened by intervening buildings to the west. Works in the Inner Basin would be largely screened by buildings, but restricted views would be experienced from the south-western corner of R16. Construction traffic and the Main Works Compound would be visible in the basin and along Hanover Quay from northern elevations. Many views would be focused internally onto the courtyards within the development. Open views over the closest part of the basin will remain unaltered and where visible the works will form a minority of views experienced. The magnitude of change would be *low.*

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *slight, negative, temporary to short-term.*

R17 (85m east) A high rise block and a medium rise block of residential development on Ringsend Road. There are clear expansive views over the Outer and Inner Basin.

Sensitivity Receptors would be residents at home. Sensitivity is *high*.

Magnitude Views from the northern and western elevations have clear views over the work site adjacent to Grand Canal Square/Quay. The works in the Inner Basin would be visible obliquely to the south. The proposal would intrude into a significant proportion of the available vista and would be one of the most noticeable elements particularly for views from lower floors. A considerable degree of visual clutter or disharmony is also likely to be generated, appreciably reducing the visual amenity of the scene. Views from the top floors of the high-rise block would be less affected. The magnitude of change would be *high.*

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *significant, negative, temporary to short-term.*

R18 (95m east) A collection of medium and high-rise blocks of mixed-use development on Barrow Street, including the listed buildings of Bowland Mills. Three tall towers are currently under construction at time of writing and two of these will house office units. Residences will be accommodated in the southern most tower and in the renovated mill building on the edge of the basin.

Sensitivity Receptors would be commercial staff and residents at home. Sensitivity is *high*.

Magnitude The tall office blocks will provide the most expansive views over the basin and the works site. There will be views experienced from the upper floors of the development over much of the work site within the basin and the two construction compounds. The works at SJRQ will not be visible. Views will be focused by the direction of elevations and by adjacent buildings and it will not be possible to view the entire site from any one viewpoint due to its extent and the separated nature of the various sites and compounds. Views from western elevations will be most affected due to their clear views over the work sites in the Inner Basin. The tow residential blocks will have clear views over the Inner Basin area from their western elevations. The Inner Basin Works Compound would be visible on the far side of the basin. The proposed works would occupy a central portion of the Inner Basin and would intrude into a significant proportion of the available views and would be one of the most noticeable elements particularly for views from lower floors. A considerable degree of visual clutter or disharmony is also likely to be generated, appreciably reducing the visual amenity of the scene. The magnitude of change would be *high.*

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *significant, negative, temporary to short-term.*

R19 (55m east) A collection of mixed-use developments including some residential, accommodated within modern and listed historic buildings on Grand Mill Quay. The buildings have clear views over the Inner Basin which is adjacent from their western elevations.

Sensitivity Receptors would be commercial staff and residents at home. Sensitivity is *high*.

Magnitude Views from the western elevations have clear views over the work site in the Inner Basin. The works in the Outer Basin would be visible obliquely to the north. The proposal would intrude into a significant proportion of the available vista and would be one of the most noticeable elements. A considerable degree of visual clutter or disharmony is also likely to be generated, appreciably reducing the visual amenity of the scene. The magnitude of change would be *high.*

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *significant, negative, temporary to short-term.*

R20 (80m east) A medium rise block of mixed-use development including office space and residential units on Barrow Street. There are limited views over the basin from western and northern elevations. These views are either oblique or focused and limited by adjacent buildings. R19 screens views from windows on lower floors.

Sensitivity Receptors would be commercial workers and residents at home. Sensitivity is *high*.

Magnitude Limited views of the works would be experienced from the western and northern elevations. These are restricted by and seen in context of adjacent buildings. The proposals would create a small increase in visual clutter for a limited number of views. Views from the top floors would be most affected. The magnitude of change would be *low.*

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *slight, negative, temporary to short-term.*

R21 (110m south) A medium rise block of residential development on Grand Canal Street Upper.

Sensitivity Receptors would be residents at home. Sensitivity is *high*.

Magnitude There are views of the Inner Basin from the north-west corner of the development, and the proposals would be evident there. Views are limited by surrounding buildings and most of the residences would not experience views of the proposals. The proposals would be seen in the context of existing large-scale development including tall buildings around the docks and the DART railway. There would be a slight increase in visual clutter and activity. The magnitude of change would be *low.*

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *slight, negative, temporary to short-term.*

R22, R23 (83m south) A terrace of two-storey houses on the eastern side of Grand Canal Quay. These include some commercial uses and the Slovakian Commercial Embassy.

Sensitivity Receptors would be commercial staff, embassy staff and residents at home. Sensitivity is *high*.

Magnitude Views of the proposals will be mainly screened by adjacent buildings and the presence of the DART viaduct. Some minor views of the works in the Inner Basin may be present from the top floor windows of R23. The magnitude of change would be *low.*

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *slight, negative, temporary to short-term.*

R24 (40m south) A medium rise block of residential development on Grand Canal Quay, with commercial uses on the ground floor, converted from a Victorian industrial building.

Sensitivity Receptors would be commercial staff and residents at home. Sensitivity is *high*.

Magnitude Views over the works in the Inner Basin would be experienced from the northern elevation. Oblique views may also be experienced from the eastern elevation. The proposed works would occupy the centre of the basin and would include nearby works at Transition Chamber 1. The proposal would intrude into a moderate proportion of the available vista and would be a noticeable element particularly for views from upper floors. A moderate degree of visual clutter or disharmony is also likely to be generated, partially reducing the visual amenity of the scene. However, these will be seen in the context of the adjacent DART railway which is a visual detractor and generates a significant amount of activity. The magnitude of change would be *medium.*

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *moderate, negative, temporary to short-term.*

R25 (adjacent) A five-story converted Victorian listed industrial building on Grand Canal Quay. The eastern elevation provides clear views over the basin

Sensitivity Receptors would be commercial staff and residents at home. Sensitivity is *high*.

Magnitude Clear views would be experienced from the eastern elevation over the work site in the Inner Basin. The works in the Outer Basin would be visible obliquely to the north. The Inner Basin Works Compound would be visible from the northern elevation in the adjacent area to the north. The proposal would intrude into a significant proportion of the available vista and would be one of the most noticeable elements in the view. A considerable degree of visual clutter or disharmony is also likely to be generated, appreciably reducing the visual amenity of the scene. The magnitude of change would be *high.*

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *significant, negative, temporary to short-term.*

R26 (adjacent) A high rise block residential development on Grand Canal Quay known as the Alto Vetro tower, with commercial uses on the ground floor. There are clear expansive views over the Outer and Inner Basin from the northern, southern and eastern elevations.

Sensitivity Receptors would be residents at home. Sensitivity is *high*.

Magnitude Views from the northern, eastern and southern elevations have clear views over the work site across the both the Inner and Outer Basin. The works in the Inner Basin would be visible from the southern elevation and obliquely from the eastern elevation. Balconies on the facades would provide even greater views of the proposals. The proposal would intrude into a significant proportion of the available vista and would be one of the most noticeable elements particularly for views from lower floors. A considerable degree of visual clutter or disharmony is also likely to be generated, appreciably reducing the visual amenity of the scene. Views from the top floors of the high-rise block would be less affected due to their more expansive nature. The magnitude of change would be *high.*

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *significant, negative, temporary to short-term.*

R27 (25m west) A medium-rise block residential development on Grand Canal Quay with some commercial uses on the ground floor. There are clear expansive views over the Outer and Inner Basin.

Sensitivity Receptors would be residents at home. Sensitivity is *high*.

Magnitude Views from the eastern elevations have clear views over the work site adjacent to Grand Canal Square/Quay. The works in the Inner Basin would be visible obliquely to the south. The proposed works would intrude into a significant proportion of the available vista and would be one of the most noticeable elements particularly. A considerable degree of visual clutter or disharmony is also likely to be generated, and screening from the proposed hoarding would limit key views over the basin, appreciably reducing the visual amenity of the scene, particularly for views from lower floors. Views from the top floors of the block would be less affected. Views from the southern elevation are mainly focused onto Pearse Street. The magnitude of change would be *high.*

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *significant, negative, temporary to short-term.*

R28 (105m west) A medium-rise block residential development on Pearse Street with some commercial uses on the ground floor.

Sensitivity Receptors would be residents at home. Sensitivity is *high*.

Magnitude Views are focused onto adjacent streets. There may be very minor views of the proposed works from balconies along the Pearce Street frontage and very oblique views from windows. The magnitude of change would be *negligible.*

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *slight, negative, temporary to short-term.*

COMMERCIAL RECEPTORS

Commercial receptors are generally of lesser sensitivity than residential receptors. Places of work are usually of a low sensitivity due to staff being focused on their work or activity rather than being aware of the surrounding views. In the case of the commercial units in Grand Canal Docks, these have been designed to maximise views over the docks and the quality of the landscape is likely to be an important part of the experience of working in the area. For the purposes of this assessment, commercial receptors have been given a *medium* sensitivity. Receptors not described in this section are expected to have an imperceptible or neutral effect.

C02 (40m north-east) Two commercial buildings overlooking SJRQ. These have expansive views over the quay and the Liffey from their northern elevations.

Sensitivity Receptors would be commercial staff engaged in work activities, with an appreciation of the expansive high-quality views over the Liffey. Sensitivity is medium.

Magnitude Receptors would experience oblique views to the west to the works area on SJRQ. Views over the Liffey are wide ranging and unobstructed, and attention is likely to be distracted by views of the Diving Bell, Samuel Beckett Bridge and features on the far bank of the river. The proposals would represent a very small proportion of the available views. The magnitude of change would be *low.*

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *slight, negative, temporary to short-term*.

C01, C03, C04, C05, C06, C15 and C16 (to perimeter of Outer Basin) Commercial buildings which border and/or overlook the Outer Basin. This includes the Bord Gáis Energy Theatre. These buildings generally have glass facades facing onto the basin, designed to make the most of views out over the water.

Sensitivity Receptors would be commercial staff engaged in work activities, with an appreciation of the expansive high-quality views over the basin. Sensitivity is medium.

Magnitude Receptors to the western end of the Outer Basin would experience views over the proposals from elevations facing the basin. The construction works in the Outer Basin and Hanover Quay for Transition Chamber 2 and 3, the pipeline and the proposed moorings to the edge of Grand Canal Square/Quay would be prominent elements. Construction hoarding to the edge of Grand Canal Quay, construction personnel and machinery would be clearly evident. These elements and would have an impact on the visual amenity of the views. Receptors are likely to be focused on the extensive views over the basin and the proposals would represent a significant proportion of available views. For receptors to the eastern end would be impacted by the presence of the Main Works Compound at the end of Hanover Quay. The magnitude of change would be *high.* The exception would be C03 located in the middle of Hanover Quay which would be more distanced from the proposals and would experience a *medium* magnitude of change.

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *moderate, negative, temporary to short-term,* excluding C03 which would experience a *slight, negative, temporary to short-term* effect.

C14 (106m west) A commercial building which partially overlooks Grand Canal Square and the Outer Basin adjacent to the Bord Gáis Energy Theatre.

Sensitivity Receptors would be commercial staff engaged in work activities, with some appreciation of the high-quality views over the basin. Sensitivity is medium.

Magnitude Views of the proposed works would be only experienced from the north-east corner of the building, and the upper floors of the building which look over Grand Canal Square. Construction hoarding to the edge of Grand Canal Quay, works on the eastern edge of the basin and works along Hanover Quay would be evident and would occupy a moderate proportion of the foreground. Where views of the proposals are experienced, they would be seen against the background of the rest of the Outer Basin and with the foreground of Grand Canal Square which would remain unaltered. The majority of views would be screened by adjacent buildings, and most views would be directed towards these buildings and adjacent streetscapes. The magnitude of change would be *low.*

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *moderate, negative, temporary to short-term,* excluding C03 which would experience a *slight, negative, temporary to short-term* effect.

C09, C17 (to perimeter of Inner Basin) Two commercial buildings which overlook the Inner Basin. These buildings have glass facades facing onto the basin, which are designed to make the most of views out over the water.

Sensitivity Receptors would be commercial staff engaged in work activities, with an appreciation of the expansive high-quality views over the basin. Sensitivity is medium.

Magnitude Receptors would experience views over the proposals from elevations facing the basin. The construction works in the Inner Basin for Transition Chamber 1 and the pipeline would be prominent in the landscape. Visual clutter and activity would be increased and this would have an impact on the visual amenity of the views. Receptors are likely to be focused on the extensive views over the basin and the proposals would represent a significant proportion of available views. Receptors would be impacted by the presence of the Inner Basin Works Compound on Grand Canal Quay. The magnitude of change would be *high.*

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *moderate, negative, temporary to short-term.*

C08, C10, C11, C13, (to within 35m of the Inner Basin) Several medium-rise commercial buildings which overlook the Inner Basin. These buildings are located close to the basin but are separated by other built form such as other buildings or the DART viaduct. The buildings are generally designed to have views over the basin but to a lesser extent than those buildings adjacent to the basin.

Sensitivity Receptors would be commercial staff engaged in work activities, with some appreciation of the expansive high-quality views over the basin. Sensitivity is medium.

Magnitude Receptors would experience views over the proposals from elevations facing the basin. The construction works in the Inner Basin for Transition Chamber 1 and the pipeline would be prominent in the landscape. Visual clutter and activity would be increased, and this would have an impact on the visual amenity of the views. Receptors in these buildings would experience views over the basin, however these are generally restricted by adjacent buildings. Views from upper floor windows would experience the greatest change due to a lesser screening effect. Receptors to the south of the DART railway experience views in the context of the railway line. Some receptors would be impacted by the presence of the Inner Basin Works Compound at on Grand Canal Quay. The magnitude of change would be *low.*

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *slight, negative, temporary to short-term.*

15.5.3 Operational Phase

Landscape Impacts

The vast majority of the changes to landscape fabric of the site will take place underwater or underground. The only parts of the development within the basin that would be visible would be the above-water portions of Transition Chambers 1 and 2, and the proposed floating moorings adjacent to Grand Canal Square. The majority of the transition chambers would be underwater but would have above-water platforms which would be visible. The pipeline will be submerged beneath the water level of the basin to a minimum depth of 1.9m. This will not be visible in normal conditions when the basin is filled. The proposals to Hanover Quay, Asgard Road and SJRQ would be underground with manholes and the outlet structure in the quay wall being the only visible parts. All landscaping and historic features will be reinstated as per existing.

The proposed floating moorings platform are essential to the protection of the pipeline from damage by boats. This will extend along the edge of Grand Canal Quay/Square between the bridge and Hanover Quay. These will be the most visually prominent part of the proposals but are not uncharacteristic of the docks; moorings of a similar type but larger scale are in use within the Inner Basin. The proposed moorings would have an impact on the perceived prominence of the 'jetty' projecting out from Grand Canal Square by reducing the amount of open water surrounding it. This would be slightly detrimental to the appearance of the jetty and Grand Canal Square. Due to elevated nature of Grand Canal Square in relation to the water level this effect will not be apparent from most views within the square itself but would be perceived more form areas around the edges of the basin. When in use the moorings will increase the amount of activity on the water which will be beneficial to the landscape amenity and general character of the docks.

Transition Chamber 1 has an above-water platform of approximately 50m^2 in area, with manhole access points, handrails and a lifting davit. Transition Chamber 1 would be located adjacent to the existing outfall structure which has set a precedent for engineered structures of this kind in the southern section of the basin. The only visible elements of the existing outfall structure are a steel beam superstructure and a chain and post boundary to the edges of the outlet. The steel beam superstructure would be removed as part of the proposals. The above-water elements of the new structure would be utilitarian but of a similar form, function and appearance to the existing. It would result in an increase in the scale and massing of engineered structures in the Inner Basin, but this would be proportionally very small compared to the overall scale of the basin and to the structures already present in the vicinity, such as the DART Viaduct, existing moorings, the Irish Waterways Visitor Centre and the large-scale buildings surrounding the docks. The DART Viaduct and associated overhead power lines and footbridge has a utilitarian appearance which detracts from the quality of the landscape to a degree. The proposed use of natural stone cladding to the walls of the platform will help to integrate the proposal into the landscape.

Transition Chamber 2 would have an above water platform of approximately 30m^2 in area, with manhole access points and handrails. Two access ramps would connect the platform to Grand Canal Quay and the adjacent proposed floating mooring platform. This will double its function as an access route to the moorings and will therefore help to integrate it with the character of the docks. The proposals would form a new utilitarian element in the Outer Basin which will be slightly detrimental to the character locally, but the scale of the structure is relatively small in relation to the overall size of the basin, and to nearby buildings and structures. The above water sections of the platform walls will be clad with natural stone to match the walls of the basin, which will help to the structure to blend into the historic setting.

Outside of the basin, new or existing culverts will carry the sewer flow beneath Hanover Quay, Asgard Road and SJRQ . Evidence of these will only be visible in the form of manhole access points to inspection chambers which will be present on Hanover Quay and SJRQ, and the outfall into the Liffey in the quay wall of SJRQ. Landscape surfaces and street furniture will be reinstated to match the existing appearance.

The proposals will result in a reduction in the amount of open water in the basin; the floating moorings would reduce the open water by 480m^2. This would be a small change relative to the size of the basin, which is approximately 84,000m^2 as a whole, and is in keeping with the present character and intended purpose of the docks. The transition chamber platforms would reduce the open water by approximately 80m^2. This would also be a very small change relative to the size of the basin. The presence of the existing outfall in the southern portion of the basin has already set a precedent for modern utilitarian structures in the basin.

Overall, the proposals would be well integrated into the receiving landscape. The proposals are mainly underwater or underground and visible parts would match the existing character of the docks which has similar features in existence. The scale of the visible changes to the basin will be small in relation to the overall scale of the docks and surrounding development. The presence of detracting features to the southern end of the basin i.e. the existing outfall structure, the DART overhead lines and DART footbridge, means that the proposals would sit well within the setting of the Inner Basin. Transition Chamber 2 will be integrated with the proposed moorings and will be similar to the existing mooring already present in the basin. The visible elements of proposals to Hanover Quay, Asgard Road and SJRQ would be limited to manhole covers and the outfall into the Liffey.

Once operational, the proposals will improve the water quality of the basin making usage for water-based activities safer, and this will have a positive effect on the landscape amenity. The landscape amenity will also be improved by the addition of the floating moorings which will allow a wider range of activities to be undertaken in the Outer Basin. There will be a beneficial change to the character of the docks as a whole through an increase in activity in the basin.

The magnitude of change during the operational phase will be *low* and *positive.* In accordance Table 15.1 and Table 15.2 the visual effect would therefore be *slight, positive and long-term.*

Visual Impacts

The operational phase will result in generally minor changes in views from surrounding residential and commercial receptors and those experienced by receptors using adjacent public open spaces. Receptors have been given reference numbers for clarity, refer to drawing DZP-JBAI-XX-DR-L-0002 (Volume 3,

Appendix 15A). Receptors have been grouped where similar effects are expected. Where the effect on receptors is not described it is expected that the effect will be *imperceptible or neutral*.

PUBLIC OPEN SPACE RECEPTORS

POS1 Grand Canal Square (adjacent) This public open space is located adjacent to the west of the basin and benefits from views over the water. It is a landmark attraction close to Dublin City Centre due to its striking landscape design and location next to the docks and the Bord Gáis Energy Theatre.

Sensitivity Receptors would be pedestrian users of the outdoor public space, either visitors or people passing through, whose attention is likely to be focused on the views over the basin. Sensitivity is *high.*

Magnitude The proposed Transition Chamber 2 and floating moorings will create new features within the views from the square. These will be most visible for receptors close to the edge of the basin. Views of the proposals reduce gradually with distance from the edge until they are screened by the landform. Most internal views within the space will not include views of the proposals due to the low level of the proposals compared to the level of the space. Where visible the proposals will slightly increase the amount of visual clutter. The proposed moorings will reduce the visual prominence of the jetty due to reduction in the amount of open water surrounding it, and this will have a minor effect on the visual appeal of the jetty. The moorings and the expected improvement in water quality created by the proposals would cause in an increase in water-based activity on the basin, and this will have a positive impact on views from the space. On balance the proposals will not detract from the visual amenity of views and the magnitude of change would be *neutral*.

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *imperceptible.*

POS2a, POS2b Grand Canal Quay (adjacent and inclusive of site compound) This public open space located adjacent to the west of the basin and benefits from views over the water. It is forms part of a wider network of public open space that borders the basin. The northern section north of Pearse Street (POS2a) forms the main pedestrian connection along the western side of the docks. The southern section (POS2b) has vehicular access. The Inner Basin Works Compound would be present within the central portion of the quay, adjacent to the Waterways Ireland Visitor Centre.

Sensitivity Receptors would be pedestrian users of the outdoor public space, either visitors or people passing through, whose attention is likely to be focused on the views over the basin. Motorists would be receptors for the southern section. Sensitivity is *high* for the northern section (POS2a) gradually reducing to *medium* for the southern section (POS2b).

Magnitude Transition Chamber 2 and the floating moorings will the most prominent new features within the views from the quay. These will be most visible for receptors close to the edge of the quay and the proposals are likely to be screened behind the edge of the quay for receptors walking along the centre of the quay. Where visible the proposals will slightly increase the amount of visual clutter but they will be seen in the context of the large expanse of water of the basin. The moorings and the expected improvement in water quality created by the proposals would cause in an increase in water-based activity on the basin, and this will have a positive impact on views from the space. On balance the proposals will not detract from the visual amenity of views and the magnitude of change would be *neutral*.

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *imperceptible.*

POS3 Hanover Quay (inclusive of part of site) This public open space is located adjacent to the north side of the basin and benefits from views over the water. It is a popular and well used space due to its valued views, shaded seating areas and city centre location.

Sensitivity Receptors would be pedestrian users of the outdoor public space, either visitors or people passing through, whose attention is likely to be focused on the views over the basin. Motorists would also be a receptor. Sensitivity is *high.*

Magnitude For receptors close to the western end of the quay the proposed Transition Chamber 2 and new moorings will be obvious features in views towards the west. These will be seen in the context of views of Grand Canal Square, the sculptural lighting poles and surrounding development. It would increase the amount of visual clutter around the edge of the basin and would affect the visual appeal of the jetty on Grand Canal Square. Manhole covers would be barely evident in the surface of the quay. Views of the proposals reduce gradually with distance as receptors move to the east. The increase in activity on the basin resulting from improvements in water quality and the provision new moorings would be a positive effect. On balance, there would be no reduction of visual amenity. The magnitude of change would be *neutral*.

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *imperceptible.*

POS4 Grand Canal Basin (inclusive of part of site) The basin is a key attraction and highly valued amenity space which is popular due to its use for water sports and other water-based activities.

Sensitivity Receptors would be users of the water whose attention is likely to be focused on the views over the basin. Sensitivity is high.

Magnitude The proposals would be most visible from locations on the western end of the Outer Basin and the southern end of the Inner Basin. The mooring platforms and transition chambers would be seen against the backdrop of the quay walls, the sculptural lighting poles of Grand Canal Quay and development around the docks. Receptors are likely to be engaged in activities and are likely to be not likely to be focused on the views of the proposals. Where observed the proposals would appear congruous with the surroundings. The magnitude of change would be neutral.

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *imperceptible.*

POS5 SJRQ (inclusive of part of site) This public open space includes areas of pedestrianised space and a cycle path. A road runs along its length. There are wide expansive views over the Liffey over to North Lotts on the opposite bank. Views of the Diving Bell and Samuel Beckett Bridge are important vistas.

Sensitivity Receptors would be pedestrian users of the outdoor public space, either visitors or people passing through, whose attention is likely to be focused on the views over the Liffey. Motorists would also be a receptor. The space has features of interest and good views but is a less valued space than Grand Canal Dock and is less unique on a city-wide level. Sensitivity is *medium.*

Magnitude The proposed works would be barely visible from the quay. Manhole covers would be the most visible elements and would be not easily noticed by the casual observer. The magnitude would be *negligible*.

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *imperceptible.*

POS6 North Wall Quay (120m north) This public open space includes areas of pedestrianised space with seating along the boundary with the Liffey. A road runs along its length. There are wide expansive views over the Liffey over SJRQ on the opposite bank. Views of the Diving Bell and Samuel Beckett Bridge are important vistas.

Sensitivity Receptors would be pedestrian users of the outdoor public space, either visitors or people passing through, whose attention is likely to be focused on the views over the Liffey. Motorists would also be a receptor. The space has features of interest and good views but is a less valued space than Grand Canal Dock and is less unique on a city-wide level. Sensitivity is *medium.*

Magnitude. From viewpoints on the quay the proposed outlet would be visible at low tide and would not be noticed by the casual observer. Attention would be directed over the Liffey and to surrounding features such as the Diving Bell and Samuel Beckett Bridge. The proposals would be a very minor element in an expansive landscape. The magnitude of change would be *negligible* (within 150m) reducing to *negligible* beyond this.

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *imperceptible*.

RESIDENTIAL AND COMMERCIAL RECEPTORS

R07, R08, R09, R11, R12 R13, R15, R16, R17, R27, C01, C03, C15 and C16 (to perimeter of Outer Basin) A selection of residential and commercial buildings which border and overlook the Outer Basin.

Sensitivity Receptors would be commercial staff and residents at home. Sensitivity is *high* at most.

Magnitude Receptors in these buildings would experience views over the proposals from elevations facing the basin. Transition Chamber 2 and the proposed moorings to the edge of Grand Canal Square/Quay would be the most prominent elements. These elements are not likely to be easily noticed by the casual observer and would have a minor impact on the visual amenity of the views. Receptors are likely to be focused on the extensive views over the basin and the proposals would represent a very small proportion of available views. There would be slight increase in visual clutter along the western edge of the basin, however, this type of development would blend well with the existing docklands character and there would not be a sense of disharmony with the surroundings. Where visible the proposals would often be seen with the background of the existing moorings in the Inner Basin. Proposals along Hanover Quay, such as manholes, will be hardly discernible from these buildings, due to their small scale and unobtrusive appearance. Proposals along Hanover Quay, such as manholes, would not be discernible from these buildings, due to their distance and screening by buildings. Some receptors such as R16 and R15 are likely to be almost fully screened by adjacent buildings but there may be some glimpsed views. The magnitude of change would be *low* or *negligible.*

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *slight, negative, and permanent* at most.

R18, R19, R20, R21, R24, R25, R26, C08, C09, C13 (to perimeter of Inner Basin) A selection of residential and commercial buildings which overlook the Inner Basin. They all have clear views over the Inner Basin.

Sensitivity Receptors would be commercial staff and residents at home. Sensitivity is *high*.

Magnitude Receptors in these buildings would experience views over the proposals from elevations facing the basin. Transition Chamber 1 would be the most prominent element for those receptors near to the southern end of the basin, whereas the proposed moorings and Transition Chamber 2 would be the most visible elements for those receptors to the north. Transition Chamber 1 would appear as a continuation of the existing outfall structure and would be of similar scale and massing, the lifting davit would be the most obvious feature, but this is visually similar to the existing outfall superstructure which will be removed as part of the proposals. The moorings blend well into the existing character of the docks. These elements are not likely to be readily noticed by the casual observer and would have a minor impact on the visual amenity of the views. Receptors are likely to be focused on the extensive views over the basin and the proposals would represent a very small proportion of available views. There would be slight increase in visual clutter along the western edge of the basin, however this would be generally seen at distance. Where visible the proposals would often be seen within the same view as the existing moorings in the Inner Basin, and the DART line to the south. Proposals along Hanover Quay, such as manholes, would not be discernible from these buildings, due to their distance and screening by buildings. The magnitude of change would be *low* or *negligible.*

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *slight, negative, and permanent* at most.

R04 and R05 Two medium rise block of mixed-use development on SJRQ, composed of residential development with commercial uses on the ground floor. The development has expansive views out across the Liffey.

Sensitivity Receptors would be commercial staff and residents at home. Sensitivity is *high*.

Magnitude There would be views across the road to the proposals. The visible proposals would be limited to manholes which will be hardly discernible due to their small scale and unobtrusive appearance. Landscaping and historic features currently present will have been reinstated to match the existing. There will be no effect on the visual amenity of views. The outfall itself would not be visible. The magnitude of change would be *neutral.*

Effect In accordance with Table 15.1 and Table 15.2 the visual effect would therefore be *imperceptible.*

15.6 Mitigation Measures

15.6.1 Construction Phase

Temporary hoardings will be put in place around land-based works along Hanover Quay and SJRQ and around the construction compounds. Also, temporary hoarding may be put in place to the edge of the construction zones on Grand Canal Quay and Grand Canal Square for works in the outer basin.

Any temporary removal for construction of existing street furniture, surfaces and historic features will be done in accordance to the advice from DCC City Architects' (Team 9). The requirements include the need for input/ engagement with the DCC Conservation Officer and the DCC Archaeologist prior to the works and a suitably qualified conservation expert to advise on and supervise the works to the Protected Structures. Such structures include the granite ashlar quay walls, stone setts, mooring rings, steps, bollards, lamp standards and crane tracks.

15.6.2 Operational phase

Manholes covers to use materials matching those surrounding by using recessed manhole covers with natural stone inserts.

Handrails and gates to platforms and moorings will be in a style that is sympathetic to the historic setting of the docks but will not be a pastiche by using direct copies of heritage styles. Simple colours and unornamented forms will be used that reflect the bollards, mooring posts and other historic remnants from the industrial use of the docks.

15.7 Residual Impacts

15.7.1 Construction Phase

The proposed mitigation measures would not result in any significant changes to the anticipated effects. There may be a slight reduction in the temporary impacts on views from Grand Canal Quay, Grand Canal Square and SJRQ through the use of more visually permeable hoarding. However, the increase in visibility of views would be balanced by the increased visibility of the construction works, and the impact would vary depending on the stage of construction.

15.7.2 Operational Phase

The proposed mitigation measures would not result in any significant changes to the effects. The scope for mitigation is small and the expected pre-mitigation effects are already insignificant.

15.7.3 Interactions

Impacts on landscape will have an effect on the setting of cultural heritage structures and features.

Impacts from noise and vibration will have an effect on the landscape amenity.

The removal of soils can remove screening properties and influence the visual impact of the proposed project.

15.7.4 Cumulative Impacts

A number of existing/commenced, approved or proposed third-party projects have been identified in the vicinity on the site. These include:

- Alexandra Basin Redevelopment;
- Barrow Street Improvements;
- Inner Basin Boardwalk;
- Boland's Mill;
- Bus Connects;
- Canal Loop Greenway;
- Campshires Public Realm;
- Dart Underground;
- Dodder Greenway;
- Dodder Public Transportation Opening Bridge;
- Dublin District Heating System;
- Dublin Eastern Bypass project;
- Extension of Luas Red Line across the River Liffey;
- Grand Canal Greenway- Grand Canal Dock Section;
- Grand Canal Quay East;
- Liffey Cycle Route;
- Liffey-Tolka Project;
- Maintenance dredging in Dublin Port;
- Malthouse;
- Metrolink;
- MP2 Project, Dublin Port Company;
- North Lotts and Grand Canal Dock SDZ Water Animation Strategy 2018;
- Point Pedestrian Bridge;
- Refurbishment of Camden Lock Gates;
- Ringsend Wastewater Treatment Plant Upgrade;
- South Campshire Flood Defence Wall project;
- Southern Port Access Route;
- Treasury Building; and
- Trinity East Innovation Hub.

Given the submerged nature of the majority of the proposed works, it is expected that the landscape will have a good capacity to absorb developments of a similar type and scale, provided that they are sensitively designed. No irreversible cumulative impacts are expected in the operational phase.

15.8 Monitoring

There would be no need for monitoring for landscape and visual effects.

15.9 References

Dublin City Development Plan 2016-2022.

Environmental Protection Agency (Ireland) (EPA), (2022). *Guidelines on the information to be contained in Environmental Impact Assessment Reports.*

Environmental Protection Agency (Ireland) (EPA), (2017). *Guidelines on the information to be contained in Environmental Impact Assessment Reports, Draft.*

Landscape Institute and Institute of Environmental Management & Assessment, 2013. *Guidelines for Landscape and Visual Impact Assessment 3rd Edition.* Routledge.

SECTION 16: Interactions

16.1 Introduction

This Section of the EIAR addresses the interactions between the various environmental aspects of the proposed Grand Canal Storm Water Outfall Extension (GCSWOE) project. For the purposes of this EIAR, 'interactions' refers to interactions between effects of the proposed development (in isolation) which relate to two or more different environmental topics, as identified in the preceding Sections 5 to 15 of this EIAR. These include Population and Human Health, Biodiversity, Water Quality and Hydrology, Land, Soils, Geology and Hydrogeology, Air Quality and Climate, Noise and Vibration, Traffic and Transport, Archaeology and Cultural Heritage, Waste Management, Material Assets and Landscape and Visual Impact.

Phase 1 of this project was completed in 2002 and comprised the installation of a culvert under Asgard Road between Hanover Quay and SJRQ. Phase 2 of the project is required to complete the proposed GCSWOE project. A detailed description of the proposed project is contained in Volume 2, Section 2 of the EIAR.

For any development with the potential for significant environmental impact there is also the potential for interaction amongst these individual impacts and the result of these interactions may either exacerbate the magnitude of the impact or ameliorate it. As recommended in the EPA 2022 guidelines, where a potential exists for significant environmental impacts to arise as a result of interaction, the relevant EIAR specialist has considered this in their Sections. Mitigation measures have been prescribed in the appropriate Section to address associated effects, as required.

As is standard practice, this Section presents a summary of interactions and interrelationships between different environmental topics which have been identified and addressed in this EIAR. It also considers the potential for mitigation measures prescribed in respect of one particular topic to give rise to unintended negative impacts in respect of one or more other topics, as appropriate.

This Section details the methodology used to assess interactions within different factors, followed by assessment of impact of these interdisciplinary interactions and conclusion.

16.2 Methodology

16.2.1 Legislation

This Section is directed by Article 3 Section 1 (e) of DIRECTIVE 2014/52/EU on the Assessment of the Effects of Certain Public and Private Projects on the Environment.

Article 3 of the Directive states:

1. *The environmental impact assessment shall identify, describe and assess in an appropriate manner, in the light of each individual case, the direct and indirect significant effects of a project on the following factors:*

(a) population and human health;

(b) biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC;

(c) land, soil, water, air and climate;

(d) material assets, cultural heritage and the landscape;

*(e) the **interaction** between the factors referred to in points (a) to (d)*

16.2.2 Guidelines

The assessment of interactions has been undertaken in accordance with the following guidelines:

- Department of Housing, Planning, and Local Government (DoHPLG) (2018), Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment;
- EPA (2022), Guidelines on the Information to be contained in Environmental Impact Assessment Report;
- EPA (2017), Guidelines on the Information to be contained in Environmental Impact Assessment Report, (Draft);
- EPA (2015) Advice Notes on Current Practice in the Preparation of Environmental Impact Statements, (Draft); and
- EC (1999) European Commission Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions.

16.2.3 Assessment of Interactions

The interaction between the various environmental topics have been covered within each of the EIAR Sections, 5 through to 15, of Volume 2 where relevant. A matrix method has been used, in which the environmental components addressed in the previous sections of this EIAR have been placed on both axes of a matrix, these interactions are summarised in Table 16.1 below.

There are cases where an effect on one element of the environment results in an effect on another element. In most cases the effect is automatically considered. For e.g., noise is assessed based on the effect of the proposed GCSWOE project on traffic during construction and the noise that the predicted traffic will generate which is compared with acceptable environmental standards which in turn are based on human health considerations.

To facilitate the understanding of, and interactions between, the various environmental disciplines, a workshop was convened for the environmental specialists and the design team. This workshop identified areas of interaction and the information exchange required to predict the direct and indirect effects of the proposed development. Where potential exists for interaction between two or more environmental topics, the relevant specialists have taken these into account when making their assessment and, where possible, complimentary mitigation measures have been proposed.

The interactions and interrelationships involved knowledge sharing and information exchange in relation to the following elements:

- Design and construction details: The design team provided project specific details to the specialist environmental team to ensure that they had sufficient information to determine the effects on the receiving environment;
- Sensitive receptors: Each specialist provided information on the receptors within their study area and their vulnerability to particular effects arising from the proposed development;
- Baseline and modelling data: For e.g., predicted traffic volumes provided by the traffic specialist were provided to the Noise and Vibration and Air specialists to predict the effects of the proposed development on the noise and air environments. Similarly, water quality modelling results were provided to the Ecologist to assess the potential impacts on the benthic fauna and the consequential effects on the food chain; and
- Impacts and mitigation measures: Each specialist assessed the effect of the other disciplines on the sensitive receptors within his/ her discipline and where necessary recommended that mitigation was provided to meet the necessary environmental standards (where available).

As a result of this collaboration, the interactions and interdependent impacts/effects are addressed in the respective sections within the EIAR and appropriate mitigation and environmental standards recommended. The residual Impacts (which consider interactions) are summarised in Volume 2, Section 18 Summary of Residual Impacts.

Table 16.1 Summary of Interactions

Activity Receptor	Population and human health	Biodiversity	Water quality and hydrology	Land, soils, geology, and hydrogeology	Air quality and climate	Noise and vibration	Traffic and transport	Archaeology and cultural heritage	Waste management	Material assets	Landscape and visual impact
Population and human health		x	✓	x	✓	✓	✓	x	✓	x	✓
Biodiversity	x		✓	✓	✓	✓	x	x	x	x	x
Water quality and hydrology	✓	✓		✓	x	x	x	x	✓	✓	x
Land, soils, geology, and hydrogeology	x	✓	✓		✓	✓	x	✓	✓	✓	✓
Air quality and climate	✓	✓	x	✓		x	✓	x	✓	x	x
Noise and vibration	✓	✓	x	x	x		✓	✓	x	x	✓
Traffic and transport	✓	x	x	x	✓	✓		x	✓	✓	x
Archaeology and cultural heritage	x	x	x	✓	x	✓	x		x	x	✓
Waste management	✓	x	✓	✓	✓	✓	✓	x		x	x
Material assets	x	x	✓	✓	x	x	✓	x	x		x
Landscape and visual impact	x	x	x	✓	x	✓	x	✓	x	x	

✓ = Interaction

x = No interaction

16.3 Interdisciplinary Interactions

The principal interactions requiring information exchange between the environmental specialists and the design team as determined in Volume 2, Section 5 to 15 are presented in Table 16.1 above and summarised below. The corresponding mitigation measures, where required, are not detailed in this Section, and can be found in each specialist Section or in Volume 2, Section 17 Summary of Mitigation.

The project in operational phase is envisaged to have interactive effects between Water Quality and Hydrology and Biodiversity. The removal of the stormwater outfall in the Grand Canal Basin will lead to a reduced input of potentially polluted stormwater. This will have a long-term positive effect as it will improve the water quality within the basin and has the potential to improve the overall WFD status of the waterbody. This will also have a positive effect on the benthic sedimentary habitat and its fauna. The WQM report identified imperceptible change in water quality of Lower River Liffey due to the new outfall. Therefore, any discharge from the new stormwater outfall will not significantly impact on the species and their habitats in the River Liffey and downstream. The interactions are described below.

16.3.1 Population and Human Health

Population and human health frequently interacts with other EIA topics, since environmental changes can directly and indirectly affect the persons who inhabit or travel through the area in question in a variety of ways. In respect of the proposed development, interactions between population and human health (receptor) and the following other environmental topics have been addressed in this EIAR:

- Water Quality and Hydrology;
- Air Quality and Climate;
- Noise and Vibration;
- Traffic and Transport;
- Waste Management; and
- Landscape and Visual Impact.

The commitment to meeting environmental limits will mitigate impacts on population and human health. For e.g., if air quality or noise standards are adhered to then no impact on human health is expected. Similarly, the health implications of water quality are considered acceptable if the water quality standards are achieved. The overall assessment of impacts on human health are summarised in Volume 2, Section 5 Population and Human Health and also in sections below.

16.3.2 Biodiversity

The assessment of impacts on Biodiversity is addressed in Volume 2, Section 6. For the proposed GCSWOE, the interaction of the biodiversity environment with other environmental factors of the EIAR have been identified within the following sections of Volume 2, Section 7 Water Quality and Hydrology and Section 8 Land, Soils, Geology and Hydrogeology.

Water Quality and Hydrology and Land, Soils, Geology and Hydrogeology

As a result of the project, the water quality within the Grand Canal Basin will improve. This in turn will improve aquatic habitats in the basin and the environment for species inhabiting the basin.

Impacts on sediment include disturbance to the silt bed of the Grand Canal Basin from dredging the footprint of the pipeline, lowering pipeline sections and construction of Transition Chambers. This could impact on the quality and distribution of aquatic habitats and species. However, potential impact will be short-term and the pipeline will provide substrate for species to recolonise. Contamination of benthic sediment during construction due to accidental spillages and fugitive emissions could end up in the Grand Canal Basin or River Liffey due to surface water run-off.

The change in water quality of the receiving waters could indirectly impact on ecological receptors downstream. The water quality modelling results of the change in water quality were reviewed to enable impacts to be assessed. The potential impacts and adequate mitigation measures for silt control and pollution control relating to the construction phase are addressed above in Section 6 Biodiversity and Section 8 Land, Soils, Geology and Hydrogeology.

Air Quality and Climate

Refer to Section 16.3.5.

Noise and Vibration

There will be an increase in noise due to construction activity. The results of the noise modelling and surveys were used to assess the impacts on birds (nesting terns). These activities will be short-term during the construction phase of the project. The noise specialist provided the biodiversity specialist with predicted noise levels resulting from the construction and operational phases. No significant impact on the sensitive receptors is predicted. Also, refer to Section 16.3.6.

16.3.3 Water Quality and Hydrology

The assessment of impacts on Water Quality and Hydrology are addressed in Section 7. The interaction of Water Quality and Hydrology with other sections is described below:

Population and Human Health

During the construction phase there is potential for impacts on the water quality within the Grand Canal Basin through resuspension of particles or accidental spill of pollutants. This will impact to varying degrees on the recreational users and water-based residents in the Dock. Silt curtains will be utilised to limit the impacts of potential resuspension in the immediate vicinity of the working area. In the absence of mitigation there is the potential for short-term impact which is moderate adverse in magnitude and moderate negative in significance. The potential impacts and mitigation measures are addressed in Section 5 Population and Human Health and Section 7 Water Quality and Hydrology. No potential impacts on human health as a result of changes in water quality at River Liffey are predicted. The enhanced water quality arising from the proposed development will facilitate growth in the local water activity employment sector.

Biodiversity

Refer to Section 16.3.2.

Land, Soils, Geology and Hydrogeology

Refer to Section 16.3.4.

Waste Management

Refer to Section 16.3.9.

Material Assets

Refer to Section 16.3.10.

16.3.4 Land, Soils, Geology, and Hydrogeology

The assessment of impacts on Land, Soils, Geology and Hydrogeology are addressed in Section 8. The impacts on the land, soils and hydrogeological environments are related to excavation and dredging during the construction phase. There will be no excavation of bedrock or the overlying boulder clay.

The interactions of Land, Soils, Geology and Hydrogeology with other disciplines are as below:

Biodiversity

The excavation run-off to surface water or disturbance to the silt bed of the Grand Canal Basin from dredging the footprint of the pipeline, lowering pipeline sections and construction of Transition Chambers could impact on the quality and distribution of aquatic habitats and species. However, potential impact will be short-term and the pipeline will provide substrate for species to recolonise.

Water Quality and Hydrology

The disturbance and displacement of the silt bed due to construction activities in the Basin and River Liffey will result in the redistribution and suspension of silt and sediments. The impact in the basin will be permanent in duration, small adverse in magnitude and slight negative in significance. There is a significant flow in the Liffey and taking into account the dilution effects and tidal flush the magnitude of the impact will be negligible in magnitude and imperceptible in significance.

The storage of contaminated soils has the potential to be mobilised by rainfall and run-off to surface water (the Basin or the Liffey). The impact will be *temporary in duration, small adverse in magnitude and slight negative in significance.*

Potential impacts during the construction phase also include the potential for leakage or spillage of construction related materials on site. Earthworks for the works on Hanover Quay and SJRQ will also require temporary dewatering to facilitate construction.

As contaminated soil will be removed from site, the contaminant flux to groundwater will be reduced. As such, the predicted impact on the hydrogeological environment is permanent, positive and imperceptible.

Air Quality and Climate

Construction phase activities such as excavations and stockpiling of materials have the potential for interactions between air quality and land and soils in the form of dust emissions. This has potential to impact on sensitive receptors in the area. Impacts and mitigation of dust generation are addressed in Volume 2, Section 9 Air Quality and Climate. The impacts of dust associated with the construction phase are predicted to be imperceptible following implementation of the proposed mitigation measures.

Noise and Vibration

The activities associated with the Land and Soils environment (excavation, transport of contaminated soils) will contribute to the noise emissions from the site. The noise and vibration impacts associated with the works are included in the assessment addressed in Volume 2, Section 10 Noise and Vibration.

Archaeology and Cultural Heritage

Excavations and piling have the potential to damage the existing Quay walls and other structures as a result of vibration and induced earth movements. The potential damage to quay walls as a result of pilling activities could result in an impact that will be moderate adverse in magnitude and significant/moderate in significance.

Waste Management

The soils at Hanover Quay and SJRQ are contaminated. The excavation of contaminated material from Hanover Quay, and SJRQ will require disposal. The impacts and mitigation measures for contaminated soil are detailed in Volume 2, Section 13 Waste Management and Section 8 Land, Soils, Geology and Hydrogeology.

Material Assets

Refer to Section 16.3.10.

Landscape and Visual Impact

The removal of soils can remove screening properties and influence the visual impact of the proposed project. The impact and mitigation measure for this has been assessed in Volume 2, Section 15 Landscape and Visual.

16.3.5 Air Quality and Climate

The assessment of impacts on air quality and climate are addressed in Volume 2, Section 9. The interactions of air quality and climate with other sections are as below:

Population and Human Health

There is an overall low risk of human health related dust impacts as a result of the construction works. The mitigation measures that will be put in place at the proposed development will ensure that the impact of the proposed development complies with all ambient air quality legislative limits and therefore the predicted impact is short-term and imperceptible with respect to human health.

Traffic and Transport

The impacts of the proposed development on air quality are assessed by reviewing the change in annual average daily traffic on roads close to the site. In this assessment, the impact of the interactions between traffic and air quality are considered to be imperceptible. Construction vehicles transporting excavated material off-site may spread dust on the adjoining road network, however following the implementation of the mitigation measures identified in Volume 2, Section 11.6.1, these impacts are predicted to be imperceptible.

Biodiversity

There is the potential for interactions between air quality and biodiversity as works will take place within a section of the Grand Canal proposed Natural Heritage Area (pNHA) (site code 002104). There is the potential for increased NO_X and NO_2 emissions from traffic accessing the site to impact the pNHA. There is no potential for significant impacts to the designated site as a result of traffic emissions. It has been determined that there is an overall low risk of dust related emissions causing ecological impacts. Once the mitigation measures outlined within Volume 2, Section 9.6.1 are implemented dust related impacts are predicted to be short-term, neutral and imperceptible.

Land, Soils, Geology and Hydrogeology

Refer to Section 16.3.4.

Waste Management

The waste generation and transport of waste from site may cause a number of direct and indirect impacts on air quality (dust, odour). However, these impacts will be imperceptible post mitigation measures detailed in CEMP and RWMP addressing inter alia the treatment, storage, and disposal of contaminated material. These plans will be updated and finalised by the Contractor prior to construction commencing. The change in air quality due to additional HGVs to transport contaminated waste material will not be sufficient to give rise to significant impacts.

No other significant interactions with air quality and climate have been identified.

16.3.6 Noise and Vibration

The assessment of impacts on noise and vibration are addressed in Volume 2, Section 10. Noise and vibration levels and limits from traffic and construction machinery has been communicated to other disciplines to facilitate their impact assessment. The development and implementation of an appropriate Construction Noise and Vibration Management Plan will be crucial to ensure that these noise levels can be complied with.

Population and Human Health

Long-term exposure to noise can cause a variety of health effects including annoyance, sleep disturbance, negative effects on the cardiovascular system. The primary noise generating phase of this project is the construction phase which is expected to be short term.

Biodiversity

Impulsive noise such as that arising during construction has the potential to impact on wild birds. Refer to Volume 2, Section 10 for mitigation measures and controls.

Traffic and Transport

Traffic associated with the construction of the proposed project will contribute to an associated increase in road traffic noise levels. In this instance, the construction phase of the project will necessitate delivery of materials to site and removal of spoil. The construction traffic volumes expected will not be sufficient to give rise to significant impacts. Refer to Section 11 for mitigation measures and controls.

Archaeology and Cultural Heritage

Refer to Section 16.3.8.

Landscape and Visual Impact

The Contractor may be obliged to erect temporary acoustic screens around some work areas to reduce noise to public space and nearest noise sensitive receptors. These screens would need to be comprised of solid plywood rather than harris fencing with debris netting.

16.3.7 Traffic and Transport

The assessment of impacts on Traffic and Transport are addressed in Volume 2, Section 11. The interactions of Traffic and Transport with other sections is as below:

Population & Human Health

There will be potential nuisance to the local population resulting from possible traffic delays due to increased traffic associated with the construction of the proposed GCSWOE. However, these impacts are predicted to be imperceptible.

Noise and Vibration

Refer to Section 16.3.6.

Air Quality and Climate

Refer to Section 16.3.5.

Waste Management

Refer to Section 16.3.9.

Material Assets

Refer to Section 16.3.10.

16.3.8 Archaeology and Cultural Heritage

The assessment of impacts on Archaeological and Cultural Heritage features are addressed in Volume 2, Section 12. There may be an interaction of Archaeology and Cultural Heritage with the Landscape and Visual Impact, Noise and Vibration and Lands, Soils, Geology and Hydrogeology.

Lands, Soil, Geology and Hydrogeology

Refer to Section 16.3.4.

Noise and Vibration

Excavations and piling have the potential to damage the existing Quay walls and other structures as a result of vibration. The resultant potential damage to quay walls will be moderate adverse in magnitude and significant/moderate in significance. Any proposed vibration could also have the potential to impact upon archaeological material, but we have no evidence that there is any archaeological material along the route so its immaterial. Further refer to Volume 2, Section 12 Archaeology and Cultural Heritage.

Landscape and Visual Impact

There may be a small visual impact on the quay wall if some of the outfall pipe were to be visible.

16.3.9 Waste Management

The assessment of impacts on Waste Management is addressed in Volume 2, Section 13. The waste generation and transport of waste from site may cause a number of direct and indirect impacts on other environmental aspects such as air quality (dust, odour), traffic, noise, water and human health. However, waste generated from the works is not likely to result in a significant impact on the receiving environment given that standard best practice guidelines and procedures will be followed. Any material arisings from excavation on site will not be reused due to its nature as contaminated material.

Water Quality and Hydrology

The soils at Hanover Quay and SJRQ are contaminated. The excavation of contaminated material from Hanover Quay, and SJRQ will require disposal. The storage of contaminated soils has the potential to be mobilised by rainfall and run off to surface water (the Basin or the Liffey). There is also potential for spillage of contaminated material arising from minor dredging works and piling works in the Basin. Refer to Volume 2, Section 6 Biodiversity and Section 7 Water Quality and Hydrology.

Land, Soils, Geology and Hydrogeology

Refer to Section 16.3.4.

Traffic and Transport

Surplus excavated material will be segregated at source and transferred directly from site by a suitably permitted Waste Contractor to suitably licensed facilities. This can lead to temporary additional increase in traffic and HGVs in the areas. However, post mitigation these impacts will be slight negative short-term impact during construction phase.

Air Quality and Climate

Refer to Section 16.3.6.

Noise and Vibration

Increased road traffic volumes will give rise to an associated increase in road traffic noise levels. In this instance, the construction phase of the project will necessitate delivery of materials to site and removal of spoil. The noise from construction traffic volumes expected will not be sufficient to give rise to significant impacts.

Population and Human Health

The spillage of contaminated waste material into the basin or increased HGVs to transport waste material can have an indirect impact on population and human health.

16.3.10 Material Assets

The assessment of impacts on Material Assets is addressed in Volume 2, Section 14. The interactions between Material Assets and other Sections within this EIAR include, Section 7 Water Quality and Hydrology, Section 8 Land, Soils, Geology and Hydrogeology, and Section 11 Traffic and Transport.

Water Quality and Hydrology

During construction, water-based recreation activities will not be permitted in the vicinity of the works within the Basin. A number of house boats adjacent the Waterways Ireland Visitor Centre will be removed from the Inner Basin, as well as a number of their floating moorings. This will result in a *short-term moderate negative impact* on the recreational activities in the area.

Construction in the vicinity of the 8ft city sewer under the basin bed at MacMahon Bridge has the potential to result in a *very significant temporary negative* impact in the event that the sewer is damaged during construction. Water mains may be required to be temporarily diverted or supported during the construction works.

The improved water quality within the Grand Canal Basin will have a positive impact on the amenity value

Land, Soils, Geology and Hydrogeology

There is a risk of damage upon services and utilities in the area of the proposed works. This may occur during excavation works. Excavations in the vicinity of services such as the high-pressure gas distribution line on SJRQ have the potential to result in a *very significant temporary negative* impact upon Gas Network Ireland service users and built heritage and infrastructure in the local area.

Traffic and Transport

Impacts will occur as a result of traffic diversions, road closures, and additional traffic due to construction traffic and HGV movements etc. At present there are no public transport routes on Grand Canal Quay, Hanover Quay or SJRQ. The proposed development will result *a short-term slight negative* impact during the construction phase.

16.3.11 Landscape and Visual Impact

The assessment of impacts on Landscape and Visual Impact are addressed in Volume 2, Section 15. There is interaction between Landscape and Visual Impact and Archaeology and Cultural Heritage, Land Soils, Geology and Hydrogeology and Noise and Vibration.

Archaeology and Cultural Heritage

The site has high heritage value due to its inclusion within the Grand Canal Conservation Area and the archaeological significance of key features of the landscape including the basin, quay walls and adjacent quays. The heritage elements are closely spatially associated to the basin and have a close visual link though a similar use of materials to the quay walls and surfaces. The Diving Bell, is located to the west of the site. This is a significant piece of industrial heritage and of high landscape value as a landmark and feature of interest. Handrails and gates to platforms and moorings should be in a style that is sympathetic to the historic setting of the docks but should not be a pastiche by using direct copies of heritage styles. Simple colours and unornamented forms should be used that reflect the bollards, mooring posts and other historic remnants from the industrial use of the docks.

Land, Soils, Geology and Hydrogeology

Refer to Section 16.3.4.

Noise and Vibration

Refer to Section 16.3.6.

16.4 Conclusion

This Section has considered the interactions between the individual environmental topics, as identified in this EIAR. It is concluded that all such interactions have been addressed herein (with corresponding mitigation measures prescribed, where needed) such that no significant, negative impacts are likely to occur as a result of same during the construction or operation of the proposed development.

SECTION 17: Summary of Mitigation

17.1 Introduction

This EIAR has assessed the impacts and resulting effects likely to occur as a result of the proposed Grand Canal Storm Water Outfall Extension (GCSWOE) project on the various aspects of the receiving environment.

The proposed GCSWOE project has been designed and will be constructed in a manner that will ensure that the potential impacts on the receiving environment are avoided where possible. Phase 1 of this project was completed in 2002 and comprised the installation of a culvert under Asgard Road between Hanover Quay and SJRQ. Phase 2 of the project is required to complete the proposed GCSWOE project. A detailed description of the proposed project is contained in Volume 2, Section 2 of the EIAR.

In cases where impacts or potential impacts have been identified, mitigation has been proposed to reduce the significance of those impacts. These mitigation recommendations are contained in the specific environmental sections within this document. This Section collates and summarises the mitigation commitments made in Section 5 to Section 15 of this Volume 2 of the EIAR. In addition to the mitigation measures proposed, appropriate management practices and commitments relating to construction activities are also provided.

The EPA *Guidelines on the Information to be contained in Environmental Impact Assessment Report*, 2022 defines mitigation measures as a '*A description of the measures envisaged to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects on the environment and, where appropriate, of any proposed monitoring arrangements.'*

17.1.1 Mitigation

Many potential environmental impacts have been identified that are associated with construction activity and methodology. A Construction Environmental Management Plan (CEMP) has been prepared and is included in Volume 3, Appendix 17A to the EIAR which will be updated and finalised by the Contractor prior to construction commencing. This CEMP incorporates the environmental commitments and mitigation contained in the EIAR and will be further updated to include any conditions that may be attached to a planning permission. The mitigation commitments are summarised in Table 17.1.

Note that in the table below, mitigation measures are itemised and numbered based on the stage that they are relevant to (i.e. construction or operational - C or O) and the Section of the EIAR that they come from. For e.g., mitigation measure C.8.1 relates to construction mitigation measure no. 1 from the Land and Soils Section 8.

A measure can be used to mitigate more than one impact on the receiving environment. This Section is a collated version of the mitigation measures outlined within each individual section, consequently there may be some repetition of the mitigation measures proposed.

17.1.2 Monitoring

Monitoring is also listed under each Section title in Table 17.2 in order to summarise any monitoring requirements identified within this EIAR. Monitoring items are numbered in the same way as mitigation measures.

Table 17.1 Summary of Mitigation Measures

Mitigation Measure No.	Construction/ Operation Phase	Impact/ Topic	Mitigation and Environmental Commitments
General			
C.Gen.1	Construction	Construction Impacts General	A CEMP has been prepared which will be a working document and will be updated and finalised by the Contractor prior to construction commencing. The CEMP regards the guidance contained in the handbook published by Construction Industry Research and Information Association (CIRIA) in the UK, *Environmental Good Practice on Site*, CIRIA 2005. Individual Management Plans relating to Waste Management, Traffic Management, Emergency Response Plans, etc. will be provided by the Contractor during the pre-construction stage to detail how the mitigation measures proposed in the CEMP will be achieved. If planning is approved, any planning conditions and monitoring requirements imposed by the planning authority will be strictly observed.
	Operational		None
Population and Human Health			
C.5.1	Construction	Human Health	The key identified aspects for controlling dust are incorporated into the CEMP prepared in respect of the proposed development. Further, a Dust Management Plan will be prepared by the Contractor to monitor and prevent significant emissions.
C.5.2	Construction	Population	Early consultation has been established between Waterways Ireland and the residents of the 20 houseboats located in serviced moorings in Grand Canal Dock who hold permits allowing them to moor there for up to one year. The timeframe of the proposed works in general and specific works impacting directly on these moorings will be communicated to Waterways Ireland well in advance, to ensure that these long-term residents and any persons proposing to use the short-term visitor moorings during the construction phase are fully aware of the constraints and can make alternative mooring arrangement for the duration as required.
C.5.3	Construction	Human Health	A Detailed Traffic Management Plan will be prepared in consultation with the stakeholders. This will co-ordinate the management of vehicular and pedestrian traffic adjacent to the site including road closures and diversions, to mitigate any traffic congestion or road safety impacts which may arise for road and pavement users. The plan will set out agreed procedures to control the movement of construction traffic and materials entering and leaving the site.

Mitigation Measure No.	Construction/ Operation Phase	Impact/ Topic	Mitigation and Environmental Commitments
C.5.4	Construction	Population	Good engagement will be continued with the water-based recreation businesses operating in the Grand Canal Dock and their clients. This will be required to minimise any impacts on the proposed development on these stakeholders.
C.5.5	Construction	Human Health	The Contractor will be required to develop a comprehensive construction Noise and Vibration Management Plan with best practice being adopted to monitor and limit the hours when high noise levels are permitted; establish channels of communication with stakeholders; select and locate plant to minimise noise levels.
C.5.6	Construction	Population	Temporary hoardings will be put in place around land-based works along Hanover Quay and Sir John Rogerson's Quay and around the construction compounds. Also, temporary hoarding may be put in place to the edge of the construction zones on Grand Canal Quay and Grand Canal Square for works in the outer basin. Refer to Section 15.6.1
C.5.7	Construction	Human Health	For the construction activities within the Basin best practice will be adopted. The use of silt curtains around the works within the basin will contain any resuspended silt particles.
O.5.1	Operational	Human Health	Overall, it has been determined that it is unlikely that there will be many potential negative impacts on population and human health during the operation phase of the scheme, conversely it is considered it will have significant positive impact on the area and the community. Therefore, mitigation measures have not generally been deemed necessary during the operational phase of the proposed development. However, in relation to plant noise the maintenance Contractor will ensure that any works are within the noise limits as set out in the EIAR.
O.5.2	Operational	Population	The vast majority of the changes to the landscape fabric of the site will take place underwater or underground, the design and materials of any new surface features will be sympathetic to the historic setting.
Biodiversity			
C.6.1	Construction	Water Quality	▪ Adoption of a surface water plan including appropriate barrier controls to prevent potentially polluted surface water from the site reaching Grand Canal Basin or the River Liffey (e.g. bunding); ▪ Oil booms and oil soakage pads will be maintained on-site to enable a rapid and effective response to any accidental spillage or discharge. These will be disposed of correctly and records will be maintained by the environmental manager of the used booms and pads taken off site for disposal; and ▪ Fail-safe site drainage and bunding through drip trays on plant and machinery will be provided to prevent discharge of chemical spillage from the sites to surface water.

Mitigation Measure No.	Construction/ Operation Phase	Impact/ Topic	Mitigation and Environmental Commitments
C.6.2	Construction	Pollution Control and Spill Prevention	Preventive Measures: ▪ Daily inspections and maintenance of plant and machinery checking for leaks, damage or vandalism will be made on all plant and equipment. The inspections will be recorded on a sign-off sheet on site; ▪ The site compound storage areas and cleaning areas will be rendered impervious and will be constructed to ensure no discharges will cause pollution to surface or ground waters; ▪ Designated locations for refuelling land-based plant and machinery off site, >100m from waterbody; ▪ Refuelling protocol to include: – Refuelling of barge/vessels to take place at designated area at/adjacent to site compound at Hanover Quay; – Vessels to be securely docked before attempting to refuel; – Clear and easy access for personnel to get from tank on quay to refuelling point on boat/barge; – Refuelling to be carried out under strict supervision of Environmental Officer; – Refuelling by trained, authorised and named personnel only; – Refuelling pipe to be supervised at all times; – Refuelling from storage tank by pump only, with automatic cut-off, and automatic retraction of hose pipe. Adequate length of hose required, to enable full and easy access to fuelling point on vessel; – No fuel to be stored at site compound; and – Spill kits and booms to be available in case of accidental spillage. ▪ Potentially contaminated run off from plant and machinery maintenance areas will be managed within the site compound surface water collection system; and Damaged or leaking containers will be removed from use and replaced immediately.
C.6.3	Construction	Pollution Control and Spill Prevention	Control Measures: ▪ Emergency response awareness training for all Project personnel on-site works; ▪ Appropriate and sufficient spill control materials will be installed at strategic locations within the site and at barge/boat refuelling area at Hanover Quay; ▪ Spills kits for immediate use will be kept in the cab of mobile equipment; ▪ Spill kits will be stored in the site compound with easy access for delivery to site in the case of an emergency. A minimum stock of spill kits will be maintained at all times and site vehicles will carry spill kits at all times. Spill kits must include suitable spill control materials to deal with the type of spillage that may occur and

Mitigation Measure No.	**Construction/ Operation Phase**	**Impact/ Topic**	**Mitigation and Environmental Commitments**
			where it may occur. Typical contents of an on-site spill kit will include the following as a minimum: – Absorbent granules. – Absorbent mats/cushions. – Absorbent booms. – Spill kits will contain gloves to handle contaminated materials and sealable disposal sacks. ▪ Track-mats, geotextile material and drain covers; ▪ Absorbent material will be used with pumps and generators at all times; ▪ All potentially polluting substances such as oils and chemicals used during construction will be stored in containers clearly labelled and stored with suitable precautionary measures such as bunding within the site compound; ▪ All used spill materials e.g. absorbent pads will be placed in a bunded container in the Contractor's compound. The material will be disposed of by a licenced waste Contractor at a licenced facility. Records will be maintained by the environmental site manager; and ▪ All tank and drum storage areas on the site will, as a minimum, be bunded to a volume not less than the following: – 110% of the capacity of the largest tank or drum within the bunded area; or – 25% of the total volume of substances which could be stored within the bunded area. , whichever is greater.
C.6.4	Construction	Silt Control and Sediment Management	▪ ▪ A silt curtain will be installed around the area of works within the Grand Canal Basin. The works within the basin will be carried out in two phases, the inner and outer basin. The silt curtain will be installed to screen the inner basin, i.e. south of MacMahon Bridge. Before works commence in the outer basin, i.e. north of MacMahon Bridge, a silt curtain will also be installed to screen the outer basin area off. The silt curtain is secured to an anchoring system and hangs within the waterbody. The curtain will be in place during the entire phase of the construction; ▪ The silt curtain will be inspected regularly and maintained to prevent failure during the work. Accumulated material upstream of the silt curtain will be carefully

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			removed and properly disposed of. Any accumulated material will be removed before removing the silt curtain; ▪ Any silt to be removed will be in inspected for protected species by ECoW and which will be returned to the Basin; ▪ The silt to be disposed off will be moved to a suitable licensed facility off-site; ▪ Bunding will be installed along Hanover Quay, between the area of works along the quay and the Grand Canal Basin prior to works commencing in this area. All surface water run-off from the construction site will be directed to a temporary facility, where the flow will be attenuated, and sediment allowed to settle. Before passing through a hydrocarbon interceptor prior to discharge. Bunding will only be removed when sediment movement is no longer a risk; ▪ Silt-traps will be maintained and cleaned regularly during the course of site works; and ▪ Lock gates will be kept closed while the construction works take place within the basin. Only necessary controls of water levels within the basin will be permitted.
C.6.5	Construction	Wet Concrete Leachate Control	▪ In order to prevent input of cementitious materials into the Grand Canal Basin from the below water elements of the construction, concrete structural elements will be precast, wherever possible; ▪ Concrete to be used below water will be a concrete mix for aquatic/marine environment, e.g. fast curing with good anti-washout properties; ▪ Where concrete or other wet materials are to be used over/below water, appropriate bunded platforms will be in place to capture any spilled concrete, sealants or other materials; ▪ For construction works within the basin a geotextile screen (silt curtain) and boom with oil barrier will be employed around aquatic works to restrict, silt or oil from polluting the water ; ▪ Batching of concrete will be done off site and delivered to site as required by Readymix truck; ▪ Only designated and trained operators experienced in working with concrete will be employed during the concrete pouring phase; ▪ Raw, uncured or waste concrete will be collected and stored appropriately for disposal by a licensed Contractor in accordance with the Waste Management Plan; ▪ A designated concrete washout area will be contained and impermeable; ▪ Large volumes of water with dissolved concrete can be pumped into a skip to settle out; settled solids will need to be appropriately disposed of off site; and

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			▪ Waters from wash facility will be recycled to the greatest extent feasible and will not be discharged directly to surface water drains, watercourses or soakaways. Waters that cannot be recycled will discharge through silt and full retention oil/petrol interceptor prior to discharge. A regular maintenance programme shall be put in place to ensure that the silt and hydrocarbon interceptors remain effective.
C.6.6	Construction	Biosecurity	Measures will need to be put in place to ensure that there is no spread of invasive non-native species or diseases. There will be no disturbance of the Grand Canal Basin outside of the proposed project area. Sediment removed will be treated as contaminated and disposed of to a licensed facility off site. The Check-Clean-Dry approach will be followed, ensuring that all barges/ boats, PPE and equipment is cleaned before entering and leaving site. For more information refer to: www.nonnativespecies.org/checkcleandry.
C.6.7	Construction	Common tern	An Ecological Clerk of Works (ECoW) will, in the appropriate season and prior to construction works commencing visually check the Camden Lock structure for the Common Tern nest. If deemed necessary, a barrier will be put in place to prevent access to the nest and ensure there is no risk of disturbance during the construction period.
	Operation		None
Water Quality and Hydrology			
C.7.1	Construction	Dredging, pilling and release of suspended solids into surrounding waters	▪ In order to reduce the impact of silt, the Contractor will be required to adopt the use of a silt curtain for the works within the Grand Canal Basin. The silt curtain is to reach from top water level to the bed level. This will limit the silt generated from dispersing through the Basin. ▪ The contractor will prepare and implement a surface water plan including appropriate barrier controls to prevent potentially polluted surface water from the site reaching Grand Canal Basin or the River Liffey (e.g. bunding). ▪ The dispersion of mud will be controlled at entry and exits to the site using wheel washes and/or road sweepers, and tools and plant must be washed out and cleaned

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			in designated areas. Containment of wheel washings for treatment prior to discharge will be required. ▪ Where sheet piles and cofferdams are being installed, the contractor will update the CEMP and provide method statements as to how the proposed mitigation measures will be achieved to minimise the disturbance and resuspension of sediments in the water. ▪ Silt fencing/curtain or similar shall be installed along/around excavated ground where the risk of sediment runoff to the River Liffey or the Grand Canal basin exists. ▪ Bunding will be installed along Hanover Quay, between the area of works along the quay and the Grand Canal Basin prior to works commencing in this area. All surface water run-off from the construction site shall be directed to a temporary facility, where the flow will be attenuated, and sediment allowed to settle, before passing through a hydrocarbon interceptor prior to discharge. Bunding should will only be removed when sediment movement is no longer a risk.
C.7.2	Construction	Contaminated soils and surface run-off	▪ Silt-traps will be maintained and cleaned regularly during the course of site works. ▪ Lock gates will be kept closed while the construction works take place within the basin. Only necessary controls of water levels within the basin will be permitted. ▪ In order to prevent input of cementitious materials into the Grand Canal Basin from the below water elements of the construction, concrete structural elements shall be precast, wherever possible. ▪ Concrete to be used below water shall be a concrete mix for aquatic/marine environment, e.g. fast curing with good anti-washout properties. ▪ Where concrete or other wet materials are to be used over/below water, appropriate bunded platforms shall be in place to capture any spilled concrete, sealants or other materials. ▪ Concrete mixing must be undertaken in designated impermeable areas to reduce the risk of runoff entering surface or groundwater environment. ▪ On-site concrete batching and mixing activities will only be allowed at the identified construction compound areas. ▪ A geotextile screen and boom with oil barrier will be required around such aquatic works to prevent runoff, silt or oil from polluting the water. ▪ Concrete waste and wash-down water will be contained and managed on site to prevent pollution of all surface watercourses.
C.7.3	Construction	Accidental spillages	▪ Measures set out in the Construction Industry Research and Information Association (CIRIA) on the control and management of water pollution from construction sites (2006) shall be adhered to by the Contractor. Good construction management practices will be employed.

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			▪ During the construction stage, all potentially harmful substances (e.g. oils, diesel, concrete etc.) will be stored in accordance with the manufacturer's guidelines regarding safe and secure buildings/compounds. ▪ The contractor will ensure that adequate means to absorb or contain any spillages of these chemicals are available at all times. Suitable measures will be taken to minimise the potential for pollution arising from accidental spillage. ▪ Oil booms and oil soakage pads will be maintained on-site to enable a rapid and effective response to any accidental spillage or discharge. These will be disposed of correctly and records will be maintained by the environmental manager of the used booms and pads taken off site for disposal. ▪ Bunding through drip trays on plant and machinery will be provided to prevent discharge of chemical spillage from the sites to surface water. ▪ The site compound storage areas and cleaning areas will be rendered impervious and will be constructed to ensure no discharges will cause pollution to surface or ground waters. ▪ Designated locations for refuelling land-based plant and machinery off site, >100m from waterbody; ▪ Refuelling protocol to include: – Refuelling of barge/vessels to take place at designated area at/adjacent to site compound at Hanover Quay; – Vessels to be securely docked before attempting to refuel; – Clear and easy access for personnel to get from tank on quay to refuelling point on boat/barge; – Refuelling to be carried out under strict supervision of Environmental Officer; – Refuelling by trained, authorised and named personnel only; – Refuelling pipe to be supervised at all times; – Refuelling from storage tank by pump only, with automatic cut-off, and automatic retraction of hose pipe. Adequate length of hose required, to enable full and easy access to fuelling point on vessel; – No fuel to be stored at site compound; and – Spill kits and booms to be available in case of accidental spillage. ▪ Potentially contaminated run off from plant and machinery maintenance areas will be managed within the site compound surface water collection system. ▪ Spill kits will be stored in the site compound with easy access for delivery to site in the case of an emergency. A minimum stock of spill kits will be maintained at all times and site vehicles will carry spill kits at all times. Spill kits must include

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			suitable spill control materials to deal with the type of spillage that may occur and where it may occur. ▪ Leaking or empty oil drums shall be removed from site immediately and disposed of via an appropriately licensed waste disposal contractor. ▪ All hazardous substances on-site shall be controlled within an enclosed storage compounds that shall be fenced off and locked when not in use to prevent theft and vandalism. ▪ The appointed contractor shall ensure that no harmful materials shall be deposited into the River Liffey or the Grand Canal Basin, including the drainage network, on or adjacent to the site.
C.7.4	Construction	Biosecurity	The eradication of the invasive species from freshwater systems is virtually impossible, so biosecurity measures will be required to ensure that the proposed development does not result in their spread to other waterbodies.
C.7.5	Construction	Flood risk	As a significant number of people will be located at the compound during the construction phase, a number of measures shall be put in place to minimise flood risk. It is recommended that the finished floor level of the compound be constructed at a level greater than the 0.5% AEP flood level at the site. The 0.5% AEP coastal flood level nearest to Compound 3 is +3.11mOD, therefore the FFL of the compound shall be set above this level. Any materials stored shall be carefully stored to prevent spillage in the event of an extreme flood.
	Operation		None
Land, Soils, Geology and Hydrogeology			
C.8.1	Construction	Management of Contaminated Material and Spoil Disposal	In order to mitigate potential impacts associated with contaminated material and spoil disposal, the contract documents for the scheme will include the following provisions: ▪ All unsuitable (contaminated) material will be disposed of in accordance with all relevant legislation; ▪ Material that cannot be re-used will be handled in accordance with the Landfill Directive (2003/33/EC); ▪ The Contractor will be required to update and finalise the RWMP addressing inter alia the treatment, storage, and disposal of contaminated material. This will provide details of the exact methods it is proposed to employ to remove spoil from the site and will include details of the location and end use of the spoil;

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			▪ As soil characteristics will vary during the construction operations, the Contractor will be required to implement, prior to the commencement of construction works, and thereafter maintain throughout the construction phase a comprehensive environmental monitoring programme in respect of the soil characteristics. If necessary, disposal outlets will be modified to ensure continuous compliance with all relevant regulations and with this EIAR; and ▪ A Project Waste Manager will be appointed by the Contractor to oversee the implementation and adherence to the plan during the construction phase of the project.
C.8.2	Construction	Dredging and silt displacement and mobilisation	In order to reduce the impact of silt, the Contractor will be required to adopt the use of a silt curtain for the works within the Grand Canal Basin. The silt curtain is to reach from top water level to the bed level. This will limit the silt generated from dispersing through the Basin.
C.8.3	Construction	Ground Movements and damage to quay walls	All construction methods employed must protect the existing quay walls and other structures from damage. Management of vibration and earth movement will be required for the proposed works on Hanover Quay and SJRQ. In order to mitigate potential impacts the contract documents for the proposed works will include the following provisions: ▪ Condition surveys of the adjacent structures will be carried out prior to construction to provide a baseline for excavation monitoring and piling works; ▪ Appropriate batters or appropriate temporary works solutions such as sheet piling and trench boxes will be adopted during excavations above groundwater to ensure cut face stability; ▪ Settlement monitoring will be carried out during construction to ensure settlements are within tolerable limits; and ▪ A specialist design and methodology to be approved by the Employer. <u>Hanover Quay</u> A sheet piled wall will not be permitted to be used to construct Transition Chamber 3 or the 2.7m by 4.0m culvert section in Hanover Quay. Construction will be carried out behind a secant wall. The use of secant piled wall will minimise working width, contain the existing contaminated material, limit any water ingress from the Basin and

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			surrounding ground and reduce vibration mitigating the impact on the Quay walls and nearby buildings. Sir John Rogerson's Quay (SJRQ) Continuous Flight Augur (CFA) piling will be used to install the outfall structure and culvert on SJRQ. Due to the fact that this a non-percussive piling technique this option will inherently reduce the level of piling vibration generated.
C.8.4	Construction	Temporary construction dewatering	Where excavations extend below groundwater, appropriate retention and construction dewatering systems will be adopted to mitigate the potential effects of drawdown on nearby structures, roads and major services. Piled cofferdams and secant piled walls will be installed. These structures will provide a barrier to prevent groundwater inflows during excavation. Consequently, only the groundwater contained within the sealing wall will need to be pumped. No significant volumes of water will be abstracted during dewatering operations. The abstracted groundwater will be groundwater that currently discharges to the Liffey as baseflow. The proposed dewatering exercise is not considered likely to result in significant effects on the hydrogeological environment. The Contractor will be required to apply for a Section 16 wastewater discharge licence for the disposal of groundwater.
C.8.5	Construction	Accidental spillage	Measures set out in the *Construction Industry Research and Information Association* (CIRIA) on the *Control and Management of Water Pollution from Construction Sites* (2006) will be adhered to by the Contractor. Good construction management practices will be employed. During the construction stage, all potentially harmful substances (e.g. oils, diesel, concrete etc.) will be stored in accordance with the manufacturer's guidelines regarding safe and secure buildings/compounds. The Contractor will ensure that adequate means to absorb or contain any spillages of these chemicals are available at all times. Suitable measures will be taken to minimise the potential for pollution arising from accidental spillage.
O.8.1	Operation	Management of Contaminated Material and Spoil Disposal	Excavation of contaminated material will take place from open trench excavations on Hanover Quay and SJRQ. Surplus material may take place within the Basin also when positioning the pipeline. All surplus materials will be treated as contaminated material and will be disposed of in accordance with relevant legislation including the Department of the Environment and Local Government (DoELG) (1996 to 2008), Waste Management

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			Acts, the DoELG (1998) Waste Management (Permit) Regulations, and the NRA (2008) Guidelines for the Management of Waste from National Road Construction Projects.
Air Quality and Climate			
C.9.1	Construction	Dust	The proactive control of fugitive dust will ensure the prevention of significant emissions. The key aspects of controlling dust are listed below. ▪ Hard surface roads will be swept to remove mud and aggregate materials from their surface while any un-surfaced roads will be restricted to essential site traffic; ▪ Any road that has the potential to give rise to fugitive dust will be regularly watered, as appropriate, during dry and/or windy conditions; ▪ Vehicles exiting the site will make use of a wheel wash facility where appropriate, prior to entering onto public roads; ▪ Vehicles using site roads will have their speed restricted, and this speed restriction will be enforced rigidly. On any un-surfaced site road, this will be 20 kph, and on hard surfaced roads as site management dictates; ▪ Public roads outside the site will be regularly inspected for cleanliness and cleaned as necessary; ▪ Material handling systems and site stockpiling of materials will be designed and laid out to minimise exposure to wind. Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods; and ▪ During movement of materials both on and off-site, trucks will be stringently covered with tarpaulin at all times. Before entrance onto public roads, trucks will be adequately inspected to ensure no potential for dust emissions. At all times, these procedures will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, movements of materials likely to raise dust would be curtailed and satisfactory procedures implemented to rectify the problem before the resumption of construction operations.
	Operational		None
Noise and Vibration			

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C.10.1	Construction	Noise Levels	The Contractor will ensure that construction noise levels are limited to 65 dB $L_{Aeq,16hour}$ at the nearest noise sensitive location. To mitigate impacts as a result of vibration the following thresholds will not be exceeded. Allowable vibration (in terms of peak particle velocity) at the quay walls outside of the permitted works area should not exceed: ▪ 3 mm/s at less than 10 Hz; ▪ 3 – 8 mm/s at 10 to 50 Hz; and ▪ 8 – 10 mm/s at 50 to 100 Hz (and above). For soundly constructed property and similar structures that are generally in good repair, a threshold for minor or cosmetic (i.e. non-structural) damage should be taken as a peak component particle velocity (in frequency range of predominant pulse) of; ▪ 15 mm/s at 4 Hz ▪ 20 mm/s at 15 Hz and ▪ 50 mm/s at 40 Hz and above. The Contractor will be required to develop a comprehensive construction Noise and Vibration Management Plan having de regard to the best practice outlined in BS 5228-1:2009+A1:2014 and BS 5228-2:2009+A1:2014. Amongst others, it is proposed that the following practices be adopted as a matter of course: ▪ Limiting the hours during which site activities likely to create high levels of noise are permitted; ▪ Establishing channels of communication between the Contractor, local authority and residents; ▪ Appointing a site representative responsible for matters relating to noise; ▪ Monitoring typical levels of noise during critical periods and at sensitive locations; ▪ Selection of plant with low inherent potential for generation of noise; ▪ Siting of noisy plant as far away from sensitive properties as permitted by site constraints; and ▪ To ensure all plant is serviced and maintained and the plant used is of latest technology with inbuilt noise mitigation.

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C.10.2	Construction	Noise Management	The impact assessment conducted for the construction activity during the construction phase has highlighted that the predicted construction noise levels will be within the adopted criteria Nevertheless, it will be a requirement for the Contractor to employ and implement best practice construction noise and vibration management techniques throughout the construction phase in order to further reduce the noise and vibration impact to nearby noise sensitive receptors. In the first instance, the Contractor will compile a Noise and Vibration Management Plan (NVMP) which will deal specifically with management processes and strategic mitigation measures to remove or reduce significant noise and vibration impacts, and cumulative noise and vibration impacts from the construction works. The Plan will also define noise and vibration monitoring and reporting. The NVMP will also include method statements for each phase of the works, the associated specific measures to minimise noise and vibration in so far as is reasonably practicable for the specific works covered by each plan and a detailed appraisal of the resultant construction noise and vibration generated.
C.10.3	Construction	Noise Management	The Contractor will provide proactive community relations and will notify the public and vibration sensitive premises before the commencement of any works forecast to generate appreciable levels of noise or vibration, explaining the nature and duration of the works. The Contractor will distribute information circulars informing people of the progress of works and any likely periods of significant noise and vibration. With regard to potential mitigation measures during construction activities, the standard planning condition typically issued by DCC states: *“During the construction and demolition phases, the proposal development shall comply with British Standard 5228 “Noise Control on Construction and open sites Part 1. Code of practice for basic information and procedures for noise control.”* The BS5228 standards include guidance on several aspects of construction site mitigation measures, including, but not limited to: ▪ selection of quiet plant; ▪ control of noise sources; ▪ screening;

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			▪ hours of work; ▪ liaison with the public; and ▪ monitoring. Noise control measures that will be considered include the selection of quiet plant, enclosures and screens around noise sources, limiting the hours of work and noise monitoring.
O.10.1	Operation	Noise Levels	The appointed maintenance Contractor will ensure that the works will be undertaken in a manner that ensure that the limits set are achieved.
Traffic and Transport			
C.11.1	Construction	Traffic Management Plan	Construction related HGV trips will adhere rigidly to the DCC HGV Management Strategy and associated cordon. A Preliminary Traffic Management Plan will be drafted by the Project Supervisor Design Process for the works in full consultation with DCC, An Garda Síochána, the Fire Service and the Ambulance service prior to the issuing of tender documents. When the works are awarded to a Contractor, the Preliminary Traffic Management Plan will be developed by the Project Supervisor Construction Phase into a Detailed Traffic Management Plan in full consultation with the same stakeholders. All traffic management plans, including working times, will be agreed with and approved by Dublin City County Council Transportation Department in advance of implementation.
C.11.2	Construction	Traffic	Either a stop and go or a temporary traffic signal system will be utilised to maintain two-way traffic flow on SJRQ where possible. Delivery vehicles will not utilise Blood Stoney Road to access the works site. Tracked excavators will be moved to and from the site on low-loaders and will not be permitted to drive on the street pavements. The Contractor is to arrange for staff parking at on-site facility. Contractor's, Subcontractor's or supplier's vehicles or staff vehicles, or any vehicles associated with the works are not permitted to park, idle or queue on the public road network.

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C.11.3	Construction	Dust and construction material	Wheel washers / judder bars will be placed at all site access points to minimise the migration of detritus onto the public roads, where appropriate. The roads will be inspected and cleaned on a regular basis. Haul vehicles will be covered after loading to ensure there is no risk of construction material falling or to any prevent any nuisance due to dust particles. Water bowsers will be deployed within the sites during periods of hot weather to damp down potential dust generation from unbound surfaces.
C.11.4	Construction	Abnormal load	An Application for an Abnormal Load Permit will be made to DCC in advance for any abnormal loads exceeding the thresholds laid out in the Road Traffic (Construction and Use of Vehicles) (S.I. No. 5/2003) Regulations 2003. Where possible abnormal load movements will be restricted to evening or night-time to minimise disruption to local traffic and traffic on strategic routes.
	Operation		None
Archaeology and Cultural Heritage			
C.12.1	Construction	Pre-construction survey and agreements	The following mitigation measures will be carried out before Construction Works commence. ▪ A conservation expert (Grade 1 Conservation Architect preferably) with proven and appropriate expertise shall be employed to design, manage, monitor and implement all proposed new work from initial concept design stage through to construction stage and to ensure adequate protection of the historic fabric during the work. In this regard, all permitted works shall be designed to cause minimum interference to the structures and/or fabric. All works to the historic fabric shall be carried out in accordance with best conservation practice and the Architectural Heritage Protection Guidelines for Planning Authorities (2011) and Advice Series issued by the Department of the Environment, Heritage and Local Government. Any repair works shall retain the maximum amount of surviving historic fabric in situ. Items to be removed for repair off-site shall be recorded prior to removal, catalogued and numbered to allow for authentic re-instatement. All existing original features, in the vicinity of the works shall be protected during the course of the refurbishment works. All repair of original fabric shall be scheduled and carried out by appropriately experienced conservators of historic fabric. The architectural detailing

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			and materials in the new work shall be executed to the highest standards so as to complement the setting of the protected structure and the historic area; ▪ Prior to the commencement of works a detailed pre-construction survey of the location of the outfall at SJRQ will be carried out and elements of SJRQ to be impacted upon will be recorded. This will include features within the works area such as cobbling, metal tracks, stone setts (also identified as historic street surfaces in Appendix 6 of the Draft Dublin City Development Plan 2022-2028 and protected in accordance with Policy BHA 18(a))and bollards that are part of the quays and any features that are deemed of archaeological or architectural importance that might be impacted upon by the proposed works., The survey will include detailed plans and elevations of the quay wall at the outfall exit location crossed referenced against detailed photographic record; detailed set of drawings will be prepared, cross-referenced against marked-up photographs (to-scale photogrammetric survey)of the historic vertical and horizontal surfaces of the area to record the condition of the historic surfaces and to inform any repairs required. This will be carried out using a drone photographic survey, superimposed / cross referenced at scale on a set of CAD drawings so as to identify the presence of such features and to calculate the area of historic surfaces that may be impacted by the development and to identify the necessary repairs; ▪ Prior to the commencement of works a detailed pre-construction survey of the location of Transitional Chamber 3 at the junction of Grand Canal Docks and Hanover Quay will be carried out and elements of the north wall of the Grand Canal Docks along Hanover Quay to be impacted upon will be recorded. This will include any features within the works area such as the iron mooring points and stone steps and any other features that are deemed of archaeological, cultural heritage or architectural importance that might be impacted upon by the proposed works. The survey will include detailed plans and elevations of the quay wall at the outfall exit location; detailed set of drawings will be prepared, cross-referenced against marked-up photographs (to-scale photogrammetric survey)of the historic vertical and horizontal surfaces of the area to record the condition of the historic surfaces and to inform any repairs required. This will be carried out using a drone photographic survey, superimposed / cross referenced at scale on a set of CAD drawings so as to identify the presence of such features and to calculate the area of historic surfaces that may be impacted by the development and to identify the necessary repairs; and ▪ Prior to the commencement of works the removal of sections of wall (including as of yet unidentified sections) will be agreed in writing with both the City Archaeologist and Conservation Officer. The removal of quayside fixtures will also

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			be agreed in writing with the City Archaeologist/Conservation Officer prior to removal.
C.12.2	Construction	Quay walls	The following mitigation measures will be carried out during the construction phase. ▪ The perimeter of the temporary construction compound at Hanover Quay will be placed at 1m distance from the edge of the quay wall. This will ensure that the cast iron moorings are outside the compound and will not be impacted. If for any reason this is not possible then the moorings will be removed for the duration of the works, stored safely and re-instated on completion. Any historic surfaces deemed vulnerable will be protected. A conservation specification and methodology for this aspect of the work shall be prepared by the conservation professional and submitted to the Conservation Officer for their written agreement in advance of works commencing. This will fully mitigate any impact on this part of Hanover Quay. No ground works are proposed within either compound area; and ▪ Any quayside masonry and/or associated fixtures and fittings that require removal as part of the development will be recorded in advance, retained and every attempt will be made that these are re-instated. Where re-instatement is not possible suitable long-term storage or re-use options will be agreed in advance with the Dublin City Archaeologist and Conservation Officer.
C.12.3	Construction	Groundworks	▪ As pre-development test excavation of areas to be impacted is not feasible due to the nature of works and location, monitoring of all groundworks will be necessary. Therefore it is recommended that prior to groundworks/excavation a conservation specification and methodology for the careful lifting, protecting, and setting aside of the historic surfaces shall be prepared by the conservation professional and submitted to the Conservation Officer for their written agreement in advance of works commencing. Subsequently, following lifting of these historic surfaces in line with the agreed specification and methodology, breaking and removal of the deposits will be carried out by a suitably qualified archaeologist in line with a method statement prepared and approved by the City Archaeologist, and under Licence from the Department of Housing, Local Government & Heritage in consultation with the National Museum of Ireland . Should significant archaeological material be identified during works, preservation in situ where possible or preservation by record is recommended where other mitigation measures are not possible. This will require strategies to be implemented that will require consultation with the Department of Housing, Local Government & Heritage and the Dublin City Archaeologist and Conservation Officer of Dublin City Council; and

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			▪ Should any previously unknown, concealed historic fabric is discovered / uncovered in the course of opening up / excavation / construction work, the Conservation Officer shall be contacted and informed so as agree in writing a preferred methodology for its careful and authentic reinstatement.
C.12.4	Construction	Underwater Archaeology	▪ In the underwater areas (the area of the Grand Canal Basin and the River Liffey) archaeological monitoring during excavation/ moving of silts will be required by a suitably qualified archaeologist with maritime experience who will monitor the material being disturbed from the basin and riverbed. Provisions will be made to fully resolve any archaeological material/ features/ deposits observed during the monitoring.
	Operation		None
Waste Management			
C.13.1	Construction	Excavated Material	The surplus material arising from piling works and from excavated soil from open trench works on Hanover Quay and SJRQ will not be reused on site and will be transported offsite to a suitably licenced acceptance facility. The Contractor will be responsible for ensuring compliance with statutory obligations for the collection and transport of waste. All material will be treated as contaminated material and will be disposed of at suitably licenced facilities. Actions regarding waste material and removal will be undertaken as per the Guidelines for the Management of Waste from National Road Construction Projects, Transport Infrastructure Ireland, 2017.
C.13.2	Construction	Redistribution of displaced soil and silts	Within the basin, waste will be minimised by the redistribution of displaced soil and silts. Redistribution of suitable displaced material will not extend more than 10 metres from the pipeline structure and will not raise the bed level above the top of the structure (0.8 mOD) on the basin bed thus maintaining the minimum draught for boat traffic within the basin. Resuspension of sediments will be confined within silt curtains during the construction stage in the basin.
C.13.3	Construction	Management Plans and Contract Documents	Management Plans including method statements will be developed for excavations and construction activities that may encounter contaminated or hazardous material.

Mitigation Measure No.	Construction/ Operation Phase	Impact/ Topic	Mitigation and Environmental Commitments
			In order to mitigate potential impacts associated with contaminated material and silt/ soil disposal, the contract documents for the proposed development will include the following provisions: ▪ The Contractor will be required to update and finalise the CEMP during the pre-construction phase of the proposed development; ▪ The Contractor will be required to update and finalise the RWMP addressing inter alia the treatment, storage, and disposal of contaminated material. ▪ A Project Waste Manager will be appointed by the Contractor to oversee the implementation and adherence to the Waste Management Plan during the construction phase of the proposed development. ▪ All contaminated material will be disposed of in accordance with all relevant legislation including the Department of the Environment and Local Government (DoELG) (1996 to 2008) Waste Management Acts, the DoELG (1998) Waste Management (Permit) Regulations, the Guidelines for the Management of Waste from National Road Construction Projects (TII, 2017), East-Midland Region Waste Management Plan (2015-2021), and the Landfill Directive (2003/33/EC). ▪ All waste will only be removed by Waste Contractors authorised under the Waste Management (Collection Permit) (Amendment) Regulations (2008). ▪ Waste will be delivered to authorised waste facilities in accordance with the Waste Management Acts 1996-2010.
C.13.4	Construction	Contaminated and hazardous material	Other mitigation measures include: ▪ Fuels, waste fuels, and waste materials will be stored temporarily in designated areas that are isolated from surface water features. Skips will be closed over/ covered to prevent materials being blown or washed away and to reduce the likelihood of contaminated water leakage. ▪ All hazardous materials including waste oil, solvents, paints, and soil etc. will be stored in sealed containers and kept separate from inert waste materials while awaiting collection from the appropriate waste carrier. ▪ Re-fuelling, lubrication, storage areas and site offices will follow best practice procedures when setting up, operating, and taking down near surface water bodies. ▪ Contaminated soils will be removed as soon as possible from active working areas. ▪ Any potential hydrocarbon or hazardous material spills will be reported immediately to the following authorities, EPA, DCC, and the Eastern Regional Fisheries Board. ▪ A separate container will be located in the Contractors compound to store absorbents used to contain spillages of hazardous materials. The container will be

Mitigation Measure No.	Construction/ Operation Phase	Impact/ Topic	Mitigation and Environmental Commitments
			clearly labelled and the contents of the container will be disposed of by a licenced Waste Contractor at a licenced site. Records will be maintained of material taken off site for disposal. ▪ All such spills will be recorded on an Incident Report Form. ▪ On site segregation of waste materials will be carried out to increase opportunities for off-site recycling and disposal especially for waste generated at site compounds such as organic waste, packaging waste, mixed dry recyclables and mixed dry non-recyclable. ▪ A maintenance programme for the bunded areas will be managed by the site environmental manager. The removal of rainwater from the bunded areas will be their responsibility. Records will be maintained of materials taken off site for disposal. ▪ Drainage collection system for washing area to prevent run-off into surface water system.
O.13.4	Operation	Maintenance	The maintenance activities for the pipeline and the disposal of any waste arising as part of these activities will be done in accordance with relevant guidance documents and policies. No other mitigation measures are proposed for the operational phase of the project.
Material Assets			
C.14.1	Construction	Utilities	Mitigation by avoidance will be the primary mitigation measure implemented during the proposed development. This will be applied during the construction phase in the avoidance of utilities such as underground services. Consultation has been undertaken with utility providers to determine the location of services prior to commencement of works. Management plans including method statements and risk assessments will be developed for excavations in proximity to underground utilities. Where excavations of intrusive works are located nearby utilities it may be necessary to have a plant protection officer/ representative from the respective utility provider onsite during the works. Any required supervision of excavation works nearby utilities will be agreed with the respective utility provider. In particular detailed individual method statements will be provided by the Contractor and developed in consultation with respective utility owner with respect to the 8ft city sewer under MacMahon Bridge and the high-pressure gas mains on SJRQ.

Mitigation Measure No.	Construction/ Operation Phase	Impact/ Topic	Mitigation and Environmental Commitments
			Any necessary re-routing of utilities will be identified and agreed with the relevant utility provider. A record of the position, size and type of all services encountered or affected by the works will be documented. Access to the existing fire hydrants along the Grand Canal Quay, Hanover Quay and SJRQ will not be hindered.
C.14.2	Construction	Landscape, Visuals and Archaeology	Sensitive design in temporary works will be undertaken. Temporary hoardings will be put in place around land-based works along Hanover Quay and SJRQ and around the construction compounds. Also, temporary hoarding may be put in place to the edge of the construction zones on Grand Canal Quay and Grand Canal Square for works in the outer basin. Any existing street furniture, surfaces, and historic features such as the granite ashlar quay walls, stone setts, mooring rings, steps, bollards, lamp standards and crane tracks, which are to be temporarily removed for construction, will be done so under supervision of a qualified archaeologist and catalogued Following the construction phase, the Campshires will be reinstated as existing. The extent of the existing quay wall requiring demolition to allow for the installation of the culvert will be minimised. Care will be taken not to damage the existing stone as they will be reinstated around the culvert structure. All construction works will be temporary and carried out in accordance with best practice guidelines to minimise impacts upon receiving communities.
Landscape and Visual			
C.15.1	Construction	Landscape and Visuals	Temporary hoardings will be put in place around land-based works along Hanover Quay and SJRQ and around the construction compounds. Also, temporary hoarding may be put in place to the edge of the construction zones on Grand Canal Quay and Grand Canal Square for works in the outer basin. Any temporary removal for construction of existing street furniture, surfaces and historic features will be done in accordance to the advice from DCC City Architects' (Team 9). The requirements include the need for input/ engagement with the DCC Conservation Officer and the DCC Archaeologist prior to the works and a suitably qualified conservation expert to advise on and supervise the works to the Protected Structures.

Mitigation Measure No.	Construction/ Operation Phase	Impact/ Topic	Mitigation and Environmental Commitments
			Such structures include the granite ashlar quay walls, stone setts, mooring rings, steps, bollards, lamp standards and crane tracks.
O.15.1	Operation	Landscape and Visuals	Manhole covers to use materials matching those surrounding by using recessed manhole covers with natural stone inserts. Handrails and gates to platforms and moorings will be in a style that is sympathetic to the historic setting of the docks but will not be a pastiche by using direct copies of heritage styles. Simple colours and unornamented forms will be used that reflect the bollards, mooring posts and other historic remnants from the industrial use of the docks.

Table 17.2 Summary of Monitoring Requirements

Monitoring Measure No.	Construction/ Operation Phase	Impact/ Topic	Monitoring Requirements
General			
	Construction		
	Operation		None
Population and Human Health			
C.5.1	Construction	Population and Human Health	Specific Health and Safety monitoring will be carried out in line with the Site Management Plan and Building Certification Regulations.
	Operation		None
Biodiversity			
C.6.1	Construction	Water Quality	The Grand Canal Basin will be monitored during the construction phase of the project to check for the level of suspended solids in the water at different locations while works are taking place within the Basin. If a significant increase of suspended solids is recorded, the works will be temporarily stopped and be re-assessed and further mitigation measures be put in place before works can continue.
O.6.1	Operation	Water Quality	During the operational phase, the water quality in the River Liffey will be monitored by the EPA (as part of the WFD). DCC will monitor the water quality from the new stormwater outfall. The water monitoring will enable comparison with the results of the modelling of the predicted water quality to ensure there will be no negative impact on River Liffey and downstream habitats and species. Adequate measures will be taken if the monitoring finds the discharge to have a negative impact on water quality and such measures take the Water Framework Directive into account.
Water Quality and Hydrology			
C.7.1	Construction	Water Quality	The Grand Canal Basin will be monitored during the construction phase of the project. The monitoring will measure the level of suspended solids in the water at different locations within the basin while works are taking place within the Grand Canal Basin. If a significant increase of suspended solids be recorded, the works will be temporarily stopped and be re-assessed and further mitigation measures be put in place before works can continue.
O.7.1	Operation	Water Quality	During the operational phase, the water quality in the River Liffey will be monitored by the EPA (as part of the WFD). DCC will monitor the water quality from the new stormwater outfall. The water monitoring will enable comparison with the results of the

Monitoring Measure No.	Construction/ Operation Phase	Impact/ Topic	Monitoring Requirements
			modelling of the predicted water quality to ensure there will be no negative impact on River Liffey and downstream habitats and species. Adequate measures will be taken if the monitoring finds the discharge to have a negative impact on water quality and such measures take the Water Framework Directive into account.
Land, Soils, Geology and Hydrogeology			
C.8.1	Construction	Contaminated Soil	Any excavation will be monitored during earthworks to ensure the stability of side slopes and to ensure that the soils excavated for disposal are consistent with the descriptions and classifications according to the waste acceptance criteria testing carried out as part of the site investigations.
C.8.2	Construction	Ground Movements	Movement monitoring will be carried out during any activities which may result in ground movements or movements of any nearby structures.
	Operation		None
Air Quality and Climate			
	Construction		None
	Operation		None
Noise and Vibration			
C.10.1	Construction	Noise and Vibration	Noise and vibration monitoring will be undertaken during the construction phase at the nearest noise sensitive location to the works area. Noise and vibration monitoring will be undertaken in accordance with Iarnród Éireann requirement at Transition Chamber 1. Vibration monitoring will also be completed during piling work at the Outfall works area.
	Operation		None
Traffic and Transport			
	Construction		None
	Operation		None
Archaeology and Cultural Heritage			
C.12.1	Construction	Groundworks	Archaeological monitoring of all ground disturbance associated with the proposed development with the provision for recording and excavation (if required) will mitigate

Monitoring Measure No.	Construction/ Operation Phase	Impact/ Topic	Monitoring Requirements
			any potential impact and preserve any archaeological, architectural and cultural heritage features identified by record.
	Operation		None
Waste Management			
C.13.1	Construction	Groundworks	All excavation will be monitored during earthworks to ensure that the soils excavated for disposal are consistent with the descriptions and classifications according to the waste acceptance criteria testing carried out as part of the site investigations.
	Operation		None
Material Assets			
C.14.1	Construction	Utilities	Monitoring of material assets, will involve supervision of buried utilities where open trench excavation is scheduled. This will occur, at the discretion of the relevant utility provider, at Hanover Quay, and SJRQ. The present utilities here include: ▪ Hanover Quay: BT Ireland, E-Net, ESB, Gas Networks Ireland, IW, Virgin Media. ▪ SJRQ: BT Ireland, E-Net, ESB, Eir, Gas Networks Ireland, IW.
	Operation		None
Landscape and Visual			
	Construction		None
	Operation		None

SECTION 18: Summary of Residual Impacts

This Section collates and summarises the residual impacts predicted in Section 5 to Section 15 in this Volume 2 of the EIAR resulting from the proposed Grand Canal Storm Water Outfall Extension (GCSWOE) project on the various aspects of the receiving environment.

The proposed GCSWOE project has been designed and will be constructed in a manner that will ensure that the potential impacts on the receiving environment are avoided or mitigated where possible. Phase 1 of this project was completed in 2002 and comprised the installation of a culvert under Asgard Road between Hanover Quay and SJRQ. Phase 2 of the project is required to complete the proposed GCSWOE project. A detailed description of the proposed project is contained in Volume 2, Section 2 of the EIAR.

The residual impacts are the impacts that remain following the implementation and incorporation of the mitigation measures and environmental commitments summarised in Volume 2, Section 17 Summary of Mitigation. Ideally, in cases where a negative impact has been predicted, the residual impact following the implementation of mitigation measures and good construction practice will be "Neutral". However, in a few isolated cases, despite the fact that steps have been taken to minimise the impact, a residual negative impact remains. Where an impact is positive no mitigation is required.

On the basis of the assessment of potential impacts and the recommended mitigation measures in this EIAR, the proposed GCSWOE project is not likely to impose any significant adverse effects on the environment. Table 18.1 below lists the residual impacts (both positive and negative) of the proposed project following mitigation. The majority of impacts on the environment are either non-existent or of imperceptible/slight significance.

Table 18.1 Summary of Residual Impacts

Impact/Topic	Construction/ Operation Phase	Residual Impact	Significance
Population and Human Health	Construction	Once the mitigation measures as proposed are implemented no residual significant impacts are expected to arise as a result of the construction and operation of the proposed development. However, the overall proposed development will result in a slight negative short-term impact during construction phase.	Short-term, Slight Negative
	Operation	The Dublin Port Company have indicated that berthing at the SJRQ may be restricted in the vicinity of the outfall. This will result in *slight negative long-term effect* during the operational phase. However, the proposed development will result in *slight to moderate, long-term and positive* impacts on population and human health during the operation phase.	Long-term, Slight Negative Long-term, Slight to Moderate Positive
Biodiversity	Construction	The construction of the new stormwater outfall will cause a re-suspension of sediment within the Grand Canal Basin and potential pollution incidents caused by accidental spills or leaks, e.g. oil/ diesel from machinery and concrete. Silt and pollutants have the potential to be transported in water and thus impact on ecological features downstream, such as the Lower River Liffey, aquatic fauna, and the ecological features of Dolphin's Dublin Docks pNHA, i.e. the Common Tern population. There is also the potential for disturbance of the nesting Common Tern pair at the Camden Lock structure. Mitigation measures are being implemented, including pollution control, silt management control, and concrete leachate control to prevent any adverse effects on receiving ecological features. An EcoWwill inspect the nesting site of the Common Tern prior to construction and a barrier will be put in place if required to prevent disturbance. There will be a temporary loss of benthic habitat at the footprint of the pipeline within the Grand Canal Basin and a small permanent loss of *Fucus ceranoides (*Horned Wrack*)* on reduced salinity eulittoral rock habitat at the outfall at SJRQ. The benthic habitat is anticipated to naturally recolonise after construction and the *Fucus ceranoides (*Horned Wrack*)* on reduced salinity eulittoral rock habitat will be partly recolonised. No mitigation measures are proposed.	Temporary, Slight Negative

Impact/Topic	Construction/ Operation Phase	Residual Impact	Significance
		With the implementation of proposed mitigation measures in place for the protection of surface water, the residual impact of the construction phase is assessed to be of temporary slight negative impact on account of the loss of habitat within the Grand Canal Basin and quay wall.	
	Operation	There will be a permanent slight reduction of the quay wall habitat area (74.75m^2) at SJRQ due to the new outfall. However, in the context of the total area of quay wall habitat along the Lower River Liffey it is anticipated to have a negligible impact on this habitat of local value. The removal of the stormwater outfall in the Grand Canal Basin will lead to a reduced input of polluted water. This will have a long-term positive effect as it will improve the water quality within the basin and has the potential to improve the overall WFD status of the waterbody. This will also have a positive effect on the benthic sedimentary habitat and its infauna. The residual impact during operation is assessed to be positive due to the improvement of water quality within the Grand Canal Basin. The discharge from the combined stormwater overflow outfall will cause a very slight change in water quality in the River Liffey. The WQM report has shown that the hydrodynamic properties of the River Liffey will dilute and disperse contaminants over relatively short spatial scales with changes in pollution concentrations from the baseline being less than 1% in much of the Lower Liffey. There will be no discernible change in the ability to meet the surface water environmental quality standards (EQS). The WFD status for the Lower Liffey Estuary and Dublin Bay will remain good.	Grand Canal Basin: Long-term, Moderate Positive River Liffey: Slight/Imperceptible
Water Quality and Hydrology	Construction	On implementation of the appropriate mitigation measures, it is expected that the potential impact during construction will be effectively mitigated. The residual impact of the construction phase is assessed to be of small adverse magnitude and slight negative significance and temporary in duration on account of the short-term works to be carried out in the basin.	Temporary, Small adverse, slight negative
	Operation	The removal of the stormwater outfall from the Grand Canal Basin will lead to a reduced input of polluted water to the basin. This will have a long-term positive effect as it will improve the water quality within the basin and has the potential to improve the overall WFD status of the waterbody. The residual impact during	Grand Canal Basin: Long-term, Positive

Impact/Topic	Construction/ Operation Phase	Residual Impact	Significance
		operation is assessed to be *positive* due to the improvement of water quality within the Grand Canal Basin. The discharge from the combined stormwater overflow outfall will cause a very slight change in water quality in the River Liffey. The WQM report has shown that the hydrodynamic properties of the River Liffey will dilute and disperse contaminants over relatively short spatial scales with changes in pollution concentrations from the baseline being less than 1% in much of the Lower Liffey. There will be no discernible change in the ability to meet the surface water environmental quality standards (EQS). The principal operating impact of the extension of the stormwater outfall to River Liffey will be a change in the water quality of the receiving waters. The impact will be *slight/imperceptible*. There will be no change in the WFD status of the Lower River Liffey or Dublin Bay. There will be no impact on the designated bathing waters of Dublin Bay.	River Liffey: Slight/Imperceptible
Land, Soils, Geology and Hydrogeology	Construction	Once the mitigation measures as proposed are implemented, no residual significant impacts on the land soils and hydrogeological environment are expected to arise as a result of the construction of the proposed development.	Neutral
	Operation	Once the mitigation measures as proposed are implemented, no residual significant impacts on the land soils and hydrogeological environment are expected to arise as a result of the operation of the proposed development.	Neutral
Air Quality and Climate	Construction	Air Quality- Once the dust minimisation measures outlined in Section 9 are implemented, the impact of the proposed development in terms of dust soiling will be short-term, negative, localised and imperceptible at nearby receptors.	Short-term, Negative, Imperceptible
		Climate- According to the IAQM guidance site traffic, plant and machinery are unlikely to have a significant impact on climate. Therefore, the predicted impact is neutral, short-term and imperceptible.	Short-term, Neutral, Imperceptible
		Human Health- Best practice mitigation measures are proposed for the construction phase of the proposed development which will focus on the pro-active control of dust to minimise generation of emissions at source. The mitigation measures that will be put in place during construction of the proposed development will ensure that the impact of the development complies with all EU ambient air quality legislative limit values which are based on the protection of human health (see Table 9.1).	Short-term, Negative, Imperceptible

Impact/Topic	Construction/ Operation Phase	Residual Impact	Significance
		Therefore, the impact of construction of the proposed development is likely to be negative, short-term, localised and imperceptible with respect to human health.	
	Operation	There are no predicted impacts to air quality or climate as a result of the operational phase of the proposed development.	Neutral
Noise and Vibration	Construction	Once the mitigation measures as proposed are implemented, no residual significant noise or vibration impacts are expected to arise as a result of the construction of the proposed development.	Neutral
	Operation	Once the mitigation measures as proposed are implemented, no residual significant noise or vibration impacts are expected to arise as a result of the operation of the proposed development.	Neutral
Traffic and Transport	Construction	The proposed development will result in a slight negative short-term impact during construction phase due to construction traffic trips and temporary traffic management measures.	Short-term, Slight Negative
	Operation	The proposed development will result in no long-term impacts during the operation phase.	Neutral
Archaeology and Cultural Heritage	Construction	If the mitigation measures above are fully implemented there will be no residual impacts on the archaeological, architectural or cultural heritage resource as any features of significance would be preserved either in situ or by record.	Neutral
	Operation	There will be no residual impacts during the Operational phase as there are no Impacts or Mitigation proposed for this phase.	Neutral
Waste Management	Construction	The potential impacts associated with construction phase include the risk of spillage of contaminated material and hydrocarbons as previously mentioned. However, the risk of this is low given that best practice guidelines (mitigation measures) will be followed. As previously mentioned, waste generated from the works is not likely to result in a significant impact on the receiving environment given that standard best practice guidelines and procedures will be followed.	Short-term, Neutral, Imperceptible

Impact/Topic	Construction/ Operation Phase	Residual Impact	Significance
		Consequently, the resultant impact from the proposed development in relation to waste management is *short term, neutral and imperceptible*.	
	Operation	In terms of waste management there are no identified potential impacts associated with the operational phase of the proposed development.	Neutral
Material Assets	Construction	There will be a *short term moderate negative* impact on the public amenity of the Basin itself, the Grand Canal Docks, and SJRQ during the construction phase. This will be due to visual impact, recreation, removal of available public space, construction noise, and traffic diversions. There will be a *short-term moderate negative* impact on residents in the immediate vicinity of the Grand Canal Docks and SJRQ from construction activities, most notably, noise, dust, vibration, visual impact, and traffic disruptions. There will be a *slight negative* impact on traffic during the construction phase due to diversions, road closures, and additional traffic due to construction traffic and HGV movements etc.	Short-term, Moderate Negative
	Operation	River Liffey There will be a *not significant temporary negative* impact on the receiving waters of the River Liffey during the operational phase of the proposed development. This will occur when there is an overflow from the Storm Water Outfall Extension. This is not anticipated to noticeably reduce the amenity value of the River Liffey or to impact upon its users. Grand Canal Basin There will be a *significant permanent positive* impact on the amenity of the Grand Canal Basin for recreational users and the public as a result of the proposed development from moving the Storm Water Outfall to the River Liffey where it will be better assimilated. Utilities Following reinstatement there will be no negative impacts on material assets during the operational stage. Other	River Liffey- Temporary, Not Significant, Negative Grand Canal Basin- Permanent, Significant, Positive

Impact/Topic	**Construction/ Operation Phase**	**Residual Impact**	**Significance**
		The Dublin Port Company have indicated that berthing at the SJRQ may be restricted in the vicinity of the outfall. This will result in *slight negative long-term effect* during the operational phase.	Other- Slight Negative, Long-term
Landscape and Visual Impact	Construction	The proposed construction works mitigation measures would not result in any significant changes to the anticipated impacts There may be a slight reduction in the temporary impacts on views from Grand Canal Quay, Grand Canal Square and SJRQ through the use of more visually permeable hoarding. However, the increase in visibility of views would be balanced by the increased visibility of the construction works, and the impact would vary depending on the stage of construction.	Landscape- Western side of basin, spaces Grand Canal Quay, Grand Canal Square and Hanover Quay - Temporary, Significant, Adverse Asgard Road- Temporary, Medium Slight Adverse SJRQ- Temporary, Moderate Adverse Visuals- Grand Canal Square- Temporary to Short-term, Significant, Negative, Grand Canal Quay-Temporary, Significant, Negative Hanover Quay- Temporary, Significant, Negative Grand Canal Basin- Temporary, Significant, Negative SJR- Moderate, Negative, Temporary, reducing to

Impact/Topic	Construction/ Operation Phase	Residual Impact	Significance
			imperceptible with distance for viewpoints beyond around 150m. North Wall Quay- Moderate, negative, temporary, reducing to imperceptible for angled views. Residential Receptors- Temporary to Short-term, Slight to Moderate to Significant Negative. Commercial Receptors- Temporary to Short-term, Slight to Moderate Negative.
	Operation	The proposed mitigation measures would not result in any significant changes to the effects. The scope for mitigation is small and the expected pre-mitigation effects are already insignificant.	Landscape- Long-term, Slight, Positive Visuals- Grand Canal Square, Grand Canal Quay, Hanover Quay, Grand Canal Basin, SJRQ, North Wall Quay- Imperceptible Residential and Commercial Receptors- Permanent, Slight, Negative to Imperceptible.

SECTION 19: Cumulative Impacts

19.1 Introduction

This section presents a summary of the potential cumulative impacts and the resulting effects arising from the proposed development, when considered in combination with other existing and/ or approved projects. The cumulative impact assessments have been undertaken by each specialist and outlined in each relevant Section of this Volume 2 of the EIAR.

Phase 1 of this project was completed in 2002 and comprised the installation of a culvert under Asgard Road between Hanover Quay and SJRQ. Phase 2 of the project is required to complete the proposed Grand Canal Storm Water Outfall Extension (GCSWOE) project. A detailed description of the proposed project is contained in Section 2 of the EIAR.

This section provides a summary description of the potential cumulative impacts and/ or effects identified within the above sections and provides a reference to the relevant section where the potential impact and/ or effects has been assessed.

The section details the methodology used to assess interaction/inter-relationship and cumulative effects with the nearby developments, followed by assessment of cumulative impacts, indirect impacts and interactions and conclusion.

19.2 Methodology

19.2.1 Legislation

The EIA Directive 2011/92/EU (as amended 2014/52/EU) requires that the EIAR considered the potential for significant cumulative effects to arise as a result of (i) the interaction between the various impacts within a single project, and (ii) the interaction between all of the different existing and/ or approved projects in the same area as the proposed project.

Specifically, Article 3(1) and Annex III of the EIA Directive (2014/52/EU) confirm that the likely significant effects on the environment must be considered with regard to the impact of any project.

- Annex III (3)(g) includes for: "the cumulation of the impact with the impact of other existing and/ or approved projects"; and
- Annex IV (5)(e) includes for a description of the likely significant effects of the project on the environment resulting from inter alia "the cumulation of effects with other existing and/ or approved projects, taking into account any existing environmental problems relating to the areas of particular environmental importance likely to be affected or the use of natural resources".

19.2.2 Guidelines

The cumulative impact assessments have been undertaken in accordance with the following guidelines:

- Department of Housing, Planning, and Local Government (DoHPLG) (2018), Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment;
- EPA (2022), Guidelines on the Information to be contained in Environmental Impact Assessment Report;
- EPA (2017), Guidelines on the Information to be contained in Environmental Impact Assessment Report, (Draft);
- EPA (2015) Advice Notes on Current Practice in the Preparation of Environmental Impact Statements, (Draft);
- EC (1999) European Commission Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions; and
- EU (2017) Environmental Impact Assessments of Projects, Guidance on Screening (Directive 2011/92/EU as amended by 2014/52/EU).

As stated in the DoHPLG (2018) guidance document, "*Effects are not to be considered in isolation but cumulatively i.e. when they are added to other effects. A single effect on its own may not be significant in terms of impact on the environment but, when considered together with other effects, may have significant impact on the environment. Also, a single effect which may, on its own, have a significant effect, may have a reduced and insignificant impact when combined with other effects*".

The EPA guidelines (2022) define cumulative impacts as "*The addition of many minor or insignificant effects, including effects of other projects, to create larger, more significant effects. While a single activity may itself result in a minor impact, it may, when combined with other impacts (minor or significant), result in a cumulative impact that is collectively significant.*'' The EC guidelines (1999) provide further detail describing the cumulative impacts as "*impacts that result from incremental changes caused by other past, present, or reasonably foreseeable actions together with the project*."

The EC Guidelines (1999) also considers 'Indirect Impacts' as well as 'Impact Interactions' in addition to 'Cumulative Impacts' and states that these three types of impact overlap. For the purposes of this assessment, these impacts were considered as follows:

- Indirect Impacts: Impacts on the environment that are not a direct result of the proposed development, often produced away from or as a result of a complex pathway; and
- Impact Interactions: Where two impacts have the potential to interact to create a new type of impact.

19.2.3 Assessment of Cumulative Impacts

In accordance with the EPA Draft 2017 Guidelines, an EIA Scoping Report was prepared (JBB, 2020) which identified existing and/ or approved projects with the potential for cumulative impacts with the proposed development. The Scoping Report considered three categories of plans/ projects based on the following:

- Existing or commenced projects with a valid planning permission within the vicinity of the proposed development that have the potential for significant cumulative effects with the proposed development;
- Approved projects with a valid planning permission that have not commenced construction within the vicinity of the proposed development that have the potential for significant cumulative effects with the proposed development; and
- Proposed projects that do not have planning permission but have the potential for significant cumulative effects with the proposed development.

19.3 Plans

The following plans were identified as potential sources of cumulative impacts:

- Dublin City Development Plan 2016-2022;
- Dublin Port Masterplan 2012-2040;
- Greater Dublin Area Cycle Network Plan (NTA, 2013);
- Greater Dublin Drainage Strategy;
- North Lotts and Grand Canal Planning Scheme, 2014;
- Poolbeg West Strategic Development Zone Planning Scheme;
- River Basin Management Plan; and
- Irish Water's Biodiversity Action Plan (BAP).

The proposed development may contravene a number of mitigatory policies and measures set out in the Dublin City Development Plan 2016-2022**.** Therefore, there may be cumulative effects from the proposed development in combination with the Dublin City Development Plan 2016 – 2022. The projects outlined in Dublin City Development Plan that can contribute to cumulative impacts are therefore considered further in the cumulative assessment. The activities in the basin will be dovetailed by DCC where possible to avoid any cumulative impacts on the receiving environment.

The proposed development could have an in-combination effect with the Dublin Port Masterplan on the Dublin Bay Natura 2000 sites. Two of the projects outlined in the Dublin Port 2040 Masterplan, Alexandra Basin Redevelopment and MP2, have been granted permission and construction phase is underway. These projects have been considered in-combination with the proposed project.

The Irish Water's BAP has set out objectives to preserve and where possible enhance the natural environment and its ecosystems. The proposed GCSWOE project is not considered to interfere with the objectives of the BAP. It is however, anticipated that the stormwater outfall extension will have a long-term positive effect on the environment in the Grand Canal Basin as the reduction of pollutants entering the basin will improve the water quality and the benthic habitat. This is in line with two of the key objectives of the BAP, namely "issue all Irish Water sites with a clear set of measures that will enhance and protect biodiversity" and "ensure 'no net loss' of biodiversity when carrying out activities, or delivering plans or projects". The discharge from the combined stormwater overflow outfall into the River Liffey will cause a very slight change in water quality and there will be no discernible change in the ability to meet the surface water environmental quality standards (EQS). The WFD status for the Lower Liffey Estuary and Dublin Bay will remain good. The slight reduction in quay wall habitat is negligible in the context of the total area of quay wall habitat along the Lower River Liffey. Therefore, the operation of the new stormwater outfall is not anticipated to have a significant in-combination impact on the ecological features together with the Irish Water's BAP as the new stormwater outfall is in line with objective of the BAP and will not contravene the aims and objectives of the BAP.

The other plans and schemes identified have been subjected to their own environmental assessments and no significant effects have been identified. By incorporating avoidance and mitigation measures, these plans are not anticipated to have any significant effects on the receiving environment. Further, lower-level projects within these plans will be subject to their own separate environmental assessments.

19.4 Projects

There are a number of identified existing and/ or approved third party projects in the vicinity that may have the potential to interact with the proposed development. A number of projects were identified at the Scoping stage of this project, and some have been identified since then. Projects that have been identified for consideration include:

- Alexandra Basin Redevelopment;
- Barrow Street Improvements;
- Inner Basin Boardwalk;
- Boland's Mill;
- Bus Connects;
- Canal Loop Greenway;
- Campshires Public Realm;
- Dart Underground;
- Dodder Greenway;
- Dodder Public Transportation Opening Bridge;
- Dublin District Heating System;
- Dublin Eastern Bypass project;
- Extension of Luas Red Line across the River Liffey;
- Grand Canal Greenway- Grand Canal Dock Section;
- Grand Canal Quay East;
- Liffey Cycle Route;
- Liffey-Tolka Project;
- Maintenance dredging in Dublin Port;
- Malthouse;
- Metrolink;
- MP2 Project, Dublin Port Company;
- North Lotts and Grand Canal Dock SDZ Water Animation Strategy 2018;
- Point Pedestrian Bridge;
- Refurbishment of Camden Lock Gates;
- Ringsend Wastewater Treatment Plant Upgrade;

- South Campshire Flood Defence Wall project;
- Southern Port Access Route;
- Treasury Building; and
- Trinity East Innovation Hub.

19.4.1 Screening for cumulative impact assessment

In the cases where the projects are not in the immediate vicinity of the GCSWOE and have only potential construction phase cumulative impacts, these projects have been screened out. These include:

- Canal Loop Greenway; and
- Liffey-Tolka Project.

It is expected that Construction work will commence within one year of Planning Permission if received.

Existing or commenced projects

As per the list of projects in Section 19.4 above, the following projects listed below have been screened out:

- Barrow Street Improvement works;
- Boland's Mill development works;
- Refurbishment of Camden Lock Gates;
- Malthouse development; and
- Trinity East Innovation Hub.

These projects are deemed to have only construction phase related impacts with the proposed GCSWOE project. These projects are currently in or entering construction phase, and it is envisaged that these improvement works will be completed before commencement of the proposed GCSWOE project. As there is no overlap of construction phase timeline, there are **no anticipated construction phase or operational phase cumulative** impacts from the works at the developments listed below and the proposed development. Hence, these projects have been screened out.

Proposed projects

As per the Draft Transport Strategy 2022-2044 by National Transport Authority (NTA), updated assessment work, taking account of current transport policies, has identified that Dublin Eastern Bypass scheme is no longer required to be developed at this stage and it is not intended to progress this project as part of this Transport Strategy. This would instead be replaced by sustainable transport modes.

Also, the Dart Underground and Tunnel scheme is not being brought forward at this time due to funding constraints and also due to the potential to utilise the Phoenix Park Tunnel for passenger service. The timing of implementation of the Dart underground will be reassessed as part of the periodic reviews of the Transport Strategy and its implementation will be brought forward if required by emerging transport patterns. The Transport Strategy 2022-2042 also outlines that the extension of Luas Red Line across the River Liffey may be considered during the later periods of the Transport Strategy or after 2042. Hence, these three projects have not been assessed further.

It is proposed that Transport Infrastructure Ireland (TII) will apply for a Railway Order for the Metrolink project in Q2, 2022. The planning process with An Bord Pleanála is likely to take 12-18 months to complete. Once a Railway Order has been granted, work can commence on site. It is anticipated that the construction work will take between 6-8 years to complete and are not in immediate vicinity of proposed GCSWOE project. Working areas are not in immediate vicinity of the proposed project, therefore no cumulative construction impacts are anticipated.

Apart from that, there are other projects in the vicinity of the proposed GCSWOE project which are in the pipeline or in early stages and to date there is no information available on these projects progressing to planning stage. These also include projects listed in the draft Dublin City Development Plan 2022-2028 objectives and will be implemented subject to the availability of funding and environmental requirements and compliance with the NTA Transport Strategy, such as Point Pedestrian Bridge. The plan also sets objectives to implement the North Lotts and Grand Canal Dock SDZ Water Animation Strategy 2018 to promote the Dublin Docklands as a significant water focussed amenity. Other projects in early stages include a Boardwalk to be constructed on the eastern side of the inner Grand Canal Basin, Dodder Greenway, Campshire Public Realm, Southern Port Access Route, and Liffey Cycle Route. As these projects are in early phases and no information is currently available on project commencement or timeline, these projects have not been assessed further.

These projects can have potential cumulative impacts with the proposed GCSWOE during construction phase. However, as there is no evidence at the moment for the timeline of these projects to overlap with the proposed GCSWOE project, cumulative impacts have not been assessed as part of this submission. However, the EIA and AA undertaken for these developments will take into account any cumulative impacts with the proposed GCSWOE project.

These projects that have been screened out are listed below.

- Inner Basin Boardwalk;
- Campshires Public Realm;
- Dart Underground;
- Dodder Greenway;
- Dublin Eastern Bypass;
- Extension of Luas Red Line across the River Liffey;
- Liffey Cycle Route;
- Metrolink;
- North Lotts and Grand Canal Dock SDZ Water Animation Strategy 2018;
- Point Pedestrian Bridge; and
- Southern Port Access Route.

Further assessment

Projects identified for further assessment include:

- Alexandra Basin Redevelopment (ABR);
- Bus Connects;
- Dodder Public Transportation Opening Bridge;
- Dublin District Heating System;
- Grand Canal Greenway- Grand Canal Dock Section;
- Grand Canal Quay East development works;
- Maintenance dredging in Dublin Port;
- MP2 Project, Dublin Port Company;
- Ringsend Waste Water Treatment Plant Upgrade;
- South Campshire Flood Defence Wall Project; and
- Treasury Building.

Refer to Table 19.1 below for summary of cumulative impact assessment.

Table 19.1 Cumulative impact assessment – disciplines considered

Project	Discipline										
	Population and human health	Biodiversity	Water quality and hydrology	Land, soils, geology, and hydrogeology	Air quality and climate	Noise and vibration	Traffic and transport	Archaeology and cultural heritage	Waste management	Material assets	Landscape and visual impact
Alexandra Basin Redevelopment	✓	✓	✓	X	X	X	X	X	X	X	X
Bus Connects	✓	X	X	X	✓	✓	✓	X	X	X	✓
Dodder Public Transportation Opening Bridge	✓	✓	✓	X	✓	✓	✓	X	X	X	✓
Dublin District Heating System	✓	X	X	X	✓	✓	✓	X	X	X	✓
Grand Canal Greenway- Grand Canal Dock Section	✓	X	X	X	✓	✓	✓	X	X	X	✓
Grand Canal Quay East	✓	X	X	X	✓	✓	✓	X	X	X	✓
Maintenance dredging in Dublin Port	X	✓	✓	X	X	X	X	X	X	X	X
MP 2 Project, Dublin Port Company	✓	✓	✓	X	✓	✓	✓	X	X	X	X
Ringsend Wastewater Treatment Plant Upgrade	✓	✓	✓	X	X	X	X	X	X	X	X
South Campshire Flood Defence Wall project	✓	✓	✓	X	✓	✓	✓	X	X	X	✓
Treasury Building	✓	X	X	X	✓	✓	✓	X	X	X	✓

✓ denotes potential cumulative impacts
X denotes no potential cumulative impacts

19.5 Significance of Cumulative Impact

19.5.1 Construction Phase

The residual impact from the proposed development following appropriate mitigation will be negligible. Further, the projects in the Grand Canal Dock area and development plans have been screened for Appropriate Assessment and have been screened out with the conclusion that they will not have a significant impact, alone or in combination with other projects, on any of the Natura 2000 sites. Therefore, no adverse cumulative or in combination impacts will occur.

The Alexandra Basin redevelopment, MP2 Project and maintenance of dredging activity in the basin will involve dredging and relocation of sediment with potential impact on benthic communities in the bay. The impacts without mitigation might include impacts due to potential discharges of sediment and pollution from these two projects which could have a cumulative impact on habitats and species (Common Tern colony within The Dolphins Dublin Docks pNHA and aquatic fauna) and water quality which could have impacts on population and human health as well, within the boundary of the proposed project and immediately downstream. The biological communities are adapted to disturbance due to water and sediment movement in the tidal area. Mitigation measures include Water Quality Management Plan, Pollution Incident Response Plan, Dredging Management Plan, Suspended Sediment and Sedimentation Measures, Concrete and Cement Pollution Measures. Temporary negative impacts are anticipated on the benthic fauna, but recovery is expected to take <1 year and no residual impact is anticipated. No significant cumulative impacts with the proposed project are anticipated.

The following projects are still at early planning stages: Bus Connects, Dodder Public Transportation Opening Bridge, Dublin District Heating System, Grand Canal Greenway- Grand Canal Dock Section, Grand Canal Quay East development works and South Campshire Flood Defence Wall Project and Treasury Building. Their construction phases may overlap with the proposed project. It is anticipated that if construction phase overlaps there can be potential short term construction phase cumulative impacts on population and human health, noise and vibration, air quality and climate, traffic and transport and landscape and visual. Additionally, the Dodder Public Transportation Opening Bridge and South Campshire Flood Defence Wall Project could have potential discharges of sediment and pollution which could have a short-term construction phase cumulative impact on habitats and species within the boundary of the proposed project and immediately downstream. These projects will be subject to a separate Stage 1 AA and EIA Screening and potentially a Stage 2 AA and EIAR prior to commencement. Such an assessment will identify potential impacts and outline any mitigation measures required. Provided mitigation measures are in place, no significant cumulative impacts with the proposed project are anticipated.

Mitigation measures are incorporated, into the proposed GCSWOE Project including pollution prevention (including concrete) and suspended sedimentation. Having applied the mitigation measures to manage and reduce the risk of pollution, there will be no adverse significant impact upon the integrity of the European sites and receiving environment concerned. Also, following appropriate mitigation measures the residual impacts from the proposed GCSWOE development are slight negative and short-term during construction phase. **Therefore, no significant negative cumulative or in combination impacts will occur.**

19.5.2 Operational Phase

The Dublin City Development Plan has a range of policies and objectives outlining mitigation measures to offset any potential impact on the Dublin Bay Natura 2000 sites. These relate particularly to water quality and enhancement of aquatic ecosystems.

The potential for the proposed project to contravene these mitigations by extending the combined stormwater outfall to the quay of River Liffey could result in a significant in-combination impact on the Natura 2000 sites by impairing water quality. However, the spills from the CSO's to the new stormwater outfall will be intermittent and the water quality model (DHI Water Environments (UK) LTD, 2021) was undertaken to model the change in water quality in River Liffey based concentrations of MRP, DIN, BOD and *E. coli* as a result of the new stormwater outfall. For DIN there was no discernible change in the achievement of the EQS compared to the baseline, with the % difference in concentration in much of the

Lower Liffey being below 1% and the higher levels constrained to the outfall area. For MRP there was no discernible change in the achievement of the EQS compared to the baseline, with the % difference in concentration in much of the Lower Liffey being less than 1%. BOD showed no discernible change in the achievement of the EQS compared to the baseline, however this parameter showed the greatest increases compared to the baseline. It was noted that even with this large percentage increase, the resultant values were still well below the EQS thresholds. For *E. coli* the increases due to the GCSWOE were seen to be less than 2% in the time varying scenario reducing rapidly away from the outfall and between 2 and 5% for the storm-based scenarios. Importantly, at the downstream boundary these both reduced to less than a 1% increase compared to the baseline.

Due to the greater assimilative capacity of River Liffey the changes in water quality is imperceptible. Therefore, the operation of the new outfall is not anticipated to have a significant in-combination impact on the Dublin Bay Natura 2000 sites together with the Dublin City Development Plan.

The Greater Dublin Drainage Strategy includes the upgrade of Ringsend WWTP. In June 2018 Irish Water applied for (and subsequently received) planning permission for upgrade works to the Ringsend WWTP facility. These are currently on-going and will increase the capacity of the facility from 1.6 million PE to 2.4 million PE. This plant upgrade will result in an overall reduction in the final effluent discharge of several parameters from the facility including BOD, suspended soils, ammonia, DIN and MRP. An EIAR was submitted by Irish Water as part of this application.

As the changes in water quality anticipated upstream due to the proposed GCSWOE project are imperceptible and provided the mitigation measures for both the projects are implemented, there will be **no significant negative cumulative impacts or in combination impacts will occur during operational phase.**

No other project or plan is anticipated to have any operational phase cumulative impacts with the proposed GCSWOE project.

19.6 Residual Impacts

Assuming that prescribed mitigation measures are properly implemented, no significant residual cumulative impacts are anticipated as a result of the proposed development in combination with other existing and proposed plans and projects.

19.7 Conclusion

This EIAR has considered potential cumulative impacts arising from the construction and operation of the proposed GCSWOE in accordance with the EIA Directive and corresponding guidelines. It has done so mainly through the integration of cumulative impacts in the undertaking of baseline surveys related to effects on Biodiversity, Water Quality, Noise and Vibration, Air Quality and Climate, Traffic and Transport, Landscape and Visual Impacts and Waste Management.

The proposed development is not likely to give rise to any significant or interactive cumulative impacts.